The role of subjective and objective social isolation as predictors of mental health recovery

Ruimin Ma

UCL

PhD Thesis

Declaration

I, Ruimin Ma, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signed:

Date:

Acknowledgements

Sonia Johnson and Brynmor Lloyd-Evans from the Division of Psychiatry, University College London, supervised this thesis. I am extremely grateful for their efforts in supervising this work, offering insightful comments, and providing this extremely valuable research experience. Without their guidance and support throughout the whole PhD, I would not be able to enjoy these four years as a PhD student, and this thesis would not have been completed.

I would like to thank Jingyi Wang, for her patience with my frequent enquiries regarding my PhD, and I also want to thank Louise Marston from the Research Department of Primary Care and Population Health, UCL, for her helpful advice in statistics. I also need to thank Ka-Young Ban, a fellow PhD student, who always keeps me cheerful and motivated.

I am very grateful to all CORE colleagues in the Division of Psychiatry who worked on this project. Thanks to their excellent work on data collection. I am thankful to Farhana Mann, Jingyi Wang, Brynmor Lloyd-Evans, James Terhune, Ahmed Al-Shihabi and Sonia Johnson for their contributions to the systematic review.

I also want to thank my parents for their continuous support and encouragement, and Mirjana, who treats me as part of her family.

Finally, a huge thanks to Luka, for always being there for me and distract me with all the good things in life during stressful times.

Abstract

Background

Loneliness is increasingly being acknowledged as a more pervasive experience for people with mental health problems than the general population. Research also suggests that people with mental health problems tend to be more objectively socially isolated than people without mental health diagnoses. However, with most research to date are restricted to their cross-sectional design, more longitudinal studies exploring the impact of both issues on mental health outcomes are of high value.

Method

Drawing the data from the Crisis Team Optimisation and Relapse Prevention (CORE) study, this PhD thesis established whether baseline loneliness and social network size were associated with self-rated personal recovery and overall psychiatric symptom severity at 18-month follow-up among people with mental health issues. This PhD thesis also determined whether persistent severe loneliness and persistent objective social isolation were associated with poor self-rated personal recovery at 18-month follow-up. Additionally, a systematic review was carried out to evaluate the effectiveness of potential interventions for subjective and objective social isolation among people with mental health problems.

Results

The quantitative analyses indicate that greater baseline loneliness was associated with poorer personal recovery and greater symptom severity at 18-month follow-up, after adjusting for three blocks of baseline confounding variables. Persistent severe loneliness group was associated with the poorest self-rated personal recovery at 18-month follow-up, followed by the intermittent severe loneliness group and never severe loneliness group. Persistent objective social isolation group was also associated with poorer personal recovery at 18-month follow-up, compared to the never objective social isolation group.

The systematic review provides preliminary evidence supporting promising interventions with cognition modification for subjective social isolation, interventions with supported socialisation and mixed strategies for objective social isolation.

Conclusion

This research advances our existing evidence-base in the field of loneliness research. The need for more rigorous work with a longitudinal research design is warranted.

Impact statement

It has been well-acknowledged that both subjective and objective social isolation are more frequently reported by people with mental health problems, compared to the general population. Both concepts have been major areas of interest within the field of public health for the general population, especially the elderly. There is a growing body of evidence demonstrating the deleterious impacts of subjective and objective social isolation on both physical and mental health. However, evidence is scarce concerning how and to what extent subjective and objective social isolation contribute to the development and maintenance of mental health symptoms for people with diagnoses across the entire spectrum of mental disorders. In particular, there is a scarcity of empirical evidence from well-designed longitudinal research. To the best of our knowledge, no large-scale research has been conducted in the mental health field to investigate the trajectories of loneliness and objective social isolation over a relatively long follow-up period among people with mental health problems. Existing evidence yet to inform whether being persistently severely lonely could result in poorer mental health outcomes, compared to being intermittently severely, and never being severely lonely. The same research question on persistent social isolation is also less explored in the field of mental health.

During my literature search for relevant loneliness research, I recognised the importance of conducting a systematic review to synthesise current evidence on potential interventions for alleviating subjective and objective social isolation among people with mental health problems. The systematic review is presented in Chapter 3 and these findings underscore a lack of high-quality randomised controlled trials with an ability to inform what types of intervention are effective in improving subjective and objective social isolation for people with mental health problems. Therefore in this review, I emphasised the potential direction for future research, including the need to prioritise and develop more theory-driven interventions and to conduct adequately powered RCTs in loneliness research. An adapted version of this chapter has been published for a special loneliness issue on the Social Psychiatry and Psychiatric Epidemiology. I have also presented the findings from this systematic review at both national and

international conferences, such as the European Network for Mental Health Service Evaluation (ENMESH) 2019 in Lisbon.

Findings from our quantitative study addressed existing knowledge gaps, advanced our evidence-base in loneliness research in several ways. Firstly, informed by the longitudinal evidence, Chapter 5 supports a significant relationship between greater baseline loneliness and poorer mental health outcomes (i.e. self-rated personal recovery and overall symptom severity) at 18-month follow-up among people with diagnoses across the spectrum of mental disorders, after adjusting for three blocks of confounding variables. Findings further demonstrate that, compared to baseline social network size, loneliness was a better predictive factor for poor mental health outcomes at 18-month follow-up, suggesting a pressing need for future research to target loneliness as the prominent focus in mental health research.

In Chapter 6, the quantitative findings suggest that persistent severe loneliness was associated with a substantially poorer personal recovery, compared to intermittent severe loneliness and never severe loneliness, after adjusting for three blocks of potential confounders and baseline self-rated personal recovery. Our findings also underscore the harmful impact of persistent objective social isolation on self-rated personal recovery, with persistent objective social isolation being associated with poorer personal recovery at 18-month follow-up, compared to never objective social isolation over the same 18-month period. These findings not only have their implications for efficient mental health service planning, but also highlight the needs in intervention planning for persistent loneliness and objection social isolation for people with mental health problems in a timely manner. By comparing baseline characteristics of people in different severe loneliness and objective social isolation groups, I found a considerably higher risk of being persistently severely lonely or objectively socially isolated among those with specific sociodemographic characteristics, such as being unemployed or not in education. The implications of these characteristics are relevant in identifying patients who are at a higher risk of developing enduring loneliness or objective social isolation than patients without these characteristics. Subsequently, tailored and efficient prevention or treatment plans can be offered to this patient group. In summary, this 4-year PhD has strengthened my confidence in conducting high-quality research in the future,

which also encourages my future involvement in research in the field of mental health.

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List of abbreviations

AN	Anorexia Nervosa
BA	Behavioural Activation
BATD	Behavioural Activation Treatment for Depression
BN	Bulimia Nervosa
BETA	Beta Coefficient
BPRS	The Brief Psychiatric Rating Scale
CI	Confidence Interval
CRT	Crisis Resolution Team
ED	Eating Disorder
FEP	First Episode Psychosis
GAD	Generalised Anxiety Disorder
GHD	The General Health Questionnaire
GPSG	Guided Peer Support Group
HDL	High-density lipoprotein
IH-CBT	In-home Cognitive Behavioural Therapy
IQR	Interquartile Range
ISEL	The Interpersonal Support Evaluation List
ISSI	The Interview Schedule for Social Interaction
LSNS	Lubben Social Network Scale
LSNS-R	Lubben Social Network Scale-Revised
MDES	The Making Decisions and Empowerment Scale
MDD	Major Depressive Disorder
MOS-SSS	Medical Outcomes Study Social Support Survey
MSPSS	Multidimensional Scale of Perceived Social Support
N	Number of Participants
NetmumsHWD	Netmums Helping with Depression
NET	Narrative Exposure Therapy
NET-R	Narrative Exposure Therapy Revised
OARS	The Older Americans Research and Service Centre Instrument
OCD	Obsessive-Compulsive Disorder
PNQ	Personal Network Questionnaire
PPKI	The Pattison Psychosocial Kinship Inventory
PTSD	Posttraumatic Stress Disorder
QPR	The Questionnaire about the Process of Recovery
R^2 adjusted	Adjusted R^2
RCT	Randomised Controlled Trial
SCIT	Social Cognition and Interaction Training
SD	Standard Deviation
SFS	Social Functioning Scale
SMI	Severe Mental Illness
SNI	Social Network Index
SNS	Social Network Schedule
SNSS	Social Network and Social Support Questionnaire
SQLS	The Schizophrenia Quality of Life Scale
SSIAM	Structured and Scaled Interview to Assess Maladjustment
SSQ6	The Social Support Questionnaire 6
SSL	The Social Support List
TAU	Treatment-as-usual
TREE	Toward Recovery, Empowerment and Experiential Expertise

UCLA Loneliness Scale	University of California of Los Angeles Loneliness Scale
ULS-8	The Short-Form of the UCLA Loneliness Scale
USDHHS	U.S. Department of Health and Human Services

Chapter 1. Subjective social isolation, objective social isolation and their related concepts

A large number of published studies have identified social relationship as a fundamental element to our emotional, behavioural and cognitive development (Hawkley & Cacioppo, 2003). Investigating social relationships is a continuing research interest within the last few decades, and social networks have also been increasingly acknowledged as a critical component in providing both perceived and actual level of social support, social interaction, social learning, access of resources, and social influences (Berkman et al, 2000). Loneliness overlaps with subjective social isolation; it is defined as a subjective appraisal when there is a perceived discrepancy between social relationships one desires and the actual level of social support one receives (Wang et al, 2017; Peplau & Perlman, 1982). The main aim of this thesis is to examine the relationship between loneliness, objective social isolation and personal recovery among mental health service users following a mental health crisis. This introductory chapter reviews the definitions of subjective social isolation, objective social isolation and their related constructs. Studies investigating potential contributing factors to subjective and objective social isolation are also discussed.

1.1. Subjective and objective social isolation, and their related concepts

Social isolation: Social isolation can be used to describe not only the objective aspects of an individual's social relationships (i.e. objective social isolation), but also the subjective aspect (i.e. loneliness), which refers to the adequacy and the quality of one's social relationships. For example, Nicholson (2009, p. 1346) defines social isolation as 'a state in which the individual lacks a sense of belonging socially, lacks engagement with others, has a minimal number of social contacts, and they are deficient in fulfilling quality relationships.' Delisle (1988, p.361) suggests that social isolation 'denotes a lack of quantity and quality of social contacts.' Additionally, Adu-Bediako (2013) proposed five attributes of social isolation, including the number of social contacts, a sense of belonging, social engagement, quality of social relationships and valuable social network members. Zavaleta and colleagues (2014) describe social isolation based on its

external and internal characteristics. External characteristics, also referred to as objective social isolation, are the observable features of social relationships, such as the number of close social relationships (de Jong Gierveld et al, 2006). The internal characteristics are also known as subjective social isolation, it is defined as the personal attitudes toward one's social relationships, such as loneliness and perceived social support.

Research has emphasised that subjective and objective social isolation should not be considered as the same construct, even though the measures of subjective and objective social isolation are mildly correlated (e.g. Ge et al, 2017). Subjective social isolation is defined as the perceived inadequacy in an individual's social resources or a lack of closeness with others, for example, low level of perceived social support or lack of companionship (Wang et al, 2017; Cornwell & Waite, 2009b; Peplau & Perlman, 1982). By comparison, objective social isolation is characterised by a lack of social contacts or having minimal social contacts with others, for example, small social network size, or lack of social ties (Cornwell & Waite, 2009b). Wilson (1987, p.60) also defines objective social isolation as 'the lack of contact or of sustained interaction with individuals or institutions that represent mainstream society'.

Drawing upon the definition of social isolation, two recently published papers also underline the distinction between subjective and objective social isolation in their conceptual models (Wang et al, 2017; Valtorta et al, 2016a). In their paper, Valtorta and colleagues classified measures of social relationships based on two dimensions: structural/functional aspects of social relationships, and the degree of subjectivity of items from self-reported questionnaires. In the discussion of the second dimension, Valtorta and colleagues divided these items into four categories, starting from more objective measures, gradually moving towards more subjective measures with the following order: 1) items measure the size of one's social network and the range of social relationships one has; 2) items measure the availability of social relationships one perceives; 3) items measure an individual's own satisfaction towards the quality and/or the quantitative aspects of his/her social relationships (i.e. from the respondent's own perspective, which requires a comparison between the level of social interactions one received and one's social expectation or social needs); and 4) items measure an individual's positive and negative feelings towards the quality and the quantity

of his/her social relationships. Wang and colleagues adopted a different approach and categorised social relationships into five domains: 1) social network (quantity); 2) social network (structural); 3) social network (quality); 4) appraisal of relationships (emotional); and 5) appraisal of relationships (resources). These domains help researchers distinguish and identify the objective and subjective aspects of social relationships. The first two main domains, social network (quantity) and social network (structure), demonstrate the characteristics of the quantitative aspects of social interaction (i.e. the number or the structure of one's social relationships), and the remaining three domains, social network (quality), appraisal of relationship (emotional) and appraisal of relationships (resources), suggest the subjective appraisal of one's social relationships and social interaction. Although the literature review from Valtorta et al. focused on studies of older adults and cardiovascular disease, and Wang et al. exclusively targeted mental health literature with additional descriptions of the differences between individual social relationships and interpersonal connectedness, both reviews emphasised the significant conceptual distinction between subjective and objective social isolation. This distinction has been further confirmed by a large and growing body of research, demonstrating that people may experience loneliness even when there are sufficient social resources available. For example, in the DAHMS study conducted in Dublin, 32% of a community-dwelling older sample aged 65 and above reported being lonely even though they also reported having an integrated social network (Golden et al, 2009).

Loneliness: Loneliness is a related concept of subjective social isolation; it refers to an individual's subjective perception of his/her social world (Wang et al, 2017; Andersson, 1998). In the last few decades, the definition of loneliness has received a considerable amount of attention in research. Loneliness and social isolation are often used interchangeably in the literature (Wang et al, 2017). While social isolation can be measured objectively by assessing one's social network size or the intensity of the individual's social contacts (Wenger et al, 1996), loneliness is a qualitative measure of an individual's perception of his/her social contacts (de Jong Gierveld & Haven, 2004). Loneliness can only be reported subjectively by each individual himself/herself (Andersson, 1998), based on one's satisfaction towards his/her own social situations (de Jong Gierveld, 1998). Previous literature describes loneliness as a severe psychosocial problem, which

is characterised by an intense feeling of social isolation and emptiness, a sense of low self-worth, fear for one's social life (Booth, 2000; Weiss, 1973), and a disconnection from one's immediate environment and society (Hauge & Kirkevold, 2010). Loneliness has been associated with a wide range of interpersonal issues, such as poor dating and communication skills (Edwards et al, 2001; Zakahi & Duran, 1985). Belongingness theory hypothesises that human beings, as social creatures, have a desire to pursue and maintain positive and lasting social contacts with desired individuals in their social networks (Baumeister & Leary, 1995). Our sense of belonging determines how likely a person will be satisfied by his/her level of social relationships, and it is the lack of satisfaction towards social relationships that increases the risk of loneliness (Kelly, 2001; Victor et al, 2005b).

A considerable amount of literature has been published to define loneliness: Sullivan (1953, p.290) describes loneliness as 'the exceedingly unpleasant and driving experience connected with inadequate discharge of the need for human intimacy, for interpersonal intimacy'. One of the most popular and broadly cited definitions to date was from Peplau and Perlman (1982, P.31), who define loneliness as 'an unpleasant experience that occurs when a person's network of social relation is deficient in some important way, either quantitatively or qualitatively'. Young (1982, p.380) suggests that loneliness is 'the absence or perceived absence of satisfying social relationships, accompanied by symptoms of psychological distress that are related to the actual or perceived absence'. Not only Young highlights social relationships as a positive reinforcement in our social environment, loneliness has also been partially characterised 'as a response to the absence of important social reinforcement'. Weiss (1973) and De Jong Gierveld (1987, p.120) further emphasise that loneliness is caused by a lack of wanted or desired relationship, this includes 'situations in which the number of existing relationships is smaller than is considered desirable, as well as situations where the intimacy one wishes for has not been realised'.

Among these definitions, there are few key characteristics of loneliness which are recognised by most researchers: 1) Loneliness and objective social isolation are two distinct concepts; 2) Loneliness is caused by an awareness of scarcity in one's social life and social relationships with others; 3) Loneliness is a subjective

feeling that can only be described by an individual himself/herself; and 4) Loneliness is a distressing experience.

Many theories and conceptual models have been proposed to understand loneliness as a multidimensional and multifactorial construct (Yanguas et al, 2018). In their edited book 'Preventing the harmful consequences of severe and persistent loneliness', Peplau and Goldston (1982) point out two distinct perspectives from different professionals and laypeople: some researchers affirm loneliness is a natural, transient and non-pathological experience, it is commonly experienced by each individual and most of us can overcome this occasional feeling of loneliness. Others, instead, suggest loneliness is a disturbing experience, also known as severe loneliness, which is defined as a painful and persistent experience that compromises our psychological wellbeing and may in turn contribute to a broad range of mental disorders and psychological dysfunction.

A similar perspective was later adopted by Sociologist Austin (1989), who identified three main types of loneliness: 1) Existential loneliness, also named primary loneliness, is considered as a universal experience. It is characterised by a feeling of emptiness and sadness that not necessarily results from any loss or social inadequacy. Instead, it is inborn in all human beings and it is caused by individuation and an awareness of separateness as a person to the universe (Brennan, 1982); 2) Psychosocial/ordinary (secondary) loneliness is caused by situational changes in one's social relationships or temporary separation from others. Individuals who suffer from psychosocial loneliness tend to have a full awareness of their lack of social connection, and in turn, they desire companionship or longing for the type of relationship that is perceived as insufficient; and 3) Pathological loneliness is commonly experienced by individuals with abnormal social cognitions and emotions, and it is relatively more prevalent in people diagnosed across the entire spectrum of mental illnesses than the general population. This type of loneliness is particularly pervasive among patients with psychosis or schizophrenia. Therefore, it seems that this type of loneliness is likely to be an enduring and distressing experience (i.e. severe loneliness), and it should not be resolved simply by changing someone's adverse social circumstances.

A multidimensional conceptual model of loneliness was also proposed by Weiss (1973), who suggests two types of loneliness: while emotional loneliness is predicted by the absence of an intimate attachment figure, social loneliness is the perceived absence of a broader social network. The Social and Emotional Loneliness Scale for Adults from DiTommaso et al. (2004) also suggests a further classification of emotional loneliness, named family and romantic emotional loneliness (Sansoni et al, 2010). Therefore, it is hypothesised that people desire different types of social support from various social network members, and one type of relationship cannot compensate for the lack of another. Russell and colleagues (1984) emphasise that emotional loneliness may either result from a lack of intimate feeling with another person (i.e. attachment figure), or from a lack of opportunity to take care of another individual (i.e. an opportunity for nurturance), whereas social loneliness is predicted by a lack of appreciation from others (i.e. reassurance of worth), which is preventable through improved social integration (Kraus et al, 1993). Some research has attempted to support the distinction between emotional and social loneliness further: Stroebe and colleagues (1996) discovered that anxiety and marital status were only associated with emotional loneliness, and only social loneliness was predicted by the level of social support. In the case of coping strategies, Russell et al (1984) found that cognitive problem-solving techniques were involved in both types of loneliness, but only emotional loneliness was associated with problem-solving techniques from a behavioural perspective. Despite the differences, emotional loneliness shares specific characteristics with social loneliness (Russell et al, 1984). For example, there was a small correlation between the items for emotional loneliness and the ones for social loneliness on the 20-item UCLA Loneliness Scale (r= 0.17) (Russell et al, 1984) and both types of loneliness predicted depression (Ernst & Cacioppo, 1999). Furthermore, by analysing data drawing from a sample of college students, Vaux (1988) discovered that both emotional and social loneliness was associated with the provisions of social relationships, appraisals of social support, and the quantitative and qualitative characteristics of social networks. Certain personal traits have also been associated with both social and emotional loneliness, such as awkwardness in social environments, poor self-esteem and negative attitudes towards social networks (Cacioppo et al, 2006a).

In summary, with full awareness of its multidimensionality and complexity, many frameworks and conceptual models have been put forward to define loneliness, and scales have also been developed over the past decades to measure loneliness from varying perspectives. Loneliness is a multifaceted construct, and we have no sufficient knowledge of the most valid approach to measure and define loneliness, especially in the field of mental health. Therefore, to advance our understanding of loneliness and its relationship with health, researchers should take into account the multidimensionality of loneliness when evaluating this issue in future research.

Social network: Social network is a commonly used term in the literature describing the extent of one's objective social isolation (Cohen & Sokolowski, 1978; Cornwell & Waite, 2009a). Mitchell (1969 p.2) describes social network as 'a specific set of linkages among a defined set of persons, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behaviour of the persons involved'. Social network also includes both objective (e.g. network size) and interactional characteristics (e.g. network intensity) (Wang et al, 2017).

Social support: Social support is another related concept of subjective and objective social isolation (Lubben & Gironda, 2003; Victor et al, 2000a). While structural social support refers to the quantitative characteristics of our social relationships, such as social network size and the frequency of social contacts, functional social support is a subjective assessment of the quality of individual's emotional (e.g. love), informational (e.g. ideas of activities) and instrumental (e.g. food or service) support (Broadhead et al, 1989; Lehto-Jarnstsed et al, 2004). Therefore, the functional specificity hypothesis (Cutrona & Russell, 1990) claims that people tend to have goal-directed social relationships in order to access appropriate social resources when in need.

Wang et al.'s (2017) conceptual framework also successfully mapped different types of social support onto their five social isolation domains. As a multi-dimensional construct, structural social support fits with domain 1 & 2 (i.e. social network: quantity and structure); functional social support fits with domain 4 & 5 (i.e. appraisal of relationships: emotional and resources); and the quality aspect of social support fits with domain 3 (i.e. social network: quality). Social support

can also be defined based on its sources and content (e.g. emotional, informational or instrumental social support), its subjectivity and objectivity, its positivity or negativity (e.g. support in need or inappropriate help) (Sansoni et al, 2010). The Inventory of Nondirective and Directive Instrumental Support (INDIS) further distinguishes two types of instrumental support: non-directive instrumental support aims to facilitate individuals' coping process, and directive instrumental support seeks to take control over the coping process for the individual in need (Harber, 2005). Accordingly, emotional, informational and appraisal social support fit with domain 4 (i.e. appraisal of relationships: emotional), and instrumental support fits with domain 5 (i.e. appraisal of relationships: resources). The subjectivity of social support fits with domain 4 (i.e. appraisal of relationships: emotional), and the objectivity of social support fits with domain 1 & 2 (i.e. social network: quantity and structure) (Wang et al, 2016).

Perceived social support is the level of social support perceived by an individual. As an interpersonal process (Albrecht & Goldsmith, 2003), this type of social support is perceived through social connections (Thoits, 2011). The sources of support (e.g. from family, spouse or children) also affect its impact (Dean et al, 1990; Okun & Keith, 1998; Chu et al, 2010). However, social support has its costs, especially if it is delivered in a negative form (Rook, 1984, 1990; Thomas et al, 2017b). The provision of positive support can contribute to increased wellbeing of the recipients in two significant ways (Wills & Shinar, 2000): 1) the messages from the support provider lead to solutions for the problems that the recipient is experiencing; and 2) the importance of the recipient, and the level of concerns and care from the provider are perceived through the communication between the provider and recipient. Evidence to date supports an association between great perceived social support and improved health outcomes and health symptomatology (e.g. Wang et al, 2018b; Holt-Lunstad et al, 2010), compared to limited evidence demonstrating such relationship between the level of social support received and health outcomes. Therefore, it seems to be the second pathway that is considered more crucial in improving individuals' wellbeing.

As a related concept of loneliness, there is a clearly defined relationship between perceived social support and loneliness. Generally, the lower perceived level of social support, the lonelier an individual becomes (Segrin & Passalacqua, 2010).

Meta-analyses to date have also underlined a closer relationship between the perceived quality of social relationships and loneliness, rather than the number of social contacts individuals have (e.g. Pinquart & Sorensen, 2001). Thus, when individuals perceive a high level of social support from the types of social relationships they desire, the subsequent risk of loneliness can be reduced or minimised (Segrin & Passalacqua, 2010).

The conceptual distinction between subjective social isolation and depression: Loneliness, low level of perceived social support and depressive symptoms are all distressing and aversive experiences. There is a consensus among the literature that the three concepts are correlated (Sergin, 1998; Wang et al, 2018b; Liu et al, 2014). Despite the correlations between these concepts, loneliness and perceived social support should not be considered as alternative methods measuring depression, and the three constructs also should be considered as distinctive (Bell, 1985; Cacioppo et al, 2006b).

1.2. Measurements

Measures for social relationship have been summarised based on the two dimensions proposed by Valtorta and colleagues: whether the instrument measures the structural or functional aspect of social relationship, or it measures the degree of subjectivity of the items from self-report questionnaires (Valtorta et al, 2016a). In recent years, many scales have been developed for loneliness, one of the most implemented and well-established scales is the UCLA Loneliness Scale, a 20-item unidimensional questionnaire. It is designed to assess people's feelings of social isolation and the level of dissatisfaction towards their social relationships (Russell, 1996). The ULS-8, a short version of the UCLA Loneliness Scale, has also been administrated and evaluated in a broad range of populations, such as adolescents (e.g. Xu et al, 2018), colleague students (e.g. Hays & DiMatteo, 1987; Dogan et al, 2011; Wu & Yao, 2008), and elderly samples (e.g. Zhou et al, 2012; Jaafar et al, 2019). In an exploratory factor analysis of the UCLA-20, the ULS-8 was highly correlated with the original UCLA Loneliness scale (r=.01). Therefore, Hays & Dimatteo (1987) argue that the ULS-8 is a valid and reliable short scale for loneliness, and it is a better substitution for the original version of the UCLA Loneliness Scale than the ULS-4. Another commonly used

rating scale in loneliness literature is the de Jong-Giervald Loneliness Scale, it comprises five positively worded items and six negatively worded items, differentiating emotional and social loneliness. However, this scale can also be administrated as a unidimensional scale. Its short version consists of 6 items (i.e. three for emotional loneliness and three for social loneliness), and it can be administrated in large-scale surveys (De Jong Gierveld & Van Tilburg, 2010). Both scales have been widely implemented in many surveys around the world, such as Australia (Lauder et al, 2004; Victor et al, 2005a), Canada (Havens et al, 2004) and Ireland (Squires et al, 2009).

Some commonly used scales have also been developed to measure perceived social support. For example, the Lubben Social Network Scale (LSNS) was originally developed in 1988. Its revised version LSNS-R and the 6-item LSNS (LSNS-6) measure both the quantitative and qualitative characteristics of individuals' family relationships and friendships. Its longer-version, the LSNS-18, additionally comprises items measuring neighbourhood relationships. The Multidimensional Scale of Perceived Social Support (MSPSS) consists of 12 items assessing the perceived adequacy of social support from family, friends and significant others (Zimet et al, 1990). The Medical Outcomes Study Social Support Survey (MO-SSS) measures the perceived level of functional support, categorises 20 items into 4 subscales: emotional/informational, tangible, affectionate and social interactions subscale (Hawthorne et al, 2008b). The scale has been widely adopted in various languages, cultural backgrounds, and clinical samples. A summary table of available scales for subjective social isolation (including loneliness and perceived social support) is presented in Appendix 1.1.

The characteristics of one's social network are frequently used as indicators of objective social isolation. Social network can be measured based on its quantitative properties, including its size (i.e. the number of an individual's social contacts), degree (i.e. the number of social links an individual has with other people), and density (i.e. the proportion of people in one' social network connect with each other). Psychometrically robust measures of social network based on detailed and structural self-reported interviews have been developed. For example, both quantitative and structural aspects of one's social network can be measured by the Social Network Schedule (SNS), which was initially designed for people with mental disorders (Dunn et al, 1990), and it has been demonstrated

as having good feasibility (Wang et al, 2017). However, it is worth noting that measures of social network and objective social isolation are commonly relied on participants' self-report, given the practical difficulties in observing one's social interactions. Therefore, these measures are vulnerable to the variations in how people define 'social contacts', 'friendships' or 'confidant' (Palumbo et al, 2015). A summary table of available measures for objective social isolation is presented in Appendix 1.1.

Therefore, although the feeling of loneliness is linked to being objectively socially isolated, and objectively socially isolated individuals also often feel lonely, the two are not synonymous. Compelling evidence has only suggested a weak to moderate association between the two constructs (Cornwell & Waite, 2009a). In a person's social life, the size of his/her social network and the number of social contacts he/she has are important. However, the subjective appraisals of one's social relationships, such as the perceived quality of one's social bonds with others and the perceived deficiency in these social relationships, are the most pronounced factors associated with loneliness (Hawkley et al, 2008; Peplau & Perlman, 1982). After discussing the distinctions between subjective and objective social isolation and their related concepts (including loneliness), the following section moves onto the prevalence of loneliness and objective social isolation in the general population and people with mental health problems.

1.3. Prevalence of subjective and objective social isolation

Prevalence in the general population: Both subjective and objective social isolation are pervasive across all populations in our modern society over the last few decades. Children as young as three-year-olds can feel lonely (Rubin, 1982). In a large-scale UK survey, around 7% of the sample disclosed that they suffered from severe loneliness (Victor et al, 2005b). Comparable numbers were reported in an Australian sample, with 9% of the sample reporting being lonely sometimes, and 7% reporting being very lonely (Hawthorne, 2008a). More recent surveys demonstrate a growing number of people in the general population living with loneliness. In a survey of samples from four states in the US (North Carolina, New York, Ohio and Texas), 28% of the survey respondents reported being severely lonely and 27% were moderately lonely

(Musich et al, 2015). A large German adult sample was surveyed in the Gutenberg Health Study (GHS), 5% of the responders disclosed some degree of loneliness, and 1.7% of them were severely lonely (Beutel et al, 2017). Based on the European Social Survey (ESS) data, the JRC researchers (2019) found that as high as 30 million (7%) adults in Europe felt lonely, with a relatively higher proportion of people in Hungary, the Czech Republic, Italy, Poland, France and Greece being lonelier (>10%) than other countries. Some recent figures surveying loneliness in the UK were also publicised: according to the Campaign to End Loneliness (2014), over one million of the older adults in the UK were lonely most of or all the time. A recent report on the prevalence of loneliness in Ireland estimated that approximately 10% of the elderly in Ireland feeling lonely persistently (Harvey & Walsh, 2016). Another study conducted by the Co-op and the British Red Cross (2016) also revealed that about one-fifth of the UK population (i.e. 9 million) either always or often lonely. A nationwide survey was also conducted by BBC Radio 4 in collaboration with the Wellcome Collection (2018). Led by Pamela Qualter, a professor of psychology at the University of Manchester, researchers surveyed over 55,000 people in the UK, and 40% of the respondents aged 16-24 years reported being lonely often or very often, 29% of those aged 65-74 and 27% of those aged over 75 also disclosed that they felt lonely often or very often.

Regarding the prevalence of objective social isolation in the general population, in the UK alone, 6.5% reported being severely isolated, they had either little or no social contacts with either friends or family, or no social involvement in any community or organisation (Banks et al, 2009). In New Zealand, approximately 35% of the adult population in the community reported being socially isolated, either sometimes or often in the last 12 months (Nielsen, 2012). Similar results were demonstrated in another survey of a sample of community-dwelling elderly, suggesting that up to 43% of the sample were socially isolated (Nicholson et al, 2009). Analysing data from the National Health and Aging Trends Study (NHATS), Cudjoe and colleagues (2018) estimated that in 2011, 24% of the community-dwelling elderly in the US were considered as socially isolated (i.e. 7.7 million) and 4% of these 7.7 million people (i.e. 1.3 million) were severely socially isolated. A higher proportion of adults in some European countries reported being more socially isolated than others, publicised by the JRC

researchers (2019): although 7% of the population reported loneliness, many more (75 million or 18%) were socially isolated. For example, only 18% of the adults in Europe engaged socially once a month at most, and over 40% of the adults in Hungry and Greece disclosed that they only socialised with friends or families once every month or less. Based on the Irish Longitudinal Study on Ageing, approximately 7% of the older adults in Ireland felt socially isolated (Harvey & Walsh, 2016). A recent report from Teuton (2018) also revealed that approximately 6% of the adults in Scotland only maintained minimal contact with their family, friends or neighbours (i.e. fewer than once or twice per week). When social engagement is considered as the indicator of objective social isolation, the ONS (2015) reported that only 19% of adults in the UK had volunteered in a local, national or international organisation in 2012/2013, and on an individual level, reported membership of any organisations in the UK also declined by 5% between 2011 and 2018 (ONS, 2020). A comparable statistics was also reported by the residents in Scotland in 2015: about 46% have involved in some form of activities in their local community (SSA, 2015 in Teuton, 2018), and only 27% have participated in voluntary work (SHS, 2015 in Teuton, 2018).

Prevalence in people with mental health problems: A substantial amount of evidence suggests that loneliness and objective social isolation are more frequently experienced by people with mental health problems, compared to the general population. A possible explanation is that this population tends to have very different social relationships with others compared to the social bonds featured in the general population (Holwerda et al, 2012). Furthermore, their difficulties in initiating and maintaining social relationships may also limit their social interactions with others (Davidson et al, 2004; Kupferberg et al, 2016). Drawing upon the theory from Austin (1989), we may expect that this population tends to experience great loneliness, possibly pathological loneliness. In terms of objective social isolation, several researchers also highlight a number of risk factors that may interrupt the social interaction between people with mental health symptoms and their social network members, such as interpersonal stigma, low motivation and mental health symptoms. Consequently, they tend to have few social ties and small social networks but experience significant social and self-stigma that is secondary to their mental health diagnoses (e.g. Cohen et al, 2004a; Palumbo et al, 2015; Rossler, 2016).

The associations between a broad range of mental health conditions and loneliness are well-established (Meltzer et al, 2013). It has been estimated that over 50% of people with long-term mental health conditions experience loneliness (Borge et al, 1999). For people with two or three mental health diagnoses, there was a 20-fold increased likelihood of loneliness, relative to those without any mental health problems (Meltzer et al, 2013). Data from the second Australian National Survey in 2012 documented that 80.1% of patients with psychosis suffered from persistent loneliness within the last 12 months (Stain et al, 2012). The feeling of loneliness also varies across different spectrums of mental health diagnoses. By exploring the differences between outpatients with various mental health diagnoses in their subjective and objective social relationships, Giacco and colleagues (2016) demonstrated that, for people with a diagnosis of affective disorder, they experienced greater loneliness than people diagnosed with psychosis. For those with bipolar disorders who were also experiencing psychotic and depressive symptoms, they also suffered from greater loneliness than those only diagnosed with schizophrenia (Borge et al, 1999; Stain et al, 2012).

In a recent systematic review, Palumbo and colleagues (2015) emphasised that social networks of people with psychosis mainly encompass their family ties. Synthesising results from 23 papers, the authors concluded that the percentage of family ties of this population ranged from 30% to 68.7%, but the percentage of friends only ranged from 15.7% to 42.6%. Compared to the general population, people with mental health issues tend to have a small friend network size and poor friendships (Harley et al, 2012; Boeing et al, 2007). Furthermore, they also have a reduced chance of dating someone (Remschmidt et al, 1994) and getting married (MacCabe et al, 2009), especially for those in all phases of psychosis (Harrop et al, 2015). Moreover, it appears that the more hospital admissions one has, the smaller his/her social network becomes (Norman et al, 2005; Lipton et al, 1981; Holmes-Eber et al, 1990; Albert et al, 1998). In patients with schizophrenia, research has also demonstrated negative associations between the length of hospitalisation and the functional aspect of social support, the frequency of one's social contact, and the availability of family and friends (Ossman & Mahmoud, 2012; Hultman et al, 1996). In terms of the quantitative aspects of social relationships, social networks of people with schizophrenia

present some different characteristics to that of the general population. For example, their social networks tend to be more restricted (Perese & Wolf, 2005) and consist of fewer multiplex relationships (i.e. multiplex relationships are defined as social contacts that have several contexts, such as an individual is considered as both a relative and a neighbour) (Kavanagh, 1992; Semple et al, 1997; Goldberg et al, 2003). Instead, their social networks comprise more dependent and less reciprocal relationships (Lim & Gleeson, 2014; Angell & Test, 2002). Moreover, people with schizophrenia are also more likely to consider their social contacts as being less supportive and less helpful than the general population (Angell & Test, 2002; Buchanan, 2004; Jones, 1982; Wittenberg & Reis, 1986).

Overall, the majority of the existing literature has provided convincing evidence suggesting both loneliness and objective social isolation as more pervasive experiences for people with mental health symptoms than for people without these symptoms. However, what is not yet clear is how enduring these experiences can be in the general population and people with mental health problems, and the extent to which these experiences in patients with various mental disorders differ from the general population. Moreover, what we know about the prevalence of subjective and objective social isolation in the general population and clinical samples is mosty restricted to empirical studies measuring people's feelings at one time point, or in the past 12 months (Wang et al, 2018b). Although an extensive amount of research that has been carried out, there was little focus on how these experiences may change over time, and whether their trajectories are related to the course of mental illness. This PhD thesis provides a valuable opportunity to drive this growing area of research by advancing our knowledge of the trajectories of both issues over a relatively long follow-up period. Before preceding to existing evidence on the detrimental impact of subjective and objective social isolation on a range of health outcomes, it is necessary to discuss the underlying amendable and non-amendable factors that may increase the potential risk of both issues.

1.4. Factors contributing to subjective and objective social isolation

Longitudinal studies to date suggest that loneliness and objective social isolation can be transient for many (e.g. Dykstra et al, 2005; Cacioppo et al, 2009), but they may also become long-lasting issues for others (Qualter et al, 2015). A number of factors may explain why some people suffer from loneliness or being socially isolated, but others do not (De Jong Gierveld & van Tilvurg, 2006). The aetiology of both issues is multifactorial. They may result from the combinational effects of several risk factors (Havens & Hall, 2001; Howat et al, 2004), including biological determinants, sociodemographic factors, psychological factors, social variables, economic factors and health status. Therefore, the interplay between all these factors may contribute to loneliness and objective social isolation, especially in later life (Proffitt & Byrne, 1993).

1.4.1. Biological factors

Gene expression, either under- or over-expression of certain genes, has been linked to chronic loneliness (Cole et al, 2007). A genome-wide association study using the data from the UK Biobank Study estimated a 4.2% heritability of loneliness, this study also identified specific genomic loci that are associated with regular social activities attendance (Day et al, 2018). Adoption and twin studies revealed a heritable component of loneliness in both children and adults (e.g. Bartels et al, 2008; Boomsma et al, 2007). McGuire and Clifford's (2000) pioneer work on the heritability of loneliness in children included two studies, one involved biologically related and unrelated siblings from the Colorado Adoption Project, and another study recruited full siblings, and monozygotic and dizygotic twins from the San Diego Sibling Study. The two studies yielded an h^2 of 55% and 48%, respectively, suggesting a significant genetic heritability of loneliness in children samples. However, included sample sizes of both studies were considerably small. A comparable genetic heritability (h^2 =48%) was also estimiated in a Twins study of monozygotic and dizygotic twins in the Netherlands (Boomsma et al, 2005). Boomsma and colleagues therefore hypothesised that an individual might have little or no control over his/her inner emotional response to a specific stimulus. Additionally, the authors found that not only the heritability of loneliness

remained stable as people age, it also maintained the same for both males and females. Based on two small cross-sectional studies, Bartels et al. (2008) also found a 45% heritability of loneliness in children. Drawing the genotypic and phenotypic data from over 10,000 people in the Health and Retirement Study (HRS) in the Netherland, Gao and colleagues (2017) estimated a moderate heritability of 14-27% for loneliness and identified a co-heritability between loneliness, neuroticism and depressive symptoms. The heritability of children's perception towards their popularity among peers has also been overlapped with the genetic factors contributing to their sociability (Deater-Deckard et al, 1997). Therefore, these results may suggest that certain genetic factors contributing to an increased vulnerability to either depression, heritable personal traits, or self-perception may also determine the trajectory of loneliness.

Taken together, evidence to date suggests that loneliness is partially biologically predisposed. Therefore, for some people, they are more inclined to become lonelier than others. The differential susceptibility hypothesis (Belsky et al, 2007) also highlights an extreme sensitivity to the surrounding environment for some individuals with specific genetic variants. As a consequence, when exposed to disadvantageous environments, these individuals tend to develop negative emotions, such as loneliness. However, it has been suggested that as children grow, environmental factors come to play, and these factors will become increasingly crucial in determining an individual's loneliness trajectory (McGuire & Clifford, 2000; Bartels et al, 2008). McGuire and Clifford's CAP data (2000) identified individual environmental contributors to children's loneliness, and the authors hypothesised that parents' differential treatments, but most importantly, factors outside the family (e.g. peer network) may play a significant part in contributing to loneliness.

1.4.2. Demographic factors

Age: The variations of loneliness and objective social isolation across different demographic groups are evident. Both adolescents and adults who are at a college-age are the most vulnerable age groups to loneliness and objective social isolation (Brennan, 1982; Ostrov & Offer, 1978; Heinrich & Gullone, 2006; Savikko et al, 2005). The pioneering work of Collier and Lawrence back in 1951

found that approximately 65% of adolescents described social isolation as a typical experience during adolescence (Collier & Lawrence, 1951). In their literature review, Heinrich and Gullone (2006) also found that approximately 80% of adolescents were lonely sometimes, relative to 40% of adults. A recent figure was published by a national survey (BBC Radio 4, 2018), in which adolescents and young people aged 16-24 (i.e. 40%) reported more frequent and greater loneliness, compared to people aged 65-74 (i.e. 29%) and of those aged over 75 (i.e. 27%). One probable explanation is that the significant transition adolescence to adulthood may result in their tendency to become more dependent on their social groups and social support from peers and less on family members (Cheng & Chan, 2004; Meeus et al, 2005).

This dependency on peer relationships may also explain the experience of objective social isolation among children. Objective social isolation during childhood may result from children's adverse social experiences in schools (Rubin et al 2009). The onset of adolescence can become more challenging if children cannot successfully navigate themselves in their peer social network during early years (Matthews et al, 2015), since peer relationships during adolescence tend to be more complex (Hartup & Stevens, 1997), and peer interaction requires specific social skills, which should be acquired during childhood (Matthews et al, 2015). Based on the data from the Swiss Health Survey, Hämmig's cross-sectional analysis (2019) found that one-sixth of their youngest age sample (i.e. aged between 15 and 24) was socially isolated (i.e. identified as partly socially integrated), and 3.5% of this sample was very isolated with poor social integration. A variety of other factors have also been associated with having a high risk of objective social isolation in children and adolescents, including obesity, sexuality, appearance, and teenage pregnancy (Public Health England, 2015).

There has been a controversy with existing evidence for loneliness among elderly, as findings from previous research have been inconsistent: some studies identified a direct association between loneliness and an increase of age, suggesting an age-related linear trend (Singh & Misra, 2009) at least among adults aged between 18 and 54 (e.g. Wood, 1978). The English Longitudinal Study of Aging (ELSA) (Victor et al, 2003) also discovered that approximately 9% of the adults aged 50 and above reported being lonely. However, other

researchers maintain that the older population is not necessarily lonelier than other age groups (Peplau et al, 1982), especially when certain factors, such as widowhood and other age-related factors, were accounted for (Victor et al, 2005; Luanaigh & Lawlor, 2008). Indeed, there is more emerging evidence supporting the latter: a large population-based Swiss Health Survey (SHS) proposed a U-shape cross-sectional association between age and loneliness for adults aged from 15 to over 75 (Richard et al, 2017), although the authors also observed a peak of loneliness between age 30 and 60. A nonlinear model was also demonstrated by Victor and Yang (2012). The authors found that in the UK, the prevalence of loneliness was much higher for those aged under 25 and over 65, compared to those in the middle. Although some evidence suggests that adults aged 80 and over were lonelier than other age groups in the elderly samples (46% vs. 34%; Beaumont, 2013), the national loneliness survey in the UK (2018) estimated that 29% of the adults aged 65-74 reported being lonely often or very often, which is comparable to 27% of those aged 75 and over who were either lonely often or very often. Loneliness in older age may result from age- or health-related difficulties, which are more commonly experienced by this population, compared to other age groups. Factors such as physical disabilities, financial problems or transportation issues may restrict their ability to maintain social contacts with family and friends (Hawkley et al, 2008).

Age-related factors may also explain the experience of objective social isolation in the elderly. While younger people depend more on their peer groups and develop their self-definition based on their broader social relationships with peers (Meeus, 1995; Meeus et al, 2005), for people at a relatively older age, their social networks become smaller as they age. As their age increases, their social ties with non-primary group members become less significant, the number of their social relationships also decreases (Cornwell et al, 2008). Therefore, the elderly may become extremely vulnerable to objective social isolation (Marsden, 1987), demonstrated by 22.72% of the respondents who were socially isolated from family and friends in the National Survey of American Life of an adult sub-sample aged 55 and over (Chatters et al, 2017). By administrating the LSNS, Lubben and colleagues (2006) also found that 15% of the adults in London aged 65 and over were at risk of being socially isolated. Implementing the same scale in another study (Iliffe et al, 2007), a large proportion of those aged 85 and over reported

being objectively socially isolated than those aged between 65 and 74 (32% vs. 12%). Drawing from the International Social Survey programme, Banks (2009) also revealed that a more substantial proportion of the elderly aged 80 and over reported being objective socially isolated than those aged 65 to 79 (30% vs. 23%).

Gender: To date, there has been little agreement on gender differences in loneliness. Some researchers suggest loneliness as a more prevalent experience for women than for men (e.g. De Jong Gieveld et al, 1987; Beutel et al, 2017). Victor and Yang (2012) found that 9% of women reported loneliness frequently, compared to 6% of men, and 25% of women reported being lonely sometimes, relative to 22% of men. Findings from other research suggest the opposite (e.g. Hawkley et al, 2008; Mullins et al, 1996a, 1996b; Tesch-Romer et al, 2013; Menec et al, 2019), and some studies found null gender differences (e.g. Steed et al, 2007; Zebhauser et al, 2014). Few explanations were put forward to address this gender-related discrepancy of loneliness. Firstly, given women tend to have a longer life expectancy than men, there is a possibility that women may go through a higher incidence of bereavement or illness than men (Beal, 2006), which may result in a higher likelihood of being lonely among women than men. However, some researchers highlight that this between-gender difference could only be observed in studies where respondents were given questions like 'how lonely do you feel', and they were asked to rate their answers. In this case, women were more likely to admit being lonely, compared to men who were less likely to admit their feelings (Russell, 1982; Borys & Perlman, 1985). Another explanation is that other factors may interact with gender, as loneliness can be affected by the life stage a person is in (Hawthorne, 2008a; Sansoni et al, 2010), and marital status is another potential contributing factor. For example, greater loneliness has been disclosed by unmarried men (De Jong Gierveld & Raadschelden, 1982), relative to married men, married and unmarried women (De Jong Gierveld, 1971).

In terms of gender differences in objective social isolation, structural opportunities may offer some explanations. For example, some evidence suggests that women experience more structural constraints than men, such as doing housework and caring for children. Therefore, they have fewer opportunities in finding a job and tend to have a low income (Peek & O'Neil, 2001). However, between-gender differences in social network compositions suggest greater objective social

isolation in men than women; for example, women may have more family members and female friends than men (Moore, 1990). By conducting a new analysis of the English Longitudinal Study of Ageing (ELSA) in England, an Executive Summary Report (Beach & Bamford, 2014) explored the prevalence of social isolation in men and women in 2012/2013, and the report suggests a combinational effect of gender and age on objective social isolation: there was a growing number of older men experiencing more severe objective social isolation, compared to older women (men vs. women: 14% vs. 11%), older men also had fewer social contacts with their children and friends each month than their matching women counterparts.

Ethnicity: Ethnicity is another demographic factor contributing to loneliness and objective social isolation. Existing literature has established potential differences in loneliness and network characteristics between people with different ethnic backgrounds (Ajrouch et al, 2001; Hawkley et al, 2008). In the Ethnicity and Loneliness Survey of Great Britain, Victor and colleagues (2012) estimated the prevalence of loneliness in an elderly sample. Compared to the populations in their countries of origin, a relatively higher proportion of people from China, Africa, the Caribbean, Pakistan and Bangladesh reported great loneliness, ranged from 24% to 50%. In a large nationally representative adolescent sample (Madsen et al, 2016), school-aged immigrants from ethnic minority groups also had a higher vulnerability to loneliness when compared to students with a Danish origin, which further confirmed the ethnic disparities in loneliness. This increased vulnerability to loneliness among people from ethnic minority communities may result from a number of factors, including their immigration status, loss of previous social relationships, language barriers, and challenges in facing social and cultural changes (Ajrouch, 2008; Tartakovksy, 2009). Concerns over the negative influence of discrimination and racism against migrants or ethnic minorities were also raised in some studies. For example, in a study of children and young adults in Australia, greater loneliness was reported by students from minority ethnic backgrounds than those from a majority group, and their loneliness was also associated with their experience of racial discrimination (Priest et al, 2014).

In terms of differences in social network characteristics, compared to people with other ethnicities, such as Caucasians, African Americans tend to have a wider family network with extended kin members (Choi, 1995; Taylor et al, 2018).

Therefore, African Americans not only have stronger emotional bonds with their family (Silverstein & Waite, 1993; Taylor et al, 2018), they also attend more community activities, such as going to church, which may serve as a significant resource for instrumental and emotional support in times of need (Taylor & Chatters, 1986; Taylor et al, 2018). However, members from minority ethnic groups may also in a disadvantaged position, in respect of their difficulties in finding a job in the labour market (Heath & Cheung, 2007; Quillian et al, 2017), having a low social or financial status (Adams et al, 1989), exposing to racial discrimination and racism (Lee et al, 2019; Lee & Turney, 2012), and having a low income and poor educational attainment (Kao & Thompson, 2003; Banerjee et al, 2018). These factors may further limit one's network resources and result in loneliness (Smith & Kingston, 1997; Adams et al, 1989; Atchley, 1985; Lee & Turney, 2012). However, ethnic distinctions in these aspects have significantly diminished in recent years (Kao & Thompson, 2003), conceivably owing to the promotion of racial equality in our modern society.

1.4.3. Personality factors

People with certain personality traits may also be subject to a higher vulnerability to loneliness. Extensive literature has explored the personality characteristics of lonely people and emphasised evident individual differences between lonely people and their non-lonely counterparts. For example, lonely people tend to possess more negative intrapersonal characteristics (e.g. pessimism), but fewer positive intrapersonal traits, such as optimism (Ben-Zur, 2012; Neto & Barros, 2003; Davis et al, 1992; Cacioppo et al, 2006a). A number of authors have noted that lonely people tend to have poor social skills (Riggio et al, 1993; Fauziyyah & Ampuni, 2018; Segrin & Flora, 2000; Cacioppo et al, 2006a), low social motivations (Cacioppo et al, 2000), poor self-esteem (Kamath & Kanekar, 1993; Cacioppo et al, 2006a), and few positive emotions (Mehrabian & Stefl, 1995; Queen et al, 2014; Cacioppo et al, 2006a). Instead, they tend to be shy (Booth et al, 1992b; Jackson et al, 2002; Scott et al, 2018; Clark et al, 2015) and introverted (Kamath & Kanekar, 1993; Cacioppo et al, 2006a). They are also more socially anxious (Segrin & Kinney, 1995; Scott et al, 2018), socially avoidant (Nurmi et al, 1996; Wei et al, 2005) and socially alienated than non-lonely individuals (Crandall

& Cohen, 1994; Bruno et al, 2009). Moreover, compared to their non-lonely counterparts, lonely individuals tend to score higher on conformity but lower on dominance (Mehrabian & Stefl, 1995; Yilmaz, 2011; Kupersmidt et al, 1999), they are more socially dependent but have a higher social sensitivity (Overholser, 1992; Hasan & Clark, 2017; Vanhalst et al, 2017; Gardner et al, 2005). They are also more likely to have low sociability (Schmidt4 & Fox, 1995; Cacioppo et al, 2006a; Capitanio et al, 2014; Clark et al, 2015) and faith or trust in other people around them (Crandall & Cohen, 1994; Rotenberg, 1994; Qualter et al, 2013; Qualter et al, 2009).

1.4.4. Social factors

Environmental factors: Environmental contributing factors in childhood are unique for each child's development of loneliness and objective social isolation. Attachment theory (Bowlby, 1971) hypothesises that with attachment figures during their childhood, children will continue to form successful attachments towards other people later in their lives, both sustainable and satisfying social relationships. They will also be able to utilise social resources from these relationships efficiently (Sarason et al, 1987; Shallcross et al, 2014). Therefore, they tend to have high self-esteem (Arbona & Power, 2003; Barry et al, 2007), high sense of self-worth (Kenny & Sirin, 2006; Lim et al, 2012), and high cognitive abilities (Fraley et al, 2000; Mikulincer et al, 2004). Shared environmental factors, such as parents' marital status, the number of siblings one has, and living conditions, and non-shared environmental factors, such as sibling relationships and parental treatments, may also influence the formation and maintenance of support from network ties (McGuire & Clifford, 2000; Plomin & Daniels, 2011). In a longitudinal study of an adult sample (Bartels et al, 2008), the authors revealed that apart from a heritability of 45% in loneliness, the remaining variances were explained by both shared (12%) and non-shared (43%) environmental factors. Bartel and colleagues also reported that the variance explained by the heritability of loneliness was 58% at age 7, 56% at age 10 and 26% at age 12. Meanwhile, there was an increase in the impact of shared family environmental factors, explaining 6% variances at age 7, 8% and 35% at age 10 and 12, respectively. The remaining variances were contributed by the non-shared environmental

factors, such as insecure attachment during infancy (Berlin et al, 1995; Raikes & Thompson, 2008), peer rejection (McGuire & Clifford, 2000; Asher &Paquette, 2003) or peer victimisation during childhood (Renshaw & Brown, 1993; Storch, & Masi-Warner, 2004; Baker & Bugay, 2011). Although both shared and non-shared environmental factors contribute to the individual differences in loneliness during childhood (McGuire & Clifford, 2000), during adulthood, non-shared environmental factors have a more pronounced impact on the variation of loneliness (Matthews et al, 2016; Spithoven et al, 2019). For example, being a member of a social group, such as a political organisation or church group, not only improves our sense of belonging, but also increases our opportunities in engaging social activities, and developing friendships and companionships. Therefore, the risks of loneliness and objective social isolation subsequently decrease (Hawkley et al, 2010; Fratiglioni et al, 2000; Berkman, 1983).

Marital status: Both loneliness and objective social isolation are associated with marital status and recent loss. Being married is a significant factor protecting individuals from loneliness (Pinquart & Sorensen, 2003; Hawkley et al, 2008; Victor & Yang, 2012; Fokkema et al, 2011; Chen et al, 2014) and objective social isolation (Chipperfield & Havens, 2001). It also a significant positive impact on individuals' overall wellbeing (Banks et al, 2009; Boden-Albala et al, 2005). Not only does a close and happy marital relationship may potentially reduce the perceived level of daily stress (Dehle et al, 2001; Hawkley et al, 2010), married people are also more likely to have stronger social ties with both family and neighbours when compared to those who are unmarried. On the other hand, factors such as lacking a spousal confidant (Hawkley et al, 2005), going through a divorce or being widowed (Holmen et al, 1992; Wenger & Bulholt, 2004) may increase the possibility of not receiving adequate support from an intimate partner. Moreover, domestic violence (Lauder et al, 2004), caring for a dependent intimate partner, especially if the partner is in a chronic condition or the person receives no help from others, may increase the risk of loneliness (Wenger & Burholt, 2004). Situational events, such as losing a relative, spouse or friend, may also subsequently lead to loneliness and objective social isolation by preventing people from engaging networks actively, especially for older people (Pinquart & Sorensen, 2003; Nicholson, 2012).

Living situation: Living condition is another risk factor for loneliness (Routasalo et al, 2006; Wang, 2009) and small social network (Berkman, 2000), especially for elderly (Iliffe et al, 2007). Simply being alone or a sense of alienation (Cohen, 2004), or having a low satisfaction towards one's living situations (Hector-Tyalor & Adams, 1996; Prieto-Flores et al, 2011; Smith, 2012) are associated with social isolation. A survey conducted in England reported that among adults aged over 65, 17% of the respondents were living in a single-person household, and they were often or always lonely, compared to 2% of those who were sharing the same household with others (Victor et al, 2003). This finding may be explained by the fact that this group of adults tends to have fewer opportunities in engaging socially with others, either in or outside their household (Havens et al, 2004). Great loneliness has also been frequently reported by the elderly living in residential homes (Savikko et al, 2005; Nyqvist et al, 2013; Bekhet & Zauszniewski, 2012). Living close to adult children may decrease the risk of loneliness for older people (de Jong Gierveld & van Tilburg, 1999), living in the same household as their adult children or living with a higher number of children under 18, on the other hand, may increase that risk (Wenger & Burholt, 2004; Lauder et al, 2004).

In terms of objective social isolation, research has suggested an association between certain neighbourhood disorders and social isolation (Ross & Jang, 2000), such as poor neighbourhood safety (Booth et al, 2012), frequent vandalism (Nicholson, 2012), and high levels of incivilities (Lewis & Salem, 1986; Ross & Jang, 2000; Skogan, 1990). Any limiting environmental factors that create difficulties in maintaining successful social interactions with others may also increase the risk of objective social isolation (Mistry et al, 2001), such as housing types and relocation (Havens et al, 2004; Lien-Gieschen, 1993; Grenade & Boldy, 2008). By analysing the data from the Canadian Longitudinal Study on Aging, a recent study examining the effect of geographic location on the development of loneliness and social isolation reported that the prevalence of objective social isolation was 5.1%. The results of the study also illustrate that for the elderly living in an urban area, they were more likely to become objectively socially isolated, although not necessarily lonelier, compared to their rural counterparts (Menec et al, 2019). One explanation is that urban areas are mainly dominated by a relatively younger population (van Groenou et al, 1999). Or, for this age group,

there is a high possibility of living in a socioeconomically deprived residential area when they reside in an urban city (Menec et al, 2019).

Employment, education and financial status: Both employment status and educational attainment have been identified as contributing factors to financial problems, which may subsequently lead to loneliness and objective social isolation (Fokkema, de Jong Gierveld & Dykstra, 2012; Havens & Hall, 2001; Iliffe et al, 2007; Bassuk et al, 1999; Ackley & Ladwig, 2010; Zhang et al, 2010; Wu et al, 2010). Inadequate financial resources and long-term financial stress resulting from either unemployment or underemployment (Anderson & Winefield, 2011) may reduce individuals' opportunities of participating in social activities (Jones, 1992; Savikko et al, 2005; Pedulla & Newman, 2011), and in turn, lead to socioeconomic disadvantages. Having a low socioeconomic status has also been considered as another risk factor resulting in the feeling of loneliness (Hawkley et al, 2010). Work variables, such as employment types, employment environments (i.e. employed at home vs. employed outside home), and heavy physical work (e.g. farming, housekeeping and construction work), also have a considerable impact on loneliness, social network size, and opportunities of forming and maintaining social ties outside one's family network (Savikko et al, 2005). In the case of educational attainment, people with low educational achievement tend to feel lonelier and more socially isolated than those with a relatively higher education qualification (Bassuk et al, 1999; Zhang et al, 2010). One explanation is that people with low educational attainment are also less likely to secure a high-paid job (Iliffe et al, 2007; Menec et al, 2019), which limits their social opportunities of engaging in commercial activities (Hawkley et al, 2008; Tilvis et al, 2011).

Individuals who are employed may benefit from having a wider and more diverse social network than their unemployed counterparts (Peek & O'Neil, 2001). They may also have more opportunities to maintain their social contacts with colleagues, clients or supervisors, all of which are crucial factors promoting our sense of belonging, maintaining existing social ties, and being socially connected (Hawkley et al, 2005). Banks (2009) noted that people from a lower-middle-class or working-class background were 2.5 times more likely to report being socially isolated than others, even after controlling for age and gender. It has also been demonstrated that the elderly with less than 12 years of education tended to be

more objectively socially isolated than those with over 12 years of education (Bassuk et al, 1999).

Immigration status: A higher level of subjective social isolation, particularly loneliness (Madsen et al, 2016; Diehl et al, 2018), has been frequently reported by immigrants (Martins & Reid, 2007; Rashid & Gregory, 2014). Potential factors, such as a new environment, a new culture (de Jong Gierveld et al, 2015), discrimination (Yoo et al, 2009), language barriers (Treas & Mazumdar, 2002; de Jong Gierveld et al, 2015) and financial problems (Durst, 2005) may contribute to an elevated stress level, which may further result in loneliness (Smart et al, 1995; Wu & Penning, 2015) and a low level of perceived social support (Riva et al, 2018). In the 1996 Women's Health Australia Survey, Powers (2004) also found a low level of social support experienced by women with a non-English social background and those emigrated from another country. However, this vulnerability to loneliness and objective social isolation can subsequently be reduced if an individual has a supportive family network (Jasinskaja-Lahti, 2008; Zwirs et al, 2009; de Jong Giveld et al, 2015) and peer groups (Birman et al, 2002; de Jong Giveld et al, 2015; Stwart, 2014).

1.4.5. Physical health

Physical factors also contribute to loneliness and objective social isolation, for example, being disabled, low mobility, chronic stress from work or social situations, functional decline (Locher et al, 2005), and chronic physical conditions (Hawkley et al, 2008). A broad range of physical conditions, such as impaired vision and hearing (Heine et al, 2002; Jang et al, 2003; The National Council on the Aging, 1999; Luanaigh & Lawlor, 2008; Wenger & Burholt, 2004; Forbes, 1996), urinary incontinence and urine loss (Wyman et al, 1990; Yip et al, 2013) have also been associated with loneliness and objective social isolation. The number of physical conditions has been associated with loneliness and objective social isolation. Research has identified a 1.7-fold increased risk of loneliness and objective social isolation for those with four or more chronic physical conditions (Havens et al, 2004; Havens & Hall, 2001). Even perceived physical difficulties have its deleterious impact: low levels of perceived health status, perceived inability to perform daily activities independently, or fear of falling may

increase the feeling of loneliness (Savikko et al, 2005; Ryan, 1996; Iliffe et al, 2007; Zali et al, 2017).

1.4.6. Mental health

By implementing the UCLA Loneliness Scale, Russell (1982) found that certain groups of people, such as mental health service users, are more vulnerable to loneliness than others. People with severe mental illness may have different social relationships with others, relative to the types of social interactions typically experienced by people without mental health diagnoses. Due to recent changes in familial structure and more people are living in a single household than before (Holwerda et al, 2012), friendships become more and more critical in offering emotional and practical support (Sias & Bartoo, 2007). Based on the buffering effect hypothesis, social support from friends or any supportive resources may buffer against the negative consequences of daily life stressors for people with mental health problems (Sias & Bartoo, 2007; Schwarzer et al, 2004; Knoll & Schwarzer, 2002). Additionally, social support may not only encourage patients to seek professional help during a mental health crisis, it may also lead to improved physical and mental wellbeing (Jorm, 2005). However, it has been widely recognised that for people with mental health problems, they experience considerable difficulties in initiating and maintaining social relationships (Davidson et al, 2004; Reininghaus et al, 2008). Therefore, both loneliness and objective social isolation are particularly pervasive across the entire spectrum of mental health diagnoses (Baker et al, 1993; MacDonald et al, 2000; Caron et al, 1998; Gayer-Anderson & Morgan, 2013).

It has been demonstrated that people with psychosis rely heavily on their mental health services for social contact (Buchanan, 2004; Dailey et al, 2000). Poor social functioning (Keller et al, 1987; Lee et al, 2006; Rocca et al, 2009) and increased vulnerability to stressful social interactions (Cresswell et al, 1992; Myin-Germeys et al, 2001b) have been frequently reported by people with schizophrenia, which may lead to severe social withdrawal (Schneider et al, 2012). Their thoughts disorders may also provoke difficulties in expressing their feelings and thoughts (Sias & Bartoo, 2007). Additionally, they may appear to be unpredictable and dangerous (Magliano et al, 2004) due to other psychosis-

related symptoms, such as high levels of excitement (Magliano et al, 2004) and hostility (Sörgaard et al, 2001). All of these characteristics may consequently result in poorer social integration and negative relationships with friends and family (Sörgaard et al, 2001), especially for those in their early stages of psychosis and those at a young age (Giacco et al, 2012). Even for those who show no or very few negative symptoms, Lysaker and colleagues (2012) found that 38% of them did not meet up with a friend in the last week, and about 29% disclosed that they did not have a close friend. These deficits in maintaining close social relationships may also result from other commonly experienced symptoms among this patient group, such as neurocognitive impairments or impairments in social cognition (Lysaker et al, 2012). We may therefore expect that living with a mental disorder and experiencing impaired social relationships can be particularly stressful for people with mental illness, especially for those with psychosis. As a result, they feel lonely and socially isolated, which may further trigger more problems within their households or wider social networks and restrict their opportunities to acquire positive coping strategies or skills (Bellack, 1997; Cacioppo et al, 2000). Discrimination, stigma and negative attitudes toward people with mental health symptoms are also crucial factors in understanding these social difficulties experienced by people with mental health problems. Being a frequent target of public discrimination (Thornicroft et al, 2009) a detrimental impact on loneliness (Perese & Wolf, 2005; Świtaj et al, 2014, 2015): not only does public discrimination result in loneliness directly, discrimination may also have an impact on loneliness via its negative effect on one's self-esteem. Having low self-esteem may subsequently diminish their willingness or motivation to seek social support. Therefore, with a minimal level of support available, this population experiences greater loneliness than the general population (Świtaj et al, 2015).

For people with depression, while they do not necessarily spend less time with other people compared to their healthy counterparts, they tend to spend less time with others as a group member (Nezlek et al, 2000). Depressed individuals frequently experience interpersonal difficulties, which may be partially explained by their negative interactions with others and their tendency to express negative emotions toward their romantic partner (Zlotnick et al, 2000) and others (Segrin, 2010). Moreover, when depressed individuals try to find words to describe

themselves or express how they feel, they are more likely to use negative feeling words, compared to the general population and patients with a diagnosis of non-affective mental health issues (Baddeley et al, 2012). Therefore, these negative personality traits that are secondary to a depression diagnosis may further increase social stigma against this patient group and subsequently lead to more severe social exclusion.

This section reviewed existing literature supporting loneliness as a severe consequence resulting from the interplay between a number of contributing factors. Certain negative personality traits resulting from biological predisposition may contribute to the development of potential risk factors for loneliness and objective social isolation, such as negative emotions during social interaction. To the best of our knowledge, previous studies have yet dealt with the mechanisms through which biological predisposition may impact objective social isolation. There is a possibility that social network composition and social network size are also influenced by certain biological factors or personality traits that are predetermined by his/her biological predisposition. In terms of sociodemographic factors, gender, age and ethnicity are all proposed risk factors contributing to both loneliness and objective social isolation. Similar social factors associated with increased risks of loneliness and objective social isolation have also been suggested by a large number of studies, such as marital status, social loss, living situation, employment status, and educational attainment. Both physical conditions and mental health problems have also been proposed as key risk factors for loneliness and objective social isolation. Certain distinctions exist between different mental health diagnostic groups in the extent of and the experience of loneliness and objective social isolation. Still, people with a mental health diagnosis in general are at a higher risk of being lonely and objectively socially isolated than their healthy counterparts. Therefore, the following chapter summarises current evidence on the relationship between subjective and objective social isolation and health outcomes (both physical and psychological).

Chapter 2. The relationship between subjective and objective social isolation and health outcomes

Social relationships are a major area of interest within the field of physical health, psychological health (Bøen et al, 2012a), illness recovery (Sarason et al, 1996; Hendryx et al, 2009), and general wellbeing (Hawkley & Cacioppo, 2003; Merz & Huxhold, 2010). Social relationships not only affect individuals' positive and negative emotions directly, but also have an impact on their reactions to daily stresses people may experience. Other aspects, such as individuals' stress-sensitive biological systems, and changes in their health behaviours, all can be influenced by social relationships (House et al, 1988; Adam et al, 2006; Cohen, 2004). Loneliness and objective social isolation may occur when there are inadequate positive social relationships in one's social life (Peplau & Perlman, 1982; Nicholson, 2009), and both issues have deleterious effects on health outcomes and emotional wellbeing. This chapter therefore reviews evidence demonstrating the impacts of subjective and objective social isolation on individuals' physical and mental health.

For the evidence summarised in this chapter, I conducted a systematic search on Pubmed, Medline and Web of Science by using a combination of three groups of search terms with no restrictions on publication dates, language or the country of origin: 1) subjective and objective social isolation (e.g. loneliness, lonely, perceived social support, social isolation, social network); 2) mental health problems (e.g. schizo*, psychosis, psychiatr*, suicid*, learning disability); and 3) outcomes (e.g. onset, physical health, mortality, recovery, outcome*, symptom severity, personal recovery, quality of life).

Inclusion criteria of this review chapter are described below:

1) Healthy participants or people with mental health problems, such as depression, psychosis and anxiety were included. The following samples were also included: people with suicidal thoughts or suicidal behaviours, adults with dementia, people with learning disabilities, and people with alcohol or drug addiction. There was no restriction on the age of the participants;

2) Studies including a measure of subjective or objective social isolation were included; There was no restriction on the study design.

After retrieving all relevant research by screening the abstracts and reviewing the full text of potentially relevant studies, evidence from each eligible study targeting subjective social isolation was categorised into three groups: 1) evidence examining whether subjective social isolation has a role in predicting the onset of symptoms among the general population; 2) evidence examining whether subjective social isolation has an effect on symptom severity among people with diagnoses across the entire spectrum of mental disorders; and 3) evidence regarding the impact of subjective social isolation on the process of personal recovery and quality of life among people with mental health problems. Within each group, findings from each study were summarised based on whether the evidence was cross-sectional or longitudinal. The same procedure was also carried out for the studies focusing on objective social isolation.

2.1. Subjective and objective social isolation as predictors for physical health

In the general population, social support has a variety of health-promoting effects, and receiving adequate and high-quality social support from a supportive social network is indispensably essential for our physical health and mortality (Lett et al, 2007; Umberson & Montez, 2010; Holt-Lunstad et al, 2010). When facing severe and stressful events, social support not only has a positive impact on people's coping responses, it also provides useful tangible support and resources, which may facilitate efficient problem solving (Albrecht & Goldsmith, 2003). By contrast, both subjective and objective social isolation have been recognised as risk factors for individuals' poor physical health, and loneliness is widely recognised as a growing and critical public health concern (Loneliness Strategy, 2018). Its effect on physical health is comparable to the deleterious health effects from a number of other well-established risk factors, such as obesity, being a smoker, hypertension, or a sedentary lifestyle (House et al, 1982; Kobayashi & Steptoe, 2018).

Lonely individuals tend to report more medical issues than those who are less lonely (Rubenstein & Shaver, 1982; Choi, 2015; Mullins et al, 1996a; Shiovitz-Ezra & Ayalon, 2010). There is a widely acknowledged relationship between loneliness, increased somatic distress and poor health outcomes, including nausea, headaches (Pritchard & Yalch, 2009; Stensland et al, 2014), long hospital length of stay after surgery (Krampe et al, 2018), institutionalisation (Tilvis et al, 2000; Fernandez-Carro, 2016), poor hearing (Perlman et al, 1978; Sung et al, 2015), poor vision (Kivett, 1979; Tilvis et al, 2011), ischaemic stroke, and heart diseases and events (Cacioppo et al, 2002; Heikkinen et al, 2002; Kofoed et al, 2003; Hakulinen et al, 2018). There is a significant association between loneliness and specific health-related biological processes, such as elevated vascular resistance (Cacioppo et al, 2002; Hawkley et al, 2003), modified natural killer cell activity (Steptoe et al, 2004; Lutgendorf, et al, 2005), hypertension (Hawkley et al, 2010; Hawklay et al, 2006; Cacioppo et al, 2002), diminished biological stress mechanisms (Steptoe et al, 2004; Hackett et al, 2012), hormonal and autonomic changes (Uchino et al, 1996; Berkman et al, 2004; Cacioppo et al, 2002; Norman et al, 2011), and decreased immune functioning (Russell et al, 1997; Grant et al, 2009; Hawkley & Cacioppo, 2010). These effects remained significant even after controlling for depressive symptoms. Consequently, lonely people tend to have reduced ability in independent living (Seeman, 2000; Tilvis et al, 2000; Borge et al, 2006), low overall quality of life (Cacioppo et al, 2006), a short life expectancy (De Hert et al, 2011), high and early morbidity, and increased mortality rate (i.e. 40% higher than those who never feel lonely; Patterson & Veenstra, 2010) (Holt-Lunstad et al, 2015; Penninx et al, 1997; Friedmann et al, 2006; House et al, 1988; Patterson & Veenstra, 2010). Several studies investigating sleep quality also demonstrate that loneliness is one major contributing factor to long-term sleep disturbances (Cacioppo et al, 2002; Choi et al, 2015; McHugh & Lawlor, 2013; Pressman et al, 2005; Hawkley et al, 2010), including poor sleep quality and efficiency (Cacioppo et al, 2000; Mahon et al, 1993; Hawkley et al, 2010). Lonely individuals are also more likely to engage in an unhealthy lifestyle, compared to their non-lonely counterparts (Yarcheski et al, 2004; Segrin et al, 2010), such as being obese (Lauder et al, 2006; Peltzer & Pengpid, 2011), smoking (Dyal & Valente, 2015), heavy drinking (Åkerlind & Hörnquist, 1992; Hawkley et al, 2010), engaging in

aggressive behaviours or risky sexual behaviours (Peltzer & Pengpid, 2017), having a sedentary lifestyle (McAuley e al, 2007; Shankar et al, 2011), and poor eating patterns (Peplau & Perlman, 1982; Zeeck et al, 2011). Loneliness in a young age can predict health outcomes in later lives, including high cardiovascular risks, impaired immunity (Hawkley & Capitanio, 2015), high blood pressure and cholesterol level (Caspi et al, 2006), or even more severe health conditions such as malignant tumours (Thomas & Duszynski, 1974; Hermes et al, 2009).

Objective social isolation also has profound health consequences, for example, increased total high-density lipoprotein (HDL) cholesterol ratio (Grant et al, 2009), and hypertension (Shankar et al, 2011; Grant et al, 2009). There is also an increased risk of institutionalisation (Brock & O'Sullivan, 1985; Steinbach, 1992; Keefe et al, 2006; Shaw et al, 2017) and rehospitalisation for those who are objectively socially isolated (Mistry et al, 2001; Gorji et al, 2019; Shaw et al, 2017; Saito et al, 2019; Longman et al, 2013). Objective social isolation has also been positively linked to increased risks of coronary heart disease and heart events (Bunker et al, 2003; Mendes de Leon et al, 2001; Boden-Albala et al, 2005; Cohen et al, 1997; Valtorta et al, 2016b), elevated vulnerability to cancer (Ertel et al, 2009; Umberson & Montez, 2010) and increased suicidal risk (Calati et al, 2019; Kawachi et al, 1996), especially for men (Berkman et al, 2004). Consequently, objective social isolation may potentially elevate all-cause mortality rate (i.e. 2-4 times higher than socially connected populations; Eng et al, 2002; Friedmann et al, 2006; Berkman & Syme, 1979; Laugesen et al, 2018; Berkman et al, 2004; Holt-Lunstad et al, 2010), after controlling for other potential confounding factors, for example, blood pressure, smoking status and serum cholesterol levels (Shoenbach et al, 1986). Diminished health behaviours have also been associated with objective social isolation (Christakis & Fowler, 2008; Rosenquist et al, 2010; Shankar, 2011; Cornwell & Waite, 2009b), including physical inactivity (Hawkley et al, 2009; Kharicha et al, 2007; Shankar et al, 2011; Schrempft et al, 2019), smoking (Lauder et al, 2006; Shankar et al, 2011), drinking problem (Rosenquist et al, 2010), obesity (Christakis & Fowler, 2008; Holt-Lunstad et al, 2010) and unhealthy diet behaviours (Locher et al, 2005; Conklin et al, 2014; Christakis et al, 2007, 2008; Berkman et al, 2015).

Literature to date has advanced our understanding of the harmful impact of subjective and objective social isolation on physical health outcomes. These developments in both issues have heightened the need for more research in the field of mental health. Researchers have shown an increased interest in addressing whether subjective and objective social isolation have deleterious effects not only on the onset of mental health symptoms in the general population, but also on the progression of these symptoms in clinical samples with varied mental health diagnoses. However, the generalisability of many published studies on both issues remain problematic, with positive cross-sectional evidence lacking its power to inform the directions of causality between subjective and objective social isolation and mental health problems, and findings from longitudinal research remain mixed. Over the past century, although there has been a dramatic increase in promoting patient-centred personal recovery and quality of life for mental health service users, studies investigating the relationship between subjective and objective social isolation, quality of life and personal recovery are rather scarce. In the next section, I will focus on subjective social isolation and its effect on the onset of mental health symptoms in the general population, and the maintenance of symptom severity, personal recovery, as well as quality of life in people with mental health symptoms.

2.2. Subjective social isolation as a predictor for mental health

An extensive body of research has been conducted on the predictive role of loneliness in early mental health symptoms during the prodromal stage and its importance in the maintenance of these symptoms among people with mental health diagnoses. In particular, loneliness has become a major area of interest within the field of mental health. However, up to now, research has been mostly restricted to depression, especially in elderly samples. Few researchers have been able to draw on systematic research into the relationship between subjective social isolation and other diagnoses across the entire spectrum of mental disorders, such as PTSD and eating disorders, however, there is a growing interest recently in the field of psychosis.

2.2.1. Subjective social isolation as a predictor for the onset of mental illness

In the general population, subjective social isolation is perceived as one significant independent factor in predicting the development of mental illness in later life.

Depression: One systematic review involving 51 cross-sectional studies (Santini et al, 2014) concluded that perceived social support, in particular perceived emotional and instrumental support, can protect against depression in the general population. Focusing on both cross-sectional and longitudinal studies, another systematic review (Schwartz et al, 2014) also supported a negative relationship between the qualitative aspects of social relationships (e.g. perceived social support, quality of relations, presence of confidants) and depression in older adults.

There has been a considerable amount of cross-sectional evidence suggesting an association between loneliness and depressive symptoms (e.g. Ioannou et al, 2018). For example, based on a representative health survey in Singapore, Ge and colleagues (2017) confirmed an association between great loneliness and high depressive symptom score after controlling for confounders such as age, gender and employment status. However, due to the nature of a cross-sectional design, many studies could not draw any conclusions on the causal inferences between greater loneliness and more severe depressive symptoms in the general population.

Growing evidence from few recently published longitudinal studies also supports an unambiguous relationship between loneliness and the onset of depressive symptoms in various community samples (e.g. Lim et al, 2016; van Winkel et al, 2017; Domènech-Abella et al, 2019). For example, in a general community sample in a cross-lagged structural equation model, loneliness assessed at an earlier time point was a potential antecedent to future poor mental health outcomes, including depression. However, in the same model, future loneliness was not predicted by depressive symptoms at an earlier time point (Lim et al, 2016). The impact of loneliness on the development of depressive symptomatology has also been investigated in a five-year longitudinal study of a sample of middle-aged adults and elderly (Vanderweele et al, 2011).

Vanderweele and colleagues (2011) found that interventions reducing loneliness by 1 SD on their loneliness scale one and two years prior to the assessment of depression were associated with a reduction of 0.33 SD on their depressive symptomatology scale. On a smilar note, Adam and colleagues (2011) also found that among young people, a 1 SD increase on their loneliness scale at Wave I and II was associated with a 0.062 SD increase in depressive symptoms at Wave III, but a 1 SD increase in their sense of being loved and accepted at Wave I was linked to a 0.058 SD decrease in the depressive symptomatology score at Wave III. Using the Cumulative Relationship Risk Index to measure the number of relationship risks for each youth, the authors compared five youth groups: youth with no relationship risk, youth with one risk, and youth with two, three and four relationship risks. They found that youth with one, two, three and four relationship risk(s) had an increase of 0.07, 0.28, 0.42 and 0.44 SD in their depressive symptoms, respectively. This finding indicates a linear increase in the depressive symptoms with each additional risk reported, after controlling for baseline health status, demographic factors and their health behaviours. Drawing data from the Irish Longitudinal Study on Ageing, in their recently published longitudinal study of adults aged 50 and over, Domènech-Abella et al (2019) also discovered a strong and bidirectional relationship between great loneliness and a high risk of developing major depressive disorder (MDD) and generalised anxiety disorder (GAP) at two-year follow-up.

The importance of having positive parental relationships during the developmental period (Bowlby, 1997) has been implicated in longitudinal research in depression (Rauer et al, 2013). Moreover, emotional support from children also serves as a protective factor against depressive symptoms for their parents (Santini et al, 2016). An eight-year prospective study from Qualter and colleagues (2010) supports prolonged loneliness in one's childhood as a predictor of depressive symptoms at age 13. For adolescents, supportive peer relationships are a crucial factor in protecting against the onset of depressive symptoms during adolescence (e.g. Platt et al, 2013). Early psychological dysfunctions stemming from poor peer relationships have been linked to loneliness (Killen & Rutland, 2011; Killen et al, 2008; Asher et al, 1990; Cassidy & Asher, 1992; Fontaine et al, 2009; Ladd & Troop-Gordon, 2003; Kochenderfer-Ladd & Wardrop, 2003; Ladd et al, 2014), and longitudinal studies also found a

profound impact of long-term peer rejection on loneliness and subsequent depressive symptoms (Burks et al, 1995; Boivin et al, 1995; Prinstein & Aikins, 2004). Concerning evidence suggests that peer rejection may further result in decreased psychological and emotional wellbeing (Schneider et al, 1994; Ladd & Troop-Gordon, 2003; Kiesner, 2002; Reyome et al, 2010), reduced ability to cope with future social interactions (Harb et al, 2002), and a higher risk of maladjustment (Kaplow et al, 2000; Reyome, 2010). Peer rejection may also lead to more internalising problems in later life, including depression, low sense of self-worth (Fontaine et al, 2009) and anxiety (Boivin et al, 1995; McDougall et al, 2001; Cicchetti & Toth, 1998; Fontaine et al, 2009), especially social anxiety (Sletta et al, 1996; Inderbitzen et al, 1997).

Dementia and cognitive function: For people at their old age, their social environment serves as one fundamental factor contributing to their psychological balance and health (Berkman et al, 2000). Loneliness has been linked to the onset of dementia and cognitive decline (Wilson, 1987; Cacioppo et al, 2014b), and a large body of longitudinal research has been carried out in the past decades to investigate this relationship further. In a cohort study of older people without dementia, after adjusting all risk factors, the lonely ones were at a higher risk of developing dementia three years later than those who were not lonely (Holwerda et al, 2014). This relationship was also confirmed in two comparable longitudinal studies (Tilvis et al, 2004; Wilson et al, 2007) with longer follow-ups (i.e. 10-year and 65-month follow-up, respectively). In another longitudinal study, Seeman and colleagues (2001) discovered that a high level of emotional support at baseline was an independent predictor for improved cognitive function at 7.5-year follow-up, after controlling for baseline cognitive function and a number of confounding factors such as sociodemographic variables. In a meta-analysis (Kuiper et al, 2015) including 19 longitudinal cohort studies, the authors also confirmed an association between greater loneliness and a higher incidence of dementia.

Posttraumatic stress disorder (PTSD): The onset of PTSD symptoms has been linked to the qualitative aspects of social relationships, such as poor quality of social support and low level of perceived social support (e.g. Lee, 2019; Brancu et al, 2014). Two meta-analyses were conducted by Brewin et al (2000) and Ozer et al (2003), and both reviewed a large body of studies examining potential

contributing factors to the onset of PTSD symptoms. Including a wide range of study designs, the authors from the two meta-analyses concluded that social support was one of the most potent predictive factors for PTSD, among other pre- and post-trauma factors. Harvey (1996) argues for an ecological theory for trauma recovery. For children who were victims of crimes, she hypothesises that children's vulnerability to a psychological trauma may be determined by the perceived level of support from their family, especially from the mother. Perceived social support from family has a positive impact on children's adjustment to traumatic events and the development of PTSD symptoms (Elliott & Carnes, 2001). The relationship between adequate support from different social resources and PTSD symptoms has been supported by a number of cross-sectional studies (e.g. Bernard-Bonnin et al, 2008; Hyman et al, 2003; Pina et al, 2008; Morley & Kohrt, 2013). For example, in a cross-sectional cohort study of a sample of Nepalese child soldiers, Morley and Kohrt (2013) found an association between decreased peer support and worse PTSD symptoms post-war. Hyman and colleagues (2003) also observed a relationship between social support and the development of PTSD. To be more specific, by combining self-esteem support and appraisal support, Hyman et al. reported that childhood sexual abuse survivors were able to cope with difficulties more efficiently, and consequently they had a lower likelihood of developing PTSD. Pina and colleagues (2008) recruited a sample of youth who experienced Hurricane Katrina, and they discovered that extra help from either family or health professional was linked to reduced PTSD symptoms. A meta-ethnography approach was adopted by Sleijpen et al (2016). Based on the qualitative evidence from young refugees who were exposed to war and immigration, they found that social support from four primary resources, including family, people with the same cultural background, peers and professionals, has considerable health promotion effect during the process of stress coping. Another review (Afifi & MacMillan, 2011) also proposed a positive relationship between having a stable family environment, supportive relationships and greater resilience against stress resulting from child maltreatment.

A substantial number of longitudinal research also supports this relationship. A recent three-wave longitudinal study underscores the importance of perceived social support as a mediator between immediate emotional responses to trauma

and trauma-related psychopathology (Neria et al, 2019). Another longitudinal study was conducted in a sample of Palestinian residents of Gaza, Hall and colleagues (2015) identified a high incidence of PTSD in their sample, and the results support the benefit of having family and friends support in reducing the number of incident cases of PTSD over a 6-month follow-up period. A comparable result was also established in another longitudinal study (Koenen et al, 2003) of a sample of American Legionnaires, in which there was a significant association between lack of perceived social support at homecoming (i.e. year 1975) and a higher risk of developing PTSD at time 1 (i.e. year 1984). A couple of longitudinal studies also support a bidirectional relationship between social support and PTSD: a cross-lagged panel analysis conducted by Kaniasty and Norris (2008) demonstrates a 'support-to-distress' relationship between having more social support and a lower likelihood of developing PTSD among victims of natural disasters. A comparable association was illustrated by another longitudinal study using the Galveston Bay Recovery Study data (Platt et al, 2016), in which emotional support at time 1 had a negative relationship with PTSD symptoms at time 2. However, no significant association was found between informational support, tangible support and PTSD symptoms.

Eating disorders: Difficulties in social relationships may precede the onset of eating disorders (e.g. Krug et al, 2013). The perception of receiving poor social support from different social resources has been determined as a predisposing factor for emotional dysregulation, which is well characterised in anorexia nervosa (AN) (Kim et al, 2011; Adenzato et al, 2012) and the development of negative feelings towards one's body image (Limbert, 2010). One study of an adolescent sample evaluated a cross-sectional relationship between peer relationships and abnormal eating behaviours, suggesting perceived peer influence as an essential factor in determining the development of distorted body images and eating behaviours among adolescents (Lieberman et al, 2001). A comparable finding was reported by Hutchinson & Rapee (2007), they also demonstrated a contributing role played by perceived peer influence in the development of weight-related attitudes and eating behaviours. Combing qualitative and quantitative methods, Cardi and colleagues (2018) assessed patients with lifetime AN, two-third of the participants recalled that early social difficulties predicated their illness onset. The authrors also acknowledged that

these difficulties played an important part in the subsequent development of their eating disorder symptoms. A mixed methods research also identified an association between greater loneliness and poorer social functioning and a diagnosis of bulimia nervosa (BN) or anorexia nervosa (AN) (Coric & Murstein, 1993). Although a number of cross-sectional studies have been carried out on the underlying risk factors for the onset of eating disorders, to the best of our knowledge, very few longitudinal studies have been conducted to investigate subjective social isolation prior to the onset of distorted eating behaviours in community samples. Only one prospective study demonstrates that for young people with eating disorders, there was a positive association between psychosocial problems during childhood and an increased risk of psychiatric disturbance. Additionally, parents' perceived child overweight was found to be the most important predictor for the development of eating disorder (Allen et al, 2009).

Psychosis: So far, there has been little discussion in research regarding loneliness and the onset of psychosis. Cross-sectional evidence has suggested that the onset of psychotic symptoms, such as hearing voices or paranoia, was associated with low perceived social support and great loneliness (Freeman et al, 2011; Alptekin et al, 2009; Robustelli et al, 2017). A qualitative study involving problem-centred interviews also reported that people with schizophrenia identified seclusion, loneliness and social isolation as determinants for the occurrence of their illness along with other psychosocial stress factors (Holzinger et al, 2002). On the other hand, having an adequate level of perceived social support has been associated with the absence of these symptoms in a sample of at-risk adolescents after being exposed to victimisation (Crush et al, 2018a; Crush et al, 2018b).

Again, only a few longitudinal studies have been carried out to identify the contributing effect of loneliness (van der Werf et al, 2010; Lim et al, 2016) on a great variety of psychotic symptoms in the general population, with many highlight the probability of an inter-relation of loneliness and psychosis at a subclinical stage (da Rocha et al, 2018). A recent analysis carried out by Lim and colleagues (2016) is possibly the most recent and well-designed research with a principal focus on the relationship between loneliness and mental health symptoms in the general population. The results of this research provided preliminary evidence on

the association between loneliness and psychosis, which suggests loneliness as a potential antecedent to emerging symptoms of paranoia in a general community sample. Given the direction of observed effect cannot be substantiated in studies with a cross-sectional design, more longitudinal studies therefore are needed to clarify whether loneliness occurs at a specific time before the onset of psychotic symptoms, or whether psychotic symptoms serve as a strong triggering factor for loneliness.

Suicide: Long-term non-suicidal self-injury (NSSI), such as scratching and cutting, has been linked to certain mental health problems, such as depression and borderline personality disorders (Nock, 2009; Jacobson et al, 2008; Wilkinson & Goodyer, 2011; Crowell et al, 2012). Current evidence, from both cross-sectional and longitudinal research, also demonstrates a significant relationship between self-injury behaviours and parent- and peer-related loneliness, such as parental neglect and peer rejection (Brunner et al, 2014; Wright, 2016). Suicide has also been linked to loneliness. Case-control and cross-sectional studies have associated suicidal ideation and suicidal attempt with loneliness (e.g. Goldsmith et al, 2002; Lyons, 1985; Kirkpatrick et al, 1992), and the impact of peer relationships was especially prominent on suicidal ideation and suicidal attempts among adolescents (e.g. Cui et al, 2010). Some longitudinal studies (e.g. Jones et al, 2011; Schinka et al, 2013) also indicate an association between loneliness in childhood and adolescence and suicidal thoughts/self-harming later in life. A number of studies have investigated the relationship between perceived social support and suicidality in vulnerable populations (e.g. Yang & Clum, 1994; Kleiman & Liu, 2013; Levi-Belz et al, 2013, 2014). Compelling evidence suggests low perceived social support as a predecessor of suicidality among adolescents (Levi-Belz et al, 2019). On the other hand, sufficient perceived social support may serve as a strong protective factor against suicide in a sample of women who were victims of abuse (Meadows et al, 2005).

Addiction: The course of alcohol abuse is characterised by the feeling of loneliness (Kim, 1999; Hawkley & Cacioppo, 2010), low social support (Schilit & Gomberg, 1987; Hunter-Reel et al, 2010), and deficits in social interactions (Åkerlind & Hornquist, 1992). In fact, some studies describe alcoholism as 'the lonely disease' (Åkerlind & Hornquist, 1992; Alcoholics Anonymous, 1983). Based on the cross-sectional and longitudinal data from two samples of young

adults, Sadava and Pak (1994) found that unattached adults (i.e. unmarried or not in ‘a serious relationship’) were more likely to become lonely, they had a lower satisfaction towards the support they received and had more problematic drinking behaviours, compared to attached people. On the other hand, an increased satisfaction towards social relationships may serve as a facilitator during sobriety (Åkerlind et al, 1990a, 1990b). Qualitative research exploring the benefits of an alcohol-related online forum also discovered a facilitating role of mutual support among members in participants’ drinking patterns (Coulson, 2013). Furthermore, several studies revealed that not only lonely people tend to be heavier smokers than their non-lonely counterparts (Dyal & Valente, 2015), loneliness may also serve as one major factor contributing to drug addiction (Mijskovic, 1988; Stacy et al, 1995; Jensen et al, 1994; Hosseinbor et al, 2014) and generalised pathological internet use (Gao et al, 2018).

In summary, there are a substantial number of studies focusing on loneliness and depression in the general population, and longitudinal studies in both adults and adolescents have confirmed a longitudinal pathway from loneliness to depressive symptomology. A reverse pathway from depressive symptoms to loneliness is far from clear, given that published results from existing literature are rather ambiguous. Recently, despite a growing attention from pilot studies and compelling cross-sectional evidence supporting the association between loneliness and symptom onset, longitudinal evidence is still scarce for this area of research. Research in the past two decades has also evaluated the relationship between the qualitative aspects of social relationships (including loneliness), the incidence of dementia and of cognitive dysfunction in older people without dementia. Although initial evidence suggests that loneliness is a more pervasive issue among people with mental health problems than people without mental health symptoms, the association between subjective social isolation and the onset of mental health symptoms has largely been unexplored in mental disorders other than depression, such as PTSD and eating disorders. Furthermore, a large body of research to date has primarily focused on perceived social support or emotional support, rather than loneliness. The relationship between loneliness and the onset of early mental health symptoms during the prodromal stage therefore has not been clearly established.

2.2.2. Subjective social isolation as a predictor for clinical outcomes

For people with a mental health diagnosis, being lonely or having insufficient perceived social support may not only hinder their improvement of psychiatric symptoms, but also worsen their symptom severity (Wang et al, 2018b; Holahan and Moos, 1981).

Depression: Our previous knowledge of the relationship between depressive symptoms and loneliness is largely based upon empirical evidence from cross-sectional studies (e.g. Eiseman, 1984; Lasgaard et al, 2011; Lau et al, 1999). For example, a cross-sectional study from Stek and colleagues (2005) uncovered a poorer prognosis in depression among a group of lonely and depressed elderly than those who were depressed but not lonely. A large effect size (r=0.55-0.60) was also estimated in a meta-analysis investigating the relationship between depression and loneliness among adolescents from 33 included cross-sectional studies (Mahon et al, 2006).

The importance of a longitudinal design in evaluating this relationship has been increasingly recognised, and a growing number of longitudinal studies have been published. Recent evidence demonstrates a moderate but stable association between loneliness and depressive symptoms over an individual's lifespan (Nolen-Hoeksema & Ahrens, 2002; Cacioppo et al, 2010; Cacioppo et al, 2006). A recent systematic review exclusively focusing on longitudinal quantitative studies further confirmed an association between subjective social isolation and depressive symptoms in clinical samples (Wang et al, 2018b). In this systematic review, a lower level of perceived social support at baseline or greater baseline loneliness was found to be the predictive factor against greater depressive symptom severity at follow-ups in eleven longitudinal studies. However, only two studies out of these eleven studies targeted loneliness specifically. A recently published longitudinal study in the Netherland also investigated the association between baseline loneliness and symptom severity at a two-year follow-up in a sample of older adults with major depression, dysthymia or minor depression. After fully adjusting the model, the results suggest that a 1-point higher score on the loneliness scale at baseline predicted a 0.61-point higher score on the scale assessing symptom severity (Holvast et al, 2015). Current literature also hypothesises that perceived relationship quality may accelerate symptoms

reduction in depression (Kawachi & Berkman, 2001; Laird et al, 2019), and this hypothesis was supported by a number of longitudinal studies (e.g. Bosworth et al, 2008; Leskela et al, 2006; Steffens et al, 2005).

Concerning treatment responsiveness in patients with depression, intervention studies (e.g. Sherbourne et al, 2004; Dew et al, 1997) and a comprehensive review (Carter et al, 2012) suggest that treatment non-responders tend to have poorer social support than full responders. A high level of perceived social support has also been associated with a reduced possibility of recurrent depressive episodes in both longitudinal (Bosworth et al, 2002) and cross-sectional studies (Sherbourne et al, 1995). Longitudinal evidence also supports functional social support (i.e. perceived relationship quality and instrumental support) as the most effective factor in improving depression (Cappeliez et al, 2017; Brummett et al, 2000).

A broader perspective was adopted by Wang and colleagues (2018b) in their systematic review; the authors confirmed the deleterious effects of having a low level of perceived social support and great loneliness on the remission of depression. Indeed, the illness trajectory and social relationships interact with each other. While a person's illness may have an impact on the dynamics, functional and structural aspects of his/her social network, one's illness is not only defined by the members of his/her social network, the subsequent responses to one's illness (i.e. recognise or dismiss the symptoms) are also partially determined by these members (Thoits, 2011; Perry & Pescosolido, 2015). Furthermore, people with adequate social connections may also have a positive attitude towards help-seeking behaviours (Prince et al, 2018). For example, they may actively seek medical advice, and this attitude may gradually develop via socialisation (Lo & Stacey, 2008; Perry & Pescosolido, 2015).

Bipolar disorders: In people with bipolar disorders, perceived social support is a significant risk factor contributing to relapse (Johnson et al, 2003). Social Zeitgeber theory (Ehlers et al, 1988) proposes that in bipolar disorders, symptoms of depression, mania or hypomania, sleep disturbance (Harvey, 2008), and social rhythms (Grandin et al, 2006) (i.e. defined as the frequency of daily activities and the regularity of social contacts associated with these activities; Monk et al, 1990), may increase the risk of relapse during the inter-episode period. In their cross-

sectional study, Prigerson et al (1993) discovered that having a sufficient level of social support may potentially decrease the instability of social rhythm. However, robust evidence from cross-sectional research illustrates that people with bipolar disorders tend to have a lower level of perceived social support than their healthy counterparts (Beyer et al, 2003; Romans & McPherson, 1992). Additionally, this clinical group may also experience more interpersonal problems, receive less family support but a higher degree of express emotions at home (Ramana & Bebbington, 1995; Miklowitz, 2010). However, perceived social support seems only linked to depressive symptoms in bipolar disorders. Koenders and colleagues' (2015) prospective research discovered a bidirectional relationship between perceived social support and the recurrence of depressive symptoms in bipolar disorders. Other longitudinal research also failed to find any association between perceived social support and the recurrence of manic symptoms (e.g. Johnson et al, 1999; Daniels, 2000), and this relationship persists even after accounting for confounding factors such as medication compliance and clinical history (Cohen et al, 2004).

PTSD: The relationship between subjective social isolation and PTSD symptoms in people with a diagnosis of PTSD is under-examined, both cross-sectionally and longitudinally. With only 17 studies retrieved, a systematic narrative review examining social isolation and loneliness in veterans underlines the lack of research in this specific diagnostic group (Wilson et al, 2018). Literature to date has acknowledged the co-occurrence of loneliness and PTSD (Solomon & Dekel, 2008). It has also been suggested that low perceived social support is more prevalent in people with complex PTSD, and there was a unique cross-sectional association between perceived social support and complex PTSD in a research conducted by Simon and colleagues (2019). In one longitudinal research of adult trauma survivors, Robinaugh and colleagues (2012) found an association between perceived social support and the maintenance of PTSD symptom severity when negative post-trauma cognitions were jointly assessed. Overall, with the majority of studies that are cross-sectional in nature, there is still uncertainty over the relationship between subjective social isolation and PTSD.

Psychosis: Loneliness is a prevalent issue for people with psychosis (Davidson & Stayner, 1997; Czernik & Steinmeyer, 1974; Stain et al, 2012; Meltzer et al, 2013). Compared to a non-clinical sample, patients with psychosis were up to six

times more likely to report being lonely in a cross-sectional survey (Meltzer et al, 2013). The mean level of loneliness was also approaching one SD higher in people with a diagnosis of schizophrenia or schizoaffective disorder than those without these diagnoses (Eglit et al, 2018), despite some having expressed their desire to maintain contact with people in the community who are outside their mental health services (DeNiro, 1995; Morgan et al, 2012). Psychosis remains an under-researched area, especially studies examining the longitudinal impact of subjective social isolation on psychotic symptoms, compared to research with a primary focus on depression. Until recently, there has been no reliable longitudinal evidence supporting the relationship between psychotic symptoms and subjective social isolation, and most of the longitudinal research up to now has been restricted to the general population without a diagnosis within the spectrum of psychotic disorders. This lack of longitudinal research therefore precludes drawing reliable conclusions regarding the longitudinal impact of subjective social isolation on psychotic symptoms.

The relapse rate in psychosis has been linked to family relationships: expressed emotion from family members may not only result in negative emotions (Cechnicki et al, 2013; Amaresha & Venkatasubramanian, 2012), and decreased self-esteem and self-worth in people with schizophrenia (Barrowclough & Hooley, 2003), expressed emotion also predicts high relapse rates (Pharoah et al, 2006; Yang et al, 2004). A warm attitude from family members towards patients may instead prevent relapse (López et al, 2004).

Eating disorders: Distorted eating behaviours have been documented in cross-sectional studies of people with poor perceived social support (Mason & Lewis, 2015; Wiedemann et al, 2018). Loneliness and negative experiences in relationships are maintaining factors for eating disorder symptoms (Arcelus et al, 2013; Cardi et al, 2018) and both serve as significant contributing factors to greater symptom severity (Levine, 2012). A large body of cross-sectional and qualitative research exploring this relationship has been carried out in samples with a diagnosis of AN or BN (e.g. Fox & Diab, 2015; Rhind et al, 2014), and many researchers combined both qualitative and quantitative methods (e.g. Cardi et al, 2018; Pollack et al, 2015). However, again these hypotheses have yet been verified longitudinally. Overall, there is a lack of longitudinal evidence, as emphasised in the systematic review conducted by Arcelus and colleagues

(2013). Therefore, the direction of causality of the association between loneliness and the maintenance of eating disorder behaviours cannot be determined, and the findings from these cross-sectional studies should be interpreted with caution.

Learning disabilities: Similarly, for children and young students with learning disabilities, previous cross-sectional research has demonstrated that this population tends to be lonelier and less socially competent, especially for those in their pre-adolescent age (Margalit & Ronen, 1993), compared to students without learning disabilities (Margalit & Ben-dov, 1995; Pavri & Monda-Amaya, 2000; Pijl et al, 2010). Desipte many have reported a desire to build interpersonal relationships (Strunz et al, 2016), loneliness is frequently reported by people with autism spectrum disorder (ASD), and loneliness may further result in more severity depressive and anxiety symptoms (Stice & Lavner, 2019; Gelbar et al, 2014; Jackson et al, 2018). Overall, evidence supporting subjective social isolation either as a contributing factor to or a maintaining factor for learning disabilities is scarce, with the majority of studies only indicating the social challenges, including loneliness faced by children and young people with learning disabilities or ASD. Therefore, at this point, null evidence to date can support a causal pathway from loneliness to learning disabilities, or vice versa.

Personality disorders: Certain types of personality disorders have been associated with greater loneliness, compared to other types. For example, for people with borderline personality disorders (Richman & Sokolove, 1992; Liebke et al, 2017) and schizoid personality disorder (Martens et al, 2010), cross-sectional evidence illustrates that their lives are more likely to be disrupted by extreme loneliness than those with other psychiatric disorders.

Suicide: Suicide is recognised as the leading cause of death in the UK among people aged 20-34, and there were nearly 6000 suicides in the UK in 2017 alone (Office for National Statistics, 2018). Suicidal prevention requires a willingness to disclose current suicidal ideation (Frey et al, 2016). However, people with social loneliness also have a tendency to withhold suicidal thoughts (Mérelle et al, 2018; Kahn & Cantwell, 2017). When a sample of depressed people with high suicidal ideation was compared to those with depression but low in suicidal ideation (Clum et al, 1997), more suicidal thoughts from the former were consistently associated with a low level of perceived social support, even after depression was controlled

for. It is important to note that all studies are restricted by their cross-sectional study design. Longitudinal studies examining these relationships thereby are recommended.

Addiction: Loneliness and poor perceived social support may reinforce the development of alcohol abuse when abnormal drinking behaviours are emerging. Both factors also serve as barriers when an individual attempts to abstain from alcohol. It has been suggested that lonely people are more likely to drink than those who are not lonely. A qualitative study hypothesises that drinking may either serves as a solution for the lonely ones to cope with their loneliness and express their emotions (Creighton et al, 2016), or it is a behavioural response to their problems and daily stress (Peplau & Perlman, 1982; Moos et al, 2003; O'Hare, 2001). Regarding drug abuse and dependence, in a sample of regular users of methamphetamine who were followed up for five years, a low self-perceived level of social support was disclosed by the participants, Lanyon and colleagues (2019) also discovered an independent association between having a low level of perceived social support and methamphetamine dependence in this sample. On the contrary, a relationship between high perceived social support and a reduced possibility of methamphetamine dependence was also demonstrated in the same study. Not only is perceived social support considered as a critical factor for the maintenance of drug abstinence (Salmon et al, 2000), a high retention rate was also linked to a high functional social support longitudinally when a sample of substance abuser was receiving a treatment programme for their drug addiction (Dobkin et al, 2001). These findings are further supported by a recent study with a cross-sectional design (Bathish et al, 2017) and qualitative research of a group of recovering drug addicts (Mcintosh & McKeganey, 2000), in which the recovery process from addiction was characterised by a social identity switch, non-drug-related activities and relationships.

The consensus from existing evidence supports subjective social isolation as a significant factor associated with worse depressive symptoms, as found in numerous cross-sectional and some longitudinal studies. High rates of recurrence in patients with bipolar disorder and psychosis have been linked to subjective social isolation, but longitudinal evidence supporting this relationship in clinical samples remains scarce. Likewise, only cross-sectional studies were

carried out with a focus on samples with eating disorders, and there is an absence of evidence on the association between subjective social isolation and learning disabilities, similar to that of personality disorders. Therefore, although many theories and hypothesises have been put forward to address the mechanisms through which subjective social isolation may affect mental health outcomes, evidence from large-scale longitudinal studies remains scarce. No definite conclusions can be drawn concerning the direction of causality between subjective social isolation and psychiatric symptomology in mental health populations. Furthermore, a substantial amount of literature to date has only focused on perceived social support, rather than loneliness. Therefore, the relationship between loneliness and mental health outcomes is not as clearly established as the association between perceived social support and mental health outcomes. More rigorous longitudinal research is needed to untangle the relationship between loneliness and the progression of psychiatric symptoms in clinical populations.

2.2.3. Subjective social isolation as a predictor of personal recovery

The relationship between subjective social isolation, personal recovery and quality of life, has been increasingly recognised in mental health research.

Personal recovery: In the mental health field, 'recovery' is the term to describe the experience of individuals who have overcome the stigma and the challenges from having a mental disorder (Shepherd et al, 2008). The National Consensus Statement on Mental Health Recovery defines 'recovery' as a process of healing that individuals with mental illnesses go through in order to re-attain a meaningful life in their local community and achieve their own potentials (USDHHS, 2006). The National Institute for Mental Health in England also defines 'recovery' as an 'achievement of a personally acceptable quality of life' (National Institute for Mental Health in England, 2004, p.2). Historically, 'recovery', also termed as 'service-based definition of recovery' (Schrank & Slade, 2007), was defined simply as 'symptom remission and re-attain premorbid functioning' (Mueser et al, 2002), or an improvement in a person's general functioning after treatments (Harding et al, 1987). Since then, mental health research has moved forward to develop a more meaningful definition for people with mental health issues

(Andresen et al, 2003). This movement involved a shift from a traditional clinical recovery framework, which is based on professional-led research (Meehan et al, 2008), to a new concept of subjective personal recovery or user-based recovery. This new concept focuses on personal experiences and personal goals for recovery (Slade, 2009). The traditional clinical recovery focuses heavily on risk management, relapse prevention, assessments of health outcomes and global functioning for the promotion of mental health services (Meehan et al, 2008). But now, with a person-centred and strengths-based approach (Sell et al, 2006), 'recovery' is acknowledged as a multifaceted and multidimensional concept, which comprised of both autonomous and relational aspects (Onken et al, 2007). The word 'recovery' is also emphasised by the Transforming Mental Health Care in America as one single vital goal to achieve in the mental health system (USDHHS, 2006). As both a process and outcome, 'recovery' prioritises 'strength, self-agency and hope, interdependency and giving, and systematic effort, which entails risk-taking' (Ramon et al, 2007, p.119). The relational dimension of 'recovery' underscores the significance of interpersonal and family relationships and social contact with family and friends (Liberman & Kopelowicz, 2005). Its autonomous aspect highlights the importance of personal strength, self-agency and self-efficacy (Pernice-Duca, 2010).

Recent evidence suggests a relationship between loneliness and personal recovery (e.g. Roe et al, 2011). However, again there is substantially less literature investigating this relationship longitudinally. One cross-sectional study from Pernice-Duca (2010) explored the perspectives of family support from mental health service consumers in the community, and the results indicate the quality of family support as a more crucial factor in one's personal recovery than its quantity. Another study of people diagnosed with schizophrenia or schizoaffective disorder was conducted by Roe and colleagues (2011), who also reported a cross-sectional relationship between subjective personal recovery and loneliness, mediated by quality of life. Therefore, the evidence to date cannot establish whether being lonely hinders individuals' process of personal recovery, or having a good personal recovery contributes to improved social relationships with others. Therefore, more longitudinal research in personal recovery is needed, in order to determine the causal direction of the relationship between subjective social isolation and personal recovery.

Quality of life: The association between loneliness and depression has been long established, and quality of life is believed to be influenced by both loneliness and depression (Perlman & Uhlmann, 1991; Chen & Feeley, 2014; Shiovitz-Ezra & Leitsch, 2010; Odlum et al, 2018). Quality of life is acknowledged as the perceived position of an individual's life based on the culture and value he/she confides in, and it is related to his/her own expectations, goals and standards (WHOQOL group, 1998). Diminished quality of life is frequently reported by vulnerable populations, such as children and adolescents with mental health problems (Bastiaansen et al, 2004; 2005). The relationship between loneliness and poor quality of life has been established across different populations, such as mental health service users (Borge et al, 1999; Weiner et al, 2010) and older adults (Musich et al, 2015). The majority of these studies were conducted cross-sectionally; however, findings from one PhD paper (Wang, 2018a) discovered a relationship between greater baseline loneliness and poorer quality of life at 4-month follow-up in people with mental health problems, after adjusting for baseline quality of life, sociodemographic, psychiatric, and psychosocial confounding variables. Numerous researchers have also linked perceived social support to quality of life in people with severe mental illness (SMI) in their cross-sectional study (e.g. Yen et al, 2007; Koivumaa et al, 1996; Eack et al, 2007; Bechdolf et al, 2003), all of which provided preliminary evidence of the impact of subjective social factors on quality of life in this clinical population. However, very few studies examined this relationship longitudinally (e.g. Shrestha et al, 2015; Ritsner, 2003), therefore much uncertainty still exists concerning the importance of subjective social isolation in affecting the lives of patients with mental illnesses beyond symptoms remission.

Overall, despite emerging discussion of the importance of promoting person-centred care and recovery in mental health systems (HM Government, 2011), very few prospective studies have been carried out. Therefore, no definite conclusions can be drawn concerning the impact of subjective social isolation on both quality of life and personal recovery for people with mental health problems. Therefore, more high-quality and well-conducted longitudinal research is needed to establish the precise relationship between subjective social isolation, including loneliness, and subjective personal recovery in people with mental health problems.

2.2.4. Subjective social isolation and its mechanisms of effect in mental health

As discussed in the previous sections, evidence regarding the impact of subjective social isolation (including loneliness and perceived social support) on the onset of mental illness, the progression of symptom severity, quality of life, and personal recovery has been mostly restricted to cross-sectional studies. Only a handful of studies were longitudinal, and a few of them have focused on the relationship between subjective social isolation and common mental disorders other than depression. Several attempts have been made to address the mechanisms through which subjective social isolation affects mental health.

Biological process: The biological processes behind the associations between loneliness and physical outcomes have been clearly-established in previous literature; therefore, it is hypothesised that specific biological processes may also explain the relationship between loneliness and mental health outcomes. So far, our understanding in these biological processes is largely based upon studies with a primary focus on depressive symptoms. Preliminary evidence has linked loneliness to an increased number of stress-induced natural killer cells (Steptoe et al, 2004), this increase may in turn induce a considerable amount of mental stress, which has also been associated with depression (Zorrilla et al, 2001). Therefore, the number of natural killer cells may partially mediate the relationship between loneliness and depression.

One explanation for the development of PTSD also comes from a neurobiological perspective. It has been suggested that noradrenergic dysregulation plays a key part in the pathophysiology of PTSD (Geracioti et al, 2001; Hendrickson & Raskind, 2016), and stress resilience is believed to be involved in the optimal operation of the noradrenergic activity and hypothalamic-pituitary-adrenocortical (HPA) system when exposed to stressors (Charney, 2004; Koss & Gunnar, 2017). Given the possibility that having high-quality social support strengthens individuals' stress resilience, it is theorised that social support also helps to optimise the HPA system, consequently, it reduces the risk of developing PTSD symptoms (Ozbay et al, 2007). Therefore, the relationship between loneliness, depression and PTSD is largely explained by the abnormal activities in our biological systems, resulting from the exposure to daily life stressors. Since

people with mental health problems tend to face a high level of stress resulting from a broad spectrum of risk factors, such as their illness and public stigma, we may expect that these stress-related biological systems may also potentially explain the associations between subjective social isolation and other mental health symptoms. However, more research needs to be undertaken to offer more insight into the biological mechanisms behind these relationships.

Risk factors: There is a consensus between researchers that depression and loneliness are correlated (Sergin, 1998; Wang et al, 2018b; Liu et al, 2014). Studies estimated that the correlation between the two constructs is ranging from 0.38 (Russell et al, 1978) to 0.71 (Young, 1979 from West et al, 1986). In a cross-sectional study, there was a moderate correlation between the 30-item Geriatric Depression Scale (GDS) and the UCLA Loneliness Scale (r=0.4 – 0.6) in a sample of middle-aged and older adults (Adams et al, 2004). Therefore, it is not surprising that many researchers maintain the view that loneliness shares many similar risk factors for depression, such as perceived life stress, isolation and stressful life events (Cacioppo et al, 2006). There is a possibility that the presence of these risk factors may increase individuals' vulnerability to both loneliness and depressive symptoms at the same time. For example, one common risk factor, social loss (e.g. bereavement, either actual or threatened) has been significantly linked to the occurrence of initial symptoms of depression, possibly via its direct impact on loneliness. Depressive symptoms may subsequently trigger a feedback loop, resulting in a lonelier state, and in turn reduce individuals' motivation to alleviate their loneliness (Fried et al, 2015; Robinaugh et al, 2014). In support of this hypothesis, Cacioppo's (2014) evolutional theory also puts forward the idea that loneliness may lead to negative emotions, which may further trigger depressed mood.

Mediators of loneliness and mental health outcomes: Loneliness may have an indirect impact on mental health outcomes, and other factors may serve as mediators explaining the relationship between loneliness and these outcomes. For people with mental health symptoms, loneliness may create a socially disadvantaged environment and increase the feeling of hopelessness. These feelings may further diminish their motivation to seek for social support for their own recovery, which may result in great symptom severity and poor personal recovery. Several studies suggest that loneliness precipitates the feeling of

hopelessness and motivational depletion (Stek et al, 2005; Golden et al, 2009; Tops et al. 2015), which may subsequently lead to other adverse consequences, such as reduced self-care ability (Siabani et al, 2013; Falk et al, 2007), decreased mobility (Buchman et al, 2010; Petersen et al, 2014), unhealthy eating (Sheahan & Fields, 2008; Ferry et al, 2005), abnormal coping styles (Vanhalst et al, 2012), low sense of control (van Belijouw et al, 2014), and low compliance with prescribed medications (Alexa et al, 2013). All these consequences were found to be even more pronounced when depression was also present with loneliness than loneliness alone (Max et al, 2005).

In the case of eating disorders, social avoidance (Treasure & Schmidt, 2013), inadequate family support (Ghaderi, 2003), anxiety towards friendships (Westwood et al, 2016), and low-quality friendships (Sharpe et al, 2014) are characterised as the core features of AN. Therefore, for people with eating disorders, restricted dieting could be adopted as an abnormal coping strategy to alleviate their loneliness (Gerner & Wilson, 2005). Such action could be perceived as a way to become more vulnerable or attractive, or it merely serves as a strategy to gain control in some aspects of his/her life. Similar coping strategies have also been observed in people with BN. It is hypothesised that in people diagnosed with BN, their binge eating behaviours may function as an escape solution to cope with their loneliness (Mason et al, 2015b). Another possibility is that loneliness may contribute to reduced self-regulation and increased irrational decision-making (Baumeister et al, 2002), which may further trigger more binge eating behaviours (Hawkley & Cacioppo, 2010).

For people with psychosis, their initial subclinical psychotic symptoms and the maintenance of these symptoms may result from a combination of several factors that are indirectly associated with loneliness (e.g. stigma, social isolation):

1) Garety and colleagues' (2001) cognitive model of positive symptoms theorises that the interplay between low self-esteem, negative self-concept (Trower & Chawick, 1995; Kinderman & Bentall, 1996; da Rocha et al, 2018), and emotional distress, resulting from loneliness and lack of support, may trigger negative interpersonal expectations or beliefs about oneself and others (Lamster et al, 2017). These negative beliefs or expecations may subsequently provoke more paranoia and delusional moments (Sündermann et al, 2012). This theory is

supported by a study using a time-sampling technique, the Experience Sampling Method (ESM). Myin-Germeys and colleagues (2001a) discovered that in a sample of patients with chronic schizophrenia, their delusional moments were accompanied by negative feelings, such as anxiety and loneliness. Therefore, it is hypothesised that negative emotions resulting from the feelings of loneliness or negative social interactions may disrupt people's thought process, subsequently patients experience difficulty in finding alternative explanations for their abnormal thoughts, which then lead to increased anxiety and paranoia (Sündermann et al, 2012; Lamster et al, 2016). Furthermore, Myin-Gemeys and colleagues (2001a) also found a relationship between having a companion and a reduced risk of experiencing delusional moments. On the contrary, withdrawing from social activities increased that risk.

The negative consequences of stigma, both interpersonal and internalised stigma, should also be acknowledged as significant contributing factors to this pathway. Self-stigma, also named 'the second illness' (Wahl, 1999), occurs when people with mental health diagnoses internalise the negative stereotypes and discriminations from the public (Link, 1987; Corrigan & Rao, 2012). Self-stigma may prevent people from achieving their life goal and succeeding in the job market and in personal relationships (Link, 1987; Corrigan, 2009). Stigma/discrimination has been listed as a priority in the agenda for the mental health service improvement by the World Health Organisation (2001). Not only do people with psychosis frequently report social stress and poor self-esteem (Aschbrenner et al, 2013), the stress-vulnerability model also proposes that social stress precipitates the initial episode of psychosis (Meyer-Lindenberg & Tost, 2012; van Zelst, 2008). Both social stress and low self-esteem have also been associated with loneliness, self-stigma and interpersonal stigma (Corrigan & Rao, 2012; Ritsner & Phelan, 2004). Therefore, one possible mechanism through which loneliness could lead to the initial psychotic symptoms is through poor self-esteem and increased social stress.

2) Epley and colleagues (2018) proposed another potential pathway involving the theory of 'anthropomorphism', and this pathway was subsequently supported by three studies conducted by the same authors. They discovered that being lonely was associated with an increased occurrence of human agency detection in the surrounding environment, which triggers hallucinations. The Social

Deafferentation hypothesis (Hoffman, 2007) also puts forward the idea that hallucinations may arise from imaging social interactions when people with psychosis are alone and lack of inputs from genuine social contact. For people with psychosis, their lack of social interaction may not only result from low motivation and hopeless feelings, with expectations of interpersonal stigma, patients may also actively avoid social situations as a consequence (Karidi et al, 2010).

3) Although Jaya and colleagues (2016) proposed an indirect pathway from loneliness to psychotic experiences via its impact on depressive symptoms, this finding is limited to its cross-sectional nature. Another cross-sectional study further confirmed a mediating role of anxiety between loneliness and paranoia (Sündermann et al, 2014). More robust evidence was suggested by a recent trial examining the association between loneliness and a number of mental health symptoms (e.g. depression, social anxiety and paranoia). The authors reported that loneliness at an earlier time point not only predicted paranoia directly at follow-up, loneliness also affected paranoia indirectly via its impact on social anxiety (Lim et al, 2016).

4) Maladaptive coping style, such as being less problem-focused, may also serve as another factor accelerating symptom manifestation and the onset of psychotic symptoms in people at ultra-high risk for psychosis (Folkman & Lazarus, 1980; Roe et al, 2006). On the contrary, having sufficient perceived social support promotes a more active coping style, for example, adopting problem-focused coping behaviours and seeking appropriate support from others (Mian, Lattanzi & Tognin, 2017).

In summary, four mechanisms were proposed to explain the pathway from loneliness to psychotic symptoms:

1) Loneliness ➡ negative self-concept, low self-esteem ➡ negative interpersonal expectations or beliefs about self or others ➡ distorted thinking process ➡ paranoia and delusional moments

2) Loneliness ➡ human agency detection ➡ hallucinations

3) Loneliness ➡ depression, social anxiety ➡ paranoia

4) Loneliness ➡ maladaptive coping style ➡ symptom manifestation, the onset of psychosis

Direct and indirect impact of perceived social support: In the last few decades, evidence has informed the direct and indirect effect of perceived social support on mental health outcomes.

1) Buffering effects model: It has been well-demonstrated by the stress-buffering model that perceived social support buffers against stress from negative events and life stressors while promoting mental health wellbeing, subsequently it prevents the transition to mental illness (Ioannou et al, 2018; Lakey & Cohen, 2000; Blazer, 2005; Jang et al, 2005; Cohen et al, 2000), especially when there is a moderate level of stress (Ioannou et al, 2018). One explanation is that when there is adequate social support, people tend to appraise situations in life instead of responding negatively, either emotionally or behaviourally (Thoits, 1986; Szymona-Palknowska et al, 2016). Two explanations may address the buffering effect of perceived social support on quality of life. Firstly, perceived social support may buffer against the damaging impact of chronic life stresses on people's emotional wellbeing, which subsequently leads to improved quality of life (Doeglas et al, 2004). It is also possible that perceived social support may improve quality of life indirectly by reducing one's depressive symptomatology, given there is a strong and unidirectional impact from depression to quality of life, and depression has been negatively associated with perceived social support (Abbey & Andrews, 1985; Bekele et al, 2012; Wicke et al, 2014). The buffering effect of perceived social support also explains the association between great perceived social support and a reduced risk for PTSD. It has been hypothesised that perceived social support buffers against life distress by building up individuals' resilience to these stressors after the exposure to adverse life events (Ozbay et al, 2007). This hypothesis is further supported by a cross-sectional study of unaccompanied refugee minors, in which Sierau and colleagues (2018) reported a buffering effect of perceived social support received from mentors on these minors' mental health.

2) Buffering effect model with mediation: The buffering effect model of perceived social support with mediation was also proposed. For example, it has been suggested that while reducing the impact of social stigma on one's emotional

wellbeing (Link & Phelan, 2001; Müller et al, 2006), perceived social support may also promote better mental health outcomes by directly improving individuals' affiliation, sense of belonging, self-respect, social recognition (i.e. role-based purpose and meaning) and affection (Schult & Gomberg, 1987). It has also been proposed that social support and social connectedness may strengthen a belief in people that they are loved and being cared for (Cobb, 1976; Fulginiti et al, 2016), which may improve not only their self-esteem but also their sense of belonging. For example, in the case of suicidal ideation, these beliefs may directly reduce the impact of other risk factors on suicidal ideation (e.g. negative life events/stress; Meadows et al, 2005), or it may indirectly reinforce other protective factors for suicidal ideation, such as increased self-esteem (Kleiman & Riskind, in press in Kleiman & Liu, 2013). By integrating two theoretical models, the interpersonal theory of suicide (Joiner, 2005) and the sociometer theory of self-esteem (Leary et al, 1995), the findings from a cross-sectional study produced evidence of this buffering effect with mediation on suicidal ideation (Kleiman & Riskind, 2013).

3) Main-effect model: While robust evidence supports the stress-buffering effect of perceived social support, the main-effect model maintains that perceived social support can improve mental health wellbeing directly (Stroebe, 2000; Aneshensel & Stone, 1982; Hashimoto et al, 1999; Panayiotou & Karekla, 2013), regardless of individual's current stress level. This model is supported by a cross-sectional analysis from Storm and colleagues' (2018), in which a direct association between perceived social support and depressive symptoms was observed in a community sample. Comparable cross-sectional results were also reported by Eom and colleagues (2013) among their cancer patients. In a sample of people with anxiety disorders, Panayiotou and Karekla (2013) have also attempted to explore whether perceived social support moderates the relationship between anxiety disorders and quality of life. Instead, their results demonstrated a direct relationship between perceived social support, quality of life, and perceived stress in people with anxiety and their matching controls. More substantial evidence was provided by an in-depth analysis of adult patients who received a primary care intervention (i.e. anxiety treatment) in a randomised controlled trial (RCT). In this intervention trial, Dour and colleagues (2013) also discovered a

direct association between perceived social support, depressive symptoms and anxiety over an 18-month follow-up period.

Therefore, in line with the framework proposed by House et al (1988), three models were proposed for the pathway from perceived social support to mental health.

1) Buffering effects model: perceived social support ➡ life stress ➡ improved mental health

2) Buffering effects model with mediation: perceived social support ➡ mediating factors (e.g. improved self-esteem, reduced stigma) ➡ life stress ➡ improved mental health

3) Main-effect model: perceived social support ➡ improved mental health

This section focused on a number of hypotheses proposed by researchers with an aim of identifications that may underpin the relationship between subjective social isolation and mental health outcomes. However, with a lack of reliable evidence from well-designed cohort studies and the majority of which did not include measures of these proposed mediating factors, there is still much uncertainty about the mechanism through which subjective social isolation could predict diminished mental health wellbeing. Therefore, there is abundant room for further progress in determining and verifying these mechanisms. Overall, although the deleterious effect of subjective social isolation, especially loneliness, has become one of the most important issues receiving a considerable amount of attention in the field of mental health, recent developments in research have also heightened the need for more rigorous research in extending and supporting the current evidence-base in loneliness. Likewise, objective social isolation has also been widely recognised as a critical issue by many mental health researchers. Therefore, in the next section, I will move on to the negative consequences of objective social isolation in mental health, in respect of illness onset, symptom progression and personal recovery.

2.3. Objective social isolation as a predictor for mental health

Objective social isolation has been widely implicated in previous literature examining the onset and the maintenance of mental health symptoms across the entire spectrum of diagnoses, such as depression (Gutzmann, 2000), eating disorders (Tiller et al, 1997; Gorse et al, 2013; Westwood et al, 2016), and schizophrenia (Anderson et al, 2015). It has also been demonstrated that objective social isolation is a significant factor contributing to poor personal recovery and quality of life in people with mental health diagnoses.

2.3.1. Objective social isolation as a predictor for the onset of mental illness

Previous prospective literature has examined the relationship between objective social isolation and the onset of mental illness in the general population. The impact of being socially isolated or having a small social network on the development of prodromal symptoms is profound.

Depression: Depressive symptomatology has been associated with a number of indicators of objective social isolation, such as having a narrow social network (e.g. Antonucci et al, 1997), infrequent social contact with others (e.g. Yang et al, 2018; Dean et al, 1992), less social engagement (Jang et al, 2011), and being socially isolated (e.g. Iliffe et al, 2007; Small et al, 1997; Hatzenbuehler et al, 2012). For example, drawing data from a health survey in the Central of Singapore, Ge and colleagues (2017) recently conducted a population-based observational study, in which weak social connections with relatives and friends were linked to depressive symptoms after controlling for several confounders, such as age and gender. In a systematic review (Santini et al, 2014) examining social relationships in the general population, positive results were reported in four cross-sectional studies and five prospective studies. Therefore, Santini and colleagues concluded a protective role of having a large and diverse social network in the occurrence of initial depressive symptoms. A controlled study from Cornelis and colleagues (1989) measured social networks before the onset of depression and during a depressive episode in a sample of outpatients with MDD or dysthymic disorder, the authors found an association between the onset of depression and the premorbid presence of a poor social network. However, given

the potential recall bias in this study and the results were based upon data from thirty years ago, our confidence in interpreting the findings of this study is slightly restrained.

Despite the fact that numerous cross-sectional studies have underlined an association between objective social isolation and the onset of depressive symptoms, few researchers were able to draw on any longitudinal research into this relationship in the general population (e.g. Glass et al, 2006). Additionally, with the majority of studies restricted to elderly samples, positive results cannot be generalisable to a wider community population. In one longitudinal study from over thirty years ago (Holahan & Holahan, 1987), adequate social support demonstrated its effect on depression prevention in an elderly sample. It is hypothesised that having a supportive social network promotes self-efficacy, which further encourages continuous social engagement and the maintenance of social relationships. These factors are all considered as essential in maintaining psychological wellbeing for older people. A recent longitudinal analysis using the Longitudinal Aging Study in the Netherland (Braam et al, 2004) also discovered a negative association between regular church attendance and depressive symptoms over a six-year follow-up period in a sample of community-dwelling older adults, after adjusting for their religious denomination, sociodemographic variables and physical health.

However, research failed to confirm this relationship when subjective social isolation was added into the model (e.g. Kistner et al, 1999; Matthews et al, 2016). For example, cross-sectional evidence from one study (Park et al, 2013) supports a direct relationship between social engagement-related variables and depression. However, the significance of this direct effect became either insignificant or was subsequently reduced when loneliness was introduced into the model, suggesting a prominent role of loneliness in explaining the relationship between social engagement and depression in both men and women. A similar finding was reported in another cross-sectional study of a sample of community-dwelling elderly (Golden et al, 2009). In research with a longitudinal design, several social network characteristics (e.g. social network size, frequent social contact and living with someone) were associated with depressive symptoms. However, again out of all social support measures, subjective social isolation was the most potent predictor for depressive symptoms in these community samples

(Chao, 2011; Oxman et al, 1992; Peirce et al, 2000). These results thereby added additional support to the theory that the qualitative aspect of our social relationships matters the most in terms of mental health outcomes. Nevertheless, this relationship should be further confirmed by well-designed longitudinal studies of clinical samples.

Anxiety: The effect of objective social isolation on the onset of anxiety symptoms was also examined in research with a retrospective study design. For example, Grisham et al. (2011) suggest retrospectively reported social isolation during one's childhood as a specific risk factor for the onset of obsessive-compulsive disorder (OCD) in adulthood, and this association was later supported by another retrospective study of individuals with full-blown OCD (Coles et al, 2012). As part of a large population-based study, Chou and colleagues' (2011) cross-sectional secondary analysis aslo explored the relationship between infrequent social contact, the absence of frequent contact with religious groups, and current DSM-IV diagnoses. The authors found a relationship between the absence of close friends and increased risks of social phobia, depressive disorder and generalised anxiety disorder (GAP). In a sample of undergraduate students, increased social anxiety was also associated with spending more time at home (Chow et al, 2017). The majority of research up to now has been cross-sectional in nature. There is one longitudinal analysis conducted by Domènech-Abella and colleagues (2019), and the authors discovered a longitudinal and unidirectional association between social isolation and a higher likelihood of developing GAP two years later. Given limited evidence was published, there is still uncertainty over the longitudinal relationship between social anxiety and objective social isolation in the general population. Therefore, this research topic will benefit from more future research involving a great variety of community samples.

A higher risk of developing PTSD was found among veterans who received low social support (Boscarino, 1995; Kintzle et al, 2018). In the National Epidemiologic Survey on Alcohol and Related Conditions, Platt and colleagues (2014) examined the impact of social connections and perceived social support on PTSD. The results demonstrate a potentially more protective role played by the former (e.g. engagement in social groups and activities) in attenuating the risk of PTSD symptoms over the latter. However, its cross-sectional design limited the definite conclusion to be drawn concerning the direction of causality between

social connections and the onset of PTSD. More robust evidence was demonstrated by a 20-year prospective longitudinal research of Israeli veterans from the 1982 Lebanon War, the findings of this study illustrate an association between having more social resources and a longer delay in the onset of PTSD twenty years after the war (Horesh et al, 2013).

Psychosis: Using the data from the Norweigian Youth case-control studies, Bratlien and colleagues (2014) discovered that for youths with a diagnosis of psychosis, having a smaller social network was a risk factor during the premorbid period of their illness. Both retrospective and prospective birth cohort studies also demonstrate a relationship between early social isolation as a child and the development of schizophrenia later in life (Malmberg et al, 1998; Welham et al, 2009). Based on a national survey, Wiles and colleagues (2006) investigated longitudinal risk factors for self-reported psychotic symptoms in the UK. At 18-month follow-up, there was an independent association between having a small primary support group and the onset of psychotic symptoms, which further supports the hypothesis that having a restricted social network precedes the first signs of psychotic symptoms in healthy populations.

Dementia and cognitive decline: Hultsch's 'use or lose it' theory implies the significance of having regular social engagement in brain stimulation (Hultsch et al, 1999). Several social factors, such as having an extensive social network and sufficient social support, have been implicated in an extensive amount of longitudinal research as potential factors for protecting against cognitive decline in elderly samples (Drolet et al, 2013; Gow et al, 2013). In a comprehensive systematic review of longitudinal cohort studies, Kuiper and colleagues (2015) concluded that a lack of social interactions was associated with the incidence of dementia in the general population. In another population-based longitudinal study, there was a two-fold increased risk of cognitive decline in those without any social ties, compared to those who had five or more social ties, after controlling for a variety of risk factors (Bassuk et al, 1999). In a group of people in the UK aged 65 and over, objective social isolation, measured by the LSNS-6, was associated with cognitive functions at both baseline and two-year follow-up, and this association remained significant even after controlling for age, gender, education and physical health conditions (Evans et al, 2018). The Kungsholmen Project in Stockholm, Sweden, also examined the longitudinal relationship

between the incidence of dementia, decline in cognitive functions, and social network characteristics. The results suggest an association between a limited social network and a 60% increased risk of dementia (Fratiglioni et al, 2000). Preliminary evidence from other longitudinal dementia research also suggests the presence of several other social network characteristics during the period preceding the onset of dementia, such as being single and have infrequent social participation (e.g. Fratiglioni et al, 2000; Beland et al, 2005; Saczynski e al, 2006; Wang, et al, 2002; Hackett et al, 2019; Rafnsson et al, 2017). By contrast, for older people who engage in regular social contacts or those who are active in social, leisure and work aspects, they tend to be less vulnerable to the risk of developing dementia (Kondo & Yamashita, 1990; Crooks et al, 2008). This finding is further supported by Fratiglioni and colleagues (2004) who systematically reviewed longitudinal studies evaluating the impact of social network on cognitive decline and dementia; the review demonstrates a protective role played by having a socially integrated lifestyle in dementia and Alzheimer's disease. In a prospective study exploring the protective effect of social networks on the incidence of dementia in a sample of older women over a 4-year follow-up, Crooks et al (2008) estimated that the adjusted hazard ratio for the development of dementia on a broader social network was 0.74, relative to the ones with a smaller social network.

Eating disorders: Negative social experiences have been linked to the onset of eating disorder symptoms (e.g. Levine, 2012). Social networks are a significant contributing factor to the development of poor self-image (Sluzki, 1996). In a retrospective case-control study, emotional and behavioural outcomes were analysed in a group of girls with BN (Corcos et al, 2000) and healthy matching controls. In this study, semi-structural interviews were conducted, emotional and behavioural changes were recalled prior to their BN diagnoses. The results illustrate that attitudes of social withdrawal and social isolation were established as preceding factors of a clinically diagnosed eating disorder. Corcos and colleagues also suggest social negativisms, problems in interacting with peers or siblings among the most common factors preceding the onset of BN for young people. Other factors, such as failure to take control over their body image and getting along with peers, may also precipitate their social withdrawal and social isolation. In a small longitudinal study involving 41 nonclinical women who were

followed up for 14 weeks, socialisation (e.g. social proximity) was also an important factor contributing to body concerns and subsequent distorted eating behaviours (Meyer & Waller, 2001). To the best of our knowledge, a handful of research has surveyed the longitudinal association between objective social isolation and the onset of eating disorders or abnormal eating patterns, and most studies are restricted to their retrospective study design. Therefore, no evidence to date has confirmed the direction of the causality of this relationship.

There is a considerable amount of literature investigating the negative effect of objective social isolation on the onset of depressive symptoms. However, the evidence appears to favour the predictive effect of subjective social isolation on the onset of depression over objective social isolation. The relationship between objective social isolation and the onset of anxiety, including OCD, PTSD and GAD, has been reported by a small number of cross-sectional studies. However, again the lack of longitudinal research prevents us from drawing any definite conclusion to confirm this relationship. Both retrospective and prospective studies have investigated the relationship between social network characteristics and illness onset. A number of longitudinal studies have also been conducted in order to explore the protective effect of having an integrated social network or frequent social engagement on a reduced risk of dementia. Nevertheless, more longitudinal evidence is warranted for diagnostic groups other than depression, including eating disorders.

2.3.2. Objective social isolation as a predictor of clinical outcomes

Improved mental health outcomes have been linked to having sufficient social relationships and social interactions for people with mental health issues.

Depression: In terms of the relationship between depression and objective social isolation, quantitative evidence supports an association between objective social isolation, such as a lack of confidants (Winefield, 2009; Derntl et al, 2011), and the maintenance of depressive symptoms in depressed clinical samples. However, again evidence demonstrating this relationship was largely based on a cross-sectional research design and only a few longitudinal studies have been carried out to confirm this relationship. One longitudinal outcome study of the

elderly with a diagnosis of depression was conducted by Freyne and colleagues (2005), the results suggest that with a more socially integrated network, depressed elderly were more capable of achieving the best psychiatric outcomes two years later. By contrast, for those who had more dependent relationships, they had increased depressive symptoms. In another longitudinal trial (George et al, 1989), both social network size and subjective social isolation significantly contributed to severe depressive symptoms at follow-up in a sample of elderly with major depression. Among all the social variables included, subjective social support was the most potent factor associated with depression in this sample. A contradictory finding was reported by a recently published longitudinal study of people with non-recovered MDD over a ten-year follow-up period (Walker & Druss, 2015): out of the three types of social support (i.e. emotional support, unpaid assistance, and social contact with family and friends), lack of contacts with family was the only factor that was significantly associated with persistent major depression at follow-up. However, the authors acknowledged that their participants were not repeatedly measured for MDD throughout the ten-year period. Therefore, there was a high uncertainty over the relapse and recurrences of depression between the two assessment time-points.

Anxiety: Characterised by an extensive fear of social situations and subsequent panic attacks after the exposure, severe social phobia, or anxiety symptoms have been linked to social phobia disorder (APA, 2000). High level of anxiety has also been associated with objective social isolation. For example, Davidson and colleagues (1994) found an association between living in a single household, having few close friends, and social anxiety symptoms in a sample of individuals with subthreshold social phobia. One systematic review synthesised evidence from 34 studies involving clinically diagnosed samples with social anxiety, and a meta-analysis was also carried out (Teo et al, 2013). Teo and colleagues found a close association between social isolation and social anxiety disorder. However, they also noted that many included studies were cross-sectional. In another study examining early maladaptive schemas (EMSs) in people with OCD, Atalay and colleagues (2008) revealed that EMSs, including social isolation, were more predominant in people with OCD than their healthy controls. In line with this finding, a recent study exploring the Schema Therapy Mode Model of OCD in people with OCD was carried out by Basile and colleagues (2017). The authors

also concluded a significant association between social isolation and OCD symptom severity in this clinical sample. Another community-based cross-sectional study from Dahl and Dahl (2010) investigated the relationship between lifestyle and social network characteristics in a group of people with social phobia. In this study, having an unhealthy lifestyle and a small social network were more frequently reported by people with social anxiety symptoms, compared to their healthy counterparts, even after accounting for individual differences in sociodemographic variables.

Psychosis: Numerous studies have investigated social network size in people with psychosis-related illnesses (e.g. McDonald et al, 2000; Morgan et al, 2008). These results emphasise that compared to their matched healthy controls, people with psychosis had a smaller social network and fewer social relationships (McDonald et al, 2000; Goldberg et al, 2003; Giacco et al, 2016). Additionally, they also experienced more social disadvantages and were more socially isolated (Morgan et al, 2008). Furthermore, it has been suggested that people with psychosis tend to have more dependent relationships, compared to the general population, whose relationships tend to be more reciprocal in nature (Cohen & Sokolvsky, 1978; Cresswell et al, 1992). With a great emphasise on friend network and support from friends, Gayer-Anderson and Morgan (2013) systematically reviewed existing literature on the relationship between objective social isolation and psychosis. They concluded that this relationship is especially evident in people with first-episode psychosis and those living in the community with reported psychotic experience or schizotypal symptoms. In another recently published systematic review, Palumbo et al (2015) found that for people with psychosis, they had an average of 11.7 social network members and 3.4 friends in their social circles. They also confirmed a significant association between having a small social network size and great negative symptom severity in this clinical sample. However, Palumbo and colleagues also recognised a considerable heterogeneity across the included studies. To establish the association between psychotic symptoms, including negative symptoms and social contacts with friends in people with schizophrenia-related disorders, a pooled analysis was carried out by Giacco and colleagues (2012). In this study, higher negative symptoms and hostility were significantly linked to fewer social contacts with friends, and this association was especially pronounced in male

patients. Furthermore, prospective control studies and systematic reviews have also suggested that as the amount of time one spends in the hospital increases, his/her network size also decreases gradually (Becker et al, 1997; Buchanan, 2004; Lipton et al, 1981). Recent evidence also demonstrates a negative relationship between social network sizes, support from relatives, social contacts from confidants, and the frequency of mental health service use among people diagnosed with schizophrenia (e.g. Simone et al, 2013). This finding is supported by a controlled prospective study evaluating mental health service use in South London among people with psychosis, in which Becker and colleagues (1997) established an association between an increased risk of being admitted to a mental health hospital and one's social network size.

Learning disabilities: Objective social isolation has been widely studied in people with autism spectrum disorder (ASD). However, evidence to date has only supported the social challenges faced by people with ASD, and few studies explored the pathway either from being socially isolated to ASD, or vice versa. Social impairments have been characterised as the core feature of ASD (Carter et al, 2005). Both cross-sectional studies (Stice & Lavner, 2019) and longitudinal studies (Liptak et al, 2011) have established that adults with ASD or higher autistic traits tend to experience a relatively lower level of social connectedness (i.e. less socialisation, smaller social network size), compared to the healthy controls. Facing a great variety of social challenges in their day-to-day social interaction, such as poor social skills, impaired cognitions in establishing and maintaining strong relationships, also have a profound impact on social participation for people with ASD (Sterling et al, 2008; Hiller et al, 2011; APA, 2000; Frith et al, 2004; Blacher et al, 2003). By analysing the wave 1 cross-sectional data from a large cohort study of adolescents, Shattuck and colleagues (2011) discovered that compared to adolescents with mental retardation or speech/language impairment, their matching sample with ASD spent less time with friends, and they were less likely to be invited for social activities. This lack of social participation resulting from their long-lasting social challenges is even more salient for individuals with higher functioning (Bauminger et al, 2003). For people with ASD, despite many have expressed their longing for social interactions and social activities (Humphrey & Lewis, 2008), many also had great

concern over their lack of essential social skills and social challenges relating to their difficulties in communicating with others (Muller et al, 2008).

Eating disorders: A number of cross-sectional studies have identified several contributing social factors to eating disorders, including having a small social network size (Doris et al, 2014), social withdrawal (Turner et al, 2010), and spending more time alone (Tchanturia et al, 2013). Research has investigated the association between specific family support characteristics and ED, suggesting family conflicts, family functioning and certain family rules among the most important contributing factors to greater ED symptom severity (Leonidas & dos Santos, 2014; Wolfgramm, 2017). Evidence also suggests the significance of having personal social ties on body image distortions, although it varies based on one's body mass index (BMI) (Pallotti et al, 2018). For people with ED, negative peer influence and parental criticisms of their body figures and eating patterns have also been reported as two significant factors in maintaining distorted eating behaviours (Hutchinson & Rapee, 2007; Cooley et al, 2008). These findings illustrate that social deficits may not only precede the development of distorted eating patterns, but also serve as the maintaining factors for abnormal eating behaviours in ED. However, none of these studies were carried out with a longitudinal design.

Suicide: Suicide is acknowledged as one of the leading causes of death around the world (Rudd et al, 2013). Multiple suicide attempts have been implicated in previous research as one of the main factors contributing to future suicidal attempts (Miranda et al, 2008), with the numbers of attempts increases, the successful rate also raises (Harris and Barraclough, 1997). A considerable amount of evidence from cross-sectional and descriptive studies has demonstrated an association between objective social isolation and suicide attempts. For example, in a study examining the protective and risk factors of suicidal attempts in South Korea, Choi and colleagues (2013b) found that being single, having interpersonal difficulties, and being socially isolated could increase the likelihood of multiple suicidal attempts. For adolescents, friends' suicidal attempts (Bearman & Moody, 2004) and objective social isolation (Hall-Lande et al, 2007) also have a significant impact on their suicidal thoughts and suicidal attempts. Family and school connectedness, on the other hand, may serve as important factors protecting against suicidal attempts, and both factors mediate

the association between social isolation and adolescents' psychological health (Hall-Lande et al, 2007). In particular, the risk of suicidal attempts is high among mental health service users with a restricted social network. In a group of elderly with depression, suicidal attempters had a smaller social network than the non-suicidal elderly and their healthy counterparts, not only did they maintain fewer social relationships, they were also less engaged in social activities (Szanto et al, 2012).

Addiction: The importance of social factors has been frequently implicated in research investigating risk factors for alcohol abuse/dependence, such as being socially disinterested (Niño et al, 2016), having a small social network size with low diversity (Mowbray et al, 2014), or being less involved in social activities (Carman et al, 1983; Cornwell & Waite, 2009b), especially religious groups (Chou et al, 2011). A meta-analysis also confirmed a high likelihood of smoking in young adults who were socially isolated (Choi & Smith, 2013), this is further supported by a longitudinal study conducted by Osgood and colleagues (2014) among 6th graders. Longitudinal data to date have suggested an association between sufficient family support, positive peer support, positive social bonding, and lower alcohol consumption (White et al, 2006; Ramirez et al, 2012). Additionally, a marked change in the recovery process has been facilitated by disengaging from a social network in which drug use is promoted (Boshears et al, 2011; Mcintosh & McKeganey, 2000). These social factors may also facilitate self-admission to rehabilitation programmes (Strug & Hyman, 1981) and the achievement of positive outcomes after the programmes (Rychtarik et al, 1987; Stout et al, 2012; Zywiak et al, 2002), independent of the history of alcoholism and prior treatment outcomes (Booth et al, 1992a).

This section summarised current evidence examining the relationship between the progression of psychiatric symptoms and objective social isolation among people with mental health symptoms. Few longitudinal studies have been carried out in people with depression, and contradictory results have been reported by studies investigating whether subjective social isolation has a more prominent role in increasing symptom severity in people with depression, compared to objective social factors. It has been well-established that people with psychosis tend to lack social integration and have a small social network size. Certain psychotic symptoms (in particular negative symptoms) have also been

associated with greater objective social isolation in this specific clinical sample. However, little longitudinal research has been carried out. Likewise, hardly any longitudinal evidence exists for anxiety and eating disorders. Although it has been widely acknowledged that people with learning disabilities or ASD tend to face a great number of social challenges, there has been little interest in determining if objective social isolation precedes their symptoms or whether lack of capacity for social engagement is a key risk factor contributing to more social isolation. In summary, with the majority of the studies having a cross-sectional or descriptive study design, the directions of causation of these relationships cannot be inferred from these positive results. Therefore, studies with a long follow-up period are of high demand, in order to investigate the enduring effects of objective social isolation on the maintenance of psychiatric symptoms.

2.3.3. Objective social isolation as a predictor of personal recovery

Personal recovery: Close social relationships and social support are profound factors in assisting personal recovery for people with mental health problems (Soundy et al, 2015). For people with mental health symptoms, moving from being just a patient with a mental health diagnosis to a life 'beyond one's illnesses' has been acknowledged as a crucial part of the recovery process (Noordsy et al, 2002). Family support network sizes, reciprocal family relationships, and active social engagement have been associated with personal recovery in people with SMI (Corrigan & Phelan, 2004; Pernice-Duca, 2010; Hendryx et al, 2009). Even distal social support (i.e. support in the community through routine encounters) is a unique factor in promoting community integration and personal recovery (Townley et al, 2013). Again, given all evidence was obtained from cross-sectional studies, it remains unclear if social relationships promote personal recovery or making progress towards personal recovery encourages people to be more socially involved with others. Or perhaps there is a bidirectional relationship between the two.

Quality of life: Evidence to date supports a cross-sectional relationship between certain social network characteristics and quality of life in people with mental health issues, such as outpatients with schizophrenia (Sibitz et al, 2011), residents in dementia care units (Abbott & Pachucki, 2016; Miranda-Castillo et

al, 2010) and people with learning disabilities (van Asselt-Govert et al, 2015; Tobin et al, 2014). For people with SMI, social networks are believed to be one crucial factor promoting positive emotions (Greenglass & Fiksenbaum, 2009), which in turn play a crucial role in maintaining a high living quality and high life satisfaction (Baker et al, 1992; Cohen et al, 2009; Fredrickson & Joiner, 2002). Instead of a linear relationship, there seems to be a more complex relationship between social network size and quality of life than we expected. Becker and colleagues (1998) examined this relationship cross-sectionally in a group of people with psychosis in South London, and they identified an association between a medium-sized social network (i.e. 10-12 social contacts) and achieving an optimal level of quality of life. One possible explanation is that it is relatively more manageable for people with mental health problems to have access to the most appropriate support within a medium-sized social network (Albert et al, 1998).

Overall, the significant impact of objective social isolation on individuals' personal recovery and quality of life has also been recognised in recent literature. However, the relationship between objective social isolation and quality of life among people with mental health problems seems to be more complicated than we expected. Again, large-scale longitudinal studies are needed to establish a greater degree of accuracy on this relationship.

2.3.4. Objective social isolation and its mechanisms of effect in mental health

Several potential mechanisms may explain the contributing effect of objective social isolation on the onset of mental health symptoms, the maintenance of these symptoms, the process of personal recovery and quality of life among people with diagnoses across the entire spectrum of mental disorders.

Healthy lifestyle: Firstly, social network members may serve as role models for health-promoting behaviours (Gallant, 2013; Marquez et al, 2014; Strawbridge et al, 2001), which are beneficial in improving mental health wellbeing in general (Berkman & Glass, 2000). Friendships have been recognised as a facilitator prompting people with mental health problems to look after themselves. This is

supported by the finding that for mental health service users with a large number of friends in their social networks, they had a better self-care, compared to those with fewer friends, and this effect was especially evident in female patients (Evert et al, 2003).

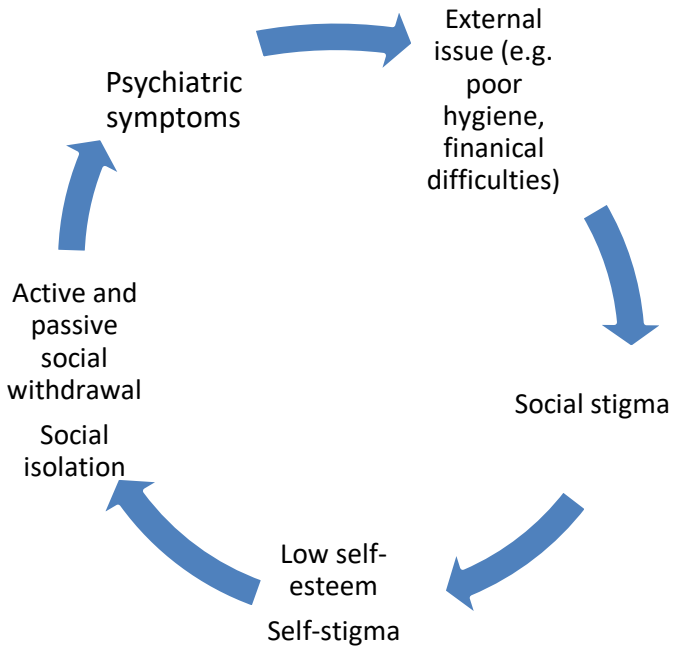
Bidirectional relationship between objective social isolation and psychiatric symptoms: Although there is insufficient longitudinal evidence demonstrating a bidirectional relationship between having an integrated social network and reduced psychiatric symptom severity, we may expect that having a mental illness itself may have a direct impact on social relationships as it may prevent people from pursuing the types of social relationships they desire.

Several factors have been identified to uncover the social network deficits in people with psychosis, such as clinical symptoms, interpersonal stigma and self-stigma. Psychotic symptoms, especially negative symptoms (e.g. anhedonia, low energy level and emotional dullness) may result in low motivation (i.e. social avolition; Strauss et al, 2013) to initiate and maintain social interactions with others (Degnan et al, 2018). Additionally, for those living in the community, external issues such as unemployment, financial difficulties, safe housing, poor personal hygiene, unusual behaviours in public, and even mental health diagnosis itself, may lead to stigma and rejections from others. Therefore, they feel isolated and excluded from social opportunities and have reduced opportunities to succeed in the labour market (Huxley & Thornicroft, 2003; Davidson & Stayner, 1997; Corrigan & Watson, 2002; Rossler, 2016). Boydell et al (2002) and Evert (2003) emphasise that people with psychosis may also actively reject social relationships or avoid social situations. These behaviours may be adopted by some of the patients as coping strategies to avoid possible future social loss (Davidson & Stayner, 1997), due to their expectations of interpersonal stigma (Karidi e al, 2010; Karidi et al, 2015).

Social relationships may also have a direct impact on mental health outcomes. Not only interpersonal issues may serve as a contributing factor to worse mental health outcomes in people with a diagnosis of psychosis-related disorders (Harvey et al, 2007; Horan et al, 2006), it is also hypothesised that the lack of disconfirmation from family or friends may also function as one maintaining factor of abnormal thoughts and beliefs (Freeman et al, 2003; Freeman et al, 2011). As

a result, a vicious cycle is formed: a number of factors including psychotic symptoms, interpersonal stigma and self-stigma limit one's ability and confidence in interacting with existing social ties and establishing new ties outside their mental health services. In turn, their lack of support and resources may further trigger relapse, which subsequently leads to decreased self-esteem and increased self-stigma, all of which may further precipitate more social isolation.

A figure of the bidirectional pathway between objective social isolation and psychiatric symptoms is present below:



The social-cognitive processing model (Lepore, 2001) was proposed to explain how social interactions affect emotional adjustment after a cancer diagnosis, this model may also be applicable to PTSD symptoms. Guay and colleagues (2006) argue that social interactions may have a significant impact on how individuals interpret or process a traumatic event, and having the opportunities to talk about the traumatic event may facilitate one's cognitive processing and emotional adjustment, which subsequently contribute to improved PTSD symptoms.

The relationship between objective social isolation and poor personal recovery in people with mental health problems may also be mediated by the effect of social relationships on mental health symptoms. There is a possibility that insufficient social resources or low social support may exacerbate psychiatric symptoms, which may subsequently interrupt individuals' personal recovery process

(Resnick et al, 2004). Therefore, for people with mental health symptoms, connecting with family and friends and maintaining these social contacts throughout their illness is crucial in improving their emotional wellbeing and promoting personal recovery during their illness (Topor et al, 2006).

The strength of different social network resources: For people with mental health problems, social network resources may serve as facilitators in many aspects of their lives, especially after being diagnosed with a mental health problem. By including patients with long-term severe psychotic symptoms, the COSTART program found that socially isolated patients were more likely to have an earlier psychotic relapse, compared to the individuals with an integrated social network (Thornicroft & Breakey, 1991). Social network characteristics also have several advantages in promoting mental health service use (Albert et al, 1998), such as providing useful information regarding appropriate services or the availability of self-help resources (Yeung, 2012; Maulik et al, 2009), identifying early signs of relapse (Graham, 2004; van Meijel et al, 2002), assisting patients' in accessing services (Maulik et al, 2009), and supporting the process of hospital discharge and community rehabilitation plan (Brugha, 1995).

Different social network members provide distinct types of social supports in different circumstances. Therefore, having a broad social network, including both distant and close social ties may be beneficial. While the familial network is more useful for providing long-term assistance and concrete services (Hortwitz, 1978; Piat et al, 2011), friendships are more helpful when it comes to peer activities, personal issues (Randolph, 1998), and when there is a need for suggestions and consultations regarding referrals to mental health services (Horwitz, 1977). Being in regular contact with friends or health professionals such as GP has been associated with more service use in the early stage of illness, which may prevent more intense psychiatric service use in the future (Gourash, 1978; Cole et al, 1995). However, the number of kin relationships in one's social network seems to be the most influential factor contributing to a high likelihood of being admitted to a hospital (Horwitz, 1977). An opposite relationship between employment and social relationships was found. For those patients who have an extensive familial network, they were more likely to be employed and live in independent accommodation, compared to the individuals whose social networks are dominated by friends (Evert et al, 2003). Granovetter (1973) also emphasises the

importance of having dyadic ties in one's social network: even weak social ties have benefits in providing informational support regarding available resources in the local communities, which may not be known to an individual's loved ones, such as family and close friends.

Chapter 2 firstly summarised evidence on physical health outcomes as a result of subjective and objective social isolation; then it reviewed the deleterious effects of both issues on the three key aspects of mental health outcomes: the onset of mental illness in the general population, the maintenance of mental health symptoms, and the improvement of personal recovery and quality of life in people with mental health diagnoses. Evidence to date has suggested subjective and objective social isolation as risk factors for developing early psychiatric symptoms in healthy subjects. It has also been demonstrated that both issues contribute to the maintenance of these symptoms after a mental health diagnosis. Furthermore, there is a growing interest in research examining the negative impact of both issues on personal recovery and quality of life in mental health service users. Some identifications that may underpin these relationships were also proposed. Longitudinal evidence also underlies the possibility that subjective social isolation is a more potent contributing factor to poorer mental health outcomes than objective social isolation. However, these results were mostly restricted to research in depressive symptoms, and contradictory results were also reported by two longitudinal studies involving clinical samples. Therefore, high-quality prospective studies involving a clinical sample with a broad range of mental health diagnoses are of high importance. Because of poor physical and mental health outcomes as a result of subjective and objective social isolation, both issues have become significant concerns in the area of research and public health. A systematic review critically reviewing current literature and synthesising evidence regarding potential interventions for alleviating subjective and objective social isolation is therefore necessary. This review will be provided in Chapter 3.

Chapter 3. The effectiveness of interventions for reducing subjective and objective social isolation among people with mental health problems: a systematic review

3.1. Introduction

It has been widely acknowledged by previous literature that for individuals with mental health diagnoses who are either subjectively or objectively socially isolated, they tend to have poor personal recovery process and great psychiatric symptom severity. Chapter 2 summarised current evidence concerning the deleterious effects of subjective and objective social isolation on mental health outcomes in a great variety of mental health conditions. Therefore, given the high importance for researchers to tackle both issues, and hope to further contribute to this growing area of research, this chapter provides a comprehensive systematic review to synthesise evidence from previous literature investigating the effectiveness of interventions for alleviating subjective or objective social isolation in people with mental health problems.

The protocol for this review was published prospectively on Prospero, full access: https://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42015023573. This systematic review has been published online by Social Psychiatry and Psychiatric Epidemiology and is available at https://link.springer.com/article/10.1007/s00127-019-01800-z. The published version of this systematic review is presented in Appendix 8.

As a rapidly developing and expanding field, there is a growing number of studies seeking to develop intervention strategies for reducing social isolation in the general population, particularly for socially isolated older people. To date, five papers have systematically reviewed potential interventions for subjective social isolation (Findlay, 2003; Cattan et al, 2005; Dickens et al, 2011; Masi et al, 2011; Perese & Wolf, 2005) (Table 3.1). With the majority of these reviews aimed at interventions for older people in the general population (e.g. Dickens et al, 2011), the most recent systematic review focused explicitly on people with a mental health diagnosis was published over a decade ago (Perese & Wolf, 2005). Another three systematic reviews of interventions for improving objective

social isolation (Newlin et al, 2015, Anderson et al, 2015; Webber & Fendt-Newlin, 2017) have also been published. These reviews are relatively recent, and all targeted people with mental health problems: one with a primary interest in psychosocial interventions (Newlin et al, 2015), one focused on social participation interventions (Webber & Fendt-Newlin, 2017); and another one evaluated interventions for increasing social network size for people with psychosis. This last paper only included five papers, but all were randomised controlled trials (RCTs) (Anderson et al, 2015). The other two papers, although they were recently published, included a wide range of study designs (e.g. single group pre- and post-test design, quasi-experimental design). Masi and colleagues' meta-analytic review, published in 2011, is considered as one of the most influential reviews published to date. The authors summarised and categorised loneliness interventions into four types. Despite providing a comprehensive review for loneliness interventions, Masi and colleagues only included 20 RCTs and merely five targeted people with mental health symptoms. There, there is no up-to-date systematic review or meta-analysis providing evidence on a variety of interventions addressing subjective and/or objective social isolation for people with mental disorders. There is no review to date has attempted to compare the characteristics of interventions that are effective for subjective social isolation and the ones for objective social isolation.

Based on a recently developed typology of interventions for loneliness and their related constructs in a state-of-art review (Mann et al, 2017), this current systematic review aims to advance our current knowledge of potential interventions with an effectiveness in addressing subjective and objective social isolation among people with mental health problems. By including RCTs only, this review seeks to synthesise the best evidence in the field. The review from Mann and colleagues structured loneliness interventions into four categories: 1) interventions addressing maladaptive social cognitions (e.g. cognitive behavioural therapy, dialectical behavioural therapy or reframing therapy); 2) social skills training and/or psychoeducational programmes (e.g. social identity group programmes, family psychoeducational programmes); 3) interventions involving supported socialisation component (e.g. peer support groups, befriending programmes); and 4) wider community approaches encouraging

social engagement with local resources in the community, and promoting community-level resource development (e.g. social prescribing, asset-based community development programmes). Similar to Masi et al.'s typology, Mann and colleagues also highlight the importance of the first three conventional types of interventions. Mann and colleagues also underscore the necessary steps we need to take in order to increase the awareness of loneliness in the wider society. Strategies such as social prescribing (i.e. community referral), in which primary healthcare professionals refer people to a wide spectrum of social interventions, groups or community activities, have been highlighted in the research agenda as a public mental health strategy to manage chronic mental health problems (Dissemination CfRa, 2015). This approach is designed to be open to all the members in the community with the involvement of a wider group of community parties, such as local community organisations and charities, thus it aims to facilitate social integration, reduce stigma towards lonely individuals with mental health diagnoses, and eventually boost self-confidence in this population (Dissemination CfRa, 2015).

Table 3.1 Existing systematic reviews and meta-analyses of interventions for subjective or objective social isolation

Authors, Published years	**Published years of included studies**	**Review method**	**Included participants**	**How interventions were categorised**	**Number of studies**	**Types of study included**
Subjective social isolation interventions						
Findlay, R. A. (2003)	1982-2002	Systematic review	Older people	1) increase social support 2) psychoeducation/social skills training	17	RCTs, non-randomised comparison studies
Cattan, M et al (2005)	1970-2002	Systematic review	Older people	1) social skills training 2) provide social support 3) psychoeducation/social skills training	30	RCTs, non-randomised comparison studies
Dickens A. P. et al (2011)	1976-2009	Systematic review	Older people	1) increase social opportunities 2) provide social support 3) psychoeducation/social skills training 4) address maladaptive social cognitions	32	RCTs, non-randomised comparison studies

Authors, Published years	Published years of included studies	Review method	Included participants	How interventions were categorised	Number of studies	Types of study included
Masi M. C. et al (2011)	1970- 2009	Meta-analysis	Adults, adolescents and children	1) increase social opportunities 2) provide social support 3) address maladaptive social cognitions 4) provide social skill trainings	50	RCTs, non-randomised comparison studies
Perese E. F. & Wolf M (2005)	Unclear	Narrative synthesis	People with mental health problems	Social network interventions: include support groups, psychosocial clubs, self-help groups, mutual help groups and volunteer groups	36	Unclear
Objective social isolation interventions						
Newlin M et al (2015)	Up to September 2014	Systematic Review and modified narrative synthesis	People with mental health problems	All types of psychosocial interventions	16	RCTs, non-randomised comparison studies and qualitative studies
Anderson K et al (2015)	2008-2014	Systematic review	People with psychosis	All types of social network interventions	5	RCTs

Authors, Published years	Published years of included studies	Review method	Included participants	How interventions were categorised	Number of studies	Types of study included
Webber M & Fendt-Newlin M (2017)	2002-2016	Narrative synthesis	People with mental health problems	Social participation intervention: include social skills training, supported community engagement, group-based community activities, employment interventions and peer support interventions	19	RCTs, non-randomised comparison studies, and qualitative studies

Abbreviation: RCT = randomised controlled trials

3.2. Methods

This systematic review aims to evaluate the effectiveness of interventions for alleviating subjective social isolation (including loneliness and perceived social support) and/or objective social isolation among people with a mental health diagnosis, such as depression, schizophrenia or anxiety.

3.2.1. Inclusion criteria

Types of study: The current systematic review only included RCTs, there were no restrictions on publication dates, the country of origin or language.

Participants: People (either inpatients or outpatients) with a primary mental health diagnosis (e.g. depression, anxiety, schizophrenia, bipolar disorders) were included. Any methods of identifying or diagnosing people as having mental health symptoms were acceptable. There were no restrictions on the age, ethnicity and gender of the participants. However, a study was excluded if the included sample was people with a primary diagnosis of learning disabilities, autism spectrum disorders, any type of dementia, any other organic illnesses, substance misuse or physical health problems, even if they had diagnoses of comorbid mental disorders.

Interventions: The current systematic review targeted interventions with an objective of alleviating subjective or/and objective social isolation for people with mental health problems. The review only included a paper if improving subjective and/or objective social isolation was stated as a primary outcome, a paper was excluded if subjective and/or objective social isolation was stated as a secondary outcome with another outcome being specified as primary. A paper was also included if there was no clear distinction made between primary and secondary outcomes, and subjective and/or objective social isolation was evaluated as one of the primary outcomes. There were no restrictions on the delivery methods of these interventions. The intended interventions in the included papers could either be delivered during face-to-face meetings, or offered online, or through telephone calls. Moreover, these interventions were not necessarily carried out by mental health professionals, they also might be delivered by, for example, peer support workers or trained volunteers.

Comparison: Included studies in the current review could compare their intended interventions either to a treatment-as-usual (however defined), or a no-treatment group, or a waiting-list control. Studies were also included if they compared two or more active treatment groups.

Outcomes: The primary outcome for this review was social isolation (either subjective social isolation or objective social isolation, or both). End-of-treatment outcomes, medium-term follow-up outcomes (i.e. up to one-year beyond end-of-treatment time-point) and longer-term follow-up outcomes (i.e. more than one-year beyond end-of-treatment time-point) were reported separately. The following secondary outcomes were also reported in this systematic review: participants' health status (e.g. symptom severity), quality of life and service use (e.g. hospital re-admission rate).

3.2.2. Search strategy

Three databases within the Ovid interface were systematically searched for relevant research: MEDLINE, Web of Science and PsycINFO. Three groups of main search terms and their related terms listed below were combined: 1) subjective and objective social isolation (e.g. lonely; perceived social support; social network; isolated); 2) mental disorders (e.g. psychosis; schizo*), and 3) trials (e.g. RCT; randomised). These search terms have been changed accordingly based on different databases in order to capture all relevant literature. The full list of the search terms is presented in Table 3.2. Reference lists from included studies, systematic reviews, meta-analyses retrieved during the searching process were hand-searched, but these systematic reviews and meta-analyses were not included in the current review. Grey literature, such as PhD thesis and report, was searched through OpenGrey by using keywords 'loneliness', 'perceived social support' and 'social isolation'.

Table 3.2 Search terms in Medline and PsycINFO

Same terms were used for the search in Web of Science with minor changes

#	**Search term**
1	loneliness.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
2	Loneliness.mp. or Loneliness/
3	lonely.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
4	(social support adj5 (subjective or personal or perceived or quality)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
5	Confiding relationship*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
6	Social isolation.mp. or Social Isolation/
7	Social network*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
8	socially isolated.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
9	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10	Mental Disorders/
11	Alcoholism/ or Middle Aged/ or Child Behavior Disorders/ or Child/ or Adolescent/ or Stress Disorders, Post-Traumatic/ or Adult/ or Depression/ or Mental Disorders/ or mental health problems.mp. or Substance-Related Disorders/
12	Bipolar Disorder/ or Psychotic Disorders/ or Aged/ or Stress, Psychological/ or Middle Aged/ or Community Mental Health Services/ or Adult/ or Mental Disorders/ or mental illnesses.mp. or Schizophrenia/

#	**Search term**
13	mental.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
14	Psychiatr*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
15	Schizo*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
16	Psychosis.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
17	Depress*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
18	Suicid*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
19	Mania*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
20	Manic.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
21	Bipolar.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
22	Anxiety.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

#	**Search term**
23	Personality disorder*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
24	Eating disorder*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
25	Anorexia.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
26	Bulimia.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
27	PTSD.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
28	Post-traumatic stress disorder*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
29	10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28
30	9 and 29
31	clinical trial.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
32	controlled study.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
33	randomized controlled trial.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

#	Search term
34	randomised controlled trial.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
35	RCT.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
36	31 or 32 or 33 or 34 or 35
37	30 and 36

3.2.3. Data extraction

RM and FM reviewed all the titles and abstracts of the retrieved studies against our inclusion and exclusion criteria, but final decisions regarding whether a paper should be included or excluded were made by three independent reviewers: RM (i.e. the first author), FM (i.e. psychiatrist and a clinical training fellow at Division of Psychiatry, UCL) and AA (i.e. medical student at UCL). After inter-rater reliability was established as good between the reviewers, the primary reviewer (RM) reviewed all full-text papers retrieved. Papers that were clearly irrelevant were excluded at this stage. Full texts of the papers deemed to be potentially relevant were further examined. These potentially eligible papers were then mixed with 10% of the excluded papers and reviewed by the other two reviewers. The final list of the included studies was reached only until all reviewers agreed on each paper. Any differences between the reviewers were resolved by consulting a further independent reviewer (SJ). Data were extracted from the included studies by RM and FM, using a standardised form developed for the review, including: first author of the paper, conduct date and publication date of the study, sample size and experimental settings, demographic information of the participants from both intervention and control groups, inclusion and exclusion criteria of the participants, the nature of the intervention (for example, the duration of the intervention and the methods of intervention delivery), follow-up details (for example, duration of the follow-up), primary and secondary outcome measures, any exclusion of the participants from final analysis and the reasons for these confounders and risk of bias.

3.2.4. Quality assessment

The quality of each included paper was assessed by using the Cochrane Risk of Bias tool (Higgins & Green, 2011). Each included study was assessed by two reviewers (RM and FM/ JT) concerning the following six domains: sequence generation, allocation concealment, blinding of participants, personnel and outcome assessors, incomplete outcome data, selective outcome reporting and other sources of bias. For each paper, the judgement regarding each domain was given, as well as the evidence that supports the judgement. For each paper, the final decision for each domain could only be achieved if both assessors agreed. If there was a disagreement, a third independent assessor (SJ) was consulted.

Full criteria of the Cochrane risk of bias tool:

1. Sequence generation: was the allocation sequence adequately generated? 1) 'YES' if the paper described a random method (e.g. coin tossing) in the sequence generation process; 2) 'NO' if the paper described a non-random process in the sequence generation, either a systematic non-random approach (e.g. based on the judgement of a clinician), or a non-random categorisation of participants (e.g. based on the participants' date of birth); and 3) 'UNCLEAR' if sufficient information was not provided to make a judgement.

2. Allocation concealment: was allocation adequately concealed? 1) 'YES' if participants were unable to foresee assignment either in advance of, or during their enrolment, due to certain methods used to conceal allocation (e.g. central allocation); 2) 'NO' if participants could foresee the allocation (e.g. open random allocation process), thus selection bias was introduced during the process; and 3) 'UNCLEAR' if no sufficient information was given to make the judgement

3. Blinding of participants, personnel and outcome assessors: was the knowledge of the allocated intervention adequately prevented? 1) 'YES' if any of the following cases: no blinding and the investigators judge that the outcomes and the measurements were unlikely to be impacted by the lack of blinding; participants were blinded and personnel were ensured; outcome assessment was blinded, and no bias could be caused by any non-blinding process, although either participants or some personnel were not blinded; 2) 'NO' if any of the following: no or inappropriate blinding and the outcomes were likely to be

influenced by the lack of blinding; the likelihood of the broken blinding process for participants and personnel; and bias were introduced due to the lack of blinding; and 3) 'UNCLEAR' if any of the following: insufficient information were provided by the authors in order to make a judgement; and the study did not address this process

4. Incomplete outcome data: were incomplete outcome data adequately addressed? 1) 'YES' if no missing data or missing data were unlikely to be related to outcomes; 2) 'NO' if missing data were likely to be associated with the true outcomes; and 3) 'UNCLEAR' if insufficient information reported, or the study did not address this issue.

5. Selective outcome reporting: were reports free of suggestion of selective outcome reporting? 1) 'YES' if any of the following: protocol is available and all outcomes have been reported in a pre-specified manner; no available protocol but the reports included all outcomes including those pre-specified outcomes; 2) 'NO' if the authors did not report all pre-specified outcomes, or one or more primary outcomes were not pre-specified; and 3) 'UNCLEAR' if no sufficient information was provided to make a judgement.

6. Other sources of bias: was the study free of other issues that could cause a high risk of bias? 1) 'YES' if the study appears to be free of other bias; 2) 'NO' if one or more risk of bias was introduced; and 3) 'UNCLEAR' if there was a possibility of risk of bias but either no sufficient information provided, or no sufficient evidence to identify the problem that may cause bias.

3.2.5. Data synthesis

A narrative synthesis was conducted, and the ESRC's Guidance on the Conduct of Narrative Synthesis in Systematic Reviews (Popay et al, 2006) was used as guidance. Because we expected a high heterogeneity in the included samples and intervention types, a meta-analysis was precluded and judged as inappropriate.

Firstly, an overall description of all included trials was provided, such as the publication dates and the background of the trials. Secondly, the included studies

were grouped into three categories: 1) those alleviating subjective social isolation; 2) those addressing objective social isolation; and 3) those targeting both outcomes. Based on Mann's (2017) typology on loneliness interventions, this review categorised interventions into 4 types: 1) social skills training and/or psychoeducational programme; 2) those involved changing maladaptive cognitions about others; 3) programmes provided supported socialisation; and 4) wider community approaches.

The characteristics of these interventions and the results of the trials were then discussed. Studies that only compared the intended interventions to a control group and studies that included different active treatment groups were discussed separately. A discussion was then provided regarding if there are any similarities or differences between the characteristics of interventions that concluded as effective. Next, differences and similarities between the interventions for subjective social isolation and the interventions for objective social isolation were discussed. The results of relevant secondary outcomes (e.g. quality of life) were also described. The current review also reported an overall assessment regarding whether evidence is sufficient enough to draw conclusions on which intervention should be implemented for which outcome. When there was a mixed picture regarding the evidence, the reasons behind were discussed. Finally, based on the results, the review moved onto a final discussion of implications for future research and future clinical practice.

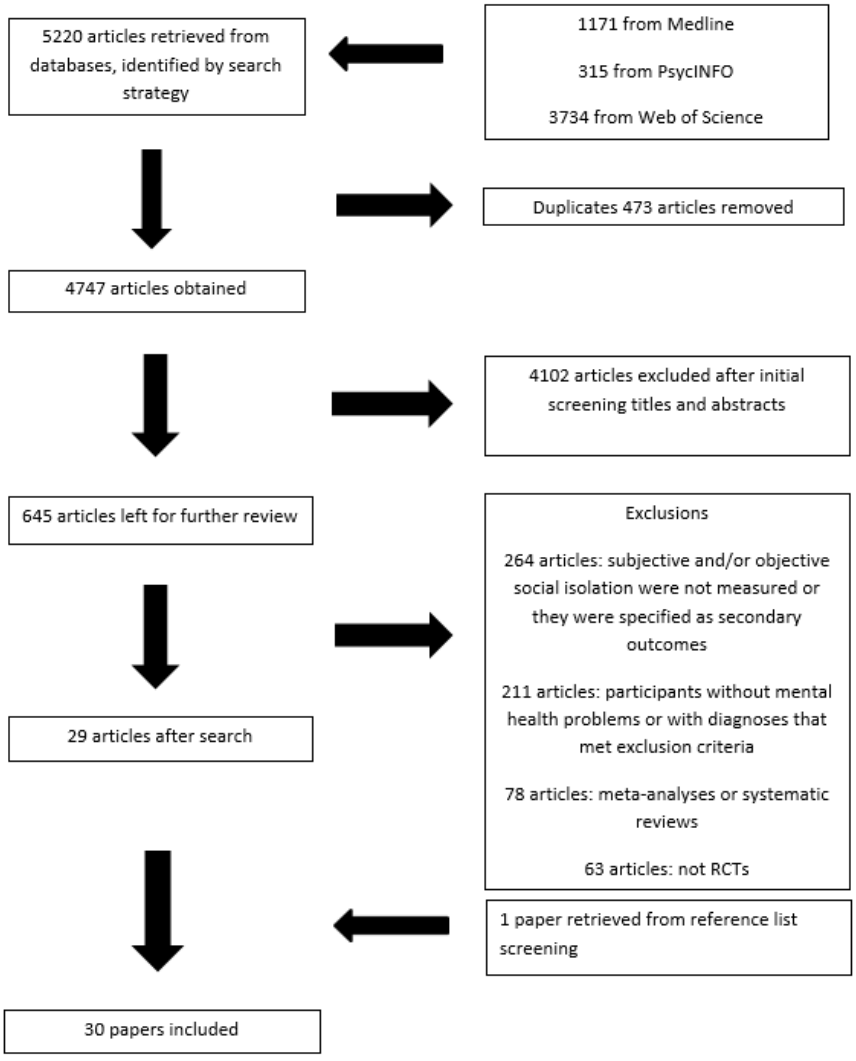
3.3. Results

Chapter 3 began by describing the methods used for the systematic review. The remaining part of the chapter proceeds and will present the results and discussion of this review.

Initially, 5220 papers in total were identified from all three databases. After removing duplicates and conducting the initial screening based on the title and abstract of each paper retrieved, 645 papers left for further examination. Based on the inclusion criteria, 29 studies were deemed eligible for inclusion. A screening process was then conducted on the reference lists of all relevant systematic reviews, meta-analyses and included studies; one paper was found

to be eligible. Therefore, thirty papers in total were included for this systematic review. The PRISMA flow diagram (Figure 3.1) demonstrates the details of the screening process.

Figure 3.1 PRISMA diagram for literature search



These thirty trials included 3080 participants in total. Sample sizes of individual trials ranged from 21 to 357. Nineteen trials included fewer than 100 participants. The median number was 88, and the interquartile range (IQR) was 104. Nine trials included sample size calculations. All papers were published between 1976 and 2016; thirteen studies were based in the US, eleven in Europe, three in Israel, two in China and one in Canada. Thirteen interventions were delivered individually, nine interventions were delivered in a group-format, four provided both individual- and group-based support, and four were online interventions. Ten

trials included different active treatment groups, four of which did not include a control group. The remaining twenty trials compared intervention groups with a control group: thirteen included treatment-as-usual groups, five included waiting-list controls, and two included no-treatment controls.

3.3.1. Interventions to reduce subjective social isolation

Fifteen trials included subjective social isolation measures (Table 3.3).

Table 3.3 Trials included subjective social isolation measures

1st author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Group-based intervention					
Hasson-Ohayon (2007) - 210 adults with severe mental illness Psychiatric community rehabilitation centre in Israel (secondary care setting)	Psychoeducation, social skills training	Illness management and Recovery Programme vs. treatment as usual Duration: 8 months	End of treatment follow-up (8 months)	Subjective social isolation outcome: Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet et al, 1990) Other outcome: personal recovery	No significant changes in perceived social support for either experimental or control group p>.05 [1]

[1] Effect size, confidence interval and actual p value not available in the paper

1st author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Silverman (2014) - 96 adults with varied Axis I diagnoses Acute care psychiatric unit in a University hospital, the Midwestern region in US (secondary care setting)	Psychoeducation	Live educational music therapy (A), recorded educational music therapy (B), education without music (C), recreational music therapy without education (D) Duration: 24 weeks	End-of-treatment follow-up (24 weeks)	Subjective social isolation outcome as the primary outcome: The MSPSS (Zimet et al, 1990)	No between group difference in perceived social support for condition A vs. B, condition A & B vs. condition C, and for condition A & B vs. D (all p>.05) F (3.87) =1.50 p=0.22, partial effect size = 0.049 for total support, 0.028 for support from significant other, 0.015 for support from family, and 0.094 for support from friends. Only a significant between-group difference between condition A vs. D on friend subscale, 95% CI (0.47, 10.40), adjusted p=.02, mean difference=5.34

1st author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Boevink (2016)- 163 adults with mental illness Mental health care organisations (community treatment team and sheltered housing organisations) in the Netherlands (secondary care setting)	Supported socialisation	Toward Recovery, Empowerment and Experiential Expertise (TREE) + care-as-usual vs. care-as-usual Duration for early starters (104 weeks) and late starters (52 weeks)	1 medium-term follow-up: 12-month (post-baseline) 1 long-term follow-up: 24-month (post-baseline	Subjective social isolation outcome: The De Jong-Gierveld Loneliness Scale (de Jong Gierveld & van Tilburg, 1991) Other outcomes: quality of Life; psychiatric symptoms	No between-group difference in loneliness, 95% CI (-0.31, 0.30), (effect size linear tread B= -0.053, p=0.98), standardised effect size was -0.001 for each year of exposure to TREE programme

1st author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Eggert (1995) - 105 high school students with poor grades (moderate or severe depression) 5 urban high schools in US (general population setting)	Supported socialisation, social skills training and wider community approaches	Assessment protocol plus 1 semester Personal Growth Class (PGCI) vs. Assessment protocol plus a 2-semester Personal Growth Class (PGCII) vs. an assessment protocol-only Duration for PGCI (5 months or 90 class days in length) and PGCII (10 months or 180 class days)	2 medium-term follow-ups: 5- and 10-month (post-baseline)	Subjective social isolation outcomes: Perceived social support was measured by calculating average ratings across 6 network support sources. Instrumental and expressive support provided source was also rated Other outcomes: depressive symptoms	All three groups showed increased network social support, F linear (1,100) = 32.08, P<.001 No between-group difference between all groups, F linear (1,100) =1.98, p=0.143
Individual-based intervention					

1st author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Zang (2014) - 30 adults aged 28-80 with PTSD Beichuan County in China (general population setting)	Changing cognitions	Narrative Exposure Therapy (NET) vs. Narrative Exposure Therapy Revised (NET-R) vs. waiting-list control Duration for NET (2 weeks) and NET-R group (1 week)	End-of-treatment follow-up (2 weeks for NET, 1 week for NET-R) 2 medium-term follow-ups: 1- or 2-week, and 3-month	Subjective social isolation outcome: The MSPSS (Zimet et al, 1990) Other outcomes: anxiety and depressive symptoms; Post-traumatic stress disorder (PTSD) symptoms	Both NET and NET-R demonstrated effects on perceived social support at post treatment, but no significant between-group difference between NET and NET-R ($F(2,26) = 0.14$, $p > 0.05$) No between-group difference between either treatment group (NET and NET-R) and waiting-list control in perceived social support (both $p > .05$)

1st author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Zang (2013) - 22 adults aged 37-75 with PTSD Beichuan Country in China (general population setting)	Changing cognitions	NET intervention vs. waiting-list control group Duration: 2 weeks	End-of-treatment follow-up (2 weeks) 2 medium-term follow-ups: 2-week, and 2-month	Subjective social isolation outcome: The MSPSS (Zimet et al, 1990) Other outcomes: subjective level of distress; depressive symptoms	No significant between-group difference in perceived social support (F (1,19) =4.25, p=.05 d=0.33
Gawrysiak (2009) - 30 adults aged >=18 with depression A public Southeatern University in US (general population setting)	Psychoeducation, social skills training and supported socialisation:	Behavioural Activation Treatment for Depression (BATD) vs. no-treatment control Duration: single session lasted 90 minutes	1 medium-term follow-up: 2-week	Subjective social isolation outcome: the MSPSS (Zimet et al, 1990) Other outcomes: depressive symptoms; anxiety symptoms	No significant between-group difference in perceived social support, F (1,28) =3.11, p=.08, d = 0.70

1st author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Conoley (1985) - 57 female psychology undergraduate students with moderate depression University Psychology department in the US (general population setting)	Changing cognitions	Reframing vs. self-control vs. waiting list control Duration: 2 weeks	End-of-treatment follow-up (2 weeks) 1 medium-term follow-up: 2-week	Subjective social isolation outcome: The Revised University of California Los Angeles (UCLA) Loneliness Scale (Russell et al, 1980); The Causal Dimension Scale (Russell, 1982) Other outcome: depressive symptoms	There was no significant treatment effect F (2,108) =.60 p>.05 [2]

[2] Confidence interval and actual p value not available in the paper

1st author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Bjorkman (2002) - 77 adults aged 19-51 with severe mental illness Case management service in Sweden (secondary care setting)	Social skills training	The case management service vs. standard care Duration: unclear	2 long-term follow-ups: 18- and 36-month	Subjective social isolation outcome: the abbreviated version of the Interview Schedule for Social Interaction (ISSI) (Henderson et al, 1980) Other outcomes: psychiatric symptoms; quality of life; use of psychiatric services	There was no significant between-group difference between two groups in social outcomes (p>.05) [3]
Mixed-format (group- and individual-based)					

[3] Effect size, confidence interval and actual p value not available in the paper

1st author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Mendelson (2013) - 78 depressed women aged 14-41 who either pregnant or with a child less than 6 month Home visiting programme in Baltimore City in the US (general population setting)	Changing cognitions	Standard home visiting services + The Mother and Babies (MB) course vs. standard home visiting services + information on perinatal depression Duration: 6 weeks	End-of-treatment follow-up (6 weeks) 2 medium-term follow-ups: 3- and 6-month	Subjective social isolation outcome: The Interpersonal Support Evaluation List (ISEL) (Cohen & Hoberman, 1983)	No significant between-group difference in perceived social support (β=6.67, SE=0.03, p<0.10) [4]
Masia-Warner (2005) - 35 high school students with social anxiety disorder Two parochial high schools in New York, US (general population setting)	Psychoeducation /social skills training, supported socialisation and changing cognitions	Skills for Social and Academic Success vs. waiting list group Duration: 3 months	End-of-treatment follow-up (3 months) 1 medium-term follow-up: 9-month	Subjective social isolation outcome: Loneliness scale (Asher & Wheeler, 1985) Other outcomes: anxiety symptoms; social phobic symptoms; depressive symptoms	No significant treatment effect, effect size=.20 [5] , p>0.05

[4] Effect size and confidence interval not available in the paper

[5] Confidence interval and actual p value not available in the paper

1st author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Online intervention					
Kaplan (2011) -300 adults with schizophrenia spectrum or affective disorder Online in the US (general population setting)	Supported socialisation	Experimental peer support listserv vs. experimental peer support bulletin board vs. waiting-list control group Duration: 12 months	2 medium-term follow-ups: 4- and 12-month (post-baseline)	Subjective social isolation outcome: The Medical Outcomes Study (MOS) Social Support Survey (Sherbourne & Stewart, 1991) Other outcomes: personal recovery; quality of life; psychiatric symptoms	No significant between-group difference on MOS F (1,298) =0.08, p=0.93, also not significant when two experimental groups compared to the control group separately (p>.05)

1st author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Rotondi (2005) - 30 patients aged >=14 with schizophrenia or schizoaffective disorder In- and out-patient psychiatric care units and psychiatric rehabilitation centres in Pittsburgh, Pennsylvania (secondary care setting)	Psychoeducation	Telehealth intervention vs. usual care group Duration: unclear	2 medium-term follow-ups: 3- and 6-month (post-baseline)	Subjective social isolation outcome: The informational support and emotional support subscales of the instrument that was developed by Krause and Markides (1990)	No significant between-group difference in perceived social support F (1,27)=3.79, p=.062
O'Mahen (2014) - 83 women aged >18 with MDD Online in the UK (general population setting)	Psychoeducation and supported socialisation	Netmums Helping with Depression (HWD) vs. treatment-as-usual Duration: unclear	End-of-treatment follow-up (unclear) 1 medium-term follow-up: 6-month	Subjective social isolation outcome: The Social Provision Scale (Cutrona & Russell, 1987) Other outcomes: depressive symptoms; anxiety symptoms	No significant between-group differences in perceived support between the intervention and control group (95% CI 1.02 to -0.02), medium effect size = 0.50 (p=0.27).

1st author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Interian (2016) - 103 veterans with PTSD Online in the US (primary care setting)	Psychoeducation and changing cognitions	The Family of Heroes intervention vs. no-treatment control group Duration: unclear	1 medium-term follow-up: 2-month follow-up (post-baseline)	Subjective social isolation outcome: The family subscale of the MSPSS (Zimet et al, 1990)	Intervention group reported a higher chance of having a decreased perceived family support over time than the control group (p=0.04)[6]

Abbreviations: MSPSS = Multidimensional Scale of Perceived Social Support; TREE = Toward Recovery, Empowerment and Experiential Expertise; PGCI = Assessment protocol plus 1 semester Personal Growth Class; PGCII = Assessment protocol plus a 2-semester Personal Growth Class; NET = Narrative Exposure Therapy; NET-R = Narrative Exposure Therapy-Revised; PTSD = Posttraumatic stress disorder ; BATD = Behavioural Activation Treatment for Depression; UCLA-R = The Revised University of California Los Angeles (UCLA) Loneliness Scale; ISSI = the Interview Schedule for Social Interaction; ISEL = The Interpersonal Support Evaluation List; MOS = The Medical Outcomes Study (MOS) Social Support Survey; NetmumsHWD = Netmums Helping with Depression; MDD = major depressive disorder

[6] Effect size not available in the paper

Two trials reported only end-of-treatment outcomes (Hasson-Ohayon et al, 2007; Silverman et al, 2014). The follow-up period of the remaining thirteen trials ranged from one week to 36 months beyond the end-of-treatment time-point. The most frequently used measures were the Multidimensional Scale of Perceived Social Support (MSPSS) and the UCLA Loneliness Scale. All measures administrated in fourteen trials have been demonstrated with good validity and reliability. However, one trial (Boevink et al, 2016) did not involve a well-established measure. Nine trials targeted people with common mental health diagnoses (e.g. depression), three included people with severe mental illnesses (e.g. schizophrenia), and the other three involved people with a wide range of mental health diagnoses. Most of the included trials involved a small sample size with fewer than 100 participants, only four trials included more than 200. Five trials reported their sample size calculations.

Three trials implemented their interventions online, one trial delivered online intervention along with telephone support, four trials involved face-to-face intervention with group formats, five provided face-to-face individual-based intervention, and two trials included interventions with both group and individual formats. Two trials provided interventions with a supported socialisation component, four trials examined social skills training and/or psychoeducational programme, four evaluated interventions involving a cognition modification element, and five combined different types of intervention. The duration of the intended interventions ranged from one week to 104 weeks, four trials failed to provide such information and one trial only included a single intervention session. (Appendix 3.1 & 3.2).

In terms of quality assessment, randomisation methods were mentioned in fifteen trials. Information regarding allocation concealment, missing data and blinding was not sufficiently provided in the majority of the included trials. For detailed quality assessments, please see Table 3.4.

Table 3.4 Quality assessment of included trials

1st author, publication year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome data	Selective outcome reporting	Other sources of bias
Kaplan K (2011)	Low Risk	UNCLEAR	High Risk	UNCLEAR	Low Risk	Low Risk
Hasson-Ohayon I (2007)	Low Risk	UNCLEAR	High Risk	UNCLEAR	Low Risk	High Risk
Rotondi A. J. (2005)	UNCLEAR	UNCLEAR	High Risk	UNCLEAR	Low Risk	High Risk
Silverman M. J. (2014)	UNCELAR	UNCLEAR	High Risk	UNCLEAR	Low Risk	Low Risk
Boevink, W (2016)	Low Risk	UNCLEAR	High Risk	UNCLEAR	Low Risk	Low Risk
Zang, Y (2014)	Low Risk	UNCLEAR	High Risk	UNCLEAR	Low Risk	High Risk
Zang, Y (2013)	Low Risk	UNCLEAR	High Risk	UNCLEAR	Low Risk	High Risk
Gawrysiak M (2009)	UNCLEAR	UNCLEAR	High Risk	UNCLEAR	Low Risk	Low Risk
Bjorkman, T (2002)	Low Risk	Low Risk	High Risk	UNCLEAR	Low Risk	High Risk
Mendelson T (2013)	UNCLEAR	UNCLEAR	High Risk	UNCLEAR	Low Risk	High Risk
O'Mahen H. A (2014)	Low Risk	Low Risk	High Risk	Low Risk	Low Risk	Low Risk
Conoley C. W (1985)	UNCLEAR	UNCLEAR	High Risk	UNCLEAR	Low Risk	High Risk
Eggert L (1995)	UNCLEAR	UNCLEAR	High Risk	UNCLEAR	Low Risk	High Risk
Masia-Warner C (2005)	UNCLEAR	UNCLEAR	High Risk	Low Risk	Low Risk	High Risk
Interian A (2016)	Low Risk	UNCLEAR	High Risk	UNCLEAR	Low Risk	High Risk
Solomon, P (1995a)	UNCLEAR	UNCLEAR	High Risk	Low Risk	Low Risk	High Risk

1st author, publication year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome data	Selective outcome reporting	Other sources of bias
Aberg-Wistedt, A (1995)	UNCLEAR	UNCLEAR	High Risk	UNCLEAR	Low Risk	High Risk
Atkinson, J. M (1996)	UNCLEAR	UNCLEAR	High Risk	UNLCEAR	Low Risk	High Risk
Terzian, E (2013)	UNCLEAR	Low Risk	High Risk	UNCLEAR	Low Risk	High Risk
Hasson-Ohayon, I (2014)	UNCLEAR	UNLCEAR	High Risk	UNCLEAR	Low Risk	High Risk
Rivera, J. J (2007)	UNCLEAR	Low Risk	High Risk	Low Risk	Low Risk	Low Risk
Solomon P (1995)	UNCLEAR	UNCLEAR	High Risk	Low Risk	Low Risk	High Risk

Of the ten trials that compared an active intervention with a control group (Hasson-Ohayon et al, 2007; Boevink et al, 2016; Zang et al, 2013; Gawrysiak et al, 2009; Bjorkman et al, 2002; Mendelson et al, 2013; Masia-Warner et al, 2005; Rotondi et al, 2005; O'Mahen et al, 2014; Interian et al, 2016), none of them found a significant between-group difference. Of the five trials comparing different active treatment groups (Silverman et al, 2014; Eggert et al, 1995; Zang et al, 2014; Conoley et al, 1985; Kaplan et al, 2011), only Silverman and colleagues (2014) reported a significant between-group difference on a friend subscale of the MSPSS, demonstrating a greater improvement in the level of social support perceived from friends in the intervention group providing music therapy and psychoeducational component, compared to other treatment groups (e.g. music alone). However, no between-group differences were found in other outcomes and this trial failed to include a control group. Due to the fact that most trials only included small sample sizes, definite conclusions cannot be drawn.

Eleven out of these fifteen trials included relevant secondary outcomes (Hasson-Ohayon et al, 2007; Boevink et al, 2016; Eggert et al, 1995; Zang et al, 2014; Zang et al, 2013; Gawrysiak et al, 2009; Conoley et al, 1985; Bjorkman et al, 2002; Masia-Warner et al, 2005; Kaplan et al, 2011; O'Mahen et al, 2014). Of

these eleven trials, significant improvements were shown in seven trials: depressive symptoms reductions were found in trials involving interventions with mixed approaches, with following samples: adults living in the community (Gawryskia et al, 2009), urban high schoolers (Eggert et al, 1995), and women diagnosed with MDD (O'Mahen et al, 2014). Another trial included an intervention with mixed strategies, it also demonstrated an improvement in social avoidance and social phobia among high school students (Masi-Warner et al, 2005). One trial targeted at people with a wide range of mental health diagnoses and the authors also found that significant progress was made towards personal recovery and personal goals after receiving social skills training with a psychoeducational component (Hasson-Ohayon et al, 2007). Another group of participants with mixed diagnoses also reported improved quality of life in a trial provided supported socialisation (Boevink et al, 2016). Despite these positive outcomes, some trials failed to find significant results on some outcomes: Gawryskia et al (2009) reported improved depressive symptoms in their sample, but there was no improvement on the scale for anxiety; Bjorkman and colleagues (2002) reported no change in quality of life in their sample with severe mental illness after receiving case management service; and the implementation of another online intervention targeting people with schizophrenia was not associated with any improvements on their quality of life and symptoms (Kaplan et al, 2011)

3.3.2. Interventions to reduce objective social isolation

Eleven trials included objective social isolation measures (Table 3.5).

Table 3.5 Trials included objective social isolation measures

1st author and sample	Intervention categorisation	Intervention name and duration	Follow-up	Objective social isolation and other outcome measures	Objective social isolation outcome
Group-based intervention					
Atkinson (1996) - 146 registered patients with schizophrenia Community clinic in south Glasgow, UK (secondary care setting)	Psychoeducation	The education group vs. waiting-list control Duration: 20 weeks	End-of-treatment follow-up (20 weeks) 1 medium-term follow-up: 3-month	Objective social isolation outcome: A modified Social Network Schedule (SNS) (Dunn et al, 1990) Other outcomes: quality of life; psychiatric symptoms; overall functioning	Significant between-group difference in the total number of contacts after the intervention (t=4.4 p<.001) and at follow-up (t=3.6 p<.001) Significant between-group difference in the number of confidants after the intervention (t=3, p=0.004) and at follow-up (t=2.8, p=0.006) Significant between-group difference over time from post-group (t=2.8 p=0.007) to follow-up (t=2.5 p=0.02)

1st author and sample	Intervention categorisation	Intervention name and duration	Follow-up	Objective social isolation and other outcome measures	Objective social isolation outcome
Hasson-Ohayon (2014) - 55 adults aged 21-62 with various mental illness 3 Psychiatric rehabilitation agencies and the University Community Clinic in Bar-Ilan University, Israel (secondary care setting)	Wider community approaches, psychoeducation/ social skills training and changing cognitions	Social Cognition and Interaction Training (SCIT) + social mentoring vs. social mentoring only Duration: unclear	1 medium-term follow-up: 6-month	Objective social isolation outcome: the socio-engagement and interpersonal-communication subscales of the Social Functioning Scale (SFS) (Birchwood et al, 1990)	Experimental group showed significantly more improvement in social engagement compared to controls ($F(1,53)=28.9$, $p<.001$, effect size=0.35), but no significant between-group difference on the interpersonal communication subscale ($F(1,53)=0.55$, $p=.464$, effect size =0.01)

1st author and sample	Intervention categorisation	Intervention name and duration	Follow-up	Objective social isolation and other outcome measures	Objective social isolation outcome
Bøen (2012) - 138 seniors with light depression 2 Municipal districts in eastern and western Oslo, Norway (general population setting)	Supported social socialisation, and wider community approaches	A preventive senior centre group programme vs. control Duration: one year	End-of-treatment follow-up (1 year)	Objective social isolation outcome: the Oslo-3 Social Support Scale (Korkeila et al, 2003) [7] Other outcomes: depressive symptoms; Life satisfaction	Both groups had an increased level of social support, but greater improvement in the intervention group than the control group, effect size =0.12, 95% CI (-0.47, 0.81). There was also a dose-response effect for social support
Individual-based intervention					

[7] Due to the fact that the Oslo-3 focuses primarily on the practical aspects of social support, , Bøen's study was considered as trials for objective social isolation only.

1st author and sample	Intervention categorisation	Intervention name and duration	Follow-up	Objective social isolation and other outcome measures	Objective social isolation outcome
Solomon (1995a) - 96 adults with schizophrenia or major affective disorders A community mental health care centre in the US (secondary care setting)	Supported social socialisation and wider community approaches	Consumer management team vs. non-consumer management team Duration: unclear	2 medium-term follow-ups: 1-month and 1-year (post-baseline)	Objective social isolation outcome: Family and social contacts; Pattison's Social Network Scale (Pattison et al, 1975) Other outcomes: use of services; quality of Life; psychiatric symptoms	No significant between groups difference (p>.05) [8] in social networks On average, participants identified 2.72 people, 1.55 positive social network members and 1.6 family members in their social networks.

[8] Effect size, confidence intervals and actual p value not available in the paper

1st author and sample	Intervention categorisation	Intervention name and duration	Follow-up	Objective social isolation and other outcome measures	Objective social isolation outcome
Aberg-Wistedt (1995) - 40 adults with schizophrenia or long-term psychotic disorder The Kungsholmen sector in Stockholm, Sweden (secondary care setting)	Psychoeducation/ social skills training	The intensive case management programme vs. standard services Duration: 2 years	1 long-term follow-up: 2-year (post-baseline)	Objective social isolation outcome: The number of people in participants' social life was measured by a standardised procedure developed from work with child psychiatric patients (Swaling et al, 1990) Other outcomes: quality of life; service use	Social network of the experimental group increased, while it decreased for the control group, but no significant between-group difference (p>.004) [9]

[9] Effect size, confidence intervals and actual p value not available in the paper; the significant level used in this study was p<.004

1st author and sample	Intervention categorisation	Intervention name and duration	Follow-up	Objective social isolation and other outcome measures	Objective social isolation outcome
Stravynski (1982) - 22 adults aged 22-57 with diffuse social phobia and avoidance personality disorder The Maudsley hospital in London, UK (secondary care setting)	Social skills training and changing cognitions	Social skills training vs. Social skill training + cognitive modification Duration: 14 weeks	End-of-treatment follow-up (14 weeks) 1 medium-term follow-up: 6-month	Objective social isolation outcome : objective social isolation subscale of the Structured and Scaled Interview to Assess Maladjustment (SSIAM) (Gurland et al, 1972) Other outcomes: depressive symptoms	No significant between-group difference, all groups reported less experience of social isolation over time p>.05 [10]

Terzian (2013) - 357 adults aged < 45 diagnosed by the schizophrenia spectrum by the ICD-10th 47 community mental health services (SPT) in Italy (secondary care setting)	Supported socialisation and wider community approaches	Social network intervention + usual treatments vs. usual treatments Duration: 3-6 months	1 medium-term follow-up: 1-year (post-baseline) 1 long-term follow-up: 2 year (post-baseline)	Objective social isolation outcome: Social networks measured by different parameters of relationships were assessed, all were summarised into a score Other outcomes: psychiatric symptoms; hospitalisation over the follow-up year	In this study, social network improvement was defined as an increase in the number, frequency, importance or closeness of relationships, an overall social network improvement was defined as an improvement in intimate or working relationships. Significant between-group differences in the improvement of social network and overall social network improvement were found. An improvement in social network was found at year 1 in 25% of patients in control group and 39.9% of patients in the experimental group (OR 2.0, 95% CI 1.3-3.1; AOR 2.4 95% CI 1.4-3.9). An overall social network improvement was found at year 1 for 30.8% of the control group and 44.5% of the experimental group (OR 2.0, 95% CI 1.2 – 2.8, AOR 2.1, 95% 1.3 -3.4) These differences remained significant at year 2 for social network improvement (31.5% in the

1st author and sample	Intervention categorisation	Intervention name and duration	Follow-up	Objective social isolation and other outcome measures	Objective social isolation outcome
					control group and 45.5% in the experimental group, OR 1.8, 95% CI 1.1to 2.8; AOR 2.1, 95% CI 1.3 to 3.5) and for overall social network improvement (33.3% for routine group, 47.9% for the experimental group, OR 1.8, 95% CI 1.2 -2.9, AOR 2.2, 95% CI 1.3 – 3.5).
Solomon (1995b) - 96 adults with schizophrenia or major affective disorders A community mental health centre in the US (secondary care setting)	Supported socialisation and wider community approaches	Consumer case management team vs. nonconsumer management team Duration: 2 years	2 medium-term follow-ups: 1-month and 1-year (post-baseline) 1 long-term follow-up: 2-year (post-baseline)	Objective social isolation outcome: Pattison's Social Network (Pattison et al, 1975) Other outcomes: quality of Life; psychiatric symptoms	No significant between-group difference in social outcome, and no significant time and condition effect on all measures, F (12,78)=1.19, p>0.05[10]

[10] Effect size, confidence interval and actual p value not available in the paper

1st author and sample	Intervention categorisation	Intervention name and duration	Follow-up	Objective social isolation and other outcome measures	Objective social isolation outcome
Marzillier (1976) - 21 adults aged 17-43 with diagnosis of personality disorder or neurosis The Maudsley Hospital in London, UK (secondary care setting)	Social skills training and changing cognitions	Systematic Desensitisation (SD) vs. Social Skills Training (SST) vs. waiting-list control Duration: 3 and half months	End-of-treatment follow-up (3.5 months) 1 medium-term follow-up: 6-month	Objective social isolation outcome: Revised-Social Diary and Standardised interview Schedule (Marzillier et al, 1976) Other outcomes: anxiety disorders; mental state; personality assessment	No significant between-group difference between SST and SD in social activities and social contacts (p>.05). SST had a greater improvement in the range of social activities (F (1, 18) =7.56, p<.025) and social contacts (F (1, 18) =9.47, p<.0.01) than the waiting-list group. SD had a greater increase in social contacts than the waiting-list group (F (1, 18) =12.46, p<0.001)

1st author and sample	Intervention categorisation	Intervention name and duration	Follow-up	Objective social isolation and other outcome measures	Objective social isolation outcome
Cole (1995) - 32 adults with major depression, dysthymic disorder or other affective disorder St.Mary's Hospital in Montreal, Canada (primary care setting)	Nonspecific type (intervention group received a psychiatric assessment at home, compared to the control group who received a standard assessment at clinic)	Home assessment group vs. clinic assessment group (treatment-as-usual) Duration: unclear	3 medium-term follow-ups: 4-, 8- and 12-week (post-baseline)	Objective social isolation outcome: Social Resources (SR) subscale from The Older Americans Research and Service Centre Instrument (OARS) (Centre for Aging and Human Development, 1978) Other outcomes: mental state; psychiatric symptoms	No significant between-group differences in social resources (p>.05)[11]
Mixed format (group- and individual-based)					

[11] Effect size, confidence interval and actual p value not available in the paper

1st author and sample	Intervention categorisation	Intervention name and duration	Follow-up	Objective social isolation and other outcome measures	Objective social isolation outcome
Rivera (2007) - 203 adults with a psychotic or mood disorder on axis I An inpatient unit in a city hospital in New York, US (secondary care setting)	Supported socialisation	Peer-assisted care vs. Nonconsumer assisted vs. standard care vs. clinic-based care Duration: unclear	2 medium-term follow-ups: 6- and 12-month (post-baseline)	Objective social isolation outcome: A modification of the Pattison Network Inventory (Pattison, 1977) Other outcomes: quality of life; psychiatric symptoms	Only peer-assisted group showed an increase in social contacts with consumer and professional staff from baseline to 12-month follow-up F (2, 118) =7.25, p<.01, effect size=0.11 No significant between-group difference in other network measures (p>.05)

Abbreviations: SNS = Social Network Schedule; SCIT = Social Cognition and Interaction Training; SFS = the Social Functioning Scale; OSSS = the Oslo-3 Social Support Scale; SSIAM = Structured and Scaled Interview to Assess Maladjustment; SD = Systematic Desensitisation; SST = Social Skills Training; OARS = the Older Americans Research and Service Centre Instrument

Atkinson et al (1996) only reported end-of-treatment outcomes, the follow-up period of the remaining ten trials ranged from four weeks to two years beyond the end-of-treatment time-point. Measures with established validity and reliability were administrated in eight trials. Objective social isolation in one trial was measured by assessing the number, frequency and types of social connections each individual had (Terzian et al, 2013), another trial included both methods (Solomon et al, 1995a), and the measure of another trial could not be validated due to little information was given (Aberg-Wistedt et al, 1995). Three trials targeted people with common mental health problems, seven trials included people with severe mental illness, and another trial involved participants with a wide range of mental health diagnoses. Most trials included fewer than 100 participants, only two trials had more than 200. Only three trials provided information on sample size calculations.

Seven trials were delivered individually, three were implemented in a group format, and one combined group and individual methods plus telephone support. Two trials provided social skills training and/or psychoeducational programme, one included supported socialisation component, seven trials examined interventions with mixed strategies, and the intervention type of another trial could not be determined. The duration of the interventions ranged from twelve weeks to two years, although four trials failed to provide such information (Appendix 3.1 & 3.2).

Regarding quality assessment, randomisation process was described only in three trials, and information on allocation concealment was provided in five trials. Seven trials did not report strategies for managing missing data. For detailed quality assessments, please see Table 3.4.

Of the six trials that compared an intended intervention group with a control group (Atkinson et al, 1996; Hasson-Ohayon et al, 2014; Bøen et al, 2012b; Aberg-Wistedt et al, 1995; Terzian et al, 2013; Cole et al, 1995), authors of four trials reported superior effects of their intervention groups over the control groups, including: a psychoeducational programme for adults with schizophrenia (Atkinson et al, 1996), a social network intervention targeting people with schizophrenia spectrum disorders (Terzian et al, 2013), a preventive senior centre group for seniors diagnosed with mild depression (Bøen et al, 2012b), and

Social Cognition and Interaction Training (SCIT) for a diagnostically-mixed patient group (Hasson-Ohayon, 2014). No significant results were found in objective social isolation outcomes in the rest of two trials: one provided social education for people with schizophrenia and one involved home assessment teams for people diagnosed with mood disorders (Aberg-Wistedt et al, 1995; Cole et al, 1995).

Of the five trials involved two or more active interventions (Solomon et al, 1995a; Stravynksi et al, 1982; Solomon et al, 1995b; Marzillier et al, 1976; Rivera et al, 2007), significant improvements were found in two trials: one trial involving systematic desensitisation and social skills training found superior effects of both intervention groups over the control group in the social contacts outcome among people with personality or mood disorders. However, no significant between-group difference was found between the two active treatment groups (Marzillier et al, 1976). In another trial from Rivera and colleagues (2007), improved social contact with staff was found in the consumer-provided programme, but not in the non-consumer support group. Two trials from Solomon and colleagues (1995a, 1995b) also examined the effectiveness of consumer versus non-consumer provided mental health care in social network size and clinical outcomes. No significant between-group difference was found between the two intervention groups. The authors also reported no significant difference when each intervention group was compared to the control group separately. Therefore, we cannot draw any clear conclusion on the effectiveness of consumer-provided intensive case management for improving objective social isolation. Stravynski et al (1982) examined whether there are any additional benefits in objective social isolation outcomes when a cognitive modification element was added onto social skills training for people with social phobia and/or avoidance personality disorders, but there was no significant between-group difference.

Ten out of eleven trials included other relevant secondary outcomes (Atkinson et al, 1996; Bøen et al, 2012b; Solomon et al, 1995a; Aberg-Wistedt et al, 1995; Stravynski et al, 1982; Terzian et al, 2013; Solomon et al, 1995b; Marzillier et al, 1976; Cole et al, 1995; Rivera et al, 2007). Four out of these ten trials found positive findings: Rivera et al (2007) reported an improvement in mental state in adults with schizophrenia and other psychotic disorders after receiving a supported socialisation intervention; improved depressive symptoms and social

avoidance were also found in a trial evaluating an intervention with mixed types of strategies among people diagnosed with social phobia and avoidant personality disorder (Stravynksi et al, 1982). Atkinson and colleagues (1996) also reported improved quality of life for people with schizophrenia who received a psychoeducational programme. Another trial from Aberg-Wistedt et al (1995) found fewer emergency visits among a sample with schizophrenia and psychotic symptoms. Few trials failed to find any positive results: consumer-led case management service offered no benefits in psychiatric symptoms and service use for people with schizophrenia or major affective disorders in the two papers from Solomon and colleagues (1995a, 1995b), and there was no change in clinical outcomes reported by Terzian et al (2013) in their social network intervention for people with schizophrenia.

3.3.3. Interventions to reduce both subjective and objective social isolation

Four trials included both subjective and objective social isolation outcomes (Table 3.6).

Table 3.6 Trials included both subjective and objective social isolation measures

1st author and sample	Intervention categorisation	Intervention name	Follow-up	Subjective/objective social isolation and other outcome measures	Subjective social isolation outcomes	Objective social isolation outcomes
Group-based intervention						
Castelein (2008) - 106 adults aged >= 18 with schizophrenia or related psychotic disorders 4 mental health centres in the Netherland (secondary care setting)	Supported socialisation	Care as usual + Guided Peer Support Group (GPSG) vs. a waiting-list control Duration: 8 months	End-of-treatment follow-up (8 months)	Subjective social isolation outcome: The Social Support List (SSL) (Bridges et al, 2002); Objective social isolation outcome: Personal Network Questionnaire (PNQ) (Castelein et al, 2008) Other outcomes: quality of Life; screening for psychosis	Experimental group had a significantly greater increase in esteem support (p=0.02), compared to WL [12]	Experimental group had a significantly greater improvement in social contacts with peers after the sessions (p=0.03), compared to WL

[12] Effect size and confidence interval not available in the paper

1st author and sample	Intervention categorisation	Intervention name	Follow-up	Subjective/objective social isolation and other outcome measures	Subjective social isolation outcomes	Objective social isolation outcomes
Gelkopf (1994) - 34 adults with chronic schizophrenics by DSM-III-R 7 chronic schizophrenia wards in Israel (secondary care setting)	Changing cognitions	Video projection of humorous movies vs. treatment-as-usual control group Duration: 3 months	1 medium-term follow-up: 2 weeks	Subjective social isolation outcome: The Social Support Questionnaire 6 (SSQ6) (Sarason et al, 1987); Objective social isolation outcome: Two measures of social network sum up the size and dispersion; Four measures assess the source of the support	A significantly greater improvement in the experimental group than the control group, in perceived amount of support from staff (F=7.90 p<.01), emotional support (F=4.80 p<.05), and instrumental support, (F=4.94 p<.05). No significant results in satisfaction towards the support (F=1.90, p>.05). [13]	A significantly greater improvement in the experimental group than the control group in the number of supporters (F=4.87 p<.05)
Individual-based intervention						

[13] Effect size, confidence interval and actual p value not available in the paper

1st author and sample	Intervention categorisation	Intervention name	Follow-up	Subjective/objective social isolation and other outcome measures	Subjective social isolation outcomes	Objective social isolation outcomes
Ammerman (2013) - 93 females aged from 16-37 with MDD A community-based home visiting programme in Southwestern Ohio and Nortern Kentucky in the US (general population setting)	Changing cognitions	In-Home Cognitive Behavioural Therapy (IH-CBT) + home visiting vs. home visit alone Duration: about 5 months	End-of-treatment follow-up (5 months) 1 medium-term follow-up: 3-month	Subjective social isolation outcome: Interpersonal Support Evaluation List (ISEL) (Cohen & Hoberman,1983); Objective social isolation outcome: Social Network Index (SNI) (Cohen et al, 1997) Other outcome: psychiatric symptoms	IH-CBT group reported a greater increase in social support (p<.001), compared to SHV. Small effect size (0.38) post treatment and moderate effect size (0.65) at follow-up	No significant between-group difference in network size (F=1.88, p>.05), network diversity (F=0.63 p>.05), and embedded networks (F=2.23, p>.05).[14]
Mixed format (group- and individual-based)						

[14] Effect size, confidence interval and actual p value not available in the paper

1st author and sample	Intervention categorisation	Intervention name	Follow-up	Subjective/objective social isolation and other outcome measures	Subjective social isolation outcomes	Objective social isolation outcomes
Schene (1993) - 222 adults aged > 60 with mental disorders University Psychiatric Clinic of the Academic Hospital in Utrecht, the Netherland (secondary care setting)	Psychoeducation/social skills training, and supported socialisation	Psychiatric day treatment vs. inpatient treatment (treatment-as-usual) Duration: averagely 24.9 months	End-of-treatment follow-up (averagely 37.6 weeks for day treatment, 24.9 weeks for inpatient treatment) 1 medium-term follow-up: 6-month	Subjective and objective social isolation outcomes: the Social Network and Social Support Questionnaire (SNSS) (Wijngaarden, 1987) Other outcomes: mental state; psychiatric symptoms; social dysfunction	No significant between-group difference in social support (F=0.20, p>.05), and no change over time (F=1.25, P>.05)[15]	No significant between-group difference in network scope (F=0.05, P>.05) and network contacts (F=0.02, p>.05)

Abbreviations: GPSG = Guided Peer Support Group; SSL = The Social Support List; IH-CBT = In-Home Cognitive Behavioural Therapy; PNQ = Personal Network Questionnaire; MDD = major depressive disorders; ISEL = Interpersonal Support Evaluation List; SNI = Social Network Index; SNSS = Social Network and Social Support Questionnaire

[15] Effect size, confidence interval and the actual p value not available in the paper

One trial reported only end-of-treatment outcomes (Gelkopf et al, 1994), the follow-up period ranged from two weeks and six months in the rest of three trials (Ammerman et al, 2013; Castelein et al, 2008; Schene et al, 1993). Besides one trial (Castelein et al, 2008), in which the authors developed their own measure for objective social isolation outcome, scales administrated in the other three trials showed satisfactory reliability and validity. One trial targeted people with common mental health problems, two targeted people with severe mental illness, and one involved people with a wide range of mental health diagnoses. Two trials involved fewer than 100 participants and only one trial had more than 200. Only one trial included a sample size calculation.

One trial delivered their intervention in an individual-format, two trials provided a group-based intervention, and one combined both methods with additional phone support. The duration of the interventions ranged from three to eight months. Intervention in one trial offered supported socialisation, two trials provided interventions changing maladaptive cognitions, and another trial involved an intervention with mixed strategies (Appendix 3.1 & 3.2).

Regarding quality assessment, two trials were at low risk of bias for sequence generation, and two trials were at low risk of bias for allocation concealment. Only one trial described a strategy for managing missing data. All trials were judged as at high risk of bias for blinding and other sources of bias, but all were at low risk of bias for selective outcome reporting (Table 3.4).

All four trials compared an intervention group with a control group. Significant between-group differences in subjective social isolation were reported by three out of four trials: one involved a peer support group for adults with psychosis (Castelein et al, 2008), one group-based intervention offered humorous movies to adults with schizophrenia (Gelkopf et al, 1994), and another trial provided in-home cognitive behavioural therapy for women with major depressive disorders (Ammerman et al, 2013). Two out of these three trials reporting significant results on subjective social isolation also revealed additional significant between-group differences on objective social isolation (Gelkopf et al, 1994; Castelein et al, 2008). Schene and colleagues (1993) failed to find any between-group difference for either outcome when they compared a psychiatric day treatment to a standard inpatient care in a sample with mixed diagnoses.

Three out of four trials also found a reduction in symptoms: one trial from Schene et al (1992) evaluated a mixed strategy for a diagnostically-mixed sample; Ammerman and colleagues (2013) offered an intervention with a cognitive modification element for women with depression; and another trial (Castelein et al, 2008) examined a supported socialisation intervention in a sample with schizophrenia. Castelein and colleagues also reported significant improvement in quality of life.

3.3.4. Overall results

Table 3.7 summarises the results for each type of intervention for subjective and objective social isolation, including the ones targeting both subjective and objective social isolation.

Table 3.7 Summary of different types of intervention and results: objective and subjective social isolation

Type of intervention	Comparison	Outcomes for subjective isolation	Outcomes for objective isolation
Changing cognitions	Intervention versus TAU or no treatment	2/4 studies found significant positive results	1/2 studies found significant positive results
	2 or more active treatments	0/2 studies found significant positive results for one form of intervention over others	N/A
Social skills and psycho-education	Intervention versus TAU or no treatment	0/3 studies found significant positive results	1/2 studies found significant positive results
	2 ore more active treatments	1/1 studies found significant positive results for one form of intervention over others	N/A
Supported socialisation	Intervention versus TAU or no treatment	1/2 studies found significant positive results	1/1 studies found significant positive results

	2 or more active treatments	0/1 studies found significant positive results for one form of intervention over others	1/1 studies found significant positive results for one form of intervention over others
Wider community approaches	Intervention versus TAU or no treatment	N/A	N/A
	2 or more active treatments	N/A	N/A
Mixed approaches (interventions with mixed components)	Intervention versus TAU or no treatment	0/5 studies found significant positive results	3/4 studies found significant positive results
	2 or more active treatments	0/1 studies found significant positive results for one form of intervention over others	0/4 studies found significant positive results for one form of intervention over others

Abbreviation: TAU = treatment as usual

Regarding the trials that included a subjective social isolation measure (i.e. combining fifteen trials included only subjective social isolation measure and the four trials targeted both subjective and objective social isolation – i.e. nineteen trials in total), significantly positive results were found in two out of six trials included interventions with a cognitive modification component. One out of three trials examining the effectiveness of interventions with a supported socialisation component reported some positive results, and one out of three trials evaluating social skills training and/or psychoeducational programme also found some promising benefits of this intervention type. No significant improvement was found in trials providing mixed intervention strategies, and no trial evaluated a wider community approach.

Of all the trials which included a measure for objective social isolation (i.e. fifteen trials), authors of one out of the two trials that involved interventions with a cognitive modification element, one out of the two trials that evaluated social skills training and/or psychoeducational programme, three out of the eight trials that examined mixed intervention strategies, and both trials that offered supported socialisation, reported significant improvement on their objective social isolation scales. Again, there was no trial involving a wider community approach.

Many trials included subjective and/or objective social isolation as one of several outcomes, without a clearly pre-specified primary outcome. For some of these trials, interventions to reduce social isolation were implemented as part of a broader service improvement strategy (e.g. Solomon et al, 1995a; Solomon et al, 1995b; Cole et al, 1995; Schene et al, 1993). Six included trials in total (Silverman et al, 2014; Stravynski et al, 1982; Terzian et al, 2013; Marzillier et al, 1976; Castelein et al, 2008; Gelkopf et al, 1994) clearly identified subjective and/objective social isolation as the primary outcome. Four out of these six trials included a control group (Terzian et al, 2013; Marzillier et al, 1976; Castelein et al, 2008; Gelkopf et al, 1994). All these trials found superior effects of their intervention groups over the control groups on the objective social isolation outcomes, including one trial examined an intervention with mixed strategies for adults with schizophrenia (Terzian et al, 2013); one provided supported socialisation for adults with schizophrenia/psychosis (Castelein et al, 2008); one evaluated two treatment groups (i.e. social skills training and systematic desensitisation) and a waiting-list control group among people diagnosed with personality disorders (Marzillier et al, 1976); and another trial involved an intervention with cognitive modification element for adults with schizophrenia (Gelkopf et al, 1994). Both Marzillier et al.'s trial and the trial from Stravynski et al offered interventions with a cognitive modification component and social skills training to a diagnostically comparable sample. However, Stravynski and colleagues included a small sample size and they did not find any additional benefits when a cognitive modification component was added onto social skills training. Silverman et al.'s trial targeted people with varied Axis I mental health diagnoses (e.g. depression, bipolar disorders) by involving four active treatment groups only, findings suggested a positive effect of its psychoeducational component over other intervention groups (e.g. music alone) on a friend subscale

of the MSPSS scale. In most trials with subjective and/or objective social isolation specified as the primary outcome, and interventions were tailored accordingly, positive results were found. Therefore, the specific focus on subjective and/or objective social isolation may be one prominent factor determining the effectiveness of an intervention.

3.4. Discussion

3.4.1. Discussion for the results

With an emerging interest in understanding subjective and objective social isolation and their related negative mental health consequences, and the ongoing debates concerning the best strategies for alleviating both issues, it is crucial to take steps in finding evidence to support potential interventions for improving subjective and objective social isolation for people with mental health symptoms. Therefore, a systematic review was carried out to synthesise evidence from RCTs of interventions for improving subjective and/or objective social isolation in people with mental health diagnoses. Given the fact that many included studies are low in quality and had small sample sizes, cautions must be applied when interpreting the results. The strategies investigated in these studies were extremely diverse, some earlier published trials failed to specify their primary outcomes, which means some trials included in this review were broad socially-oriented programmes examining social isolation measures as one of many outcomes. Additionally, with a broad range of interventions involved and low quality of reporting in some included studies, a meta-analysis was judged as inappropriate.

From a psychotherapeutic perspective, it has been suggested that compared to their non-lonely counterparts, lonely people tend to have a lower sense of self-worth, and they are more likely to blame themselves for their difficulties in social situations. Compared to people who are not lonely, lonely people also tend to engage with others with a greater sense of distrust and have a higher expectation of being rejected by others (Dagan & Yager, 2019). Therefore, it is proposed that interventions targeting these maladaptive social cognitions may serve a greater purpose in reducing loneliness than other types of intervention (Masi et al, 2011). However, in this review, only a small number of trials with small sample sizes (in

a mixture of populations) supporting that interventions involving cognitive modification (e.g. Ammerman et al, 2013) may be effective in increasing perceived social support, despite the fact that some trials with short follow-ups failed to find an effect (e.g. Zang et al, 2014, 2013). Due to limitations such as lack of sample size calculations, definite conclusions could not be drawn from studies with negative results. In terms of psychoeducational programmes and/or social skills training (e.g. Hasson et al, 2007; Silverman et al, 2014), no clear supporting evidence was discovered for subjective social isolation, although an included trial providing an educational intervention with live music component reported positive results on the friend subscale of the MSPSS (Silveman et al, 2014). Again, due to a shortage of well-powered trials with clearly focused interventions, firm conclusions cannot be drawn at this time.

There is also evidence supporting the effectiveness of some types of intervention for alleviating objective social isolation (e.g. Atkinson et al, 1996; Hasson-Ohayon et al, 2014; Bøen et al, 2012). However, these studies examined a variety of intervention types, and none of which can be demonstrated as more effective than others. There is more evidence regarding the effectiveness of group-based interventions and interventions providing supported socialisation component in improving objective social isolation than they do for subjective social isolation. All group-based interventions for objective social isolation demonstrated their effectiveness, relative to two of eight individual-based interventions. However, again the lack of power and without a clear theory-driven method for reducing objective social isolation limit our confidence in drawing definite conclusions. For people with mental health problems, especially people with psychosis-related disorders, they tend to face several challenges that may interrupt their capability in establishing and maintaining good social relationships with others, for example, internalised stigma, psychiatric symptoms, and societal discrimination (Daumerie et al, 2012). Therefore, interventions delivered in a group-format may offer opportunities for them to establish social contacts and acquire social skills with peers in a relatively safe environment. For example, a trial providing peer support groups in the Netherlands reported that the intervention improved the number of social contacts but failed to improve subjective social isolation (Castelein et al, 2008). Interventions with a supported socialisation component in this review also failed to have any clear effectiveness in improving subjective social isolation.

Therefore, it seems that the effectiveness of intervention with a supported socialisation component is more pronounced in alleviating objective social isolation than subjective social isolation. There may be two explanations to support this finding: firstly, the lack of social contacts or infrequent social interactions may not be the primary underling factor contributing to subjective social isolation, instead, social cognitions may play a more crucial role (Cacioppo & Hawkley, 2009); secondly, offering organised groups may simply not be an effective strategy help lonely individuals face their social challenges, initial meaningful relationships, maintain or improve their existing social relationships. Nevertheless, with the majority of these studies included small sample sizes and were not informed by power calculations, few firm conclusions can be drawn at this time.

Authors of some trials examining interventions with multiple components reported some positive results for objective social isolation (e.g. Hasson-Ohayon et al, 2014; Bøen et al, 2012), however, some did not (e.g. Solomon et al, 1995a; Stravynski et al, 1982). Regarding their clinical and psychosocial outcomes, two trials from Solomon and colleagues (1990a, b) did not exhibit any significant between-group differences between a consumer-provided and nonconsumer-provided support. It is of note that interventions with multiple components included in this systematic review often also involved several other outcomes and their aims extending beyond social isolation outcomes. Social skills training and psychoeducational programmes were examined in two trials (Atkinson et al, 1996; Aberg-Wistedt et al, 1995), but only Atkinson and colleagues reported a positive outcome for their social isolation measure, therefore, the effectiveness of this type of intervention cannot be determined. As suggested by Mann and colleagues (2017), there is a possibility that social skills training is more effective when the targeted client group is in recovery and preparing for wider community groups. Suggested in a trial from Hasson-Ohayon et al (2014), another possibility is that social skills training may work best when it combines with other types of interventions.

For objective social isolation, there is no substantial evidence found in trials that support the effectiveness of interventions with a cognitive modification component. Given only one (Gelkopf et al, 1994) of the two trials (Gelkopf et al, 1994; Ammerman et al, 2013) evaluating this type of intervention found significant

changes in their objective social isolation outcomes, and the trial from Gelkopf and colleague only included a small sample and a short follow-up, no definite conclusion can be confirmed regarding whether intervention involving a cognitive modification component is effective for objective social isolation or not. Stravynski and colleagues (1982) explored a cognitive modification component as an add-on treatment, and they found no additional benefit when cognitive modification component was offered along with social skills training. However, it should be acknowledged that this trial was published a few decades ago and it only included a small sample, therefore, no conclusion can be determined from the results either.

No included trials in this systematic review focused exclusively on the wider community approaches, such as social prescribing and community asset-development approaches described in the state of art review (Mann et al, 2017). Although it is difficult for individual RCTs to evaluate interventions at a wider community level, there is still high feasibility of an individual-based strategy, such as social prescribing, to be examined in RCTs.

Overall, this systematic review retrieved insufficient evidence to clearly identify effective approaches, or the relative effectiveness of different approaches for subjective and objective social isolation. However, there is some preliminary evidence suggesting the effectiveness of interventions involving a cognitive modification component for subjective social isolation, interventions with mixed strategies and supported socialisations for objective social isolation.

3.4.2. Limitations

To the best of our knowledge, this systematic review is the first to synthesise existing evidence on the effectiveness of interventions for subjective and/or objective social isolation in people with a great variety of mental health diagnoses. However, the results presented in this review should be treated with caution as it has its limitations. Firstly, this review aimed to include RCTs with a primary aim of improving subjective and/or objective social isolation. However, as we expected that there would be a limited number of studies deemed as relevant, we also included trials in which subjective and/or objective social isolation was

examined as one of several outcomes with none specified as primary. This suggests that we may have included trials in which social isolation was evaluated as one of several outcomes, but it may not have been the primary focus of the intended intervention. On the other hand, we may have excluded some trials which could offer potentially valuable evidence. Therefore, few included trials in this review actually involved theory-driven interventions with social isolation set as the principal target.

Secondly, the conclusions we have drawn for this systematic review are restricted by the high heterogeneity of the types of intervention and the included patient groups, and many included trials limited by their low methodological quality. Each intervention type was only investigated in a small number of included trials and the content of each programme varies across different trials. Many included trials scored high on risk of bias due to factors such as lack of information on randomisation process and missing data. Additionally, four trials that did not include a well-established outcome measure (e.g. Eggert et al, 1995; Terzian et al, 2013). With many studies only included small samples and lack of power calculations, these studies should be considered as pilot or feasibility trials. Therefore, firm conclusions cannot be determined based on either positive or negative results from these studies. Not only did the heterogeneity of intervention types, sample characteristics and outcome measures limit our confidence in offering conclusions, variations between these included studies also precluded the possibility of meta-analysis.

Lastly, although there were no restrictions on the language of the included trials, and during the literature search, no filter was used to exclude papers published in languages other than English, no trials in other languages were judged as eligible for this systematic review. Some of these trials may have been unavoidably missed, although this review made a great effort to retrieve all potentially relevant papers.

3.4.3. Research implication

This systematic review failed to find evidence to suggest the implementation of any intervention for subjective or objective social isolation among mental health

service users. Although interventions involving cognitive modification component exhibited more promising advantages in alleviating subjective social isolation, and interventions with mixed strategies and supported socialisation also have demonstrated their potential for reducing objective social isolation, the methodologic quality of these included trials prevent us from supporting their effectiveness. Therefore, innovation in the development of intervention and well-designed research with high quality is needed.

In general, future intervention trials may benefit from pre-specifying an aim that targets loneliness directly. To fill this gap in our knowledge of how to improve subjective and objective social isolation for this vulnerable population in particular, more well-designed RCTs in the future with a peculiar primary aim on subjective and/or objective social isolation are of high interest. The guidance on intervention outcome evaluation from Public Health in England emphasises the central role of identifying a primary intervention outcome in the process of intervention design (Public Health England, 2018). CONSORT (2010) specifies a pre-identified and pre-defined primary outcome as the most important factor of a trial to relevant stakeholders; it also warns the dangerousness of having several primary outcomes during the interpretation of the results. Having a pre-specified primary outcome has also been underlined as a practical approach to avoid selective reporting and to reduce outcome reporting bias after the trial (Thomas et al, 2017a). Therefore, future trials should acknowledge the importance of this type of RCT in warranting the most valuable evidence on what types of intervention work on which issue.

Trials, systematic reviews and meta-analyses may wish to explore these issues further and evaluate interventions for populations with specific diagnoses, considering the predictive factors and the maintaining mechanisms of subjective and objective social isolation may be different for people with different diagnoses, for example, depression and psychosis. It has been hypotheised that thought disturbance is the root of loneliness in people with psychosis (Badcock et al, 2015). Loneliness and objective social isolation are also considered as the risk factors contributing to the maintenance of distorted core beliefs in people with a diagnosis of depression or anxiety, since this population tends to hold firm and negative beliefs about themselves, others and the world. Both factors may prevent individuals from disconfirming these beliefs. Perceived social support has

also been implicated in previous research as a crucial factor in generating a reasonable interpretation of the traumatic events experienced by people with PTSD (Lepore, 2001). Therefore, trials and systematic reviews examining the most suitable interventions for specific clinical groups will be crucial in achieving maximum treatment efficacy.

Notwithstanding the fact that there is a substantial amount of publications focusing on interventions with an effectiveness in improving psychiatric outcomes (e.g. depressive symptoms, paranoia), research examining whether these interventions will exhibit a positive effect on subjective and/or objective social isolation has been overlooked. For example, intervention treating social anxiety might be another plausible treatment option for loneliness. A strong association between loneliness and social anxiety has been demonstrated in cross-sectional studies (e.g. Caplan, 2007). However, a significant advance was achieved in 2016 by Lim and colleagues, who focused on the impact of loneliness on mental health and examined which mental health symptoms would contribute to loneliness in this longitudinal study. In this study, social anxiety at an earlier state was the only factor predicting loneliness at a later time. Therefore, this result implies that interventions attempting to reduce social anxiety symptoms may subsequently alleviate the feelings of loneliness. Further confirmation of this hypothesis can be achieved by conducting a social anxiety intervention with loneliness being specified as the primary outcome. Interpersonal psychotherapy, as another example, is an evidence-based psychotherapy for depression (Weissman et al, 2000). This type of treatment has also been adapted for different clinical samples with complex issues, such as depressed women with comorbid PTSD (Duberstein et al, 2018). Although extensive evidence has confirmed the distinction between depression and loneliness, it has been hypothesised that there are some overlapping characteristics between the two constructs, e.g. shared risk factors. Therefore, there is a possibility that interventions with an effectiveness on the reduction of depressive symptoms may also have an equivalent effect on loneliness, especially when interventions also include strategies that are effective in alleviating objective social isolation and interpersonal difficulties.

Unemployment and low educational attainment are two significant factors contributing to financial difficulties. Unemployment is more commonly

experienced by people with mental health problems, especially more so for people diagnosed with schizophrenia and other psychotic problems, when compared to the general population, although many have expressed their willingness to work (Mueser et al, 2013). It has been suggested that although many patients have exhibited symptomatic remission, other presenting barriers, such as difficulty in emotion processing (Ng et al, 2015), social dysfunction, and negative symptoms may further restrain their opportunities in entering the labour market (Barrios et al, 2018). Widely acknowledged misperceptions against their abilities to work also present as one critical barrier preventing them from being considered as fit for work. As a consequence, a stereotype against mental health service users is formed: the lack of people with mental health problems in the labour market is considered as a sign of which this population cannot hold onto a job because of their psychiatric symptoms (Evans & Repper, 2000) or their unstable mental state. It has been suggested that engaging in regular work activities encourage self-appraisals and improve self-esteem (Galloway, 1991; Fowler et al, 1995), both factors have also been associated with improved clinical outcomes (Birchwood et al, 1993), improved subjective recovery (Law et al, 2016), and potentially decreased loneliness. Thereby, to reduce loneliness and promote one's personal recovery, indirect interventions, such as programmes to end poverty (e.g. the Living Wage), programmes to increase employment (e.g. the EMPOWER programme aiming to increase employment for people with traits of personality disorders; the MPRC Job Search Programme), and lifelong learning programmes, may be effective.

Wider community approaches have been considered as crucial in providing social opportunities for mental health service users, as it may encourage social engagement in the local community, boost their sense of belonging, and strengthen self-confidence (Mann et al, 2017). A substantial amount of evidence has underscored a direct and negative relationship between stigma (i.e. interpersonal stigma, internalised stigma, discrimination) and loneliness (e.g. Palumbo et al, 2015; Karidi et al, 2010, 2015). To encourage the active involvement of people with mental health problems in their local communities and subsequently reduce loneliness and social exclusion, preparation work including promoting public anti-stigma campaigns (e.g. See Me) and creating more

welcoming communities for people with mental health problems, may be a necessary first step.

Social participation interventions, including social prescribing, are also believed to be a practical approach to enhance activity participation in the community, and to facilitate the access to psychological treatments and social resources (Webber & Fedt-Newlin, 2017). This type of intervention so far has received little attention in the field, no RCTs were retrieved in the current systematic review. Therefore, evidence to date provided by these trials is rather scarce. However, actions to tackle loneliness have recently been put forward by the UK government in its Loneliness Strategy (2018), social prescribing schemes are also currently running by a broad range of local authorities and the Clinical Commissioning Groups. It has been estimated by the UK government that as high as 60% of the Clinical Commissioning Groups have invested in social prescribing strategies. Benefits of social prescribing have also been publicised by the NHS (2019), demonstrated by a decreased service use, such as reduced GP (i.e. 28% reduced rate) and A & E (i.e. 24% reduced rate) visits.

Literature has also acknowledged other benefits of promoting social participation interventions among mental health service users, including its potential in reducing stigmas at both societal and individual levels. The formation of social identity during social participation is particularly relevant and essential for people with mental health problems who tend to be a frequent target of public stigma. Positive relational experiences, such as community activities, are also beneficial in reducing psychological distress, social isolation, social anxiety (Eime et al, 2013), and conceivably loneliness. The formation of social identity through group identification is believed to have positive effects on both physical and mental health (Haslam et al, 2009), such as increased treatment adherence and reduced unhealthy and risky behaviours (Laverie, 1998; Berger & Rand, 2008). Other potential benefits are also discussed by a large and growing body of literature, including increased help-seeking behaviours (Kearns et al, 2015), and enhanced positive psychosocial outcomes, such as an increased sense of belonging, improved self-esteem, increased social support and social resources (Haslam et al, 2005; Crabtree et al, 2010; Baumeister & Leary, 1995).

However, the degree of self-identification matters: the stronger one identifies herself/himself as a member of a group or multiple community groups, the more likely the individual perceives more social support and subsequently improving their mental health wellbeing (Kearns et al, 2018). There is a possibility that reduced loneliness may promote the process of personal recovery in people with mental health problems, which may further encourage more social engagement in the community. As a consequence, it may prompt a significant reduction of loneliness. In an online survey of veterans regarding their engagement in a Veterans Service Organisation (VSO), it was discovered that reduced social isolation and the benefits veterans received from VSO activities were related to how strongly they identified themselves as a member of the organisation (Russell & Russell, 2018). Group 4 Health (G4H) programme is a newly developed intervention aiming to raise awareness of the importance of group memberships in impacting health and assist people in developing strategies for their social connectedness. Group 4 Health was recently evaluated in a randomised controlled trial of people with psychological distress (Haslam et al, 2019). The authors reported its effectiveness in reducing loneliness and social anxiety, as well as its additional benefits in improving patients' sense of belonging. Therefore, interventions aiming to strengthen people's social identity and their sense of belonging as a group member, such as religious groups, cultural communities, are promising strategies for subjective and objective social isolation, and need to be further evaluated.

Another factor that is essential during the process of social participation is the mutual support between group members. Recovery is a long journey for each individual (Slade, 2009), and a lack of reciprocal support is detrimental to the process of personal recovery (SCHÖN et al, 2009). In the trial examining the relationship between social relationship deficits and distress in people with SMI, Lim and colleagues (2014) found a significantly less symptom-related distress reported by those who had more relationship reciprocity in their social relationships, compared to those who had poor relationship reciprocity. It is plausible that reciprocal support is more likely to be formed during social participation in different community groups. There is an increasing number of popular community groups and activities promoting social participation, such as clubhouses in Sweden. These clubhouses not only provide day occupational

options, but also offer social opportunities for adults with mental health problems who have difficulties in their daily living and daily activities as a result of their psychiatric symptoms (Hultqvis et al, 2018). Social participation is also believed to be effective in reducing depressive symptoms (Boone & Leafdbester, 2006), social anxiety symptoms (Ashdown-Franks et al, 2017) and loneliness (Barber et al, 2001), especially for at-risk adolescents (Brière et al, 2018). Social anxiety symptoms are one of the potential risk factors leading to great loneliness (Lim et al, 2016), social isolation prevention strategies and interventions promoting social engagement between peers therefore may be beneficial in reducing the risk for long-lasting loneliness.

Continuous advancements have been made in digital health technologies. Computer/mobile technology has been widely utilised and has become a popular platform for intervention delivery in the medical field. These new technologies may also provide fresh new opportunities for addressing subjective and objective social isolation on a global scale. Online programmes, including peer support groups or chatrooms, may potentially be practical in offering social support (Davison et al, 2000). For example, older Australians who used the internet to communicate commnicating with family and friends also reported a decreased feeling of loneliness (Sum et al, 2008). Even simple online social participation, such as using Facebook (Myhre et al, 2017) can buffer against the negative impacts on our psychosocial wellbeing because of other risk factors in everyday life (Ang & Chen, 2018). However, only four trials targeting online interventions were found to be eligible for our review, and none has demonstrated any positive impact on subjective and/or objective social isolation. Authors from two systematic reviews (Lui, 2017; Donker, 2013) acknowledged the enormous potential of the development and implantation of mobile apps in the mental health field. Several benefits of online interventions are proposed: firstly, online social participation during patients' engagement in online intervention can compensate their lack of offline interactions with others due to some unavoidable factors that are secondary to their mental illnesses, such as physical limitations, cognitive dysfunctions and social stigma. Social participation, either online or offline, may enhance one's self-esteem, sense of belonging and group identification, all of which were pointed out above as critical elements in improving loneliness and promoting mental health wellbeing. Secondly, online support groups and online

chatrooms may offer novel ways to acquire new relationships and to re-connect with existing social contacts prior to their mental health diagnoses (Highton-Williamson et al, 2015; Naslund et al, 2016). Peer communications that are naturally formed in these online support groups have been described as 'one of the most transformational features of the internet' (Ziebland & Wyke, 2012, p221). Online groups may also produce opportunities for individuals to share personal experiences, exchange social skills and information regarding their illness and treatments (Haker et al, 2005). Other benefits of online groups have also been put forward by Thomas and colleagues (2015), who propose that online groups may offer a new platform to face and confront social stigma from the general public while promoting positive and hopeful perspectives of mental health issues. These online groups may further promote the access to online treatments and interventions, also encourage active coping strategies and behavioural activations (Killackey et al, 2011).

For people with mental health problems, they can exhibit the same level of competence as the general population in accessing online resources (Spinzy et al, 2012; Gayer-Anderson & Morgan, 2013). Meta-analyses have demonstrated the feasibility of delivering online mental health services to people with depression and anxiety (Andrews et al, 2018; Spek et al, 2007). People with psychotic disorders are as capable as the general population when accessing online- and computer-based systems (Rotondi et al, 2010). Another systematic review examining the potential of web- and phone-based interventions for people with psychosis also reported positive outcomes, such as improved social connectedness and socialisation (Alvarez-Jimenez et al, 2014). However, this review only included few RCTs, and social isolation was only measured as one of many secondary outcomes. In one recently published pilot research paper, a novel online intervention called HORYZONS was evaluated for young people with First Episode Psychosis (FEP) in one recently published pilot trial, increased social connections were reported after the participants received HORYZONS (Alvarez-Jimenez et al, 2012). Currently, a full trial of HORYZONS utilising a single-blind RCT design with an 18-month follow-up period is taking place for the same clinical population (Alvarez-Jimenez et al, 2019). In another feasibility trial, building on the concept of positive psychology intervention (PPI), Lim and colleagues (2019a) developed a digital smartphone application (app) named

+Connect. In this trial, the authors uncovered improved loneliness from baseline to 3-month post-intervention follow-up, the programme users also highlighted significant improvements in their social lives resulting from the positive reinforcement offered by the app. Biagianti and colleagues (2018) also systematically synthesised evidence on an online peer community for people with psychotic disorders, which further support the feasibility of using online peer community in this specific population, and its benefits in promoting patients' active engagement in online peer communication, and in increasing perceived social support. These benefits were found to be even more salient when an intervention facilitator was involved. Many studies to date have publicised the importance of involving intervention facilitators: people with mental health problems have acknowledged the advantages of having an intervention facilitator in guiding their sessions during an online intervention and maintaining patients' engagement (Thomas et al, 2016).

For those who are in the recovery stage, the process of personal recovery can also be facilitated by online interventions. Personal recovery is one of the most important ultimate goals for people with mental health problems, especially for those with persistent psychosis. It has been demonstrated that most people with psychosis can live their lives without being disturbed by their symptoms, however, a good personal recovery process is challenging to achieve. The feasibility of self-guided technology-based interventions for this particular population has been examined and supported (van der Krieke et al, 2014; Alvarez-Jiminez et al, 2014). Nonetheless, cautions against compulsive internet use should also be recognised: although lonely individuals have more opportunities to engage socially via social media or apps (Nowland et al, 2018), compulsive use among lonely young adults, instead, may compromise their daily interactions in real life, and their engagement in other activities outside the online world (Matthews et al, 2018), which may in turn, leads to other negative consequences, such as poor sleep (Carter et al, 2016) and addiction (Shapira et al, 2003). Ironically, all of these have also been linked to great loneliness (e.g. Taylor et al, 2017). Therefore, although digital interventions have not been sufficiently evaluated in RCTs to date, the feasibility of these interventions in alleviating loneliness in people with severe mental health problems has been established in many small pilot trials. There is a pressing need for future research with a large scale to

further examine the feasibility of digital interventions in alleviating social isolation with a long follow-up period.

3.4.4. Clinical implication

The lack of empirical evidence in our systematic review makes it difficult to suggest any recommendations concerning which types of interventions work best for subjective and/or objective social isolation. Therefore, it also failed to provide definite conclusions on the provision of interventions in mental health settings. A recent Lancet editorial (Lancet, 2018) proposes a need to switch life science funding prioritises to under-researched social, behavioural and environmental determinants of health. Both subjective and objective social isolation are among the social determinants that received little attention. Positive results from few trials, nevertheless, acknowledge the potential of interventions with a cognitive modification component for subjective social isolation. The potential effectiveness of interventions that provide support socialisation and interventions with mixed strategies for objective social isolation was also highlighted in our review.

Although a great effort was invested in summarising existing evidence on the relationship between subjective and objective social isolation and mental health outcomes, studies describing the trajectory of subjective and objective social isolation in people with mental health problems were not retrieved during the literature search. To the best of our knowledge, no studies to date have been conducted in order to explore whether persistent subjective and objective social isolation result in poor mental health outcomes among mental health service users. This thesis is designed to answer this question and aims to move our knowledge forward by filling this evidence gap. Therefore, the aims and hypotheses of this thesis are presented in the next chapter.

Chapter 4. Aims and research questions

There has been a substantial amount of evidence examining the deleterious health consequences of subjective and objective social isolation in mental health, in respect of illness onset, symptom progression and personal recovery. However, evidence to date has been to studies with a principal focus on depression, and there is a lack of prospective studies differentiating the impact of subjective and objective social isolation on a broad range of mental health outcomes in populations of all ages.

In addition to the individual burden related to poor physical and mental health outcomes, subjective and objective social isolation also create a huge financial burden for the society on a global level. Lonely people are more likely to have poor physical health and a sedentary lifestyle than their nonlonely counterparts. Factors such as smoking, drinking, physical immobility and physical dysfunction may therefore increase the risk of developing other chronic physical conditions, which subsequently increases the likelihood of intense and excess usage of healthcare services. Compared to their nonlonely counterparts, lonely people tend to rely more on their GPs and other healthcare professionals, and they have a higher likelihood of being admitted to nursing homes in the future (Russell et al, 1997). As a consequence of having mental health problems, severe societal problems may also arise, such as depression, cognitive dysfunction, and self-harm, all of which may also result from being subjectively and/or objectively socially isolated (Hawkley et al, 2010). This is supported by a study from Cacioppo and colleagues (2006), in which the progression of depression resulted in more severe health issues such as cardiovascular disease, impaired functioning, low attendance or diminished performance in the labour market, and increased use of healthcare resources. These health issues further place a heavier burden on our health system. Even loneliness itself can create additional societal burdens in healthcare. Ellaway and colleagues (1999) revealed a direct association between loneliness and the number of GP appointments, with severely lonely people visiting their GP two times more often than those who were only rarely or never lonely, after controlling for individual health status. Therefore, it seems that being persistently subjectively and/or objectively socially isolated may contribute to a significant increase in our societal and financial burden.

In the last few decades, advances have been made in research on the health impact of subjective and objective social isolation in the general population and mental health service users. Despite this growing interest in exploring the psychological consequences of both issues in people with mental health problems, surprisingly many questions remain unanswered. Subjective and/or objective social isolation can be a transient experience, but either issue can also become an enduring pain. Emerging evidence has identified subjective and objective social isolation as significant contributing factors to poor personal recovery in people with mental health problems (Resnick et al, 2004; Corrigan & Phelan, 2004). Previous studies has also found an increased risk of all-cause mortality among the elderly who suffered from chronic loneliness, compared to those who were only lonely intermittently (Shiovitz-Ezra & Ayalon, 2010). However, hardly any quantitative evidence exists for the chronicity of subjective and objective social isolation in mental health populations and we know little about whether persistent social isolation will have a more profound impact on the process of personal recovery in people with mental health diagnoses, relative to situational and intermittent social isolation. Therefore, the primary aim of this thesis is to move our evidence-base forward and address this knowledge gap.

To summarise, below are the main aims of this thesis:

1) To provide an overview of the concept of subjective and objective social isolation, and to outline existing evidence on the deleterious effects of both issues on mental health outcomes
2) To systematically review current evidence on the effectiveness of interventions for subjective and/or objective social isolation among people with mental health problems.
3) To conduct a longitudinal quantitative study in subjective and objective social isolation, and investigate their association with mental health outcomes over an 18-month follow-up period among people with mental health problems who also have accessed Crisis Resolution Team (CRT).
4) To describe the trajectories and the proportions of participants in three severe loneliness groups and three objective social isolation groups. To determine whether there are between-group differences across the three severe loneliness groups and the three objective social isolation groups in

terms of their relationships with self-rated personal recovery at 18-month follow-up.

Aim 2 (i.e. the systematic reivew) has been explored in the previous chapter. The rest of the thesis will focus on the quantitative analysis, and the purpose of this analysis is to address aims 3 and 4, which focus on three main research questions:

1) Are subjective and objective social isolation at baseline significantly related to mental health outcomes at 18-month follow-up among people with mental health diagnoses? Outcomes include self-rated personal recovery and overall psychiatric symptom severity. Self-rated personal recovery is the primary interest of outcome of this quantitative study.
2) Which concept, subjective or objective social isolation at baseline, is a stronger predictor of self-rated personal recovery at 18-month follow-up?
3) Are persistent subjective and objective social isolation associated with poor self-rated personal recovery at 18-month follow-up?

So far, the current chapter presented the main aims and research questions of this thesis. The overarching objective of the next chapter is to give a brief description of the study context of the quantitative study. Methods of the quantitative study, including hypotheses and a detailed analysis plan will be presented in Chapter 5.

Study context

Data for this quantitative analysis were drawn from the Crisis Team Optimisation and Relapse Prevention (CORE) study, which is funded by the National Institute for Health Research. This quantitative analysis is not part of the analysis of the main trial; instead, it used all trial participants as a single cohort in analyses, due to the relevant measures of the CORE programme that are related to my own research interest and hypotheses.

The CORE study was a multi-site randomised controlled trial aiming to examine the effectiveness of a peer-provided self-management intervention for mental health patients following a period of care from Crisis Resolution Teams (CRTs) in six NHS Trusts, including Camden and Islington, North East London, South

London and the Maudsley, West London, Avon and Wiltshire, and Surrey and Borders. Between them, the trusts cover both inner city, mixed urban and rural areas. Therefore, the cohort for this thesis is demographically and diagnostically mixed, and the participants tend to have varying levels of care and support from mental health services. However, these participants were all recovering from a recent mental health crisis when assessed at baseline.

CRT service offers an alternative to the adult populations who are experiencing a severe mental health crisis in order to prevent them from admitting into a hospital as an inpatient. They aim to offer rapid assessments at patients' house or community, provide accessible home treatment with minimal restrictions and disruptions to patients' lives, therefore to ensure patients can be discharged as soon as possible (Wheeler, Lloyd-Evans et al, 2015; Johnson, 2013). A full protocol of the CORE study has been published (Johnson et al. 2017), as are the main trial results (Johnson et al. 2018).

Following their discharge from CRT, some patients were referred back to primary care, while others had a multi-disciplinary package of care from secondary mental health services. Additionally, half of the participants were offered the CORE trial intervention in addition to their treatment-as-usual.

Participants: Eligibility criteria required participants have been on the caseload of one of the participating CRTs for at least a week and have the capacity to provide a written informed consent to take part in the study. The trial planned to recruit 440 participants in total, and has set an overall threshold of 50% of participants to be screened as having a severe mental illness (e.g. bipolar disorders, schizophrenia or other psychosis), in order to ensure the sample is able to broadly represent CRT service users. The main aim of this trial is to support patients after they have been discharged from a CRT service, therefore, a cut-off point of one-month post-discharge from the CRT to be eligible to enter the study has also been set.

Chapter 5. Quantitative study: methods

This chapter follows on from the previous chapter, which outlined the research questions and aims of this PhD thesis. What follows is a detailed description of the research methods of this thesis, including included variables and data analysis plan.

5.1. Research questions and hypotheses

Research question 1: Are subjective and objective social isolation significantly related to mental health outcomes at 18-month follow-up in people with mental health problems?

This question will address four hypotheses:

- Hypothesis 1: There is an association between greater baseline loneliness and poorer self-rated personal recovery at 18-month follow-up
- Hypothesis 2: There is an association between having a smaller social network size at baseline and poorer self-rated personal recovery at 18-month follow-up
- Hypothesis 3: There is an association between greater baseline loneliness and greater symptom severity at 18-month follow-up
- Hypothesis 4: There is an association between having a smaller social network size at baseline and greater symptom severity at 18-month follow-up

Hypothesis 1 is the primary hypothesis for this thesis.

Research question 2: Which concept, subjective or objective social isolation at baseline, is a stronger predictor of self-rated personal recovery at 18-month follow-up?

Hypothesis: Baseline loneliness is a stronger predictor of self-rated personal recovery at 18-month follow-up, compared to baseline social network size.

Research question 3: Are persistent subjective and objective social isolation associated with poorer self-rated personal recovery at 18-month follow-up?

In this exploratory analysis, I will describe the number of my study sample in each group: 1) persistently severely lonely group: persistent severe loneliness at all three study time-points; 2) intermittently severely lonely group: intermittent severe loneliness at some time-points but not all; 3) never severely lonely group: no severe loneliness at all three study time-points; 4) persistently objectively socially isolated group: persistent objective social isolation at all three study time-points; 5) intermittently objectively socially isolated group: intermittent objective social isolation at some time-points but not all; and 6) never objectively socially isolated group: no objective social isolation at all three study time-points. We will then explore whether persistent severe loneliness group and persistent objective social isolation group are associated with poorer self-rated personal recovery at 18-month follow-up, compared to intermittent severe loneliness group and intermittent objective social isolation group, as well as no severe loneliness group and no objective social isolation group.

- Hypothesis 1: Participants with persistent severe loneliness would have the poorest self-rated personal recovery at 18-month follow-up, followed by participants who suffered from intermittent severe loneliness, and then participants who were never severely lonely.
- Hypothesis 2: Participants with persistent objective social isolation would have the poorest self-rated personal recovery at 18-month follow-up, followed by participants who suffered from intermittent objective social isolation, and then participants who were never objectively socially isolated.

5.2. Measures

All recruited participants were assessed during structured interviews at three time-points: baseline, 4-month follow-up, and 18-month follow-up. Sociodemographic details were collected at the baseline interview only. Measures used in this thesis include:

Social isolation variables

- Subjective social isolation: The UCLA Loneliness Scale (ULS-8). The ULS-8 was used in this thesis as the primary measure of loneliness. It contains eight self-reported items, and participants were asked to rate on a 4-point Likert scale. The score of each item is ranging from 1 for 'never' to 4 for 'always', therefore the total score is a sum-up number scored between 8 and 32. The ULS-8 was drawn from the original version ULS-20, which consists of 20 items. Based on an exploratory factor analysis, Hays and Dimatteo (1987) identified 8 items to form the ULS-8 and found a high correlation between the ULS-8 and ULS-20 (r=.91). The authors argued that ULS-8 is a reliable and valid unidimensional instrument and a better substitute for ULS-20 when compared to ULS-4. The homogeneity of ULS-8 was found to be higher than ULS-20, and it takes only about one to two minutes to be filled out, thus it may significantly reduce participants' burden, in turn increase the quality of the results.

- Objective social isolation: Lubben Social Network Scale (LSNS-6). The original LSNS consists of 10 items, it was developed initially for its use in older populations (Lubben, 1988). This instrument has been translated into different languages and has been used around the world in both research and clinical areas (Stuck et al, 1999). The revised version of LSNS, which consists of six items, has been reviewed by Lubben and Gironda (2003), named LSNS-6. It has been suggested as a more suitable scale for social isolation screening, compared to the original version. LSNS-6 is a constructed instrument with six questions in total: three questions aim to evaluate individuals' kin relationships; another comparable three items evaluate their non-kin relationships. The total scale is the sum up of all six items, and the total score ranged from 0 to 30. Lubben and colleagues (2006) tested the LSNS-6 in community-dwelling elderly from three European cities (i.e. Hamburg, Solothurn, and London) in order to screen for their experience of social isolation. They found that the internal

consistency for the instrument was consistent across all three sites, and Cronbach alpha scores were also consistent across these cities. Excellent convergent validity was indicated by a high correlation between the LSNS-6, two subscales (i.e. family and friends subscales) and other measures (i.e. selected social and health indicators) that have been used for social integration. The item-total scale correlation analyses also indicated that the items of the LSNS-6 were homogenous and the patterns were similar across all sites. For this thesis, a sum-up score of item 1 and item 4 of the LSNS-6 was extracted. One item describes the number of family members an individual has (i.e. how many relatives do you see or hear from at least once a month), the second item describes the number of friends an individual has (i.e. how many of your friends do you see or hear from at least once a month). The total sum-up score ranged from 0 to 10. This total score was used as an indicator of objective social isolation. The higher the score, the less objectively socially isolated for a participant.

Mental health outcome measures

- Psychiatric symptoms: The Brief Psychiatric Rating Scale (BPRS). The BPRS was developed to provide a brief and rapid assessment in an efficient and accurate manner, in order to evaluate treatment changes and provide a comprehensive description of major symptoms in psychiatric patients (Overall & Gorham, 1962). The questionnaire contains 24 symptom constructs and each question is rated on a 7-point Likert scale, ranging from ‘not present (score 1)’ to ‘extremely severe (score 7). Therefore, the range of possible total score is from 24 to 168, with a higher score indicating more severe psychopathology. The ratings of some items are completed based on the observation of the respondents’ physical, intellectual or social behaviours. The remaining items are rated based on the direct report from the respondent during the interview. However, the intensity of the

verbal report and the behaviour of the respondent while he/she is reporting relevant experiences should also be considered. Based on the suggestions from Overall and Gorham (1962), the items that are rated based on the verbal report from the respondents include: somatic concern, anxiety, depression, suicidality, guilt, hostility, elevated mood, grandiosity, suspiciousness, hallucinations, unusual thought content, bizarre behaviour, self-neglect and disorientation. The items that are based on the behavioural observation of the respondents include: conceptual disorganisation, blunted affect, emotional withdrawal, motor retardation, tension, uncooperativeness, excitement, distractibility, motor hyperactivity, mannerisms and posturing. It has been recommended that elevated mood, bizarre behaviour and self-neglect can also be rated based on observation (Overall & Gorham, 1962). For this thesis, only the BRPS total score was used for the quantitative study.

- Self-rated personal recovery: The Questionnaire about the Process of Recovery (QPR). QPR has two subscales (i.e. intrapersonal and interpersonal subscales), contains 22 items in total, with a Likert response Scale, ranging from ‘strongly disagree (score 0)’ to ‘strongly agree (score 4)’. Thus, the total score of the QPR ranged from 0 to 88, where a higher score indicates more promising progress towards recovery. By investigating people with psychosis, Neil and colleagues (2009) evaluated the reliability and validity of QPR. It has been demonstrated that the questionnaire has a satisfactory internal consistency, construct validity and reliability, and it also exhibits stability across time. High associations between QPR and the items from the Making Decisions and Empowerment Scale (MDES), the General Health Questionnaire (GHD), and the Schizophrenia Quality of Life Scale (SQLS), have also been found, respectively. Therefore, QPR is considered as a reliable tool for psychiatric patients in order to set up their goals and move towards recovery.

Control variables

- Age, will be used as a continuous variable
- Gender, include 2 groups: male and female
- Ethnicity include 16 groups (based on the 2001 UK National Census Categories): White British, White Irish, White other, Black/Black British Caribbean, Black/Black British African, Black/Black British other, Asian/Asian British Indian, Asian/Asian British Pakistani, Asian/Asian British Bangladeshi, Asian/Asian British other, mixed White/Black Caribbean, mixed White/Black African, mixed White/Asian, other mixed, Chinese and other ethnic group.
- Marital status, include 4 groups: single, married/cohabiting, separated/divorced and widowed
- Employment status, include 8 groups: in open market employment (16 hours + per week), in open market employment (<16 hours per week), permitted work/shelter work, voluntary/unpaid work, education/study/training (16 hours + per week), education/study/training (<16 hours per week), full time caring role, none of above.
- Education level, include 6 groups: school leveller (no qualifications), GCSEs or equivalent, A levels or equivalent, HND or other professional qualification (non-graduate), degree and postgraduate degree
- Housing, include 6 groups: independent permanent accommodation, independent temporary accommodation, accommodation with 24 hour staff support, accommodation with staff support (not 24-hour), street homeless/direct access hostel, and other.
- Born in UK, include 2 groups: yes and no
- Contact children under 16, include 4 groups: not applicable, no contact, contact but not live with, and live with dependent children.

- Current diagnosis (diagnosed by clinicians), include 9 groups: schizophrenia/schizoaffective disorder, bipolar affective disorder, other psychosis, depression, anxiety disorder, post-traumatic stress disorder, borderline/emotionally unstable personality disorder, other personality disorder and other diagnosis
- Number of psychiatric inpatient hospitalisations, include 4 groups: never, once, 2-5 times and more than 5 times
- Number of years since first contact with mental health services, include 5 groups: < 3 months, 3 months-1 year, 1-2 years, 2-5 years, 6-10 years and > 10 years

For this thesis, some of the variables were recoded accordingly, a summary table is presented below:

Table 5.1 Summary table for measurements

Main outcome measures	
UCLA Loneliness Scale (USL-8)	The sum-up score ranged from 8 to 32. For this thesis, the participants were considered as being severely lonely if his/her total score was 24 or above. This cut-off point is defined as scoring an average score of three per item, which is equivalent to experiencing the problem sometimes, rather than rarely or never. Three groups of participants were categorised based on their loneliness score: 1) Persistent severely lonely: including people who scored as being severely lonely at all three time-points 2) Intermittent severely lonely: including people were scored as severely lonely at one or two time-points 3) Never severely lonely: including people remain not severely lonely at all three time-points
Lubben Social Network Scale (LSNS-6)	The sum-up score from the scores of two items (Q1 & 4) of LSNS-6 was extracted. The total sum-up score ranged from 0 to 10. For this thesis, a cut-off point of lower than four was used to group participants into socially isolated and not socially isolated groups (Lubben et al, 2006).

	Three groups of participants were used based on their Lubben Social Network score: 1) Persistent objectively socially isolated: including people who scored as socially isolated at all three time-points 2) Intermittent objectively socially isolated: including people who scored as social isolated at one or two time-points 3) Never objectively socially isolated: including people who never feel socially isolated at all three time-points
The Questionnaire about the Process of Recovery (QPR)	Continuous variable, total score ranged from 0 to 88 with a higher score indicates a more promising progress towards recovery
The Brief Psychiatric Rating Scale (BPRS)	Continuous variable, total score ranged from 24 to 168, with a higher score indicating a more severe psychopathology
Socio-demographic variables	
Age	Continuous variable
Gender	0=male 1=female
Ethnicity	1=white 2=black 3=Asian/Chinese 4=mixed/other
Marital status	1=married/cohabiting 2=single/separated/divorced/widowed
Employment status	0=not in employment/education/full time caring role 1=in employment/education/full time caring role
Education level	1=no qualification 2=other qualification (i.e. GCSEs or equivalent/A levels or equivalent/ HND or other professional qualification) 3=degree
Housing	1=permanent & supported accommodation (i.e. independent permanent accommodation/accommodation with 24-hour staff support/accommodation with staff support but not 24-hour) 2=unstable accommodation (i.e. independent temporary accommodation/street homeless/direct access hostel/other
Born in UK	0=no

	1=yes
Contact with children under 16	0=no contact 1=contact with dependent children (i.e. contact with dependent children but not living together/living with dependent children) 2=not applicable (i.e. no children under 16)
Psychiatric variables	
Current diagnosis	1=schizophrenia or schizoaffective disorder/bipolar affective disorder/other psychosis 2=depression/anxiety disorder/post-traumatic stress disorder 3=borderline or emotionally unstable personality disorder/other personality disorder 4=other diagnosis
Number of psychiatric inpatient hospitalisations	0=never 1=once 2=2 and more (i.e. 2-5 times/more than 5 times)
Number of years since first contact with mental health services	0=less than 3 months 1=3 months-2 years (i.e. 3 months-1 year/1-2 years) 2=2-10 years (i.e. 2-5 years/6-10 years) 3=more than 10 years

5.3. Procedures

Recruitment and consent: The CORE trial was approved by the London Camden and Islington Research Ethics Committee (REC ref: 12/LO/0988). The progress of the trial was overseen by the Trial Steering Committee and Data Monitoring Committee.

Clinical staff in 25 CRTs were consulted to assist researchers in identifying potentially eligible service users who meet the inclusion criteria of the study. Either CRT clinical staff or other community mental health services that were known to the potential participant contacted him/her initially to provide basic information regarding the study and asked if he/she is willing to be contacted by a researcher in order to discuss the study in detail. At this stage, clinicians screened out the service users who were unwilling to participate, those who were at a serious risk of harming either themselves or others, and those who lack the capacity to give consent. Clinicians also assisted in the identification of the

potential participants who have been diagnosed with schizophrenia, other psychosis or bipolar disorders. For those who have expressed an interest in taking part in the study, clinical staff passed on their information (i.e. name and contact details) to a researcher. At this stage, the researcher double-checked with the clinician if there are any known limitations and risks that may determine where meetings could take place with the participant. Study researchers kept a record of the potential participants' contact details, as well as the date and the name of the clinician. Study researchers also asked the clinician who spoke to the potential participants to make a note in their patient records that the patient has agreed to be contacted by a study researcher.

A study researcher then contacted the potentially eligible participants to provide details about the study and answer any questions they might have. For those who were willing to take part, the researcher sent a written information sheet regarding the study, and then arranged a meeting with the participants to obtain their written, informed consent. After such consent was provided, the participants were asked to provide their preferred contact details for follow-up assessment and further contact from peer support workers if they were allocated to the treatment group. The participants were asked for the following details to mitigate the risk of loss to follow-up: 1) contact details of family members or involved staff that the researcher could contact if the participant could not be reached for follow-up assessment; 2) permission to obtain information on their service use from other health services, if the participants have moved or the records were unattainable from the Trust. For those who consented to take part in the study, the researcher contacted their manager and psychiatrist of the CRT in writing. A copy of their signed consent was also enclosed and sent to their GP. For those who were allocated to the treatment group, CRT staff helped the researcher to inform other involved mental health staff regarding their participation.

Optional consent to be contacted by a study researcher to ask for willingness to participate in a longer-term follow-up up to 3 years after their enrolment of the study was also obtained from participants. A record was also kept for those who consented to be contacted for a longer-term follow-up.

Baseline interview: Once the written consent for participation has been obtained, before the randomisation process, a structured interview was

conducted by a study researcher for each participant to complete baseline measures. Usually, it took approximately one hour to complete. Based on the suggestions and risk-related limitations advised by CRT clinicians prior to the interview, the meeting place could be the participant's home, or NHS or university premises. After the interview, the participants were offered a £20 as a gift to acknowledge their contribution to the study.

The 4-month and 18-month follow-up interviews: Four months after the enrolment of the study, researchers contacted participants as soon as possible to remind their due completion of another assessment. At this stage, the researchers would discuss the procedure of this assessment interview, answer their questions about the assessment interview and ask their willingness to participate and complete the interview. For those who were still willing to take part, the researcher would send another copy of the information sheet and arrange a meeting with the participants. At the beginning of the interview, a written informed consent was asked again from the participants, followed by a constructed interview that lasted about one hour. Once the assessments were completed, the participants were offered another £20 as a gift to acknowledge their contribution to the study. If a face-to-face follow-up interview was not possible, for example, if the participant has moved to an unreachable area, but the participant was still willing to complete the follow-up interview, a phone interview was arranged. A copy of the information sheet would be sent to the participants in advance, and the participant's consent would be confirmed either by writing, or by email, or verbally recorded on the phone. Verbal consent would be audio-recorded and then safely stored in password-protected folders on the UCL secure network. For a phone interview, the Brief Psychiatric Rating Scale would not be completed at this time, as it requires ratings based on the researcher's observation of the participant. All other self-reported questionnaires would be completed.

Eighteen months after the enrolment of the study, researchers contacted participants again to complete another assessment. The same procedure as the 4-month follow-up was followed.

Data storage: Following the procedures of university data protection, all data recorded on papers were stored securely at University College London or the

University of the West of England. Participants were only identified by their individual study IDs, their consent forms, and contact information. A single copy identifying participants' names and their IDs was stored separately from other data. All data were stored in locked filing cabinets in locked offices within university premises.

Audio-recordings of consent to participate in a phone interview were downloaded directly by the study researcher from the audio-recorder onto a secure folder that was only able to be accessed by the research team on a secure network at UCL. Once this was completed, the recordings on the audio-recorders were deleted immediately.

Sealed Envelope, the independent data management service that was used for the study, commissioned by the Priment Clinical Trials, would monitor and ensure secure data storage. Participants also would only be identified by their study IDs in the databases. Data were only accessed by the study researchers by using secure log-ins. After the completion of recruitment and data collection, Sealed Envelope would arrange with the study team to access the data for analysis.

After the completion of data collection, all paper records were transferred to UCL, and the data would be stored securely by the study team for one year after the completion of the study. Paper records and consent forms were archived securely according to the UCL data protection procedures.

5.4. Analysis

Based on the aims and research questions listed in Chapter 4, hypotheses were tested in this thesis. For this thesis, the primary aim was to explore the relationship between baseline loneliness and patients' self-rated personal recovery at 18-month follow-up. Patients' psychiatric symptoms at 18-month follow-up were determined as the secondary outcome.

Initial analyses: Descriptive statistics were analysed for all variables at baseline, 4-month and 18-month follow-ups. For normally distributed continuous variables, the mean and standard deviation were reported. For non-normally distributed data, the median and inter-quartile range were reported instead. Frequency and

percentage within each category were reported for categorical variables. The distribution of each variable will be presented in Chapter 6.

Due to the fact that a large number of participants were lost to follow-up, to avoid overadjusting the models, three blocks of confounding variables were selected based on if they were associated with baseline loneliness and baseline personal recovery in the univariate linear regression models, which were previously reported in Wang (2018b). Correlation matrix of the coefficients was used to test collinearity between baseline independent variables. The correlation between loneliness and self-rated personal recovery was -0.39, and there was a positive correlation between social network size and personal recovery (r=0.35). Additionally, loneliness and the BPRS total score were positively correlated (r=0.36), and the correlation between social network size and the BPRS total score was -0.27. Some researchers suggest that collinearity will become a problem for model estimation when the correlation coefficients between two or more predictors are larger than 0.50 (Donath et al, 2012), and some others suggest a cut-off of 0.70 and above (Dormann et al, 2012). Nevertheless, all correlations between our baseline variables were not large enough to cause collinearity in the models.

Research question 1: Are subjective and objective social isolation at baseline significantly related to 18-months mental health outcomes among people with mental health issues?

1. Differences in baseline variables between those who completed 18-month follow-up and those who did not were examined and tested by t-test and chi-square test. When certain variables were found to be different between completers and non-completers, these variables were controlled in the model since they are the predictors of missingness.

2. <u>Hypothesis 1: There is an association between greater baseline loneliness and poorer self-rated personal recovery score at 18-month follow-up.</u> Five models are described below:
   1) Univariate linear regression model: QPR 18-month follow-up score (dependent variable) and baseline loneliness score (i.e. ULS-8) (independent variable).

2) Linear regression model: the relationship between QPR 18-month follow-up score and baseline loneliness score (i.e. ULS-8), adjusting for baseline social network size (i.e. 2-item summed-up score from the LSNS-6).
3) Linear regression: the relationship between QPR 18-month follow-up score and baseline loneliness score (i.e. ULS-8), adjusting for baseline social network size (i.e. 2-item summed-up score from the LSNS-6), and baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status).
4) Linear regression: the relationship between QPR 18-month follow-up score and baseline loneliness score (i.e. ULS-8), adjusting for baseline social network size (i.e. 2-item summed-up score from the LSNS-6), baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status) and baseline psychiatric variables (i.e. BPRS total score, number of years since first contact with mental health services, number of psychiatric inpatient hospitalisations).
5) Linear regression: the relationship between QPR 18-month follow-up score and baseline loneliness score (i.e. ULS-8), adjusting for baseline social network size (i.e. 2-item summed-up score from the LSNS-6), baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status), baseline psychiatric variables (i.e. BPRS total score, number of years since first contact with mental health services, number of psychiatric inpatient hospitalisations), and baseline QPR score.

3. <u>Hypothesis 2: There is an association between having a smaller baseline social network size and poorer self-rated personal recovery at 18-month follow-up.</u> Five models are described below:
   1) Univariate linear regression model: QPR 18-month follow-up score (dependent variable) and social network score at baseline (independent variable).
   2) Linear regression model: the relationship between QPR 18-month follow-up score and baseline social network size (i.e. 2-items summed-

up score from the LSNS-6), adjusting for baseline loneliness score (i.e. ULS-8).

3) Linear regression: the relationship between QPR 18-month follow-up score and baseline social network size (i.e. 2-item summed-up score from the LSNS-6), adjusting for baseline loneliness score (i.e. ULS-8) and sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status).
4) Linear regression: the relationship between QPR 18-month follow-up score and baseline social network size (i.e. 2-item summed-up score from the LSNS-6), adjusting for baseline loneliness score (i.e. ULS-8), baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status), and baseline psychiatric variables (i.e. BPRS total score, number of years since first contact with mental health services, number of psychiatric inpatient hospitalisations).
5) Linear regression: the relationship between QPR 18-month follow-up score and baseline social network size (i.e. 2-item summed-up score from the LSNS-6), adjusting for baseline loneliness score (i.e. ULS-8), baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status), baseline psychiatric variables (i.e. BPRS total score, number of years since first contact with mental health services, number of psychiatric inpatient hospitalisations), and baseline QPR score.

4. <u>Hypothesis 3: There is an association between greater baseline loneliness and greater psychiatric symptom severity at 18-month follow-up.</u> Five models are described below:
    1) Univariate linear regression model: BPRS 18-month follow-up total score (dependent variable) and baseline loneliness score (i.e. ULS-8) (independent variable).
    2) Linear regression model: the relationship between BPRS 18-month follow-up total score and baseline loneliness score (i.e. ULS-8), adjusting for baseline social network size (i.e. 2-items summed-up score from the LSNS-6).

3) Linear regression: the relationship between BPRS 18-month follow-up total score and baseline loneliness score (i.e. ULS-8), adjusting for baseline social network size (i.e. 2-item summed-up score from the LSNS-6) and sociodemographic variables (age, gender, ethnicity, educational attainment, education/employment status).
4) Linear regression: the relationship between BPRS 18-month follow-up total score and baseline loneliness score (i.e. ULS-8), adjusting for baseline social network size (i.e. 2-item summed-up score from the LSNS-6), baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status), and baseline psychiatric variables (i.e. number of years since first contact mental health services, number of psychiatric inpatient hospitalisations).
5) Linear regression: the relationship between BPRS 18-month follow-up total score and baseline loneliness score (i.e. ULS-8), adjusting for baseline social network size (i.e. 2-item summed-up score from the LSNS-6), baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status), baseline psychiatric variables (i.e. number of years since first contact mental health services, number of psychiatric inpatient hospitalisations), and baseline BPRS total score.

5. Hypothesis 4: There is an association between having a smaller social network size and greater psychiatric symptom severity at 18-month follow-up. Five models are described below:
   1) Univariate linear regression model: BPRS 18-month follow-up total score (dependent variable) and social network size (i.e. 2-item summed-up score from the LSNS-6) at baseline (independent variable).
   2) Linear regression model: the relationship between BPRS 18-month follow-up total score and baseline social network size (i.e. 2-item summed-up score from the LSNS-6), adjusting for baseline loneliness score (i.e. ULS-8).

3) Linear regression: the relationship between BPRS 18-month follow-up total score and baseline social network size (i.e. 2-item summed-up score from the LSNS-6), adjusting for baseline loneliness score (i.e. ULS-8) and baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status).
4) Linear regression: the relationship between BPRS 18-month follow-up total score and baseline social network size (i.e. 2-item summed-up score from the LSNS-6), adjusting for baseline loneliness score (i.e. ULS-8), baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status), and baseline psychiatric variables (i.e. number of years since first contact mental health services, number of psychiatric inpatient hospitalisations).
5) Linear regression: the relationship between BPRS 18-month follow-up total score and baseline social network size (i.e. 2-item summed-up score from the LSNS-6), adjusting for baseline loneliness score (i.e. ULS-8), baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status), baseline psychiatric variables (i.e. number of years since first contact mental health services, number of psychiatric inpatient hospitalisations), and baseline BPRS total score.

Research question 2: Which concept, subjective or objective social isolation at baseline, is a stronger predictor of mental health outcomes at 18-month follow-up?

Hypothesis: Baseline loneliness is a stronger predictor of self-rated personal recovery at 18-month follow-up, compared to baseline social network size.

1. Multivariate linear regression model: QPR 18-month follow-up score as dependent variable, baseline loneliness score (i.e. ULS-8) and baseline social network size (i.e. 2-item summed-up score from the LSNS-6 as independent variables.
2. Standardisation of the coefficient was used to determine which independent variable (i.e. baseline loneliness or social network size) have

a greater impact on the dependent variable (i.e. QPR at 18-month follow-up).

Research question 3: Are persistent subjective and objective social isolation associated with poor self-rated personal recovery at 18-month follow-up?

1. All participants who have responded all three time-points were included for this research question. Differences in baseline variables between those who completed loneliness scale and the LSNS-6 at baseline and both follow-ups and those who did not were examined and tested by t-test and chi-square tests. When variables were found to be different between completers and non-completers, these variables were controlled in the model as they are the predictors of missingness.
2. The participants were categorised into three groups (persistent severely lonely, intermittently severely lonely and never severely lonely) based on their ULS-8 scores at baseline, 4-month and 18-month follow-up.
    - The participant was considered as being severely lonely if his/her total score for ULS-8 scale was 24 or above. This cut-off point is defined as an average score of 3 per item, which is equivalent to experiencing the problem sometimes, rather than rarely or never.
    - Persistently severely lonely group: including people who scored as being severely lonely at all three time-points.
    - Intermittently severely lonely group: including people were scored as severely lonely at one or two time-points.
    - Never severely lonely group: including people remain not severely lonely at all 3 time-points.
3. The participants were divided into 3 groups (persistently socially isolated, intermittently socially isolated and never socially isolated) based on their social network size (i.e. 2-item summed-up score from the LSNS-6) at baseline, 4-month and 18-month follow-up.
    - A cut-off point of a score lower than 4 was be used to divide participants into socially isolated and not socially isolated groups.

- Persistently objectively socially isolated group: including people who scored as socially isolated at all 3 time-points.
- Intermittently objectively socially isolated group: including people who scored as social isolated at one or two time-points.
- Never objectively socially isolated group: including people who never feel socially isolated at all 3 time-points.

4. Characteristic differences (e.g. sociodemographic or diagnostic difference) between three severe loneliness groups were tested by t-test and chi-square tests. Characteristic differences between three objective social isolation groups were also tested by t-test and chi-square tests.

5. Hypothesis 1: Participants with persistent severe loneliness would have the poorest self-rated personal recovery score at 18-month follow-up, followed by participants who suffered from intermittent severe loneliness, and then participants who were never severely lonely. Five models were described below:
   1) Univariate linear regression: the relationship between loneliness groups (independent variable) and QPR score at 18-month follow-up (dependent variable).
   2) Linear regression: the relationship between loneliness groups (independent variable) and QPR score at 18-month follow-up (dependent variable), adjusting for baseline social network size (i.e. 2-item summed-up score from the LSNS-6).
   3) Linear regression: the relationship between groups (independent variable) and QPR score at 18-month follow-up (dependent variable), adjusting for baseline social network size (i.e. 2-item summed-up score from the LSNS-6) and baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, and education/employment status).
   4) Linear regression: the relationship between groups (independent variable) and QPR score at 18-month follow-up (dependent variable), adjusting for baseline social network size (i.e. 2-item summed-up score from the LSNS-6), baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment

status), and baseline psychiatric variables (i.e. number of years since first contact mental health services, BPRS total score, number of psychiatric inpatient hospitalisations).

5) Linear regression: the relationship between groups (independent variable) and QPR score at 18-month follow-up (dependent variable), adjusting for baseline social network size (i.e. 2-item summed-up score from the LSNS-6), baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status), baseline psychiatric variables (i.e. number of years since first contact mental health services, BPRS total score, number of psychiatric inpatient hospitalisations), and baseline QPR score.

6. Hypothesis 2: Participants with persistent objective social isolation would have the poorest self-rated personal recovery score at 18-month follow-up, followed by participants who suffered from intermittent objective social isolation, and then participants who were never objectively socially isolated. Five models were described below:
   1) Univariate linear regression: the relationship between social isolation groups (independent variable) and QPR score at 18-month follow-up (dependent variable).
   2) Linear regression: the relationship between social isolation groups (independent variable) and QPR score at 18-month follow-up (dependent variable), adjusting for baseline loneliness score (i.e. ULS-8).
   3) Linear regression: the relationship between social isolation groups (independent variable) and QPR score at 18-month follow-up (dependent variable), adjusting for loneliness score (i.e. ULS-8), and baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status).
   4) Linear regression: the relationship between social isolation groups (independent variable) and QPR score at 18-month follow-up (dependent variable), adjusting for loneliness score (i.e. ULS-8), baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status), and baseline

psychiatric variables (i.e. number of years since first contact mental health services, number of psychiatric inpatient hospitalisations, BPRS baseline score).

5) Linear regression: the relationship between social isolation groups (independent variable) and QPR score at 18-month follow-up (dependent variable), adjusting for loneliness score (i.e. ULS-8), baseline sociodemographic variables (i.e. age, gender, ethnicity, educational attainment, education/employment status), baseline psychiatric variables (i.e. number of years since first contact mental health services, number of psychiatric inpatient hospitalisations, BPRS baseline score), and baseline QPR score.

5.5. Missing data

Baseline and 18-month follow-up data were checked for missing values. Case mean substitution was implemented to resolve missing data for continuous variables including loneliness, social network size, QPR and BPRS at baseline and 18-month follow-up. Case mean substitution is a type of missing data technique using the mean score of the remaining items within a scale for a given individual to estimate the missing values (Raymond, 1986), this strategy preserves data and is easy to use (Hawkins & Merriam, 1991). Previous literature also supports the equivalent effectiveness of case mean substitution and other techniques when there was a low level of data missing (e.g. Parent, 2013; Saunders et al, 2006; Gilley & Leone, 1991; Kaufman, 1988; Roth et al, 1999), for example, when there was less than 15% of data missing (Raymond & Roberts, 1987). Eekhout and colleges (2014) suggest that case mean substitution should not lead to a high bias if 25% or less of items were missing, and 10% or less of total case were missing (Donner, 1982). For this thesis, only when there were less than 25% of items missing on a single scale, the missing items were substituted with the mean of the scale. Cases with over 25% of data missing on each scale were removed from the final analysis.

Chapter 6. Loneliness and social network size as the predictors of mental health outcomes among a group of Crisis Resolution Team (CRT) users: 18-month follow-up data

Hypotheses and methods for the quantitative study were described in Chapter 5. This chapter reports the results for Research Questions 1 and 2. The results for Research Question 3 will be reported in Chapter 7.

6.1. Sample characteristics

In total, 399 participants were included in the baseline analysis. The age of these 399 participants ranged from 18 to 75. The median age was 40 years (IQR 29.9 – 49.9). Approximately 40.0% of the participants were male and a large proportion of the sample were from a White ethnic background (63.8%). Approximately one-third of the sample were married or in cohabiting at the time of the assessment. The majority of the participants were born in the UK (77.3%) and almost all of them (96.5 %) were either in permanent or supported accommodation. Over half of the participants reported having no children. For those who had children, the majority had contact with them. Just over half of the participants were not employed, not in education or any full-time caring role, and roughly one-third of the whole sample had a degree-level qualification in education. Participants with a psychotic diagnosis, including schizophrenia, schizoaffective disorder, bipolar affective disorder or any other types of psychotic-related disorders accounted for slightly over one-third of the whole sample. Over half of the participants have never been admitted as psychiatric inpatients, and above one third had a relatively long history of mental health problems (i.e. over 10 years since they had first contact with mental health services). Total symptom severity score of the Brief Psychiatric Rating Scale (BPRS) reported by the participants ranged from 24 to 79, the median of the BPRS at baseline was 43 (IQR 35 – 51), which was equivalent to ‘being moderately ill’ (Leucht et al, 2005). The total score of the Questionnaire about the Process of Recovery (QPR) reported by the participants ranged from 1 to 87, the median of the QPR at baseline was 53 (IQR 41- 65). Detailed characteristics of the sample at baseline are presented in Table 6.1.

Table 6.1 Sample characteristics at baseline

Variables	N (%) or mean (SD) or median (IQR)
Age	40.0 (29.90 – 49.98)
Gender	
Male	160 (40.20%)
Female	238 (59.80%)
Ethnicity	
White	254 (63.82%)
Black	80 (20.10%)
Asian/Chinese	30 (7.54%)
Mixed/other	34 (8.54%)
Marital status	
Single/separated/divorced/widowed	308 (77.39%)
Married/cohabiting	90 (22.61%)
UK born	
Yes	304 (77.35%)
No	89 (22.65%)
Housing	
Permanent/supported accommodation	384 (96.48%)
Unstable accommodation	14 (3.52%)
Contact with children under 16	
No contact	25 (6.27%)
Contact with dependent children	104 (26.07%)
Having no children	270 (67.67%)
Employment/education status	
Not in employment education or full time caring role	204 (51.91%)
Yes	189 (48.09%)
Educational attainment	
No qualification	76 (19.10%)
Other qualifications	213 (53.52%)
Degree	109 (27.39%)
Diagnosis	
Schizophrenia or schizoaffective disorder/bipolar affective disorder/other psychosis	124 (31.88%)
Depression/anxiety disorder/post-traumatic stress disorder	100 (25.71%)
Borderline or emotionally unstable personality disorder/other personality disorder	48 (12.34%)
Other diagnosis	117 (30.08%)
Number of psychiatric inpatient hospitalisations	
Never	240 (60.30%)
Once	60 (15.08%)

Variables	N (%) or mean (SD) or median (IQR)
More than 2 times	98 (24.62%)
Number of years since first contact with mental health services	
Less than 3 months	67 (16.83%)
3 months- 2 years	67 (16.83%)
2-10 years	126 (31.66%)
More than 10 years	138 (34.67%)
BPRS score (24-168)	43 (35 – 51)
QPR score (0-88)	53 (41 – 65)
Loneliness score (8-32)	22 (19 – 25)
Social network size (0-10)	4.90 (2.25)

Abbreviations: N =number of participants; SD = standard deviation; IQR = interquartile range; BPRS = The Brief Psychiatric Rating Scale; QPR = The Questionnaire about the Process of Recovery.

For BPRS, QPR, loneliness and social network size, range of scores is shown between brackets.

6.2. Loneliness and social network size at baseline

The total score of the ULS-8 reported by the participants ranged from 8 to 32, the median score of the ULS-8 at baseline was 22 (IQR 19 – 25). As was mentioned in the previous chapter, a cut-off score of ULS-8 was decided at 24, which means if a participant scored 24 or above, he/she would be considered as severely lonely. Therefore, the participants at baseline should be considered as being moderately lonely. For detailed results of each item of the ULS-8 at baseline, please refer to Appendix 6.1.

There are eight items in total in the ULS-8, for the items asking ‘How often do you feel that you lack companionship’, ‘How often do you feel left out’, and ‘How often do you feel isolated from others’, 70% of the participants reported that they sometimes or always felt that they lack companionship, felt being left out and being isolated from others. For the items asking ‘How often do you feel unhappy being so withdrawn’, and ‘How often do you feel people are around you but not with you’, over 70% of the participants reported that, at least sometimes, they felt unhappy because being socially withdrawn, and almost 80% of them also felt that people were ‘around them but not with them’. For the item asking ‘How often do you feel that you lack companionship’, approximately 20% of the sample reported that they always had no one they can turn to, and only 17.0% feel that they always were an outgoing person when they were asked ‘How often do you feel that you are an outgoing person’. When asked about ‘How often can you find

companionship when you want it', almost 30% were always able to find companionship when they want it.

The total score of the social network size measure reported by the participants (i.e. 2 items sum-up score from the LSNS-6) ranged from 0 to 10, and the mean score of the baseline social network size (i.e. the sum-up score of item 1 and 4) was 4.9 (SD=2.25). Approximately one third (29.8%) of the participants reported having three or four family members they see or hear from at least once a month, followed by participants (25.1%) who reported having two family members they see or hear from at least once a month. Almost one-quarter of the participants reported that they had three or four friends they see or hear from at least once a month, and approximately half of the participants reported having two or less friends they see or hear from at least once a month. Detailed results of the two items of the LSNS-6 are presented in Appendix 6.2.

6.3. Lost to follow-up

Compared to baseline, 89 participants (22.3%) were lost from baseline to 4-month follow-up, therefore, 310 (77.7%) participants in total completed 4-month follow-up assessments. Of these 310 participants, 59 (19.0%) participants were lost from 4-month to 18-month follow-up, resulting in 251 (81.0%) participants in total who have completed 18-month follow-up assessments. Compared to the non-completers, completers at 18-month follow-up were more likely to hold a degree-level qualification in education ($p=0.002$), they were also more likely to be employed, in education or a full-time caring role ($p<.001$). No other baseline variables showed any statistically significant differences between the completers and non-completers. Therefore, both variables (i.e. educational attainment and employment status) were added into the explanatory models since they were the predictors of missingness. Detailed baseline variable comparisons between these two groups of respondents at 18-month follow-up are reported in Appendix 6.7.

6.4. 4- and 18-month follow-up outcome results

The following section will report loneliness, BPRS, QPR and social network scores at 4– and 18-month follow-up among the 251 participants who completed 18-month follow-up.

4-month follow-up: There was a small change in loneliness score from baseline to 4-month follow-up. The median of the ULS-8 at baseline was 22 (IQR 19 – 25), the median at 4-month follow-up was 21 (IQR 16 – 24). For detailed results on each item of the ULS-8, please see appendix 6.3. At 4-month follow-up, above 70% of the participants reported that, at least sometimes, they felt unhappy because being socially withdrawn, and they felt that people were around them but not with them. At least 60% sometimes or always felt that they lack companionship, being left out and being isolated from others. About one-third of the sample felt that they were always an outgoing person, and approximately 30% reported that they could always find companionship when they want it.

The mean of social network size at 4-month follow-up was 5.1 (SD=2.3). About 50% of the participants reported that they had two or less relatives and friends they see or hear from at least once a month. The results on the two items of the LSNS-6 at 4-month follow-up are presented in appendix 6.4.

18-month follow-up: At 18-month follow-up, the median of the ULS-8 at 18-month follow-up was 21 (IQR 17 – 24). For detailed results of each item of the ULS-8, please see appendix 6.5. Over 70% of the participants reported that, at least sometimes, they felt unhappy because being withdrawn and they felt that people were ‘around them but not with them’. Above 60% feel that they lack companionship, being left out and being isolated. Over 13% of the participants reported that they were always outgoing and more than 30% reported that they could find companionship when they want it.

The mean of social network size was 5.2 (SD=2.4). Approximately 50% of the participants reported that they had 2 or less relatives and friends they see or hear from at least once a month. Appendix 6.6 presents detailed results of the two items of the LSNS-6 at 18-month follow-up.

Table 6.2 presents baseline, 4-month and 18-month follow-up outcomes on BPRS, QPR, ULS-8 and social network size for the 251 participants who

completed questionnaires at all three time-points. For this sample, the BPRS score declined from baseline to 4-month follow-up, and remained unchanged from 4-month to 18-month follow-up. Loneliness score also decreased from baseline to 4-month follow-up, and it remained the same from 4-month to 18-month follow-up. In terms of self-rated personal recovery, the QPR score increased continuously from baseline to 18-month follow-up. The same pattern was observed for social network size, it continuously increased throughout the whole period of 18 months. Therefore, there was a pattern of change over the 18-month period for each variable, however, both loneliness score and social network size only changed slightly, especially from 4- to 18-month follow-up.

As shown in Table 6.3, the effect sizes of changes over time in the BPRS total score and QPR score were only small to medium (Cohen's d 0.31 – 0.44).

Table 6.2 Outcomes on BPRS, QPR, loneliness and social network size from baseline to 18-month follow-up

Variables	**Baseline Mean (SD) or Median (IQR)**	**4-month follow-up Mean (SD) or Median (IQR)**	**18-month follow-up Mean (SD) or Median (IQR)**
BPRS score (24-168)	43 (35 – 51)	37 (30 - 48)	37 (30 - 48)
QPR score (0-88)	53 (41 – 65)	59 (47 - 66)	60.5 (49.5 - 69)
Loneliness score (8-32)	22 (19 - 25)	21 (16 - 24)	21 (17 - 24)
Social network size (0-10)	4.90 (2.25)	5.06 (2.27)	5.17 (2.35)

Abbreviations: SD = standard deviation; IQR = interquartile range; BPRS = The Brief Psychiatric Rating Scale; QPR = The Questionnaire about the Process of Recovery.

For BPRS, QPR, loneliness and social network size, range of scores is shown between brackets.

Table 6.3 Differences between outcome variables (i.e. BPRS and QPR) from baseline to 18-month follow-up

Outcome Variables	**P-value**	**Effect size (Cohen's d)**
BPRS total score	0.0001	0.31
QPR score	<.001	-0.44

Abbreviations: BPRS = the Brief Psychiatric Rating Scale; QPR = the Questionnaire about the Process of Recovery.

For BPRS, QPR, loneliness and social network size, range of scores is shown between brackets.

6.5. Research question 1: Are subjective and objective social isolation at baseline significantly related to 18-months mental health outcomes among people with mental health issues?

In Table 6.4, model 1a and 1b are the univariate linear regression models which explain the association between baseline loneliness and the self-rated personal recovery (i.e. QPR score) at 18-month follow-up, and the association between baseline social network size and self-rated personal recovery at 18-month follow-up, respectively.

Hypothesis 1: There is an association between greater baseline loneliness and poorer self-rated personal recovery score at 18-month follow-up

Based on the univariate linear regression model (i.e. model 1a), baseline loneliness was a significant predictive factor of self-rated personal recovery at 18-month follow-up: a high loneliness score at baseline was linked to poor self-rated personal recovery at 18-month follow-up (coef. -1.37, 95% CI -1.76, -0.97, p<.001). This negative association remained statistically significant after controlling for baseline social network size (coef. -1.28, 95% CI -1.71, -0.85, p<.001) in model 2, and after controlling for baseline social network size and sociodemographic variables in model 3 (coef. -1.21, 95% -1.66, -0.76, p<.001), explained 15.6% and 14.9% of the variance in self-rated personal recovery at 18-month follow-up, respectively. However, such association became slightly weaker after the model additionally adjusting for psychiatric variables (i.e. model 4), with a one-point increase of loneliness score was associated with a 0.81-point (p=0.001) decrease of QPR score at 18-month follow-up, which explained 20.0% of the variance in self-rated personal recovery. Finally in model 5, when baseline social network size, baseline sociodemographic variables, baseline psychiatric variables, and baseline QPR were introduced in the model, the association between baseline loneliness and self-rated personal recovery at 18-month follow-up became statistically insignificant (coef.-0.34, 95% CI -0.84, 0.16, p=0.18). Self-rated personal recovery at 18-month follow-up was only associated with its baseline score (coef. 0.29, 95% CI 0.17, 0.41, p<.001), two or more hospitalisations (coef. 5.67, 95% CI 1.03, 10.31, p=0.02), and 2-10 years since

first contact with mental health services (coef. -9.12, 95% CI -14.53, -3.71, p=0.001). This final model (model 5) explained 27.2% of the variance in self-rated personal recovery at 18-month follow-up.

Hypothesis 2: There is an association between having a smaller baseline social network size and poorer self-rated personal recovery at 18-month follow-up

In model 1b, social network size at baseline was a significant predictive factor of self-rated personal recovery at 18-month follow-up. There was a significant positive relationship between the two variables: the bigger the social network size one had at baseline, the better the personal recovery process was found at 18-month follow-up (coef. 1.45, 95% CI 0.63, 2.28, p<.001), this univariate model explained 4.3% of the variance in self-rated personal recovery score. However, this relationship became statistically insignificant after baseline loneliness was introduced into the model in model 2, and the relationship between baseline social network size and self-rated personal recovery at 18-month follow-up remained insignificant in the rest of the models (i.e. model 3, 4 and 5). For the detailed results of the five models, please refer to table 6.4.

Table 6.4 Potential baseline risk factors of self-rated personal recovery at 18-month follow-up[a]

Variables	**Model 1a**		**Model 1b**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value
Psychosocial variables												
Loneliness	-1.37 (-1.76, -.97)	**<.001**[b]			-1.28 (-1.71, -.85)	**<.001**	-1.21 (-1.66, -.76)	**<.001**	-0.81 (-1.29, -.32)	**0.001**	-0.34 (-.84, .16)	0.18
Social network size			1.45 (.63, 2.28)	**0.001**	0.44 (-.41, 1.29)	0.31	0.31 (-.60, 1.21)	0.50	0.53 (-.38, 1.44)	0.25	0.50 (-.37, 1.36)	0.26
Sociodemographic variables												
Age (years)							0.03 (-.13, .19)	0.69	0.01 (-.16, .17)	0.91	-0.07 (-.23, .10)	0.42
Gender (0=male, 1=female)							-0.41 (-4.19, 3.36)	0.83	0.81 (-2.95, 4.57)	0.67	1.46 (-2.14, 5.07)	0.42
Ethnicity												
White							Reference		Reference		Reference	
Black							2.14 (-2.39, 6.68)	0.35	1.97 (-2.52, 6.45)	0.39	-0.13 (-4.49, 4.23)	0.95
Asian/ Chinese							4.17 (-2.89, 11.22)	0.25	1.19 (-5.91, 8.29)	0.74	0.31 (-6.47, 7.09)	0.93
Mixed/other							-2.61 (-9.24, 4.02)	0.44	-2.77 (-9.41, 3.87)	0.41	-4.43 (-10.80, 1.94)	0.17

Variables	**Model 1a**		**Model 1b**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value
Employment/ education status (0= not in employment/ educated/full-time caring role, 1=yes)							3.35 (-.78, 7.48)	0.11	2.95 (-1.25, 7.15)	0.17	2.29 (-1.73, 6.31)	0.26
Educational attainment												
No qualification							Reference		Reference		Reference	
Other qualifications							1.49 (-3.96, 6.95)	0.59	1.56 (-3.82, 6.94)	0.57	1.36 (-3.78, 6.49)	0.60
Degree							2.51 (-3.40, 8.42)	0.40	2.67 (-3.18, 8.52)	0.37	3.15 (-2.44, 8.73)	0.27
Psychiatric variables												
BPRS total score									-0.21 (-.40, -.02)	**0.03**	-0.15 (-.33, .04)	0.12
Number of psychiatric inpatient hospitalisations												
Never									Reference		Reference	
Once									2.04 (-2.86, 6.95)	0.41	2.53 (-2.16, 7.22)	0.29
2 or more									6.02 (1.17, 10.88)	**0.02**	5.67 (1.03, 10.31)	**0.02**
Number of years since first contact with mental health services												
Less than 3 months									Reference		Reference	

Variables	**Model 1a**		**Model 1b**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value
3 months - 2 years									-2.13 (-8.63, 4.37)	0.52	-3.43 (-9.66, 2.80)	0.28
2-10 years									-8.80 (-14.46, -3.13)	**0.002**	-9.12 (-14.53, -3.71)	**0.001**
More than 10 years									-4.18 (-10.07, 1.71)	0.16	-5.64 (-11.30, .01)	0.05
QPR total score											0.29 (.17, .41)	**<.001**
R^2 adjusted	0.156		0.043		0.156		0.149		0.200		0.272	

Abbreviations: coef. = coefficient; CI= confidence interval; BPRS = The Brief Psychiatric Rating Scale; QPR = The Questionnaire about the Process of Recovery; R^2 adjusted = adjusted- R^2

a. Multivariable linear regression analyses were conducted with self-rated personal recovery at 18-month follow-up as dependent variable and other baseline factors as independent variables.

b. significant p-values are marked in bold.

In table 6.5, model 1a and 1b are the univariate linear regression models which explain the association between baseline loneliness and overall psychiatric symptom severity (i.e. BPRS total score) at 18-month follow-up, and the association between baseline social network size and overall psychiatric symptom severity at 18-month follow-up, respectively.

Hypothesis 3: There is an association between having greater baseline loneliness and greater psychiatric symptom severity at 18-month follow-up

Loneliness was a strong predictive factor for the overall psychiatric symptom severity at 18-month follow-up in model 1a. There was a strong, positive relationship between the two variables: the higher the loneliness score at baseline, the greater the symptom severity at 18-month follow-up (coef. 1.04, 95% CI 0.67, 1.41, p<.001), this association persisted after controlling for baseline social network size (coef. 0.90, 95% CI -0.50, 1.30, p<.001) in model 2, and after controlling for baseline social network size and sociodemographic variables in model 3 (coef. 0.73, 95% CI 0.33, 1.13, p<.001). Model 2 and 3 explained 12.8% and 17.8% of the variance in overall symptom severity, respectively. However, the association became slightly weaker after adjusting for baseline social network, baseline sociodemographic and psychiatric variables, with a one-point increase of loneliness score was associated with a 0.64-point (p=0.003) increase of overall BPRS score at 18-month follow-up, which explained 17.9% of the variance in overall symptom severity. Finally, in model 5, when baseline BPRS total score, baseline social network size, baseline sociodemographic and psychiatric variables were all added in the model, the association between baseline loneliness and overall symptom severity at 18-month follow-up became statistically insignificant. A greater symptom severity at follow-up was only linked to its baseline score (coef. 0.47, 95% CI 0.30, 0.63, p<.001), baseline employment status (coef. -4.14, 95% -7.62, -0.66, p=0.02), and 2-10 years since first contact with mental health services (coef. 5.13, 95% ci 0.47, 9.80, p=0.03). This final model (model 5) explained 33.4% of the variance in overall symptom severity of at 18-month follow-up.

Hypothesis 4: There is an association between having a smaller social network size and greater psychiatric symptom severity at 18-month follow-up

In model 1b, social network size at baseline was a significant predictive factor of overall psychiatric symptom severity at 18-month follow-up. There was a strong, negative relationship between the two variables: the larger the social network, the lower overall symptom severity at 18-month follow-up (coef. -1.43, 95% CI -2.18, -0.67, p<.001), explained 5.4% of the variance in the total symptom severity. This relationship again became statistically insignificant after baseline loneliness was introduced into the model, and the relationship between baseline social network size and the overall symptom severity at 18-month follow-up remained insignificant in the rest of the models (i.e. model 3, 4 and 5). For the detailed results of the five models, please see table 6.5.

Table 6.5. Potential baseline risk factors of overall symptom severity at 18-month follow-up[a].

Variables	**Model 1a**		**Model 1b**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value
Psychosocial variables												
Loneliness	1.04 (.67, 1.41)	**<.001**[b]			0.90 (.50, 1.30)	**<.001**	0.73 (.33, 1.13)	**<.001**	0.64 (.23, 1.06)	**0.003**	0.22 (-.20, .63)	0.31
Social network size			-1.43 (-2.18, -.67)	**<.001**	-0.77 (-1.55, 0.02)	0.055	-0.64 (-1.42, .13)	0.10	-0.73 (-1.53, .06)	0.07	-0.47 (-1.22, .28)	0.22
Sociodemographic variables												
Age (years)							-0.13 (-.27, .01)	0.06	-0.12 (-.27, .02)	0.09	-0.08 (-.21, .06)	0.28
Gender (0=male, 1=female)							0.48 (2.77, 3.73)	0.77	-.02 (-3.32, 3.29)	0.99	-0.34 (-3.45, 2.78)	0.83
Ethnicity												
White							Reference		Reference		Reference	
Black							-0.64 (-4.46, 3.18)	0.74	-.54 (-4.39, 3.32)	0.78	-0.46 (-4.07, 3.16)	0.80
Asian/Chinese							-2.37 (-8.25, 3.51)	0.43	-1.33 (-7.40, 4.73)	0.67	-0.55 (-6.24, 5.14)	0.85
Mixed/other							0.45 (-5.20, 6.09)	0.88	0.46 (-5.21, 6.14)	0.87	0.98 (-4.46, 6.43)	0.72

Variables	**Model 1a**		**Model 1b**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value
Employment/ education status (0= not in employment/ educated/full-time caring role, 1=yes)							-6.7 (-10.04, -2.90)	**<.001**	-6.48 (-10.07, -2.90)	**<.001**	-4.14 (-7.62, -.66)	**0.02**
Educational attainment												
No qualification							Reference		Reference		Reference	
Other qualifications							-4.37 (-8.91, .17)	0.059	-4.59 (-9.17, -.01)	0.05	-3.46 (-7.78, .85)	0.12
Degree							-3.69 (-8.65, 1.28)	0.15	-3.74 (-8.73, 1.24)	0.14	-3.30 (-7.97, 1.38)	0.17
Psychiatric variables												
Number of psychiatric inpatient hospitalisations												
Never							Reference		Reference		Reference	
Once									-1.62 (-6.04, 2.81)	0.47	-1.61 (-5.76, 2.54)	0.45
2 or more									-1.62 (-5.84, 2.61)	0.45	-2.07 (-6.05, 1.92)	0.31
Number of years since first contact with mental health services												
Less than 3 months							Reference		Reference		Reference	
3 months - 2 years									2.80 (-2.87, 8.39)	0.34	3.80 (-1.50, 9.09)	0.16

Variables	**Model 1a**		**Model 1b**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value
2-10 years									5.60 (.63, 10.57)	**0.03**	5.13 (.47, 9.80)	**0.03**
More than 10 years									3.74 (-1.43, 8.91)	0.16	3.54 (-1.30, 8.39)	0.15
BPRS total score											0.47 (.30, .63)	**<.001**
R^2 adjusted	0.117		0.054		0.128		0.178		0.179		0.334	

Abbreviations: coef. = coefficient; CI= confidence interval; BPRS = The Brief Psychiatric Rating Scale; QPR = The Questionnaire about the Process of Recovery; R^2 adjusted = adjusted- R^2

a. Multivariable linear regression analyses were conducted with overall severity of psychiatric symptoms at 18-month follow-up as dependent variable and other baseline factors as independent variables.

b. significant p-values are marked in bold.

This chapter has described the main findings of the first research question of the quantitative study, which aimed to explore the relationship between baseline loneliness, baseline social network size and psychiatric outcomes (i.e. self-rated personal recovery and overall symptom severity) at 18-month follow-up. These results reflect that both baseline loneliness and baseline social network size were significant factors associating with self-rated personal recovery and overall symptom severity at 18-month follow-up when no other baseline variables were controlled for. However, when baseline QPR score was introduced into the final model, self-rated personal recovery at 18-month follow-up was only associated with its baseline score, having two or more hospitalisations, and 2-10 years since first contact with mental health services. A comparable result was also found for overall symptom severity, after baseline BPRS total score was added into the final model.

Therefore, hypotheses 1, 2, 3 and 4 were not confirmed. However, it has been argued that in many situations, adjusting baseline score may induce a false statistical association (e.g. Glymour et al, 2005), in this case, between baseline loneliness and QPR at 18-month follow-up. A full discussion is presented in Chapter 8.1.2.

6.6. Research question 2: Which baseline variable is a stronger predictor of self-rated personal recovery at 18-month follow-up, loneliness or social network size?

For research question 2, it is hypothesised that baseline loneliness is a stronger predictor of self-rated personal recovery at 18-month follow-up than baseline social network size. Table 6.4 in the previous section has demonstrated that loneliness at baseline is a stronger predictor of self-rated personal recovery at 18-month follow-up than baseline social network size, considering the association between baseline social network size and QPR at 18-month follow-up immediately became insignificant when baseline loneliness was also introduced into the model. This is further confirmed by the results in Table 6.6. As shown in the table, one standard deviation increase in loneliness scale at baseline was associated with a 0.37 standard deviation decrease in 18-month QPR score, with the other variables held constant. One standard deviation increase in baseline social network size was also linked to a 0.07 standard deviation increase in 18-month QPR score while holding other variables constant. Therefore, our hypothesis for research question 2 was confirmed: loneliness score at baseline was a stronger predictor of 18-month QPR than social network size at baseline. In Chapter 7, the results for research question 3 will be presented.

Table 6.6 The relationship between standardised loneliness score and social network size at baseline and self-rated personal recovery at 18-month follow-up[1]

Variables	**QPR 18-month follow-up score**		
	Coef.	**P value**	**Beta**
Loneliness baseline score	-1.28	<.001	-.37
Baseline social network size	0.44	0.31	.07

Abbreviations: QPR = The Questionnaire about the Process of Recovery; coef. = coefficient; beta = beta coefficient

a. Multivariable linear regression analyses were conduct with QPR 18-month follow-up score as dependent variable, baseline loneliness score and baseline social network size as independent variables. Standardisation of the coefficient was used to determine which independent variable at baseline is a stronger predictor of QPR at 18-month follow-up

Chapter 7. Research question 3: Are being persistently subjectively or objectively socially isolated associated with poorer self-rated personal recovery at 18-month follow-up, compared to being intermittently subjectively or objectively social isolated and never being subjectively or objectively socially isolated?

7.1. The comparison between participants who completed and who did not complete loneliness and social network measure at 18-month follow-up

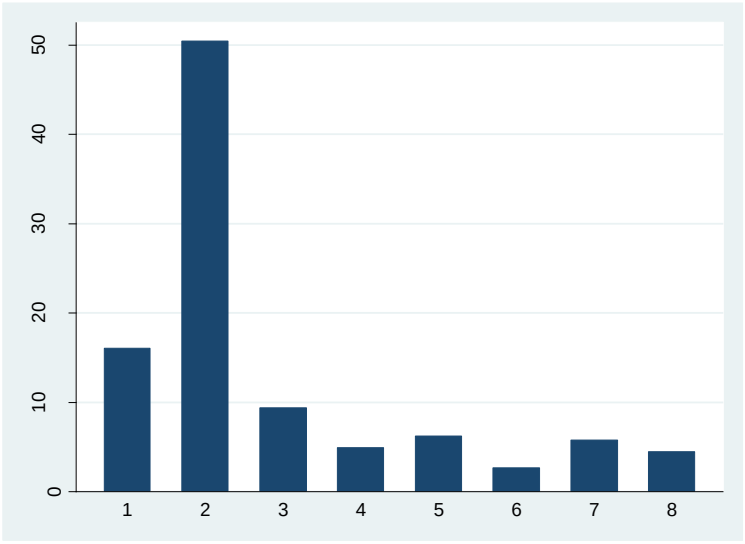
In the previous chapter, research question 1 and 2 were answered. For research question 3, only participants who completed the ULS-8 and LSNS-6 at all three time-points were included in the analysis. After excluding 27 participants who had missing data for either of the two measures at 4-month follow-up assessment, 224 participants in total were included in the final analysis for research question 3. Compared to the non-completers, completers at 18-month follow-up were more likely to hold a degree-level qualification in education ($p=0.002$), they were also more likely to be employed, in education or a full-time caring role ($p<.001$). No other variables demonstrated statistically significant difference between completers and non-completers at 18-month follow-up. Again, since they are the predictors of missingness, both variables (i.e. educational attainment and employment status) were added into the explanatory models, which investigate the association between three loneliness groups and self-rated personal recovery at 18-month follow-up, and the association between objective social isolation groups and self-rated personal recovery at 18-month follow-up. Appendix 7.1 presents detailed baseline variable comparisons between these two groups of respondents (i.e. 18-month follow-up completers and non-completers) at 18-month follow-up.

7.2. Severe loneliness and objective social isolation groups

As described in Chapter 5, the total score of the ULS-8 ranged between 8 and 32. For this thesis, the participant would be considered as being severely lonely if he/she scored 24 or above on the ULS-8. Of the 224 participants who completed the 18-month ULS-8 and LSNS-6, 36 participants (16%) were grouped into persistently severely lonely group since they suffered from persistent severe loneliness (i.e. score 24 or above on the ULS-8) from baseline to 18-month follow-up, 113 participants (50%) did not report that they feel severely lonely at any time point, therefore, they were grouped into never severely lonely group. The rest of the sample, in total 75 participants (34%), were grouped into intermittently severely lonely group, with six subgroups: 1) those who were severely lonely at baseline, and then they were no longer severely lonely at 4- and 18-month follow-up; 2) those who were severely lonely at baseline and 4-month follow-up, and then no longer severely lonely at 18-month follow-up; 3) those who were not severely lonely at baseline, but became severely lonely at 4-month follow-up, and then became not severely lonely again at 18-month follow-up; 4) those who were not severely lonely at baseline, and became severely lonely at 4- and 18-month follow-up; 5) those who were not severely lonely at baseline and 4-month follow-up, then became severely lonely at 18-month follow-up; and 6) those who were severely lonely at baseline, then not severely lonely at 4-month follow-up, and then became severely lonely at 18-month follow-up.

Figure 7.1 demonstrates the percentage of each severely lonely group. One limitation of this analysis is that we could not track the history of loneliness and objective social isolation prior to the time of baseline. Therefore, it is uncertain if participants already suffered from loneliness or objective social isolation before they entered the study. Due to this limitation, throughout the rest of the paper, ‘persistently severely lonely’ refers to as ‘go on to suffer from persistent loneliness from baseline to 18-month follow-up, ‘persistent socially isolated’ refers to as ‘go on to suffer from a persistent objective social isolation’, ‘never experience loneliness’ refers to as ‘go on to never suffer from loneliness’, and ‘never experience objective social isolation’ refers to as ‘go on to never suffer from objective social isolation’.

Figure 7.1 Percentage of participants in severely lonely groups



Group 1: persistently severely lonely (N=36)

Group 2: never severely lonely (N=113)

Group 3: severely lonely – not severely lonely – not severely lonely (N=21)

Group 4: severely lonely – severely lonely – not severely lonely (N=11)

Group 5: not severely lonely- severely lonely – not severely lonely (N=14)

Group 6: not severely lonely – severely lonely – severely lonely (N=6)

Group 7: not severely lonely – not severely lonely – severely lonely (N=13)

Group 8: severely lonely – not severely lonely – severely lonely (N=10)

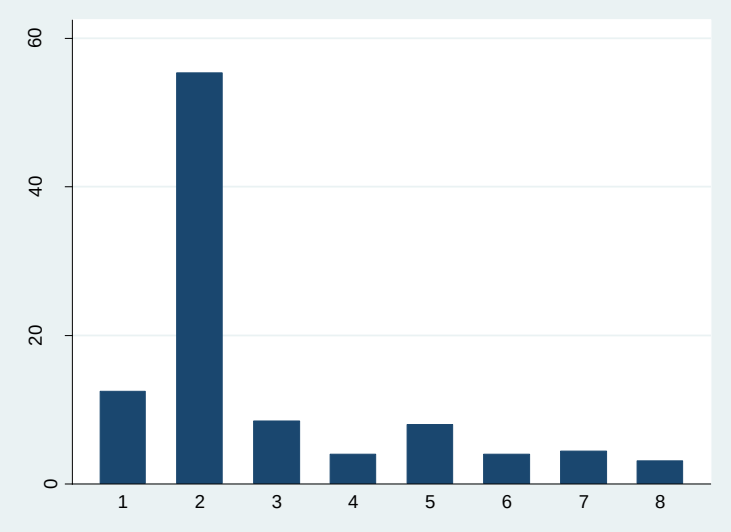
Abbreviation: N = numbers of participants

Of these 75 participants who suffered from intermittent severe loneliness, a pathway out of loneliness was observed for 32 participants (Group 3 and 4); a pathway into loneliness was observed for 19 participants (Group 6 and 7), and 24 participants were observed with fluctuating loneliness (Group 5 and 8).

Of the same 224 participants who completed both the ULS-8 and LSNS-6 at 18-month follow-up, 28 participants (13%) were grouped into persistently objectively socially isolated group as they suffered from persistent objective social isolation from baseline to 18-month follow-up. There were 124 participants (55%) reported never being objectively socially isolated throughout this 18-month period, therefore, they were grouped into never objectively socially isolation group. The rest of the participants (n=72; 32%) were grouped into intermittently objectively socially isolated group, with six subgroups: 1) those who were objectively socially

isolated at baseline, then they were no longer objectively socially isolated at 4- and 18-month follow-up; 2) those who were objectively socially isolated at baseline and 4-month follow-up, then became not objectively socially isolated at 18-month follow-up; 3) those who were not objectively socially isolated at baseline, became objectively socially isolated at 4-month follow-up, and then not objectively socially isolated again at 18-month follow-up; 4) those who were not objectively socially isolated at baseline, became objectively socially isolated at 4- and 18-month follow-up; 5) those who were not objectively socially isolated at baseline and 4-month follow-up, became objectively socially isolated at 18-month follow-up; and 6) those who were objectively socially isolated at baseline, were not objectively socially isolated at 4-month follow-up, and then became objectively socially isolated again at 18-month follow-up. Figure 6.2 indicates the percentage of each objectively socially isolated group.

Figure 7.2 Percentage of participants in objectively socially isolated groups



Group 1: persistently objectively socially isolated (N=28)

Group 2: never objectively socially isolated (N=124)

Group 3: objectively socially isolated – not objectively socially isolated – not objectively socially isolated (N=19)

Group 4: objectively socially isolated – objectively socially isolated – not objectively socially isolated (N=9)

Group 5: not objectively socially isolated – objectively socially isolated – not objectively socially isolated (N=18)

Group 6: not objectively socially isolated – objectively socially isolated – objectively socially isolated (N=9)

Group 7: not objectively socially isolated – not objectively socially isolated – objectively socially isolated (N=10)

Group 8: objectively socially isolated – not objectively socially isolated – objectively socially isolated (N=7)

Abbreviation: N = numbers of participants

Of these 72 participants who suffered from intermittent objective social isolation, a pathway out of objective social isolation was observed for 28 participants (Group 3 and 4); a pathway into objective social isolation was observed for 19 participants (Group 6 and 7), and 25 participants were observed with fluctuating objective social isolation (Group 5 and 8).

7.3. The comparisons of baseline variables between participants in different loneliness and objective social isolation groups

Table 7.1 summarises the differences in baseline variables between those who suffered from persistent severe loneliness, those who experienced intermittent severe loneliness, and those who never reported being severely lonely. Compared to those who never experienced severe loneliness, those who suffered from intermittent severely lonely were younger (p=0.004). For those who experienced persistent severe loneliness, compared to those who never reported being severely lonely, they were more likely to be single, separated, divorced or widowed (p<.001), and were less likely to be employed, in education or in any full-time caring role (p=0.002). There were significant differences between the three loneliness groups in terms of their baseline social network size: the persistent severe loneliness group had the smallest social network size (mean= 3.2, SD= 2.1), followed by those who were intermittently severely lonely (mean= 4.7, SD= 2.4). Those who never reported being severely lonely had the largest baseline social network size (mean = 5.7, SD= 1.9). Regarding the BPRS total score and QPR at baseline, statistically significant differences were also found between the three loneliness groups: for those who experienced persistent severe loneliness, not only did they score the highest on the BPRS (mean = 51.2, SD= 36), they also scored the lowest on the QPR (mean= 35.1, SD=13.9) at baseline, followed by those who reported being intermittently severely lonely (BPRS: mean = 44.77, SD= 9.33; QPR: mean = 49.59, SD=16.83). Those who never reported being severely lonely scored the lowest on the BPRS (mean= 39.8, SD= 9.2) but the highest on the QPR (mean= 57.4, SD= 15.7) at baseline. For detailed results of baseline variables in different loneliness groups, please see table 7.1.

Table 7.1 The comparisons of baseline variables between three loneliness groups[a]

Variables	**Loneliness groups**							
	Persistently severely lonely group (Group 1)		**Intermittently severely lonely group (Group 2)**		**Never severely lonely group (Group 3)**			
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**Mean (SD) or %**	**N**	**P value**	**95% CI/ Pearson chi2**
Age	40.90 (11.49)	36	36.54 (12.25)	75	41.95 (12.68)	113	Group 1 vs. Group 3: 0.66 Group 2 vs. Group 3: **0.004**[b] Group 1 vs. Group 2: 0.08	Group 1 (37.01, 44.79) Group 2 (33.72, 39.36) Group 3 (39.58, 44.31)
Gender (%)							0.25	2.76
Male	27.78%	10	44.00%	33	40.71%	46		
Female	72.22%	26	5.00%	42	59.29%	67		
Ethnicity							0.77	3.32
White	62.86%	22	56.00%	42	65.49%	74		
Black	17.14%	6	25.33%	19	20.35%	23		
Asian/Chinese	11.43%	4	9.33%	7	5.31%	6		
Mixed/other	8.57%	3	9.33%	7	8.85%	10		
Marital status							**<.001**	**19.17**
Single/Separated/ divorced/widowed	88.89%	32	86.87%	65	61.95%	70		
Married/Cohabiting	11.11%	4	13.33%	10	38.05%	43		
UK born							0.99	0.03
No	25.71%	9	24.332%	18	25.00%	28		
Yes	74.29%	26	75.68%	56	75.00%	84		

Variables	Loneliness groups							
	Persistently severely lonely group (Group 1)		Intermittently severely lonely group (Group 2)		Never severely lonely group (Group 3)			
	Mean (SD) or %	N	Mean (SD) or %	N	Mean (SD) or %	N	P value	95% CI/ Pearson chi2
Housing							0.49	1.42
Permanent/ supported accommodation	100%	36	96.00%	72	96.46%	109		
Unstable accommodation	0%	0	4.00%	3	3.54%	4		
Contact with children under 16							0.78	1.75
No contact	2.78%	1	8.00%	6	6.19%	7		
Contact with dependent children	27.78%	10	20.00%	15	22.12%	25		
Having no children	69.44%	25	72.00%	54	71.68%	81		
Educational attainment							0.11	7.45
No qualification	2.71%	9	13.33%	10	13.27%	15		
Other qualification	37.14%	13	60.00%	45	48.67%	55		
Degree	37.14%	13	26.67%	20	38.05%	43		
Employment/ education status							**0.002**	**12.91**

Variables	**Loneliness groups**							
	Persistently severely lonely group (Group 1)		**Intermittently severely lonely group (Group 2)**		**Never severely lonely group (Group 3)**			
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**Mean (SD) or %**	**N**	**P value**	**95% CI/ Pearson chi2**
Not in employment/ education/ full time caring role	68.57%	24	46.58%	34	34.51%	39		
Yes	31.43%	11	53.42%	39	65.49%	74		
Loneliness score	27.77 (2.13)	36	23.52 (3.76)	75	19.28 (3.15)	113	Group 1 vs. Group 3: **<.001** Group 2 vs. Group 3: **<.001** Group 1 vs. Group 2: **<.001**	Group 1 (27.05, 28.49) Group 2 (22.66, 24.39) Group 3 (18.69, 19.87)
Social network size	3.19 (2.10)	36	4.73 (2.37)	75	5.69 (1.93)	113	Group 1 vs. Group 3: **<.001** Group 2 vs. Group 3: **0.003** Group 1 vs. Group 2: **0.001**	**Group 1 (2.49, 3.90)** **Group 2 (4.19, 5.28)** **Group 3 (5.33, 6.05)**
Numbers of psychiatric inpatient hospitalisations							0.49	3.45
Never	69.44%	25	64.00%	48	59.29%	67		
Once	19.44%	7	13.33%	10	15.93%	18		
More than 2 times	11.11%	4	22.67%	17	24.78%	28		

Variables	**Loneliness groups**							
	Persistently severely lonely group (Group 1)		**Intermittently severely lonely group (Group 2)**		**Never severely lonely group (Group 3)**			
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**Mean (SD) or %**	**N**	**P value**	**95% CI/ Pearson chi2**
Number of years since first contact mental health services							0.08	11.38
Less than 3 months	5.56%	2	18.67%	14	17.70%	20		
3 months – 2 years	5.56%	2	22.67%	17	15.04%	17		
2-10 years	41.67%	15	32.00%	24	32.74%	37		
More than 10 years	47.22%	17	26.67%	20	34.51%	39		
Current diagnosis							0.09	10.96
Schizophrenia or schizoaffective disorder/bipolar affective disorder/other psychosis	19.44%	7	21.92%	16	39.09%	43		
Depression/ Anxiety disorder/ post-traumatic stress disorder	36.11%	13	30.14%	22	21.82%	24		

Variables	**Loneliness groups**							
	Persistently severely lonely group (Group 1)		**Intermittently severely lonely group (Group 2)**		**Never severely lonely group (Group 3)**			
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**Mean (SD) or %**	**N**	**P value**	**95% CI/ Pearson chi2**
Borderline or emotionally unstable personality disorder/ other personality disorder	16.67%	6	13.70%	10	8.18%	9		
Other diagnosis	27.78%	10	34.25%	25	30.91%	34		
BPRS total score	51.19 (12.62)	36	44.77 (9.33)	75	39.79 (9.23)	112	Group 1 vs. Group 3: **<.001** Group 2 vs. Group 3: **0.0004** Group 1 vs. Group 2: **0.003**	Group 1 (46.93, 55.46) Group 2 (42.63, 46.92) Group 3 (38.06, 41.51)
QPR total score	35.06 (13.92)	36	49.59 (16.83)	75	57.43 (15.65)	113	Group 1 vs. Group 3: **<.001** Group 2 vs. Group 3: **0.0013** Group 1 vs. Group 2: **<.001**	Group 1 (30.34, 39.77) Group 2 (45.71, 53.46) Group 3 (54.52, 60.35)

Abbreviation: SD = standard deviation; CI= confidence interval; N = number of participants; BPRS = the Brief Psychiatric Rating Scale; QPR = the Questionnaire about the Process of Recovery

a. t-test and chi-square test were conducted to examine the differences in baseline characteristics between three loneliness groups

b. significant p-values are marked in bold.

Table 7.2 demonstrates the between-group differences in baseline variables between the three objective social isolation groups. Compared to those who suffered from persistent objective social isolation, a larger proportion of those who never reported being objectively socially isolated was born in the UK (p=0.02). For those who experienced persistent objective social isolation, compared to those who were never objectively socially isolated, they were less likely to be employed, in education or any full-time caring role (p=0.01), they were less likely to be admitted as a psychiatric inpatient (p=0.001), and they were also more likely to have a diagnosis of depression, anxiety disorder or post-traumatic stress disorder (p=0.03). There were significant differences between the three objective social isolation groups in terms of their baseline loneliness score, with the persistently objectively socially isolated group scoring the highest on the loneliness scale (mean = 26.1, SD = 3.8), followed by those who were intermittently objectively socially isolated (mean = 22.65, SD = 4.31). Those who never reported being objectively socially isolated scored the lowest on the loneliness scale (mean=20.8, SD=4.2). Regarding the BPRS total score and QPR at baseline, statistically significant differences were also found between the three objective social isolation groups: those who experienced persistent objective social isolation, not only did they score the highest on BPRS (mean = 49.2, SD=10.8), they also scored the lowest on the QPR (mean = 41.5, SD= 15.7) at baseline, followed by those who reported being intermittently objectively socially isolated (BPRS: mean = 44.68, SD=11.48; QPR: mean = 50.71, SD= 17.44). Those who were never objectively socially isolated scored the lowest on the BPRS (mean = 41.2, SD= 9.5) but the highest on the QPR (mean = 53.7, SD= 17.5) at baseline. For detailed results of baseline variables between different objective social isolation groups, please see table 7.2.

So far, this chapter has examined the between-group differences in baseline variables between the severe loneliness groups and objective social isolation groups. The results highlight that for those who suffered from persistent severe loneliness and persistent objective social isolation, they scored the highest on the loneliness scale at baseline, but had the smallest baseline social network size. Moreover, they also scored the highest on BPRS scale, but had the lowest QPR score at baseline. Regarding sociodemographic variables at baseline, these two groups of participants were also more likely to be unemployed, not in any

education or any full-time caring role. Additionally, those who suffered persistent severe loneliness were more likely to be single, separated, divorced or widowed than those who never reported being severely lonely. For those who were objectively socially isolated persistently, they were less likely to be born in the UK, compared to those who were never objectively socially isolated. Moreover, they were also more likely to be diagnosed with depression, anxiety disorder or PTSD, but they were less likely to be admitted as inpatient previously than those who never suffered from objective social isolation.

Table 7.2 The comparison of baseline variables between three objective social isolation groups[a]

Variables	**Objective social isolation groups**							
	Persistently objectively socially isolated group (Group 1)		**Intermittently objectively socially isolated group (Group 2)**		**Never objectively socially isolated group (Group 3)**			
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**Mean (SD) or %**	**N**	**P value**	**95% CI/Pearson chi2**
Age	43.76 (10.06)	28	40.29 (11.9)	72	38.92 (13.26)	124	Group 1 vs. Group 3: 0.07 Group 2 vs. Group 3: 0.47 Group 1 vs. Group 2: 0.18	Group 1 (39.86, 47.66) Group 2 (37.48, 43.10) Group 3 (36.57, 41.28)
Gender (%)							0.23	2.97
Male	25%	7	43.06%	31	41.13%	51		
Female	75%	21	56.94%	41	58.87%	73		
Ethnicity							0.75	3.48
White	50%	14	59.15%	42	66.13%	82		
Black	28.57%	8	22.54%	16	19.35%	24		
Asian/Chinese	7.14%	2	8.45%	6	7.26%	9		
Mixed/other	14.29%	4	9.86%	7	7.26%	9		
Marital status							0.06	5.52
Single/Separated/ divorced/widowed	78.57%	22	83.33%	60	68.55%	85		
Married/ Cohabiting	21.43%	6	16.67%	12	31.45%	39		
UK born							**0.02**[b]	**7.62**
No	42.86%	12	28.17%	20	18.85%	23		
Yes	57.14%	16	71.83%	51	81.25%	99		

Variables	**Objective social isolation groups**							
	Persistently objectively socially isolated group (Group 1)		**Intermittently objectively socially isolated group (Group 2)**		**Never objectively socially isolated group (Group 3)**			
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**Mean (SD) or %**	**N**	**P value**	**95% CI/Pearson chi2**
Housing							0.59	1.07
Permanent/ supported accommodation	96.43%	27	98.61%	71	95.97%	119		
Unstable accommodation	3.57%	1	1.39%	1	4.03%	5		
Contact with children under 16							0.88	1.17
No contact	7.14%	2	5.56%	4	6.45%	8		
Contact with dependent children	17.86%	5	26.39%	19	20.97%	26		
Having no children	75.00%	21	68.06%	49	72.58%	90		
Educational attainment							0.18	6.30
No qualification	28.57%	8	15.49%	11	12.10%	15		
Other qualification	35.71%	10	47.89%	34	55.65%	69		
Degree	35.71%	10	36.62%	26	32.26%	40		
Employment/ education status							**0.01**	**9.50**

Variables	**Objective social isolation groups**							
	Persistently objectively socially isolated group (Group 1)		**Intermittently objectively socially isolated group (Group 2)**		**Never objectively socially isolated group (Group 3)**			
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**Mean (SD) or %**	**N**	**P value**	**95% CI/Pearson chi2**
Not in employment/ education/ full time caring role	67.86%	19	47.14%	33	36.59%	45		
Yes	32.14%	9	52.86%	37	63.41%	78		
Loneliness score	26.07 (3.78)	28	22.65 (4.31)	72	20.82 (4.19)	124	Group 1 vs. Group 3: **<.001** Group 2 vs. Group 3: **0.004** Group 1 vs. Group 2: **0.0004**	**Group 1 (24.61, 27.54)** **Group 2 (21.64, 23.66)** **Group 3 (20.08, 21.57)**
Social network size	1.75 (0.97)	28	3.76 (1.78)	72	6.40 (1.50)	124	Group 1 vs. Group 3: **<.001** Group 2 vs. Group 3: **<.001** Group 1 vs. Group 2: **<.001**	**Group 1 (1.38, 2.12)** **Group 2 (3.35, 4.18)** **Group 3 (6.13, 6.66)**
Numbers of psychiatric inpatient hospitalisations							**0.001**	**19.27**
Never	82.14%	23	45.83%	33	67.74%	84		
Once	14.29%	4	16.67%	12	15.32%	19		

Variables	**Objective social isolation groups**							
	Persistently objectively socially isolated group (Group 1)		**Intermittently objectively socially isolated group (Group 2)**		**Never objectively socially isolated group (Group 3)**			
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**Mean (SD) or %**	**N**	**P value**	**95% CI/Pearson chi2**
More than 2 times	3.57%	1	37.50%	27	16.94%	21		
Number of years since first contact mental health services							0.08	11.44
Less than 3 months	17.86%	5	13.89%	10	16.94%	21		
3 months – 2 years	17.86%	5	13.89%	10	16.94%	21		
2-10 years	32.14%	9	23.61%	17	40.32%	50		
More than 10 years	32.14%	9	48.61%	35	25.81%	32		
Current diagnosis							**0.03**	**14.01**
Schizophrenia or schizoaffective disorder/ bipolar affective disorder/ other psychosis	14.81%	4	39.44%	28	28.10%	34		
Depression/ Anxiety disorder/ post-traumatic stress disorder	37.04%	10	25.35%	18	25.62%	31		

Variables	**Objective social isolation groups**							
	Persistently objectively socially isolated group (Group 1)		**Intermittently objectively socially isolated group (Group 2)**		**Never objectively socially isolated group (Group 3)**			
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**Mean (SD) or %**	**N**	**P value**	**95% CI/Pearson chi2**
Borderline or emotionally unstable personality disorder/ other personality disorder	25.93%	7	9.86%	7	9.09%	11		
Other diagnosis	22.22%	6	25.35%	18	37.19%	45		
BPRS total score	49.21 (10.82)	28	44.68 (11.48)	71	41.19 (9.54)	124	Group 1 vs. Group 3: **0.0001** Group 2 vs. Group 3: **0.02** Group 1 vs. Group 2: 0.08	Group 1 (45.02, 53.41) Group 2 (41.96, 47.39) Group 3 (39.49, 42.88)

Variables	Objective social isolation groups							
	Persistently objectively socially isolated group (Group 1)		Intermittently objectively socially isolated group (Group 2)		Never objectively socially isolated group (Group 3)			
	Mean (SD) or %	N	Mean (SD) or %	N	Mean (SD) or %	N	P value	95% CI/Pearson chi2
QPR total score	41.54 (15.74)	28	50.71 (17.44)	72	53.69 (17.46)	124	Group 1 vs. Group 3: **0.001** Group 2 vs. Group 3: 0.25 Group 1 vs. Group 2: **0.02**	**Group 1 (45.02, 53.41)** **Group 2 (50.58, 56.79)** **Group 3 (41.96, 47.39)**

Abbreviation: SD = standard deviation; CI= confidence interval; N = number of participants; BPRS = the Brief Psychiatric Rating Scale; QPR = the Questionnaire about the Process of Recovery

a. t-test and chi-square test were conducted to examine the differences in baseline characteristics between three objective social isolation groups

b. significant p-values are marked in bold.

7.4. Association between three loneliness groups, objective social isolation groups and self-rated personal recovery at 18-month follow-up

Hypothesis 1: Participants with persistent severe loneliness would have the poorest self-rated personal recovery at 18-month follow-up, followed by participants who suffered from intermittent severe loneliness, and then participants who were never severely lonely.

Multivariate linear regression analysis results are presented in Table 7.3. The results demonstrate the association between the three loneliness groups and self-rated personal recovery at 18-month follow-up. In model 1, intermittent severe loneliness ($p<.001$) was associated with a significant 9.8-point decrease on the QPR scale at 18-month follow-up, compared to the participants who were never severely lonely. Being persistently severely lonely instead resulted in a significant 21.75-point decrease on the QPR scale at 18-month follow-up ($p<.001$), compared to those who never reported being severely lonely. This result indicates a more marked decrease on the QPR scale at 18-month follow-up for those who suffered from persistent severe loneliness (with being never severely lonely used as a reference category) than the intermittent severe loneliness group. This association remained statistically significant ($p<.001$) even after controlling for the three blocks of baseline variables (i.e. social network size, sociodemographic and psychiatric variables) and baseline QPR score. In the final model, there was a significant association between persistent severe loneliness, intermittent severe loneliness and poorer QPR at 18-month follow-up, with persistent severe loneliness group (coef. = -12.8, $p<.001$) predicting a greater decrease on the QPR scale than intermittent severe loneliness group (coef. = -7.8, $p<.001$). Self-rated personal recovery score at 18-month follow-up was additionally associated with '2-10 years since first contact with mental health services' (coef. = -8.2, $p=0.003$) (with 'less than 3 months since first contact with mental health services' as a reference category), and baseline QPR score (coef. = 0.22, $p<.001$). This final model explained 32.9% of the variance in self-rated personal recovery at 18-month follow-up. For detailed results, please see Table 7.3.

Table 7.3 Multivariate linear regression between three loneliness groups and 18-month QPR, controlling for baseline variables[a]

Variables	**Model 1**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value
Loneliness group										
Never severely lonely group	Reference		Reference		Reference		Reference		Reference	
Intermittently severely lonely group	-9.80 (-13.59, -6.02)	**<.001**[b]	-9.69 (-13.57, -5.81)	**<.001**	-9.73 (-13.88, -5.59)	**<.001**	-8.73 (-12.85, -4.61)	**<.001**	-7.78 (-11.80, -3.75)	**<.001**
Persistently severely lonely group	-21.75 (-26.58, -16.93)	**<.001**	-21.46 (-26.70, -16.22)	**<.001**	-19.83 (-25.55, -14.12)	**<.001**	-16.27 (-22.16, -10.37)	**<.001**	-12.83 (-18.83, -6.83)	**<.001**
Psychosocial variable										
Social network size			0.12 (-.69, .93)	0.77	0.05 (-.82, .91)	0.92	0.14 (-.72, 1.01)	0.75	0.05 (-.79, .89)	0.91
Sociodemographic variables										
Age (years)					-0.3 (-.18, .13)	0.75	-0.06 (-.22, .10)	0.47	-.12 (-.28, .038)	0.14
Gender (0=male, 1=female)					0.03 (-3.69, 3.75)	0.99	0.81 (-2.86, 4.48)	0.67	1.24 (-2.33, 4.81)	0.49
Ethnicity										
White					Reference		Reference		Reference	
Black					2.09 (-2.33, 6.51)	0.35	2.09 (-2.29, 6.47)	0.35	0.53 (-3.80, 4.85)	0.81

Variables	**Model 1**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value
Asian/Chinese					1.23 (-5.70, 8.17)	0.73	-0.76 (-7.65, 6.14)	0.83	-.65 (-7.34, 6.03)	0.85
Mixed/other					-3.26 (-9.57, 3.06)	0.31	-2.92 (-9.25, 3.41)	0.36	-4.28 (-10.46, 1.90)	0.17
Employment/ education status (0=not in employment/ educated/full time caring role, 1=yes)					2.69 (-1.39, 6.76)	0.20	2.62 (-1.44, 6.69)	0.21	2.18 (-1.77, 6.13)	0.28
Educational attainment										
No qualification					Reference		Reference		Reference	
Other qualifications					1.52 (-3.94, 6.98)	0.58	1.03 (-4.40, 6.46)	0.71	.91 (-4.35, 6.18)	0.73
Degree					1.64 (-4.21, 7.49)	0.58	1.16 (-4.63, 6.96)	0.69	1.40 (-4.21, 7.02)	0.62
Psychiatric variables										
Number of psychiatric inpatient hospitalisations										
Never							Reference		Reference	
Once							1.87 (-2.97, 6.71)	0.45	2.16 (-2.53, 6.86)	0.36
2 or more							5.21 (.56, 9.86)	**0.03**	4.37 (-.17, 8.90)	0.059
Number of years since first contact with mental health services										
Less than 3 months							Reference		Reference	

Variables	**Model 1**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value
3 months - 2 years							-3.60 (-9.87, 2.67)	0.26	-4.48 (-10.57, 1.61)	0.15
2-10 years							-8.06 (-13.51, -2.60)	**0.004**	-8.20 (-13.49, -2.91)	**0.003**
More than 10 years							-3.79 (-9.51, 1.92)	0.19	-4.84 (-10.41, .72)	0.09
BPRS total score							-.19 (-.38, .0002)	0.05	-0.13 (-.31, .06)	0.17
QPR total score									0.22 (.10, .33)	**<.001**
R^2 adjusted	0.273		0.270		0.244		0.286		0.329	

Abbreviation: CI= confidence interval; N = number of participants; BPRS = the Brief Psychiatric Rating Scale; QPR = the Questionnaire about the Process of Recovery; R^2 adjusted = adjusted- R^2

a. multivariable linear regression analyses were conducted with QPR at 18-month follow-up as dependent variable and other factors as independent variables

b. significant p-values are marked in bold.

Hypothesis 2: Participants with persistent objective social isolation would have the poorest self-rated personal recovery score at 18-month follow-up, followed by participants who suffered from intermittent objective social isolation, and then participants who were never objectively socially isolated.

The results of the multivariable linear regression analyses in Table 7.4 demonstrate a significant association between the three social isolation groups and self-rated personal recovery at 18-month follow-up. In model 1, being persistently objectively socially isolated was significantly associated with a decreased personal recovery at 18-month follow-up (coef. =16.35, p<.001) (with being never objectively socially isolated as a reference category). Suffering from intermittent objective social isolation was also linked to a decrease on the 18-month QPR (coef. =3.5, p=0.10) (with being never objectively socially isolated as a reference category), however, this result was not significant. This association between persistent objective social isolation and the QPR scale at 18-month follow-up remained statistically significant even after controlling for the three blocks of baseline variables (i.e. loneliness, sociodemographic and psychiatric variables) and baseline QPR score. In the final model, persistent objective social isolation (coef. =-9.8, p=0.001) resulted in a greater decrease on the QPR scale, compared to other objective social isolation groups. Self-rated personal recovery score at 18-month follow-up was also associated with '2-10 years (coef. = -9.6, p=0.001) and over 10 years (coef. = -5.9, p=0.04) since first contact with mental health services' (with 'less than 3 months since first contact with mental health services' as a reference category), and its baseline score (coef. = 0.26, p<.001). This final model explained 28.5% of the variance in self-rated personal recovery at 18-month follow-up. Detailed results are shown in Table 7.4.

Based on the results, hypothesis 1 is confirmed: severe loneliness, either as an enduring (i.e. persistent severe loneliness) or a transient experience (i.e. intermittent severe loneliness), was associated with a poor QPR score at 18-month follow-up, with being persistently severely lonely leading to a greater decrease on the QPR scale, compared to those who only reported being intermittently severely lonely. Hypothesis 2 is partially supported: even though being intermittently objectively socially isolated was not necessarily associated

with poor personal recovery at 18-month follow-up, there was a significant association between persistent objective social isolation and poor personal recovery at 18-month follow-up.

To sum up, this chapter demonstrates the trajectories of loneliness and objective social isolation over an 18-month follow-up period. The results emphasise a strong association between persistent severe loneliness, intermittent severe loneliness and poor personal recovery at 18-month follow-up. Additionally, persistent objective social isolation was also associated with poor personal recovery at 18-month follow-up. Given that loneliness itself is a distressing experience, and objective social isolation is also frequently reported by people with mental health diagnoses, the results from this quantitative study raise some important research implications for future research and clinical practice, which will be discussed in the next chapter.

Table 7.4 Multivariable linear regression between objective social isolation groups and 18-month QPR, controlling for baseline variables[a]

Variables	**Model 1**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value
Social isolation group										
Never socially isolated group	Reference		Reference		Reference		Reference		Reference	
Intermittently socially isolated group	-3.53 (-7.68, .62)	0.10	-1.75 (-5.80, 2.30)	0.40	-0.64 (-4.77, 3.48)	0.76	-2.13 (-6.37, 2.12)	0.33	-2.23 (-6.32, 1.85)	0.28
Persistently socially isolated group	-16.35 (-22.18, -10.53)	**<.001**[b]	-11.17 (-17.19, -5.16)	**<.001**	-10.63 (-4.77, 3.48)	**0.001**	-10.75 (-16.93, -4.57)	**0.001**	-9.75 (-15.71, -3.79)	**0.001**
Psychosocial variable										
Loneliness score					-.878 (-1.33, -.43)	**<.001**	-0.52 (-1.01, -.04)	**0.04**	-0.12 (-.63, .38)	0.63
Sociodemographic variables										
Age (years)					0.06 (-.10, .22)	0.45	0.02 (-.14, .18)	0.80	-.05 (-.22, .11)	0.51
Gender (0=male, 1=female)					-.37 (-4.22, 3.48)	0.85	0.52 (-3.29, 4.34)	0.79	1.23 (-2.46, 4.92)	0.51
Ethnicity										
White					Reference		Reference		Reference	
Black					2.51 (-2.08, 7.09)	0.28	2.55 (-1.99, 7.09)	0.27	0.73 (-3.73, .18)	0.75
Asian/Chinese					0.89 (-6.33, 8.11)	0.81	-1.60 (-8.81, 5.61)	0.66	-1.92 (-8.85, 5.02)	0.59
Mixed/other					-1.62 (-8.22, 4.97)	0.63	-1.55 (-8.18, 5.08)	0.65	-3.47 (-9.91, 2.98)	0.29

Variables	**Model 1**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value
Employment/ education status (0= not in employment/educated/full time caring role, 1=yes)					4.09 (-.08, 8.25)	0.054	3.86 (-.31, 8.04)	0.07	3.08 (-.95, 7.11)	0.13
Educational attainment										
No qualification					Reference		Reference		Reference	
Other qualifications					1.30 (-4.37, 6.97)	0.65	0.59 (-5.04, 6.22)	0.84	.30 (-5.12, 5.71)	0.91
Degree					1.89 (-4.19, 7.98)	0.54	1.26 (-4.78, 7.29)	0.68	1.36 (-4.45, 7.16)	0.65
Psychiatric variables										
Number of psychiatric inpatient hospitalisations										
Never							Reference		Reference	
Once							2.06 (-3.00, 7.12)	0.42	2.31 (-2.57, 7.18)	0.35
More than 2 times							4.92 (-.13, 9.96)	0.056	4.50 (-.36, 9.35)	0.07
Number of years since first contact with mental health services										
Less than 3 months							Reference		Reference	
3 months - 2 years							-3.77 (-10.29, 2.75)	0.26	-4.86 (-11.14, 1.43)	0.13
2-10 years							-9.31 (-14.97, -3.64)	**0.001**	-9.56 (-15.01, -4.12)	**0.001**
More than 10 years							-4.56 (-10.49, 1.38)	0.13	-5.90 (-11.64, -.15)	**0.04**

Variables	**Model 1**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	Coef. (95% CI)	P-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value	Coef. (95% CI)	P-value	Coef. (95% CI)	p-value
BPRS total score							-0.20 (-.41, .0002)	0.050	-0.17 (-.36, .03)	0.10
QPR total score									0.26 (.14, .38)	**<.001**
R^2 adjusted	0.115		0.188		0.182		0.227		0.285	

Abbreviation: CI= confidence interval; N = number of participants; BPRS = the Brief Psychiatric Rating Scale; QPR = the Questionnaire about the Process of Recovery; R^2 adjusted = adjusted- R^2

a. multivariable linear regression analyses were conducted with QPR at 18-month follow-up as dependent variable and other factors as independent variables

b. significant p-values are marked in b

Chapter 8. Discussion

The main findings of the quantitative analysis were presented in Chapter 6 and 7. The results demonstrate a significant association between baseline loneliness and 18-month self-rated personal recovery (i.e. measured by QPR) and overall symptom severity (i.e. measured by BPRS), after adjusting for the three blocks of baseline variables. The analysis also suggests that for those who suffered from persistent severe loneliness over an 18-month follow-up period, they had the poorest personal recovery at 18-month follow-up, followed by those who reported being intermittently severely lonely and then those who were never severely lonely. For those with persistent objective social isolation, they also had poorer personal recovery at 18-month follow-up, compared to those who were never objectively socially isolated.

In Chapter 8, I will start with a discussion of the main findings of the quantitative analysis, then I will discuss how these results are related to previously published literature. Strengths and limitations will also be discussed in this first section. In section 8.2, I will consider and discuss the implications for future research, and in section 8.3, I will move on to the implications for future clinical practice.

8.1. Discussion for the quantitative study

8.1.1. Sample characteristics

The severity of subjective isolation in people with mental health problems:

Loneliness has been described as one of the most enduring lifetime problems and each individual tends to experience loneliness at least once in a lifetime (e.g. Heinrich & Gullone, 2006; Hawthorne, 2008a). In our sample, the median of the loneliness score at baseline was equivalent to a moderate level of loneliness (median=22) among people with mental health problems who left CRT services with an age range of 18 and 75. This finding illustrates that people with a broad range of mental health diagnoses experienced a more severe level of loneliness than the general population: significantly lower loneliness scores were reported by three studies involving samples of college students with a mean age of 22.9 (Tsai et al, 2017), 19.4 (Cooper et al, 2016) and 19.5 (Pereira et al, 2014) respectively. Mean loneliness score in each of these three studies was 16.5,

16.56, and 14.79 respectively. Among another sample of young adults between the age of 19 and 39, their loneliness remained relatively lower (Mean=15.8) (Bonin et al, 2000) than our sample. In studies focusing on loneliness in elderly samples aged 60 and over, and these samples also scored much lower in loneliness than our sample (Panagiotopoulos et al, 2013; Wang, Hu et al, 2017), with a mean loneliness score of 17 and 12.9 respectively.

The Adult Psychiatric Morbidity Survey in England (2017) has determined loneliness as one cruicial factor associated with diagnoses across the entire spectrum of mental disorders (Meltzer et al, 2013), and the loneliness score in the current study is also comparable to the findings of a number of previously published studies of people with mental health diagnoses. For example, people with autism spectrum disorders (Mean=21.9, SD=4.9; Syu & Lin, 2018), patients with social anxiety (Mean=23.7 – 25.1, SD= 2.8- 4.7; Jazaieri et al, 2012), and patients with varying diagnoses who were under secondary mental health services (e.g. complex depression and trauma, community rehab), including psychosis, personality disorders and other common mental disorders (Mean=21.65, SD=5.12; Alasmawi et al, in preparation).

The extent of objective social isolation in the study sample: Given that the LSNS-6 was developed to measure both subjective and objective aspects of social isolation (Wang et al, 2017), to the best of our knowledge, this study is the very first study to date examined its objective aspect alone. Our sample scored a mean of 4.90 based on the sum-up score of item 1 and 4 (sum-up score range 0-10), indicating a total number of approximately 5 family members and friends that participants heard from in the previous month. Although there were no comparable samples that could be retrieved from studies of the general population and that of people with mental health problems using the same measure, previous literature has indicated that mental health service users tend to have a relatively smaller social network size than the general population (e.g. Boeing et al, 2007; Harrop et al, 2015). For example, by simply asking the size of one's friendship network, one trial estimated a mean of 11.13 reported by a sample of American adults of 25 to 74 years of age (Wang & Wellman, 2010), and another comparable result was reported by the general adult population in the UK, with an average number of 10.6 reporting for men and 7.6 for women (Wighton, 2007). On the contrary, studies of people with mental health problems

reported a much smaller social network size than the general population: when assessing friendship network size, an average number of 3.4 was reported in a systematic review of patients with psychotic disorders (Palumbo et al, 2015), and a mean of 1.6 was reported by people with schizophrenia or schizoaffective disorder aged 18 to 65 in southeast England (Harley et al, 2012). Another trial found a mean LSNS-6 score of 2.23 in a sample of adults of 18 to 79 years of age who received psychiatric treatments in Poland18 to 79 (Chrostek et al, 2016).

None of the studies involving mental health patients have administrated the same measure for social network size, therefore, no comparison can be made at this time. Nevertheless, given the fact that the mean social network size reported by the current sample is significantly lower than studies of the general population, our results support previous literature, in which people with mental health problems tend to have a smaller social network than individuals without a mental health diagnosis.

The severity of illness in the study sample: Regarding the BPRS score at baseline, the current sample scored a median of 43.76 (IQR 35 – 51), this is equivalent to 'being moderately ill' according to the cut-off point proposed by Leucht and colleagues (2005). This sample seems to be less unwell, compared to previous studies of adults with SMI, and two potential possibilities may explain this finding: firstly, since our participants were assessed soon after they left the CRTs (i.e. within one month after their discharge), they may have already started their process of recovery at the time of assessment. Secondly, the current CRT sample included people with a wide range of mental health diagnoses who could be supported in the community, therefore, there is a possibility that they tended to be less unwell than typical secondary mental health service users with a diagnosis of SMI. For example, patients in a psychiatric intensive care unit (M=53.1; Dazzi et al, 2017) and patients with SMI who were discharged from hospitals and emergency rooms (M=53.7; Velligan et al, 2017) scored much higher on the BPRS than our sample. Furthermore, Leucht retrieved seven trials and included 1979 participants in total with a mean age of 35.8 who were diagnosed with schizophrenia or schizophreniform disorders. Their average BPRS score ranged from 53 (Wetzel et al, 1998 in Leucht et al, 2005) to 65 (Carrie`re et al, 2000 in Leucht et al, 2005). Compared to these seven trials, our sample had a relatively lower BRPS score and had diagnoses of varying mental

health problems (e.g. depression, personality disorders). In a sample of patients with MDD (age range 18 to 65), the mean BPRS score was 35.37 for those with a suicidal attempt and 31.38 for those without a suicidal attempt (Li et al, 2019). Both groups had a lower BPRS score than our sample, and this may due to the fact that only 25.7% of our sample had a diagnosis of depression or anxiety disorder.

In respect of personal recovery, the QPR score of our sample (M=51.7) was comparable to previous studies: in a trial providing a team-level intervention with a main focus on staff behavours, the mean QPR score in people with psychosis was 56.89 and 57.32 for the control and intervention group respectively (Slade et al, 2015). Another comparable score (M=57.50, SD=11.65) was also reported by another trial of people with persistent psychotic disorders (Thomas et al, 2016).

The course of assessment for loneliness, social network size and mental health outcomes: Overall, there was a slight decrease in the overall symptom severity from baseline to 4-month follow-up, and this score remained stable from 4-month to 18-month follow-up. Meanwhile, there was an increasing trend of self-reported personal recovery across the same 18-month period. However, the effect size was only small to medium. Loneliness score decreased from baseline to 4-month follow-up and also remained stable from 4-month to 18-month follow-up. There was also an increase in social network size from baseline to 4-month follow-up, and then from 4-month to 18-month follow-up. These results demonstrate an overall improvement in loneliness, social network size, overall symptom severity and self-reported personal recovery after the participants were discharged from the CRT services. However, it is of note that social network size only changed slightly, especially from 4-month to 18-month follow-up, and both loneliness and BPRS remained stable from 4-month to 18-month follow-up. Peplau and Perlman (1982) highlight that loneliness is a typcial experience that everyone may experience at some point in life. The fluctuation of the loneliness score from baseline to 18-month follow-up further supports the idea that loneliness can be either transient or enduring experience.

8.1.2. Research question 1: Are subjective and objective social isolation significantly related to 18-month mental health outcomes in people with mental health problems?

Hypothesis 1: There is an association between greater baseline loneliness and poorer self-rated personal recovery at 18-month follow-up

This thesis aims to examine the relationship between baseline loneliness, baseline social network size and two mental health outcomes at 18-month follow-up: self-rated personal recovery (i.e. measured by the QPR) and overall symptom severity (i.e. measured by the BRPS total score).

In the initial univariate linear regression analysis (i.e. model 1a), there was a strong association between greater baseline loneliness and poorer personal recovery at 18-month follow-up. This association was independent of baseline social network size after baseline social network size was adjusted for in model 2. The regression coefficient of loneliness was larger than that of social network size (-1.12 vs. 0.31), which suggests a better predictive effect for baseline loneliness on personal recovery at 18-month follow-up than for baseline social network size. The association between baseline loneliness and 18-month personal recovery maintained its significance in model 3 after additionally adjusting for baseline sociodemographic variables. None of the sociodemographic variables exhibited a significant association with 18-month personal recovery, and this lack of significant association was maintained in both model 4 and model 5. After additionally adjusting for baseline psychiatric variables in model 4, the coefficient of loneliness decreased, but the significance of the association between baseline loneliness and personal recovery at 18-month follow-up persisted. Two baseline psychiatric variables '2 or more psychiatric inpatient hospitalisations' and '2-10 years since first contact with mental health services', were also significantly associated with 18-month personal recovery in model 4. In the final model (i.e. model 5), when baseline personal recovery was considered simultaneously with other confounding variables, the coefficient of loneliness significantly decreased, and the relationship between baseline loneliness and 18-month personal recovery became statistically insignificant. Baseline personal recovery became the

strongest predictor of personal recovery at 18-month follow-up, along with the two baseline psychiatric variables (i.e. '2 or more psychiatric inpatient hospitalisations' and '2-10 years since first contact with mental health services').

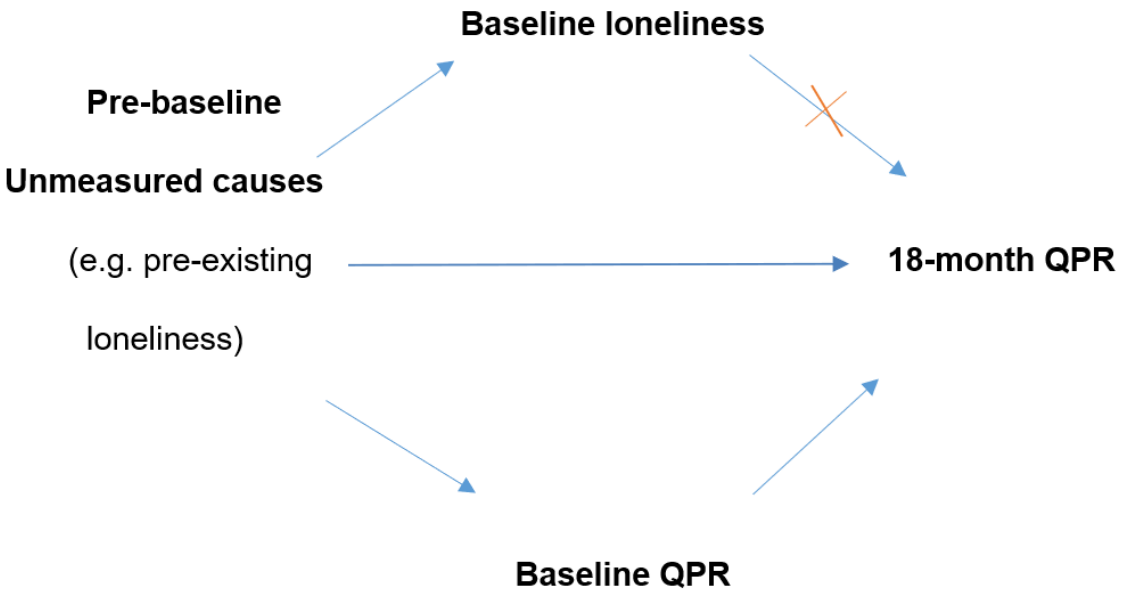
This finding differs from a study of patients with psychosis (Roe et al, 2011), in which there was a negative association between loneliness and personal recovery, and this relationship was fully mediated by quality of life. However, Roe's finding should be interpreted with caution due to its cross-sectional design. On the other hand, our result for hypothesis 1 is in agreement with the 4-month data analysis of the CORE trial, reported by Wang (2018a), who also did not find a significant association between baseline loneliness and personal recovery at 4-month follow-up, after fully adjusting for baseline confounding variables and baseline personal recovery. While this result is contradictory to our expectations, there are two potential explanations for why baseline loneliness did not appear associated with self-rated personal recovery at 18-month follow-up in the fully adjusted model. Firstly, calculating Cohen's d for the difference between QPR at baseline and 18-month follow-up yields d = -0.44, which reflects a small to medium effect size (Cohen, 1988; Sawilowsky, 2009). Given such a small change from baseline to 18-month follow-up and the large correlation (r= 0.50) between baseline QPR and QPR at 18-month follow-up, the lack of predictive power of baseline loneliness should not be an unexpected result. There is a possibility that our sample may ha already reached good progress in personal recovery when they left the CRT, and their progress after was rather slow over time.

Secondly, given loneliness was only measured from the baseline time point, we could not determine the exact trajectory of loneliness before the participants entered the trial. As suggested by the Lord's Paradox (1967), with available data, it is practically impossible to take account of any pre-existing relationship (i.e. before baseline) by using any statistical methods or procedures. By controlling baseline QPR in the final model, there was a possibility that biases were introduced into the model, although the initial intention was to eliminate biases (Glymour et al, 2005). It is plausible that loneliness has already had an effect on personal recovery before baseline. As illustrated by Figure 8.1 below, assuming there was no measurement error, and baseline loneliness and QPR were both influenced by certain pre-baseline unmeasured causes (e.g. pre-baseline loneliness), then if the improvement of QPR has begun before the baseline

assessment, adjusting baseline QPR would lead to a pathway from the pre-baseline unmeasured causes to the 18-month QPR. As a result, the association between baseline loneliness and the 18-month QPR would not be shown, and the coefficient would be reduced, compared to the unadjusted model.

Overall, given that the longitudinal association between loneliness and personal recovery remains under-researched, future studies using a longitudinal design will be of great value for understanding how loneliness serves as a persistent barrier and impedes the process of personal recovery over time.

Figure 8.1 Causal diagram between pre-baseline factors, baseline loneliness, baseline QPR and 18-month QPR



In model 3, when baseline sociodemographic variables were introduced into the model, the model explained 14.9% of the variance in the QPR at 18-month follow-up, it dropped from 15.6% in model 2. As adjusted R^2 increases only when the newly added predictors improve the model more than it would be expected by chance alone (Harris & Jarvis, 2014), this finding suggests that sociodemographic variables were not useful in the model or they did not improve the model as much as it would be expected. This hypothesis is consistent with the final result that none of the sociodemographic variables was associated with the QPR at 18-month follow-up, after adjusting for baseline QPR. Again, this result was in line with the previous analysis of the 4-month data conducted by Wang (2018a), in which none of the sociodemographic variables at baseline was significantly linked to the QPR at 4-month follow-up.

Our results also suggest that having 2-10 years of mental health service contact was linked to the 18-month QPR, but being known to service for less than 2 years and more than 10 years were not. It is possible that having a short mental health history may not have a sufficient impact on one's personal recovery process, as participants either had not experienced a severe mental health crisis or patients had only been in the initial stage of their illnesses. On the other hand, we may expect that having a long mental health history (i.e. over 10 years) may contribute to a poor recovery process, yet, surprisingly there was null evidence indicating an association between 'more than 10 years since first contact with mental health services' and personal recovery at 18-month follow-up. This result may just be a chance finding, however, it is also possible that living with a mental health problem over an extended period of time may gradually become a normal part of a patient's life, and it may lose its impact on their recovery process over time. In fact, other factors may serve as more important contributors to patients' personal recovery, such as feeling hopefulness and high self-esteem (Leamy et al, 2011). The 18-month follow-up results also demonstrate that being admitted to hospitals as an inpatient more than two times was linked to the 18-month QPR after adjusting for all baseline variables in the final model. The number of psychiatric admissions can be considered as an indicator of one's mental state, that is, the more psychiatric admissions one has, the more likely he/she is experiencing a severe and enduring mental illness, which may lead to more difficulties in recovering from psychiatric symptoms and psychological distress, and this may further slow down the process of personal recovery.

Hypothesis 2: There is an association between having a smaller social network size at baseline and poorer self-rated personal recovery at 18-month follow-up

The aim of hypothesis 2 was to examine if there is an association between social network size at baseline and the QPR at 18-month follow-up. However, the only significant association between the two variables was in the univariate linear regression model 1b. When baseline loneliness was introduced into the model in model 2, the association became statistically insignificant. This result was also comparable to the 4-month follow-up analysis (Wang, 2018a). Therefore, the

overall evidence reflects that social network size may not be a significant predictive factor for one's personal recovery. However, this finding may also be explained by the fact that social network size may have already had an effect on personal recovery before the time of baseline assessment, as explained by the Lord's Paradox. Baseline loneliness was associated with the QPR at 18-month follow-up at a statistically significant level in model 2 when social network size was also in the model, and this suggests that baseline loneliness was a more potent predictor of personal recovery at 18-month follow-up than baseline social network size. More analyses were carried out to explore this further in research question 2.

Hypothesis 3: There is an association between greater baseline loneliness and greater psychiatric symptom severity at 18-month follow-up

For this hypothesis, from model 1a to model 4, baseline loneliness was significantly associated with the BPRS total score at 18-month follow-up when variables including baseline social network size, sociodemographic and psychiatric variables were controlled for. This relationship again became statistically insignificant when baseline BPRS total score was additionally adjusted for in the final model (i.e. model 5). This result is also again, consistent with the 4-month data analysis conducted by Wang (2018a), in which there was a significant association between baseline loneliness and the 4-month BPRS before baseline BPRS was adjusted for in the final model. In our study, this finding may be explained by the small change from baseline BPRS to BPRS at 18-month follow-up (d=0.31), leading to baseline BPRS being a strong predictor of its 18-month follow-up score. Although existing literature supports a prominent role of psychiatric symptoms at baseline in predicting poor psychiatric outcomes at a later stage (Spijker et al, 2001; Ormel et al, 1993), there is also a possibility that loneliness has already had an effect on psychiatric symptoms prior the baseline assessment, therefore, loneliness had no further independent effect on psychiatric symptoms at 18-month follow-up.

There was a significant association between baseline employment status and the 18-month psychiatric symptoms, net of sociodemographic, psychiatric and psychosocial variables, and baseline BPRS score. As an independent predictor

of the overall symptom severity at 18-month follow-up, employment may have a positive effect on our mental health wellbeing. Alternatively, to explain this relationship further, it is also plausible that being able to hold onto a job may reflect a relatively stable mental state resulting from regular social engagement. All these engagements are potentially crucial in further improving one's mental state and reducing psychological distress.

Despite a growing interest in the deleterious impact of loneliness on mental health outcomes, little evidence to date addresses the longitudinal pathway from loneliness to poor mental health outcomes (e.g. psychiatric symptoms and personal recovery). Many researchers emphasise that not only does loneliness have a detrimental effect on psychiatric symptoms (e.g. Alpass & Nebille, 2003; Alptekin et al, 2009; Rudolph et al, 2008; Vanderweele et al, 2011; Nolen-Hoeksema & Ahrens, 2002; Adam et al, 2011; Strauss & Carpenter, 1977), loneliness is also a contributing factor to poor personal recovery (e.g. Wang et al, 2017; Roe et al, 2011). Many also highlight a bidirectional relationship between loneliness and certain psychiatric symptoms, such as depressive symptomatology (e.g. Power et al, 2018; Domènech-Abella et al, 2019). In a longitudinal study of middle-aged and older adults, Cacioppo and colleagues (2006) concluded that although depressive symptoms at a later stage were only predicted by baseline loneliness after controlling for demographic variables, psychosocial risks and baseline depressive symptoms, loneliness at a later stage was predicted by both social support and depressive symptoms at baseline. However, other authors maintain that loneliness has a more potent longitudinal impact on psychiatric symptoms than vice versa, for example, a recent study from Lim and colleagues (2016) calls into question this bidirectional relationship between loneliness and depressive symptomology. They suggest a predictive effect of baseline loneliness on social anxiety, paranoia and depression at follow-up in a community sample, but loneliness at follow-up could only be predicted by baseline social anxiety. Nonetheless, given the fact that the relationship between loneliness and psychiatric symptoms varies across a number of studies, the causal relationship between loneliness and certain mental health outcomes is thereby difficult to be determined at this time. More valuable research focusing exclusively on people with mental health problems is needed to explore this relationship further.

Hypothesis 4: There is an association between having a smaller social network size at baseline and greater psychiatric symptom severity at 18-month follow-up

Social network size at baseline did not predict the overall symptom severity at 18-month follow-up after baseline loneliness was added into the model 2. This result again indicates that loneliness is a better predictor of the overall symptom severity than baseline social network size.

Again, we cannot make any assumption regarding the predictive effect of objective social isolation on symptom severity and personal recovery. Certain objective social indicators, such as small social network and infrequent social contact, have been associated with multiple psychiatric outcomes in people with depression or psychosis (e.g. Gillies et al, 1993; Meeks & Hammond, 2001), and great social integration has been only reported by mental health service users who have achieved good progress in their personal recovery (Corrigan & Phelan, 2004; Resnick et al, 2004). However, given that the evidence was retrieved from cross-sectional studies, the causal pathway linking objective social isolation with mental health outcomes should be further explored in future well-designed longitudinal research.

8.1.3. Research question 2: Which concept, subjective or objective social isolation at baseline, is a stronger predictor of mental health outcomes?

Hypothesis: Baseline loneliness is a stronger predictor of self-rated personal recovery at 18-month follow-up, compared to baseline social network size.

In the previous section, the results demonstrate that baseline loneliness was a stronger predictor of personal recovery at 18-month follow-up, compared to social network size at baseline. The standardised regression coefficient of loneliness was found to be larger than that of social network size (-0.37 vs. 0.07), which strengthens our confidence in concluding a better predictive effect for the

subjective appraisals of one's social relationships on personal recovery than for the objective measures of social relationships. The quantitve aspects of our social connections, the frequency of social contacts and our social network sizes, instead, may be more closely related to other health outcomes, such as physical health and cognitive performance (Beller & Wagner, 2018).

8.1.4. Research question 3: Are being persistently subjectively or objectively socially isolated associated with poorer self-rated personal recovery at 18-month follow-up, compared to being intermittently subjectively or objectively social isolated and never being subjectively or objectively socially isolated?

Of the 224 participants who completed both the ULS-8 and LSNS-6 at all three time points, 16% reported being severely lonely at all three time points, 34% reported being intermittently severely lonely, and 50% reported that they were never severely lonely. A similar pattern was found in objective social isolation: 13% reported being persistently objectively socially isolated, 32% reported being intermittently objectively socially isolated, and the rest of participants (55%) were never objectively socially isolated. These numbers demonstrate a certain fluctuation in loneliness and objective social isolation across the 18-month follow-up period. This result is in line with the hypothesis that both loneliness and objective social isolation can either be a transient or an enduring experience, which is determined by the interplay of a number of contributing factors that people may experience around the time of assessment.

When comparing the characteristic differences between the three severe loneliness groups, the results reveal that participants who suffered from intermittent severe loneliness were younger than those who were never severely lonely. However, no between-group age difference was found between persistent severe loneliness group and never severe loneliness group, which suggests that age may not be a significant factor in predicting the trajectory of loneliness. Overall, according to our results, none of the basic demographic characteristics (i.e. age, gender and ethnicity) was associated with loneliness. This result may further highlight the possibility that loneliness is a universal experience that

everyone may experience at least once in their lifetime, even though previous evidence has suggested that people with certain demographic variations (e.g. young age, ethnic minority background, being a woman) may be particularly vulnerable to loneliness. The current study found null evidence supporting these previous findings, but we might also suppose that for people with mental health problems, having a mental health diagnosis itself is a strong predictive factor for loneliness, regardless of one's age, gender or ethnic background.

For those who suffered from persistent severe loneliness, when compared to those who were never severely lonely, they were more likely to be single, separated, divorced or widowed, and they were less likely to be employed, in education or in any full-time caring role. It is well acknowledged that meaningful support from a significant other is an indispensable protective factor against loneliness (Pinquart & Sorensen, 2003; Hawkley et al, 2008). It has also been suggested that being in a stable and supportive relationship with either a romantic or marital partner is beneficial for both physical and emotional wellbeing, and this may be explained by the possibility that this type of relationship satisfies individuals' psychological needs, including a sense of belonging, a sense of security, the feeling of being loved and protected, as well as the feeling of being cared for (Strong et al, 2011). The fulfilment of these needs may subsequently reduce the risk of loneliness (Green et al, 2001). However, simply having a partner is not enough: having a bad marital or intimate relationship may result in negative consequences in emotional wellbeing, including a feeling of being excluded, and ironically, loneliness (Hendrick, 2004).

In terms of employment status, one explanation is that being able to hold on to a regular job may reflect a stable mental state. We might also suppose that employment provides more social opportunities for people with mental health problems. Therefore, for people without a job or any work-related activities, there is a reduced number of opportunities for them to participate in social activities and interact with people outside their home and mental health services. Unemployment has also been linked to more financial difficulties (Fokkema et al, 2012), which may further restrict their accessibility to the types of social activity that involve spending money. With few exceptions, our analysis failed to find any between-group differences between the three loneliness groups in their previous hospital admission (i.e. number of hospitalisations and number of years since first

contact mental health services) and current diagnosis, despite the fact that previous literature has suggested a relationship between great loneliness and a high likelihood of being admitted as an inpatient (Prince et al, 2018).

Our results demonstrate that for participants who were persistently severely lonely, they reported having the smallest social network size at baseline, followed by those who were intermittently severely lonely. Those who were never severely lonely scored the highest on the baseline social network scale. These findings support previous research in which there was a significant correlation between subjective and objective social isolation, even though they are two distinct constructs (Coyle & Dugan, 2012). In previous literature, several factors were found to be the key risk factors contributing to both loneliness and objective social isolation, including small social network size and infrequent social interaction with friends and family (Hawkley et al, 2005). In the current sample, for participants who had persistent severe loneliness, not only did they score the highest on the BPRS, they also scored the lowest on the QPR scale at baseline, followed by those who reported being intermittently severely lonely. Those who were never severely lonely scored the lowest on the BPRS but the highest on the QPR at baseline. These results suggest that being more ill or having poorer personal recovery at baseline may contribute to persistent severe loneliness. However, the directions of causality between loneliness and the two mental health outcomes cannot be determined in the current study, which highlights a need for future research to explore these relationships further with a study design resolving this specific research question. Further analyses were conducted in this thesis to determine if either persistent or intermittent severe loneliness has a negative impact on the participants' personal recovery at 18-month follow-up and the results suggest that the longer an individual confined in a severely lonely state, the higher the risk of having poorer personal recovery at 18-month follow-up. Details were discussed in the later section.

Between-group differences in baseline variables between the three objective social isolation groups were also reported. The results demonstrate that compared to those who reported being persistently objectively socially, a larger proportion of those who were never objectively socially isolated were born in the UK. This result supports the finding from previous literature, in which compared to native citizens, immigrants tend to have fewer social resources and less social

support, especially for those with a racial minority background (Portes, 1998). Between those who experienced persistent objective social isolation and those who were never objectively socially isolated, the former group was less likely to be employed, in education or any full-time caring role, they were also less likely to be admitted as a psychiatric inpatient, and they were more likely to be diagnosed with depression, anxiety disorders or PTSD. We might suppose that for those who were unemployed, they were more likely to experience financial difficulties, had fewer social opportunities, and were more likely to be excluded from social activities.

In terms of mental health diagnoses, for those with a diagnosis of depression, or anxiety disorder or PTSD, they were more likely to report having a smaller social network but were not necessarily lonelier than people with psychotic disorders. This may be explained by the possibility that people with psychotic disorders tend to have low self-esteem and fear of being judged, which may result in a feeling of hopelessness, lack of motivation, and excessive fear of having social contact with others. However, our finding is inconsistent with previous findings from Giacco and colleagues (2016), the authors reported that patients with psychotic disorders were less likely being lonely but had fewer social contacts than people with mood disorders. The results in the current study could just be a chance finding, and it is also worth noting that one limitation of our study is the missing data on the diagnosis variable. Nevertheless, our results further highlight that significant between-group differences exist between various diagnostic groups in terms of their social relationships and experience of loneliness.

Regarding hospital admission, the result was not as expected: for those who were less objectively socially isolated, they had a higher likelihood of being admitted as an inpatient previously than those who were persistently objectively socially isolated. Again, this could just be another chance finding. However, there are two possible explanations for this unexpected finding: firstly, for those who were socially excluded over an extended period of time, they may have few friends or family around to encourage them to seek help or psychiatric treatments; consequently, they were less likely to be admitted as an inpatient. Secondly, for those with multiple hospital admissions, their social network may consist of other mental health service users that they encountered during their admissions, which may subsequently reduce their objective social isolation.

Among the three objective social isolation groups, not only did the persistent objective social isolation group score the highest on the BRPS, this group also had the lowest score on the QPR at baseline, followed by those who were intermittently objectively socially isolated. Those who were never objectively socially isolated scored the lowest on the BPRS but had the highest score on the QPR. These results indicate that being more ill or having poorer personal recovery at baseline may also compromise one's social relationships over an extended period of time, which in turn may result in persistent objective social isolation. However, again the causal directions of these relationships cannot be inferred by our data at this time.

Hypothesis 1: Participants with persistent severe loneliness would have the poorest self-rated personal recovery score at 18-month follow-up, followed by participants who suffered from intermittent severe loneliness, and then participants who were never severely lonely.

The current study aimed to investigate whether persistent severe loneliness was significantly associated with poor self-rated personal recovery at 18-month follow-up. Our results confirm that being persistently severely lonely was a significant independent predictor of poorer self-rated personal recovery at 18-month follow-up, even after controlling for the three blocks of baseline variables (i.e. social network size, sociodemographic and psychiatric variables) and baseline QPR score.

While the traditional view on mental health recovery mainly focuses on symptom reduction (i.e. clinical recovery), the new concept of subjective personal recovery emphasises heavily on a consumer-centred recovery model. This new model underlines the importance of living a hopeful life for mental health service consumers, despite the possibility that many still experience persistent difficulties and their lives are disrupted by their mental health symptoms (Mental Health Commission of Canada, 2012). Five recovery processes were proposed by the CHIME framework (Leamy, 2011): connectedness, hope, identity, meaningfulness, and empowerment. According to this new concept, patients with mental health problems should be treated as independent individuals who should be actively involved in their own treatment and recovery process (Davidson et al,

2005). Personal recovery is a subjective aspect of human experiences (Roe & Davidson et al, 2005), whether one is in recovery is dependant on the individual's perspective of what recovery means to him/her (Roe et al, 2011). Previous literature supports a positive relationship between social support and personal recovery (Corrigan & Phelan, 2004; Pernice-Duca & Onaga, 2009; Chang et al, 2013). In a study of adults with schizophrenia spectrum disorders, the authors concluded that it is the quality of social connections and the deep integration within one's local community that was associated with individuals' well-developed personal narratives (Lysaker et al, 2010). The results of our study are in line with the previous findings that subjective social isolation matters more to an individual's personal recovery than objective social isolation, and these results further strengthen our confidence in concluding that the duration of one's loneliness is a critical factor in determining his/her personal recovery process. However, the mechanisms through which being chronically lonely may impact individuals' personal recovery remain unclear. It is possible that several key factors, such as self-efficacy, self-esteem, and socioeconomic status, may play a part. Future longitudinal studies exploring these mechanisms may therefre be crucial in equipping researchers with knowledge of what factors should be the potential targets for reducing loneliness in future intervention trials.

Hypothesis 2: Participants with persistent objective social isolation would have the poorest self-rated personal recovery score at 18-month follow-up, followed by participants who suffered from intermittent objective social isolation, and then participants who were never objectively socially isolated.

The results for Research question 1 suggest a significant relationship between baseline social network size and personal recovery at 18-month follow-up in the univariate linear regression model; however, this relationship was not as significant as the association between baseline loneliness and personal recovery at 18-month follow-up. Moreover, for Research question 3, there was a less prominent effect for the duration of objective social isolation on personal recovery than that for loneliness. Nevertheless, our unanticipated results still provide

considerable insight into the detrimental effect of persistent objective social isolation on personal recovery.

Overall, Research question 3 explored the relationship between the loneliness groups, the objective social isolation groups and personal recovery at 18-month follow-up. The results illustrate that the longer an individual suffered from loneliness, the poorer personal recovery he/she had at 18-month follow-up, independent of the three blocks of baseline confounding variables (i.e. social network size, sociodemographic and psychiatric variables) and baseline personal recovery. Although objective social isolation demonstrated a slightly smaller explanatory power in the current study, persistent objective social isolation still exhibited a significant association with self-rated personal recovery at 18-months follow-up, after controlling for the three blocks baseline confounding factors and baseline personal recovery.

8.1.5. Strengths and limitations

Our study makes several noteworthy contributions to the field of loneliness research, and it benefits from the following strengths: 1) it included a large and diagnostically diverse clinical sample; 2) The sample was drawn from a standard mental health service in the UK (i.e. CRTs), and the participants were recruited right after having a mental health crisis. Therefore, they were offered a similar service experience and they were at an illness stage that is of high clinical relevance; 3) To the best of our knowledge, for the first time, this study has provided preliminary evidence examining whether persistent severe loneliness and persistent objective social isolation have a significant impact on self-rated personal recovery among mental health patients following a mental health crisis. Therefore, this study has advanced our current knowledge of loneliness and objective social isolation concerning their impact on mental health outcomes, which were not previously provided by existing cross-sectional studies; and 4) The current study allows a between-group comparison between loneliness and objective social isolation in relation to their impact on mental health outcomes among people with mental health problems.

The results of this quantitative research contribute additional evidence to the association between persistent severe loneliness, persistent objective social

isolation, and self-rated personal recovery. These results also suggest that interventions directly target at loneliness, and to a lesser but also important extent at objection social isolation, may have an indirect effect on personal recovery. Therefore, we hope that the results from the current study will benefit future research and clinical practice by providing new evidence and placing the prevention of persistent loneliness and objective social isolation as a priority on both research and clinical agenda for people with mental health problems. Notably, this study is not without its drawbacks. The findings of this thesis, therefore, are subject to the limitations listed below.

Generalisability of the results: The generalisability of our results is subject to certain limitations.

Firstly**,** the scope of this study was limited in terms of the sample involved. For this sample, the median of age was 40 with a minimum of 18 and a maximum of 75, our findings therefore may not be generalisable to children, adolescents or older populations aged over 75. This sample also was predominately white (64%) and the majority of them (77%) were born in the UK. Although these characteristics suggest a diverse sample that was recruited for this study, the results may not be generalisable to all patients, such as people from other minority ethnic groups and non-UK born immigrants. Regarding diagnosis, there is a relatively large proportion of the participants (30%) belonged to 'other diagnoses', although great efforts were invested in categorising participants into precise diagnostic groups. We might suppose that these participants might be new to mental health services, therefore, no formal diagnoses were given. This limitation may also be explained either by poor or incorrect recordings in the health records, or uncertain diagnosis of some patients among clinicians. Given that a large proportion of participants had missing records for their diagnosis, and only approximately one-third of our sample had diagnoses within the spectrum of psychotic disorders, the findings of this study may not be generalisable to people with specific diagnoses.

The response and attrition rate of this trial may compromise the generalisability of our findings. Figure 8.2 below describes the recruitment and retention process. As shown in figure 8.2, only 441 of the 3288 initially assessed patients were enrolled in the main trial. Given this relatively low response rate, there is a

possibility that this cohort may not genuinely represent the characteristics of the CRT service users. This quantitative analysis used a convenience sample from the CORE main trial, and considering the fact that the CORE trial is an intervention trial with a principal aim of reducing readmission rate through peer support, there is a possibility that the CORE trial was more appealing to certain patients who were interested in taking part in this specific type of intervention. It is also plausible that the most severely unwell patients may have lacked decision-making capacity to agree to sign up for the trial, therefore, this further limited our confidence in generalising the findings to severely unwell patient groups.

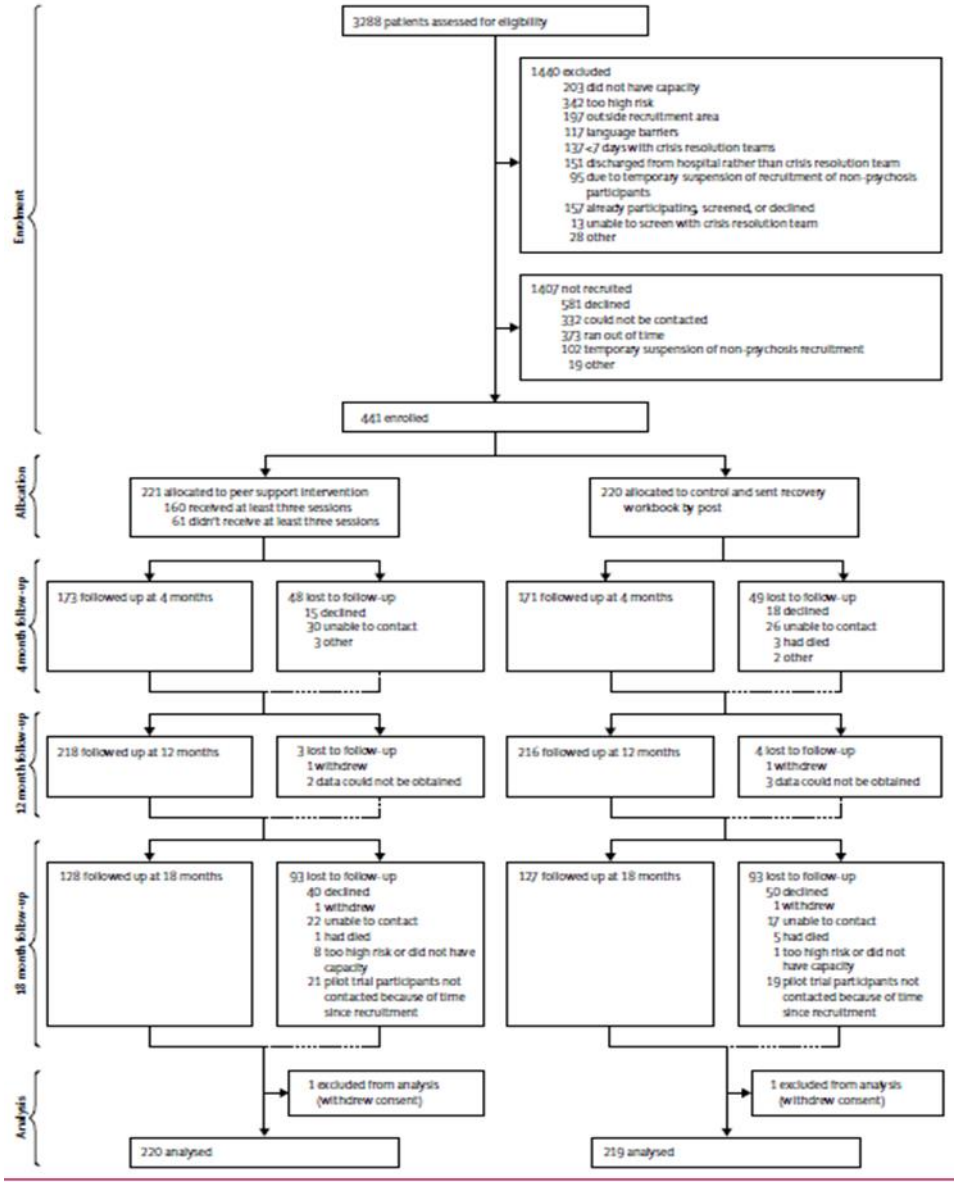
Bias could also be introduced during the recruiting process, which may also have an impact on our interpretation of the results. Participants were recruited after being discharged from the CRT. Therefore, while CRT was provided as an alternative service to hospital admission, participants in this study still scored lower on the BPRS than the participants from previous studies. This suggests that our sample either had tended to be less unwell than typical secondary mental health service users or that they have already started their recovery process at the time of CRT discharge. In either circumstance, results may not be generalisable to people who are either currently in a psychiatric crisis or in a very stable mental health state. For the CORE programme, eligible participants were on the CRT staff's caseload and were identified by the CRT staff. Therefore, we could not exclude the possibility that some potential participants were disregarded or overlooked during recruitment. Moreover, there is a possibility that for those who had a good engagement with the CRT staff, they were more likely to be recruited and contacted by the CRT staff than those who were less engaged. Also, there is a higher possibility for patients who were in a relatively more stable mental state to give informed consent, compared to those who were not well at the time of recruitment. Again, all these limitations suggest that our findings may not be applicable to patients with great symptom severity.

The inclusion and exclusion criteria of this intervention trial should also be considered as one of the limitations. One criterion of this trial was to exclude people who could not understand English, therefore, our results may not be generalisable to patients whose first language is not English. This study also excluded participants who were assessed by clinicians as having a serious risk

of inflicting harm to either themselves or others, which may further limit the representativeness of this sample.

The CORE trial was implemented with the aim of representing CRT users in the UK by including inner cities, suburban and rural areas. Therefore, the findings may only apply to people in the UK. Given the fact that loneliness and personal recovery are both subjective concepts, people may thereby describe their loneliness and personal recovery based on their cultural backgrounds, beliefs, and values. On account of the above reasons, future replicated studies will benefit from re-examining these results with a culturally distinct sample.

Figure 8.2 The recruitment and retention process of the CORE trial



Recruitment process and follow-up rate: Identified by research in epidemiological cohorts, a 50-80% follow-up rate was recommended as an acceptable level (Kristman et al, 2004; Babbie, 1973). For the current study, a follow-up rate of 58% was achieved at 18-month follow-up. However, Altman (2000) reasons that whether a trial is good or not should be determined by a number of factors, including a consideration of whether a high follow-up rate is achievable. He highlights that low drop-out rates were particularly rare for intervention trials, unless an improbably short follow-up time was offered. Great efforts were made in the current study to follow up participants, such as making contacts by email, text and calls. For those who moved out of the catchment areas or had difficulties in attending appointments after baseline, phone call interviews were offered. Given both subjective and objective social isolation can be lifetime issues for people with mental health problems, future study will benefit from planning an even longer follow-up period, examining the fluctuation of both issues over time and investigating whether other factors may have an impact on their fluctuation (e.g. which life stage an individual is in). One limitation of having a long follow-up that researchers should be mindful about is the possibility that follow-up rates can be further compromised if long follow-ups are offered since there is a high likelihood of participants being lost to follow-ups due to reallocation, death or other unforeseen circumstances.

For this study, 148 participants were lost from baseline to 18-month follow-up. Comparisons of baseline variables were made between the completers who completed 18-month follow-up and those who did not in order to confirm the predictors of missingness. The results from the drop-out control comparison reveal that the completers were more likely to hold a degree-level qualification in education than the non-completers. This finding supports a previous study, in which participants with less formal education were more likely to drop out from a web-based cessation programme than those with a relatively higher education level (Strecher et al, 2008). In another longitudinal study examining a cigarette and marijuana prevention programme, drop-outs had a lower academic achievement compared to the programme completers (Siddiqui et al, 1996). Comparable findings were also reported in The Netherland Mental Health Survey and Incidence Study (de Graaf et al, 2000), and in another study involving an HIV-1 perinatal transmission cohort in Malawi (Ioannidis et al, 1999).

We may expect that in a trial, without the responsibility for going to work, studying or caring for someone, participants should have the flexibility to accommodate the follow-up appointments. However, our finding argues the opposite: the 18-month follow-up completers were more likely to be in employment, or education, or a full-time caring role than the noncompleters. This result mirrors the findings from some previous literature, suggesting unemployment as one important factor contributing to patients' disengagement from psychological treatments (e.g. Trepka, 1986; Tehrani et al, 1996), although other trials found null evidence suggesting an association between employment status and a high drop-out rate (e.g. Louks et al, 1989; Koch & Gillis, 1991). One possible explanation is that an individual's mental state or health status could be a precipitating factor prior to their unemployment or disengagement from any other outdoor activities. Therefore, it can be difficult for this particular patient group to attend appointments.

Previous analysis of the CORE data (Wang, 2018a) demonstrates that none of the baseline sociodemographic variables was significantly associated with baseline loneliness. Nevertheless, given employment status and educational attainment were the predictors of missingness in this study, both factors were added into the explanatory models for research question 1. Other factors associated with baseline loneliness in the baseline analysis (Wang, 2018a) were also added into the models, including social network size, number of psychiatric inpatient hospitalisations, number of years since first contact with mental health services, and the BPRS score.

A second drop-out control comparison was conducted to examine the differences in baseline variables between the completers who completed the ULS-8 and LSNS-6 at all three time points (i.e. baseline, 4-month and 18-month follow-up) and the non-completers who failed to do so. Again, given there were significant between-group differences in their employment status and educational attainment, both variables were then added into the explanatory models for research question 3.

Measurements: As explained previously, all the scales used in the current study were well-established. Good variability and reliability of each scale have been demonstrated, and these scales were implemented in previous studies across

different countries (Wang et al, 2017). The ULS-8 was administrated as the primary measurement for loneliness at baseline, 4-month and 18-month follow-up. Based on the range and distribution of loneliness score from baseline to 18-month follow-up (Table 2) presented in the result chapter, there were no ceiling effects. Additionally, the severity of loneliness of this cohort was comparable to that of other previously reported studies of patients with mental health diagnoses, such as autism spectrum disorder, social anxiety, and psychosis (e.g. Syu & Lin, 2018; Jazaieri et al, 2012). Although the original UCLA loneliness scale and the short-version ULS-8 have been widely used, they were specifically designed to measure loneliness for the general population; in particular, they have been extensively implemented in lonely older samples in the general population. Therefore, there is a growing concern over their extensive administration in mental health research, as they were not originally designed for people with mental health problems. Moreover, despite its high validity and reliability, the items of the ULS-8 have been criticised for only measuring the intensity of an individual's lonely state at the time of assessment. Without a consideration of loneliness from a temporal perspective, these items cannot measure how long each individual has been lonely. It has also been suggested that the scale also fails to assess the types of social relationships each individual has (e.g. Rubenstein & Shave, 1982). Loneliness is a multidimensional and multifaceted construct, many conceptual models and different dimensions of loneliness have been proposed to fully understand loneliness from different perspectives (e.g. Weiss, 1973; DiTommaso & Spinner, 1997; Hawkley et al, 2005). However, the ULS-8 only measures loneliness unidimensionally. When social and emotional loneliness were measured separately, research reported that the prevalence of loneliness was twice as high as when loneliness was measured with a unidimensional scale (Hyland et al, 2018). Although this finding was only reported by one study of a community sample in the U.S., there is a possibility that the ULS-8 may have underestimated the proportion of participants in our sample who would be considered as severely lonely. More research therefore is needed to support this finding for people with mental health problems.

Another arguable weakness of this study is the definition of severe loneliness, which was determined by a cut-off point of 24 and above on the ULS-8. The ULS-8 consists of 8 items, and its total score ranged from 8 to 32. Participants in our

sample were considered as ‘severely lonely’ if they scored 24 or above, which indicates that these participants have on average scored at least ‘sometimes’ on each item, rather than ‘never’ or ‘rarely’. Although it seems to be an arbitrary decision, previous guidelines on the ULS-8 have not advised any appropriate cut-off point to differentiate severe loneliness from moderate loneliness and no loneliness. It would not be appropriate if we set the cut-off point higher than 24 (e.g. 30), given the fact that the majority of participants would have been excluded from the analysis for Research Question 3. For example, we found that only 20 participants (7.5%) at baseline and 15 participants (6.0%) at 18-month follow-up scored 30 and over on the ULS-8.

As previously discussed, loneliness is a complex construct, and many previous attempts have been made to capture its multidimensional nature. So far, although having a precise measure of loneliness is considered as one of the most important priorities in public health (Zarei et al, 2015), loneliness research is still a continuously growing field, and researchers are still playing catchup in order to fully understand this issue. Loneliness can be understood from many perspectives (Yanguas et al, 2018). For example, one of the most cited conceptual models of loneliness is from Weiss (1973), his typology distinguishes social loneliness from emotional loneliness. Weiss proposed that while emotional loneliness is associated with deficits in attachment, social loneliness is linked to the perceived absence of a broader social network. Additionally, emotional loneliness can be further divided into two aspects: romantic and family emotional loneliness (DiTommaso & Spinner, 1997). The third dimension of loneliness, collective loneliness, was later proposed by Hawkley and colleagues (2005), which refers to the perceived absence of social identities or a lack of meaningful social connections within a social group. Therefore, offering a comprehensive and rigorous definition of loneliness remains a major challenge for researchers, practitioners and policy makers (Care Connect & Age UK, 2018).

Despite many loneliness scales that have been widely administrated for loneliness research, these are not the scales in which people with lived experience in loneliness and mental health have actively collaborated on development. Additionally, we have yet to determine if the same score on a loneliness scale reflects a similar experience for different individuals. Many conceptual models of loneliness have been proposed (e.g. Weiss et al, 1973),

however, it is unlikely for a scale to capture all the conceptual dimensions of loneliness (e.g. social loneliness, emotional loneliness and collective loneliness). Items of each loneliness scale are also varied, depending on whether an item measures the frequency, intensity or duration of an individual's self-perceived loneliness (Office for National Statistics, 2018). If the debate on loneliness is to be moved forward, there is a pressing need to acknowledge that perhaps loneliness can only be understood through multiple means and existing loneliness scales should be revised. For this thesis, the results of categorising loneliness from a temporal perspective have been explored: this is not the only approach and the number of time-points involved is small, but it does go beyond the usual cross-sectional investigations. Our preliminary findings advance the current status of literature by providing detailed evidence on how loneliness impacts personal recovery over a relatively long follow-up period.

A recently published conceptual review from Wang and colleagues (2017) identified some well-established measures for social isolation and their related concepts in mental health research. The authors concluded that both UCLA Loneliness scale and de Jong-Gierveld Loneliness scale are the standard scales in assessing the overall perceived adequacy of emotional support one receives. Therefore, despite all the uncertainty regarding its suitability, the ULS-8 should be considered as a suitable and appropriate choice for loneliness for our study. The 11-item de Jong-Gierveld Loneliness Scale and its shorter version (six-item) are multidimensional scales assessing both emotional and social loneliness, this measure can also be administrated as an alternative in future loneliness research.

Objective social isolation in the current study was assessed by combining item 1 and 4 from the LSNS-6. The two items were used in this study to measure the number of family and friends each individual has in his/her social network, and the sum-up score of these two items was used as an indicator to determine whether a participant is objectively socially isolated or not. The LSNS-6 intends to measure both subjective and objective aspects of one's social support network, and this 6-item short version focuses on family and friend network. Therefore, this scale has not been established as a measure of objective social isolation. Again, this scale was also not initially developed for people with mental health problems. Given this scale was chosen based on convenience (i.e. the scale was pre-

selected for the CORE main trial), future replicated trials will benefit from implementing a measure that was designed to measure objective social isolation only. For example, Wang and colleagues' conceptual review (2017) recommends a number of measures for social network domains, one good example is the Social Network Schedule (SNS), which was initially developed for inpatients and mental health service users in the community (e.g. Priebe et al, 2013; Lloyd-Evans et al, 2015). This scale measures the size of one's social network, the frequency of these social contacts, the density of one's social network (i.e. the proportion of social ties between people within the social network) and the proportion of one's kin and non-kin social contacts within that network. The score of each of these domains can be reported separately (Wang et al, 2017). The SNS has been demonstrated as having a good reliability and validity (Dunn et al, 1990; Leff et al, 1990). Therefore, this scale can be used in future research where subjective and objective social isolation are measured separately.

All the questionnaires involved in the current study were self-reported measures. Self-reported measures have benefits in providing opportunities for respondents to express their own perspectives, such as the scales for loneliness. However, self-reported measures can also be burdensome and some are prone to reporting bias as the rating scales are subject to participants' tendency to give either middle or extreme answers (Furnham, 1986). Therefore, the accuracy of the responses might be compromised.

The BPRS was used in the current study to measure the severity of psychiatric symptoms at all three time points. This scale has been vigorously validated in people with psychosis (e.g. Adams & El-Mallakh, 2009; Kopelowicz et al, 2008), and recently its validity has also been examined in people with other diagnoses, such as mood disorders (Zanello et al, 2013; Picardi et al, 2008). For the BPRS, there is emerging evidence suggesting a satisfactory to excellent interrater reliability and longitudinal sensitivity to changes in symptom severity (Furukawa, 2010; Zanello et al, 2013). It has also been suggested that using its subscale scores is a more effective way in determining symptom changes in specific symptom domains than its overall score (Lachar et al, 2001). However, given our cohort comprised of patients with various diagnoses, and only 32% were diagnosed with schizophrenia or other psychotic disorders, using the BPRS total score was judged as an appropriate way to inform the overall symptom severity

of this sample. Ratings of a selection of items on the BRPS scale were based on a structured interview conducted by the study researchers. Although all researchers received extensive training in using the measure, we cannot rule out the possibility of unreliability in how these items were scored. Another limitation of this quantitative research is that we did not include a measure of depression in the analysis. We acknowledge that it would be desirable to include a depression scale, for two main reasons: firstly, as discussed in Chapter 2, robust evidence to date has resulted in a more clearly established association between loneliness and depressive symptomology in patients with mental health problems than for other mental health symptoms and conditions; secondly, one recent cross-sectional study has also found that affective symptom severity was a more potent predictor of personal recovery in people with SMI, compared to overall symptom severity (Van Eck et al, 2018). However, as noted previously, our current study included a clinically and diagnostically varied sample, therefore, the total BPRS score was considered as a more appropriate method to inform the overall symptom severity of our sample than the subscales. Additionally, the scales used for this thesis were pre-determined for the main CORE trial, so that I could not have included a specific measure of depression. The affective subscale of the BPRS was not included in the analysis, due to the fact that the reliability and validity of the affective subscale of the BPRS as a measure of depression have not been confirmed. Therefore, future studies will benefit from involving a well-established depression scale, such as the Beck Depression Inventory II (Beck et al, 1996), in order to explore whether depressive symptoms are a stronger predictor of self-rated personal recovery than other types of symptom among people with mental health problems.

Analysis: Since the percentage of missing data was relatively low for each of these variables, case mean substitution was implemented to resolve missing data for continuous variables including loneliness, social network size, personal recovery and symptom severity at baseline and 18-month follow-up. Based on the assumption that all items within a scale are closely correlated (Fox-Wasylyshyn & El-Masri, 2005), case mean substitution is a missing data technique using the mean score of the remaining items within the scale for a given individual to estimate the missing values (Raymond, 1986). This strategy not only preserves data well, it is also easy to use (Hawkins & Merriam, 1991). The

strategy is considered as particularly useful for self-report questionnaires and for when all items measure a specific concept. This technique acknowledges the differences between individual participants; thus, it is also considered as a unit-weighted regression approach. By examining case mean substitution on unidimensional scales, good empirical results were discovered (Roth et al, 1999). For the current study, there were 399 participants in total at baseline. For each item on the BPRS, the item-level missingness ranged from 0.25% to 0.75%, and 2.01% of the cases were missing. For loneliness, the item-level missingness ranged from 0 to 0.75% and 2.01% cases were missing. None of the items on the LSNS-6 were missing. The range of the item-level missingness on the QPR was from 0.25% to 0.75% and 2.51% cases were missing. At 18-month follow-up, as shown in the section 5.3., there were 251 participants left for follow-up analysis, and total missing cases on the BPRS, ULS-8, LSNS-6 and QPR were 10.76%, 4.78%, 0.40% and 5.98%, respectively. The item-level missingness was ranged from 9.16% to 9.96% for the BPRS, 0.80% to 3.19% for the ULS-8, 0.40% for the LSNS-6, and 0.40% to 5.59% for the QPR. Therefore, besides the BPRS at 18-month follow-up, each scale had a relatively small percentage of missing data on each item and had a small percentage of total cases missing, at both baseline and 18-month follow-up. Previous studies also support equivalent effectiveness between case mean substitution and other techniques when there is a low level of missing data (e.g. Parent, 2013; Saunders et al, 2006; Gilley & Leone, 1991; Kaufman, 1988; Roth et al, 1999). There is no restricted guidance about what level of missingness should be considered as acceptable for using the case mean substitution. However some researchers offered some suggestions: both Little and Rubin (2002) and Roth (1999) found that this technique was vigorous when the item-level missingness was 20% and below, regardless of whether the missing pattern was at random or systematic; Eekhout and colleges (2014) pointed out that case mean substitution should not lead to a high bias if there was a 25% or less item-level missing, and 10% or less case-level missing (Donner, 1982). Downey and Kings (1998) also found accurate estimations of means and standard deviations when there was less than 30% missing data. The total case missing on the BPRS at 18-month follow-up was 10.76%. There are two possible explanations for this relatively higher missing percentage. Firstly, for the participants who moved out of the catchment area, the study researchers

provided phone interviews. Because scoring on certain items of the BPRS requires observation during a face-to-face interview, this scale was not assessed during a phone interview, which may result in the whole questionnaire missing for some participants. Secondly, the BPRS is a lengthy questionnaire consisting of 24 items, and the interview lasted about one hour or longer for each participant. When attending a lengthy interview, some participants might refuse to answer a long questionnaire that requires more time to complete. This is likely to be the case, considering most of the missing cases (i.e. 88.89%) had a variable-level missingness (i.e. missing all items on a multi-item measure), and the BPRS was the very last questionnaire to complete in the interview. As recommended by Kristman and colleagues (2004), if data are 'missing at random' and dropouts are related to variables that were measured at baseline or follow-up instead of the outcome variable, this type of missing data can be ignored when relevant baseline variables are controlled for in the analysis. On another note, we cannot rule out the possibility that data were missing not at random (MNAR), as those who did not answer the BPRS could be more ill than those who did, as pointed out by Raaijmakers (1999): participants with extreme opinions are more likely to avoid answering questions that are related to the topic, and in this case, it is their illness.

In order to replace missing data on the BPRS scale but not to increase risk of bias, based on a recent meta-analysis (Dazzi et al, 2016, p.140), mean substitution was conducted for each subscale: affect subscale included items for 'anxiety, depression, suicidality and guilt', positive symptoms subscale included items for 'grandiosity, suspiciousness, hallucinations and unusual thought' content, and negative symptoms subscale included items for 'blunted affect, emotional withdrawal and motor retardation'. Only when there was a less than 25% item-level missingness for each subscale, the missing items were substituted with the mean of that subscale. For cases with over 25% of data missing for each item, they were removed from the final analysis. For future research, it will be useful if researchers can evaluate whether missing data follow a pattern (i.e. MNAR). This can be achieved by including certain responses in the measures, such as 'not applicable', 'rather not answer' or 'not sure' (Saunders et al, 2006).

Another limitation that is worth noting is that a participant would be considered as 'currently employed' if he/she answered 'yes' in any of the following: 'currently in open market employment (either part-time or full time', 'currently in permitted work or sheltered work', 'currently in voluntary or unpaid work', 'current in education, study or training (either part-time or full-time), and 'currently in full-time caring role'. Although it is hypothesised that being employed or in education can protect against loneliness and objective social isolation, some researchers have speculated that the negative consequences of being a full-time carer, including restricted social opportunities (Schene et al, 1994) and lack of social support (Highet et al, 2004), may lead to loneliness or objective social isolation (Hayes et al, 2015; Highet et al, 2004). However, given only a small number of participants (3.59%) was caring for another individual full-time, it should not impact our results substantially. Nevertheless, further research investigating these factors as independent predictors of loneliness is thereby recommended.

When categorising participants into different loneliness and objective social isolation groups, for those who were severely lonely and objectively socially isolated from baseline to 18-month follow-up, they were categorised as persistently severely lonely and persistently objectively socially isolated respectively. For those who were severely lonely and objectively socially isolated at one or two time point(s), they were categorised as intermittently severely lonely and intermittently objectively socially isolated respectively. For those who did not report being severely lonely and objectively socially isolated from baseline to 18-month follow-up, they were categorised as never severely lonely and never objectively socially isolated respectively. However, one limitation of this categorisation strategy is that the study could not measure each participant prior to their participation in the CORE programme, and all variables were only measured three times over the 18-month period, which may suggest that these results cannot reflect the course of loneliness and objective social isolation very well over this period. Therefore, a full discussion of the trajectory of loneliness and/or objective social isolation before baseline lies beyond the scope of this study, and the nature of the data precludes us from drawing any conclusion regarding the direction of causality between loneliness and persona recovery, and between objective social isolation and personal recovery. Based on the results, a reverse causal pathway between the two variables cannot be ruled out.

There is a possibility that having better progress in personal recovery may empower people with an improved ability to establish social contacts: this progress may also subsequently reduce loneliness. Although this study cannot provide a full explanation of the directions of causation of these relationships, the current study provides preliminary longitudinal evidence for a strong association between persistent severe loneliness and poor personal recovery. Therefore, a key research priority should be put into practice, in order to fully understand the direction of causality between persistent severe loneliness and personal recovery, as well as what the implications are for the development of loneliness interventions. Loneliness and objective social isolation themselves have been increasingly recognised as pressing issues on a global level, regardless of being a predictor or a negative consequence of personal recovery. Interventions with effectiveness in alleviating subjective and/objective social isolation therefore are of high relevance for the general population and mental health service users, and future studies of novel interventions are warranted.

8.2. Research implication

Persistent severe loneliness: Loneliness is described as a distressing experience for one's emotions and cognitions (Sadler & Johnson, 1980), it can be transient for some people but can also be intensively persistent for others (Peplau & Perlman, 1982). Young (1982) defines persistent loneliness as a dissatisfaction towards one's relationships over a long period of time (i.e. two or more consecutive years), while transient loneliness is likely driven by the disruption of an individual's social relationships due to situational circumstances. In the current study, 16% of our cohort (i.e. secondary mental health service users) suffered from persistent severe loneliness and 13% were persistently objectively socially isolated. Not only will future research benefit from conducting more longitudinal research examining the trajectories of loneliness and objective social isolation over a long period of time in the general population and clinical samples, the results of our quantitative analysis also underscore a need for future research to explore the extent and impact of persistent severe loneliness and persistent objective social isolation in both populations, in order to further verify our findings.

Differences between diagnostic groups in the experience of loneliness and objective social isolation: As discussed in the previous section, it is somewhat surprising that for those with a mood disorder diagnosis, they had fewer social contacts, but they were not necessarily lonelier than those with a psychosis-related disorder. This finding is contradictory to a previous study, in which people with psychosis reported being less lonely but had fewer social contacts, compared to people with mood disorders (Giacco et al, 2016). It is difficult to explain this unexpected result, since the extent of and reasons for any diagnostic differences in the experience of loneliness and objective social isolation remain unclear. However, this discrepancy could be attributed to the possibility that our results might just be a chance finding. Nevertheless, this result does reflect significant differences between different diagnostic groups in relation to their social relationships and feelings of loneliness. Future studies with a focus on this specific area of research are therefore recommended.

Understanding the direction of causation between social isolation and mental health outcomes: So far, an extensive amount of research has been conducted to extend our knowledge of the associations between subjective and object social isolation and a broad range of mental health outcomes. However, there has been little agreement on the causal directions of these relationships, and much of the research up to now has been cross-sectional in nature. Therefore, these studies pre-exclude the possibility of inferring the directions of causality of these relationships, and longitudinal studies with an appropriate design to examine these associations are rather piecemeal. Despite the fact that our study provides high-quality longitudinal evidence and it is one step forward from previous cross-sectional studies, we still cannot determine the directions of effect. We may expect that the feelings of loneliness may lead to poor personal recovery and great symptom severity. However, we also cannot rule out the possibility that simply having a mental health diagnosis itself or poor mental health outcomes may serve as a causative factor of great loneliness. Two important research papers with a cross-lagged panel design have attempted to address the longitudinal pathway between loneliness and psychiatric symptoms (Lim et al, 2016; Cacioppo et al, 2010). Another multilevel cross-lagged structural equation analysis was also conducted to explore the reciprocal relationship between social capital (including measures of social participation, social network

and loneliness) and perceived mental health in the UK (Yu et al, 2015). The overall evidence suggests loneliness as a unique and independent factor predicting changes in depressive symptoms (Cacioppo et al, 2010; Lim et al, 2016), social anxiety and paranoia over time (Lim et al, 2016). However, social anxiety in an earlier time-point was found to be the only factor that could predict loneliness at a later time in Lim and colleagues' study, above and beyond trait levels and prior states of these constructs. Depressive symptoms (Cacioppo et al, 2010) and paranoia (Lim et al, 2016) failed to exhibit such predictive effects on loneliness, and Yu and colleagues (2015) also did not to establish any reverse causality between loneliness and perceived mental health. Given the variations in these published studies, studies evaluating the directions of causality of these relationships are of high relevance in future research agenda. Additionally, since all three studies were restricted to the general population, more longitudinal studies targeting people with mental health problems, specifically with a long follow-up period, are recommended.

In terms of what types of analysis plan will be considered as satisfactory for future trials, it seems that utilising cross-lagged panel model is one appropriate approach, which can be utilise to analyse reciprocal relationships or the directional causality between two or more variables over time. This analytical strategy can be used in longitudinal studies and it controls the correlations between variables within each time point and their stability over time (Kearney, in press). Therefore, future research recognising and confirming the causal relationship between subjective and objective social isolation, and mental health symptoms will be valuable in increasing our confidence in determining which co-occurring factors should be targeted at, in order to maximise the effectiveness of interventions for reducing subjective and objective social isolation and for improving mental health outcomes.

Understanding the mechanisms through which loneliness and objective social isolation affect mental health outcomes: It is of note that the mechanisms through which loneliness and objective social isolation may impact various mental health outcomes remain unclear. In Chapter 2, we acknowledged that there are a number of proposed pathways from loneliness and objective social isolation to poor mental health outcomes (e.g. Cacioppo et al, 2006, 2014b; DeWall & Pound, 2011; Garety et al, 2001; Lim et al, 2016). Although existing

theories have put forward potential pathways from biological, psychological and social perspectives, future research needs to account for the varying mechanisms and mediating factors behind the associations between social isolation and mental health outcomes, and more robust evidence is needed to confirm these pathways.

There was a significant association between being employed and improved psychiatric symptoms at a later stage, and employment status was also linked to persistent severe loneliness and persistent objective social isolation. Hence, there is a possibility that engaging in work or university activities may alleviate one's loneliness and objective social isolation, subsequently, it leads to improved mental health outcomes and psychological wellbeing. These results are in agreement with previous evidence suggesting the claim that unemployment has a detrimental effect on our psychological health, including mental health outcomes and emotional wellbeing (e.g. Murphy & Athanasou, 1999; Royal College of Psychiatrists, 2008; Waddell & Burton, 2006; Department for Work and Pensions/Department of Health, 2009). A meta-analysis estimated a weighted effect size of 0.54 for the effect of gaining employment on mental wellbeing and an effect size of 0.36 for the effect of losing employment on mental health (Murphy & Athanasou, 1999). Despite many have expressed their willingness to work, it has been reported that only 15% of people with SMI in the UK are in the labour market (Evans & Repper, 2000), and less than half of our cohort was employed at the time of baseline assessment. Being employed is not only associated with fewer psychiatric symptoms (Mueser et al, 1997; Bell et al, 1996; Royal College of Psychiatrists, 2008; Strickler et al, 2009), but also linked to other benefits such as increased self-esteem (Van-Dongen, 1996; Goldsmith et al, 1996), improved quality of life (Bond et al, 2001), higher recovery rate (Warner, 1994) and fewer financial struggles (Bush et al, 2000; Vuori & Vesalainen, 1999). On the other hand, unemployment has been linked to social loneliness (e.g. Creed & Reynolds, 2001; Evans & Repper, 2000). Jahoda (1982) proposes the concepts of manifest and latent functions associated with work activities: the concept of manifest functions refers to the financial security associated with being employed, and the latent functions are linked to the fulfilment of one's psychological needs through employment since employment is beneficial in strengthening our social ties and promoting self-definition outside of our regular

family network. Unemployment may lead to problems in both functions, but it is more damaging to one's psychological wellbeing (i.e. latent functions) (Paul & Batinic, 2010). However, it is worth acknowledging that few of these studies were surveyed in people with mental health problems, and our study cannot provide identifications that may underpin these associations or the causal directions of these associations. Hence, future trials can explore this further by targeting people with mental health issues, and possibly investigate how and why employment benefits our health while protecting against loneliness.

There is still limited knowledge of many potential factors that are associated with loneliness, which may in turn contribute to poor mental health outcomes. The current study failed to account for certain related concepts of loneliness. It is only until recently, researchers began to realise that certain concepts such as self-efficacy, self-esteem and self-concept, may be closely related to loneliness and mental health outcomes. Self-efficacy is defined as an individual's belief about his/her own capability in initiating social contacts, or their ability to maintain social relationships (Gecas, 1989). It is hypothesised that, instead of generalised self-efficacy, social self-efficacy is a more relevant concept of loneliness (Lim et al, 2018). Self-concept is characterised as one's own judgement on his or her self-worth (Harter, 1982), it is emphasised as a significant factor for protecting against life stressors (Geyh et al, 2011). Self-concept has also been implicated in the improvement of mental health, physical health (Park, 2003), and psychological wellbeing (Taylor & Brown, 1988). Xu and colleagues (2018) also emphasise the importance of self-concept in their study, in which they investigated the relationship between perceived social support, self-concept and mental health in a sample of mainland Chinese college students. In this study, both sufficient self-concept and perceived social support had a positive impact on mental health, self-concept also served as a mediator of the relationship between perceived social support from different social resources (i.e. parents, teachers and peers) and students' mental health.

Self-esteem, as one key component of self-concept, is also linked to loneliness, both directly and indirectly (Tharayil, 2007). Self-esteem has also been acknowledged as a mediator of the relationship between depression and perceived social support (Du et al, 2016; Symister & Friend, 2003). Lonely individuals tend to have low confidence in their social world (Cacioppo et al, 2006;

Luhmann & Hawkley, 2016). For people with mental health problems, their interpersonal difficulties have also been associated with loneliness, depressive symptoms and their shyness, all of which have been implicated as important risk factors resulting in low self-esteem (Lin et al, 2018). Therefore, future research taking these personal qualities into account will need to be undertaken in order to disentangle their relationships with loneliness, mental health outcomes, and related psychosocial difficulties.

The results from the current study demonstrate that loneliness is a more potent risk factor for poor personal recovery than the quantitative aspects of social relationships, which also confirms the finding from an integrative review of personal recovery from Salzmann-Erikson (2013). Five dimensions of personal recovery were put forward by Whitley and Drake (2011): 1) clinical: involves symptom reduction and reduced utilisation of psychiatric treatments; 2) existential: includes self-efficacy, empowerment and spirituality; 3) functional: consists of basic daily functioning, such as education and employment; 4) physical: includes basic general health; and 5) social: consists of social re-connectedness and social engagement. The current study evaluates personal recovery with a main focus on the final component. Synthesising evidence from previous literature, the review from Salzmann-Erickson (2013) highlights the importance of socialisation during the process of recovery. In particular, a sense of belonging stemming from being a member of a social group was emphasised as a critical component in reducing the likelihood of stigmatisation (Ng et al, 2008). In an Australian National Survey of Psychosis, over 80% of the respondents disclosed that during their process of recovery, loneliness is one of the biggest challenges they had to overcome (Morgan et al, 2012). One longitudinal study also provided evidence suggesting loneliness and relationship quality as two strong predictors of mental health outcomes. Objective aspects of one's social relationships, such as social network size or living alone, instead, are the best predictors of physical health and cognitive performance (Beller & Wagne, 2018).

Developing better and comprehensive measures for loneliness and objective social isolation: In terms of measurements, as described in our limitation section, the current study administrated the LSNS-6 as the measurement for objective social isolation. However, this scale is designed with

a focus on both subjective and objective aspects of one's social relationships. Future studies involving a scale measuring subjective and objective social isolation separately are therefore recommended. The Social Network Schedule (SNS) (Dunn et al, 1990) is one option. However, compared to the scales for loneliness, measures of objective social isolation are far from established in research. Not only can objective social isolation be experienced differently across various life stages (Arsenault, 2019), it is also possible that objective social isolation experienced by people with mental health problems can be vastly distinct from that of the general population. Therefore, future research will be of high value if comprehensive measures of objective social isolation can be developed and evaluated for people with mental health problems. Although alternative strategies (e.g. observation) measuring objective social isolation are not available nor considered as practical, concerns are also raised regarding the essential paradox about using self-reported questionnaires to assess objective social isolation, given different interpretations of 'what is a social contact' and 'what is the definition of a friend' may lead to unreliable findings. Palumbo and colleagues' systematic review (2015) also acknowledged this issue by stating the fact that there is a considerable variation in the definition of 'friendship' and the extent of the overlap between 'friend' and other social roles in one's social circle across the studies. Therefore, future systematic review with an aim of synthesising evidence on social network composition and/or social network size of a specific sample will also benefit from studies including clear and consistent definitions of social roles and friendship.

Both the UCLA Loneliness Scale and de Jong-Gierveld Loneliness Scale are frequently used measures for loneliness in research. Both scales have been administrated in a great variety of sample groups, including the general population and people with mental health problems. In keeping with a recently published Loneliness Strategy from the UK government, the guidance for loneliness measure was also published (Office for National Statistics, 2018) (. The ONS recommends that the 'gold standard' should include both direct and indirect measures of loneliness in order to capture loneliness in a valid and reliable manner. Specifically, the ONS proposed that a standard measurement can include the three items from the UCLA 3-item Loneliness scale and one direct question assessing the frequency of the respondent's loneliness. By

standardising a loneliness measure, this strategy may be able to align all future research and build up an evidence base for future evaluation. Future steps validating these scales in people with mental health problems are therefore recommended. There is also abundant room for future progress in determining whether future research should tailor a loneliness measure exclusively for people with mental health problems.

8.3. Clinical implication

The results from the current study suggest that it is clinically important for mental health services to identify and address loneliness among their service users. The prolonged experience of loneliness in certain patient groups should be of particular concern for health practitioners. Our systematic review demonstrates that evidence concerning how to address loneliness and objective social isolation efficiently among people with mental health problems remain scarce. However, it is still of high importance for health practitioners to acknowledge their detrimental impact on health outcomes, and to identify these problems in a timely manner and potentially address them through goal-setting (Pinfold et al, 2016).

Although limited evidence was found in the quantitative study, distinct characteristics of mental health patients who are of high susceptibility to persistent severe loneliness should be recognised, including: 1) being single, separated, divorced or widowed; and 2) unemployed, not in education or any full-time caring role.

There is certain hesitation in much research concluding the significance of objective social isolation (i.e. the quantitative aspects of one's social relationship) in mental health outcomes. Literature has demonstrated that simple social participation is insufficient in maintaining lasting and intimate relationships with others (i.e. high-quality relationships), and high-quality social relationships have been acknowledged as a more crucial factor for improving mental health outcomes than objective social factors. However, despite all these findings, social participation still provides a range of benefits, including guidance, advice or simply companionships (Olds & Schwartz, 2009). These social resources are also essential in maintaining patients' mental state. Objective social isolation has been widely recognised as a contributing factor to future loneliness. Although our

results only support persistent objective social isolation as a relatively more potent risk factor for poor personal recovery over intermittent objective social isolation, recognising whether a mental health service user is suffering from objective social isolation still requires attention. Therefore, mental health patients with certain characteristics who are also at an increased risk of objective social isolation should also be monitored, including: 1) with a diagnosis of depression, anxiety disorders or PTSD; 2) unemployed, not in education or any full-time caring role; 3) born outside the UK; and 4) never been admitted as a psychiatric inpatient.

As previously mentioned, the guidance for measuring loneliness is targeted at all public settings and health practices (ONS, 2018); it recognises that by regularly screening people who attend appointments, for example, at their GP surgeries and by asking four simple questions, loneliness can be increasingly identified and treated efficiently. Additionally, efficient prevention plans can also be organised and preventional intervention programmes (e.g. educational programme) should be available pre-emptively to protect people with mental health problems from experiencing greater loneliness severity. Therefore, a key policy priority should also be put in place for the routine screening for loneliness and its integration into routine care.

Concerning public agenda, there is a need for implementing societal and local community-level approaches to create accepting, connected communities, in which everyone is included, including people with mental health problems. These actions may further facilitate the development of more community-based activities, involving both the general public and people with mental health problems. This action may continuously encourage social connectedness between the two populations. A Connected Society: a strategy for tackling loneliness was put forward by the UK government (2018). With the ultimate goal in preventing loneliness all at once or for most of the time, this strategy aims to strengthen the foundation of our society and to create a positive framework for all aligned public sectors and organisations. The strategy encourages all societal sectors to recognise the importance of social wellbeing, to work together to provide a foundation for people, and to promote positive relationships. It further underlines the importance of tackling the stigma around loneliness and promoting

one’s resilience against loneliness, especially when they are in a crucial stage of their lives.

Innovations in public welfare in reducing loneliness at a societal level are also promising: public benefits, such as free travel pass for those with difficulties in getting around, may encourage more community engagement and social activities for people with mental health problems. Increased public transportation use, which was improved by providing free bus rides for the elderly, has been concluded as a facilitator for more physical activities and face-to-face contact with children and friends. This strategy may further improve individuals’ mental wellbeing and loneliness (Reinhard et al, 2018). The UK’s Loneliness Strategy specifies (2018) that local authorities, government, employers, voluntary and community sectors, as well as individuals, all play a significant role in contributing to actions against loneliness. Progress in reducing loneliness at a societal level should and will be monitored closely; strategies should also be updated accordingly to keep up with new evidence and recommendations supported by well-implemented research in the relevant fields.

Chapter 9. Conclusions

Referring back to the research questions outlined in Chapter 4, one of the main goals of this thesis is to examine the associations between baseline loneliness, baseline objective social isolation and mental health outcomes (i.e. personal recovery and psychiatric symptoms) at 18-month follow-up among people who were recruited from CRT services. This thesis also sets out to determine if persistent severe loneliness and persistent objective social isolation are related to poor personal recovery at 18-month follow-up. To take a step further, we also systematically synthesised current evidence on interventions for improving subjective and objective social isolation among people with mental health problems. The main findings from the systematic review and the quantitative study are summarised below:

1) This study lacks robust evidence on how to alleviate loneliness or objective social isolation in the mental health context. Preliminary evidence of the systematic review suggests that potentially effective interventions may include interventions involving a cognitive modification component for subjective social isolation, and interventions providing mixed strategies and supported socialisation for objective social isolation. However, given the considerable variability between included trials and their methodological limitations, such as small sample sizes, these conclusions should be interpreted with caution.
2) Our sample (i.e. CRT service users who recently experienced a mental health crisis) experienced a moderate level of loneliness, which confirms the previous findings that people with mental health problems tend to suffer from greater loneliness than the general population.
3) The results also suggest that people with mental health problems tend to have a smaller social network size than individuals without a mental health diagnosis.
4) Greater loneliness at baseline was associated with poorer self-rated personal recovery and greater overall psychiatric symptom severity at 18-month follow-up, after adjusting for baseline social network size, sociodemographic and psychiatric variables. However, these associations did not remain their statistical significance when self-rated personal recovery and overall symptom severity at baseline were added into the

final model. It is also not possible to confirm the direction of causality of the association between loneliness and these health outcomes.

5) Baseline social network size failed to show any significant association with personal recovery and overall symptom severity at 18-month follow-up when baseline loneliness was introduced into the model.
6) Baseline loneliness is therefore a more potent predictor of personal recovery at 18-month follow-up than baseline social network size
7) If an individual suffered from persistent severe loneliness or intermittent severe loneliness over an 18-month follow-up period, he/she was more likely to be single, separated, divorced or widowed, and being unemployed, compared to an individual who was never severely lonely. Persistently severely lonely people also had the smallest social network size, the greatest symptom severity and the poorest personal recovery, compared to people who were intermittently severely lonely and those who were never severely lonely.
8) If an individual suffered from persistent objective social isolation, he/she was less likely to be born in the UK, be employed, but he/she was more likely to be admitted as a psychiatric inpatient, and diagnosed with depression, anxiety disorders or post-traumatic stress disorder, compared to an individual who was never objectively socially isolated. Persistent objective socially isolated individuals also had the highest loneliness score, the greatest overall symptom severity and the poorest personal recovery, compared to people who were never objectively socially isolated.
9) Being persistently or intermittently severely lonely was significantly associated with poor personal recovery 18 months later, even after controlling all three blocks of baseline variables (i.e. social network size, sociodemographic and psychiatric variables), and baseline QPR score
10) Objective social isolation had a less prominent effect on personal recovery compared to loneliness. Only persistent objective social isolation was associated with poor personal recovery at 18-month follow-up, after controlling for all three blocks of baseline variables (i.e. social network size, sociodemographic and psychiatric variables), and baseline QPR score

In conclusion, this thesis extended our knowledge of subjective and objective social isolation in people with mental health problems specifically. The epidemiology of loneliness based on this sample further supports that compared to the general population, people with diagnoses across the entire spectrum of mental disorders are more likely to experience greater loneliness and have a smaller social network size. Dispite the quantitative analyses found null evidene suggesting a significant association between baseline loneliness and mental health outcomes (i.e. self-rated personal recovery and psychiatric symptoms) at 18-month follow-up after adjusting for the baseline mental health variables, it validated our previous understanding that loneliness is a more potent predictor of mental health outcomes than objective social isolation. Therefore, future large-scale research investigating and confirming these relationships with a long follow-up period is warranted. This thesis also provides preliminary evidence on and a new understanding of the roles of persistent severe loneliness and persistent objective social isolation in contributing to personal recovery at a later stage. The analyses of the quantitative data also identified specific characteristics (i.e. sociodemographic, psychiatric and psychosocial factors) associated with persistent severe loneliness and persistent objective social isolation in a clinical population recruited from a standard secondary mental health service in the UK, which encourages the recognition of potentially at-risk populations in a general health setting. To the best of our knowledge, this work is the very first quantitative research with a longitudinal design, which examined the impact of persistent severe loneliness and persistent objective social isolation on personal recovery for people with mental health diagnoses. Therefore, we are hoping this work will serve as a foundation for future research to further verify these findings.

The systematic review in this thesis also strengthens our understanding of loneliness interventions and interventions for objective social isolation. Firstly, it recognises a shortage of evidence on loneliness interventions; secondly, it underscores the potential effectiveness of interventions involving a cognitive modification component for subjective social isolation, and interventions providing mixed strategies and interventions including a supported socialisation component for objective social isolation. Lastly, it acknowledges the important steps future research needs to take in developing and evaluating new

interventions for subjective and objective social isolation for people with mental health problems.

Notwithstanding the limitations of the quantitative research and systematic review, we believe that this thesis will contribute to the evidence-base of loneliness research, and will encourage the implementation of more rigorous research in the near future. I also hope the findings of this thesis will further promote the awareness of subjective and objective social isolation in the mental health field, at both individual and public level.

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Appendices

Appendix 1.1. Measures and Scales for subjective and objective social isolation

	Measures	**Description**	**For which Populations**
Subjective social isolation	The University of California at Los Angeles (UCLA) Loneliness Scale (Russell et al, 1978)	A unidimensional scale to assess the frequency and intensity of one's lonely experiences, 20 items	General population (e.g. elderly, lonely students, immigrants) People with mental health problems (e.g. psychiatric inpatients, people with depression)
	ULS-8 (Hays & DiMatteo, 1987)	A short-form of UCLA Loneliness Scale, 8 items	General population (e.g. university students, adolescents, elderly sample) People with mental health problems (e.g. people with depression, mixed sample with various diagnoses)
	The De Jong-Gierveld Loneliness Scale (De Jong-Gierveld et al, 1985)	A 11-item scale measures the feeling of severe loneliness, contains 5 positive and 6 negative items A short-form contains 6 items of the original de Jong-Gierveld Loneliness Scale, contains 3 items for emotional loneliness and 3 items for social loneliness	General population (e.g. national survey samples from severe countries, elderly Chinese) People with mental health problems (e.g. mixed samples with various diagnoses)

	Measures	Description	For which Populations
	Multi-dimensional Scale of Perceived Social Support (MSPSS) (Zimet et al, 1990)	A 12-item scale to measure perceived overall amount of social support and support from significant other/friends/family	General population (e.g. Chinese university students, young adults, adults with physical disabilities) People with mental health problems (e.g. people with posttraumatic stress disorder, women with severe depressive symptoms)
	The Pattison Psychosocial Kinship Inventory (PPKI) (Pattison, 1981)	Measure the number of people and relationship one considered as important	General population (e.g. dysfunctional families) People with mental health problems (e.g. adults with schizophrenia, people with psychosis
Objective social isolation	Social Network Index (SNI) (Cohen et al, 1997)	12-item scale, measure the number of people one has regular contact with	General population (e.g. women with breast cancer, people with severe traumatic brain injury, African-American in urban area) People with mental health problems (e.g. old adults with depressive symptoms, people with posttraumatic stress disorder)

	Measures	Description	For which Populations
Multi-domain measures	Lubben Social Network Scale (LSNS-6)	A revised version, contains 6 items, evaluates the quantity and quality of one's relationship with family and friends	General population (e.g. community-dwelling elderly, Korean American caregivers) People with mental health problems (e.g. mixed samples with different diagnoses, depressed immigrants)
	Social Network Schedule (SNS) (Dunn et al, 1990)	A 6-item scale, measures both quantitative (i.e. the size of one's social network size, the frequency of social communication and the time one spent on socialisation) and qualitative (i.e. quality and intimacy of one's social relationships, intensity of social interaction) aspects of one's social connections	People with mental health problems (e.g. people with non-organic psychosis, people with intellectual disability)
	Medical Outcomes Study (MOS) Social Support Scale (Sherbourne & Stewart, 1991)	A 20-item survey measures dimensions of social support: emotional/informational, tangible, affectionate and positive social interaction	General population (people with heart failure in Hong Kong, mothers with children in treatment) People with mental health problems (e.g. adults with schizophrenia spectrum or affective disorder)

	Measures	Description	For which Populations
	Interview Schedule for Social interaction (ISSI) (Henderson et al, 1980)	50 items, measures the availability and perceived adequacy of attachment and social integration	General population (e.g. patients with rheumatoid arthritis, people from Canberra suburbs) People with mental health problems (e.g. outpatients with schizophrenia, inpatient male offenders

Abbreviations: UCLA Loneliness Scale = University of California Los Angeles Loneliness Scale; ULS-8 = the Short-Form of the UCLA Loneliness Scale; MSPSS = Multidimensional Scale of Perceived Social Support; SNI = Social network Index; PPKI = The Pattison Psychosocial Kinship Inventory; SNS = Social Network Scale; MOS = Medical Outcomes Study Social Support Scale; ISSI = Interview Schedule for Social interaction.

Appendix 3.1. Characteristics of included trials

Study	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
Subjective social isolation trials						
Kaplan K (2011)	Online intervention, US	300 adults with a diagnosis of a schizophrenia spectrum or an affective disorder	2 medium-term follow-ups: 4- and 12-month (post-baseline)	The Medical Outcomes Study (MOS) Social Support Survey (Sherbourne & Stwart, 1991)	1) Personal recovery 2) Quality of Life 3) psychiatric symptoms	Supported socialisation
Hasson-Ohayon I (2007)	Psychiatric community rehabilitation centre, Israel	210 adults with severe mental illness	End-of-treatment follow-up	Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet et al, 1990)	Personal recovery	Psychoeducation/social skills training
Rotondi A. J. (2005)	In- and outpatient psychiatric care units and psychiatric rehabilitation centres, Pittsburgh, Pennsylvania	30 patients aged >=14 with schizophrenia or schizoaffective disorder	2 medium-term follow-ups: 3- and 6-month (post-baseline)	The informational support and emotional support subscales of the instrument that was developed by Krause and Markides (1990)	N/A	Psychoeducation
Silverman M. J. (2014)	Acute care psychiatric unit, a university hospital, the Midwestern region, US	96 adults with varied Axis I diagnoses	End-of-treatment follow-up	The Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet et al, 1990)	N/A	Psychoeducation

Study	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
Boevink, W (2016)	Mental health care organisations, the Netherlands	163 adults with mental illness	1 medium-term follow-up: 12-month (post-baseline) 1 long term follow-up: 24-month (post-baseline)	The De Jong-Gierveld Loneliness Scale (De Jong Gierveld & Van Tilburg, 1991)	1) Quality of Life 2) psychiatric symptoms	Supported socialisation
Zang, Y (2014)	Beichuan County, China	30 aged 28-80 with PTSD	End of treatment follow-up 2 medium term follow-ups: 1- or 2-week, and 3-month	the Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet et al, 1990)	1) anxiety and depressive symptoms 2) PTSD symptoms	Cognition modification
Zang, Y (2013)	Beichuan County, China	22 aged 37-75 with PTSD	End of treatment follow-up 2 medium term follow-ups: 2-week, and 2-month	the Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet et al, 1990)	1) subjective level of distress 2) depressive symptoms	Cognition modification
Gawrysiak M (2009)	A Public Southeastern university, US	30 aged >=18 with depression	1 medium term follow-up: 2-week	The Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet et al, 1990)	1) depressive symptoms 2) anxiety symptoms	Psychoeducation/social skills training and supported socialisation

Study	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
Bjorkman, T (2002)	One of ten case management services, Sweden	77 adults aged 19-51 with severe mental illness	2 long term follow-ups: 18- and 36-month	the abbreviated version of the Interview Schedule for Social Interaction (ISSI) (Henderson et al, 1980)	1) psychiatric symptoms 2) Quality of life	Social skills training
Mendelson T (2013)	Baltimore City, US	78 depressed women aged 14-41 who either pregnant or with a child less than 6 month	End of treatment follow-up 2 medium term follow-ups: 3- and 6-month	The Interpersonal Support Evaluation List (ISEL) (Cohen and Hoberman 1983)	N/A	Cognition modification
O'Mahen H. A (2014)	Online intervention, UK	83 women aged >18 with MDD	End of treatment follow-up 1 medium term follow-up: 6-month	The Social Provision Scale (Cutrona & Russell, 1987)	1) depressive symptoms 2) anxiety symptoms	Psychoeducation and supported socialisation
Conoley C. W (1985)	Psychology Department, US	57 female psychology undergraduate students with moderate depression	End of treatment follow-up 1 medium term follow-up: 2-week	The Revised UCLA Loneliness Scale (UCLA-R) (Russell, et al., 1980) The Causal Dimension Scale (Russell, 1982)	Depressive symptoms	Cognition modification

Study	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
Eggert L L (1995)	5 urban high schools, US	105 high school students with poor grades	2 medium term follow-ups: 5- and 10-month (post-baseline)	Perceived social support: measured by calculating average ratings across 6 network support sources. Instrumental and expressive support provided source was also rated	Depressive symptoms	Supported socialisation, social skills training and wider community groups
Masia-Warner C (2005)	Two parochial high schools, New York city, US	35 high school students with social anxiety disorder	End of treatment follow-up 1 medium term follow-up: 9-month	Loneliness Scale (Asher & Wheeler, 1985)	1) anxiety symptoms 2) social phobic symptoms 3) depressive symptoms	Psychoeducation/ social skills training, supported socialisation and cognition modification
Interian A (2016)	Online intervention, US	103 veterans with PTSD	1 medium term follow-up: 2-month follow-up (post-baseline)	The family subscale of the Multidimensional Scale for Perceived Social Support (Zimet et al, 1990)	N/A	Psychoeducation and cognition modification
Objective social isolation trials						
Solomon, P (1995a)	A community mental health centre, US	96 adults with schizophrenia or	2 medium term follow-ups: 1-month and 1-year (post-baseline)	1) Family and social contacts	1) use of services	Supported social socialisation and wider community groups

Study	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
		major affective disorders		2) Pattison's Social Network scale (Pattison, Difrancisco, Wood, Frazier, & Crowder, 1975)	2) Quality of Life 3) psychiatric symptoms	
Aberg-Wistedt, A (1995)	The Kungsholmen sector, Stockholm, Sweden	40 adults with schizophrenia or long-term psychotic disorder diagnosed by DSM-III-R schizophrenic disorders	1 long term follow-up: 2-year (post-baseline)	The number of people in participants' social life was measured by a standardised procedure developed from work with child psychiatric patients (Swaling et al, 1990)	1) Quality of life 2) Service use	Psychoeducation/social skills training
Stravynski, A (1982)	Maudsley hospital, London, UK	22 adults aged 22-57 with diffuse social phobia with avoidance personality disorder	End of treatment follow-up 1 medium term follow-up: 6-month	Structured and Scaled Interview to Assess Maladjustment (SSIAM) (Gurland et al, 1972)	Depressive symptoms	Social skills training and cognition modification
Atkinson, J. M (1996)	Community clinic, South Glasgow, UK	146 registered patients with schizophrenia	End of treatment follow-up 1 medium term follow-up: 3-month	A modified Social Network Schedule (SNS) (Dunn et al, 1990)	1) quality of life 2) psychiatric symptoms 3) overall functioning	Psychoeducation

Study	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
Terzian, E (2013)	47 community mental health services (SPT), Italy	357 adults aged < 45 diagnosed by the schizophrenia spectrum by the ICD-10th	1 medium term follow-up: 1-year (post-baseline) 1 long term follow-up: 2 year (post-baseline)	Social network: different parameters of relationships were assessed; all were summarized into a score	1) psychiatric symptoms 2) hospitalisation over the follow-up year	Supported socialisation and wider community groups
Hasson-Ohayon, I (2014)	3 psychiatric rehabilitation agencies and the University Community Clinic, Bar-Ilan University, Israel	55 adults aged 21-62 with severe mental illness	1 medium term follow-up: 6-month	Social Functioning Scale (SFS) (Birchwood et al, 1990)	N/A	Wider community group, psychoeducation/social skills training and cognition modification
Rivera, J. J (2007)	A city hospital, New York, US	203 adults with a psychotic or mood disorder on axis I	2 medium term follow-ups: 6- and 12-month (post-baseline)	A modification of the Pattison Network Inventory (Pattison, 1977)	1) Quality of life 2) psychiatric symptoms	Supported socialisation

Study	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
Solomon P (1995b)	A community mental health centre, US	96 adults with schizophrenia or major affective disorders	2 medium term follow-ups: 1-month and 1-year (post-baseline) 1 long term follow-up: 2-year (post-baseline)	Pattison's Social Network (Pattison, Difrancisco, Wood, Frazier, & Crowder, 1975)	1) Quality of Life 2) psychiatric symptoms	Supported socialisation and wider community groups
Marzillier J, S (1976)	The Maudsley hospital, UK	21 adults aged 17-43 with diagnosis of personality disorder or neurosis	End of treatment follow-up 1 medium term follow-up: 6-month	Revised-Social Diary and Standardised Interview Schedule (Marzillier et al, 1976)	1) anxiety disorders 2) mental state 4) personality assessment	Social skills training and cognition modification
Bøen, H (2012b)	2 municipal districts, eastern and western Oslo, Norway	138 seniors with light depression	End of treatment follow-up	the Oslo-3 Social Support Scale (OSSS-3) (Korkeila et al, 2003)	1) depressive symptoms 2) Life satisfaction	Supported social socialisation, and wider community group
Cole M (1995)	St. Mary's hospital, Montreal, Canada	32 adults with major depression, dysthymic disorder or other affective disorder	3 medium term follow-ups: 4-, 8- and 12-week (post-baseline)	The Older Americans Research and Service Centre Instrument (OARS) (Centre for Aging and human Development, 1978)	1) mental state 2) symptoms	N/A
Trials for both subjective and objective social isolation						

Study	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
Schene, A. H (1993)	University Psychiatric Clinic of the Academic Hospital, Utrecht, the Netherland	222 adults aged > 60 with mental disorders	End of treatment follow-up 1 medium term follow-up: 6-month	Subjective social isolation outcome: Social Network and Social Support Questionnaire (SNSS) (Wijngaarden, 1987) Objective social isolation outcome: Social Network and Social Support questionnaire (SNSS) (Wijngaarden, 1987)	1) mental state 2) psychiatric symptoms 3) social dysfunction	Psychoeducation/social skills training, and supported socialisation
Castelein, S (2008)	4 mental health centres, the Netherlands	106 adults aged >= 18 with schizophrenia or related psychotic disorders	End of treatment follow-up	Subjective social isolation outcome: The Social Support List (SSL) Objective social isolation outcome: Personal Network Questionnaire (PNQ) (Castelein et al, 2008)	1) Quality of Life 2) screening for psychosis	Supported socialisation

Study	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
Gelkopf M (1994)	7 chronic schizophrenic wards, Israel	34 adults with chronic schizophrenics by DSM-III-R	1 medium term follow-up: 2 weeks	Subjective social isolation outcome: The Social Support Questionnaire 6 (SSQ6) (Sarason et al, 1987) Objective social isolation outcome: 1) Two measures of social network sum up the size and dispersion 2) Four measures assess the source of the support	N/A	Cognition modification

Study	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
Ammerman, R. T (2013)	Southwestern Ohio and Nortern Kentucky, US	93 females aged from 16-37 with MDD	End of treatment follow-up 1 medium term follow-up: 3-month	Subjective social isolation outcome: Interpersonal Support Evaluation List (ISEL) (Cohen & Hoberman, 1983) Objective social isolation outcome: Social Network Index (SNI) (Cohen et al, 1997)	Psychiatric symptoms	Cognition modification

Abbreviations: MOS Social Network Survey = The Medical Outcomes Study Social Support Survey; MSPSS = Multidimensional Scale of Perceived Social Support; ISSI = the abbreviated version of the Interview Schedule for Social Interaction; ISEL = The Interpersonal Support Evaluation List; UCLA-R = The Revised UCLA Loneliness Scale; SSIAM = Structured and Scaled Interview to Assess Maladjustment; SFS = Social Functioning Scale; OARS = The Older Americans Research and Service Centre Instrument; SNSS= Social Network and Social Support Questionnaire; SSL = The Social Support List; PNQ = Personal Network Questionnaire; SSQ6 = The Social Support Questionnaire 6; ISEL = Support Evaluation List; SNI = Social Netwo

Appendix 3.2. Characteristics of interventions

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Subjective social isolation trials					
Kaplan K (2011)	Experimental peer support listserv vs. experimental peer support bulletin board vs. waiting list control group	Online	Unclear, overall duration of the study was 12 months	**Experimental peer support listserv**: participants communicate anonymously via a group distribution email list **Experimental peer support bulletin board**: participants were instructed on how to create account and login to	The online communication of both listserv and bulletin board group were solely peer directed, but technical support was provided via phone or email
Hasson-Ohayon I (2007)	Illness Management and Recovery Programme vs. treatment as usual	Face-to-face sessions (group)	Weekly sessions, an hour each session Duration of the intervention was 8 months	**Intervention group:** educational handouts in Hebrew	Interventions were led by two clinicians, one of whom had weekly training sessions. For the first 8 months of intervention, clinicians attended monthly supervision sessions.

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Rotondi A. J. (2005)	Telehealth intervention vs. usual care group	Online	Unclear	**Intervention group:** online therapy groups, ask questions and receive answers, a library of previous questions, activities in the community, news items, and educational reading materials	The 3 therapy groups were facilitated by master of social work and PhD clinicians, they were all trained in Web-based interventions

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Silverman M. J. (2014)	Live educational music therapy (Condition A) vs. recorded educational music therapy (Condition B) vs. education without music (Condition C) vs. recreational music therapy without education (Condition D)	Face-to-face sessions (group)	24 weekly sessions, 45 minutes per session Duration of intervention: 24 weeks	**Condition A:** live music, a scripted educational lyric analysis session using song lyrics that focused on social support **Condition B:** recorded music, a scripted educational lyric analysis session about lyrics that focused on social support **Condition C**: Without music, a scripted educational session without music concerning support and coping **Condition D**: investigator led the group in playing rock and roll bingo, no scripted educational session	A certified music therapist with more than 12 years of clinical psychiatric experience conducted therapy sessions

Study reference	**Intervention name**	**Mode of delivery**	**Number of sessions + duration of each session + duration of intervention**	**Intervention descriptions**	**Characteristics of intervention providers**
Boevink, W (2016)	TREE + CAU vs. CAU (waiting-list control)	Face-to-face sessions (group)	**The early starters:** each session lasted 2 hours, met every two weeks duration of intervention: 104 weeks **The Late starters**: each session lasted 2 hours, met every two weeks duration of intervention: 52 weeks	**TREE model:** 1) training course 'start with recovery'' 2) developing strength 3) a one-day recovery training course	The recovery self-help working groups were facilitated by two senior peer workers, and two mental health care managers facilitated the training course

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Zang, Y (2014)	NET vs. NET-R interventions vs. waiting-list control	Face-to-face sessions (individual)	**NET group**: >=4 sessions, 60-90 minutes per session, twice weekly duration of intervention: 2 weeks **NET-R group**: >=3 sessions, 60-120 minutes per session, each session was 1-2 days apart duration of intervention: 1 week	For both groups, the narrative was recorded and corrected in subsequent reading sessions. **NET group:** created a detailed biography that focused on the traumatic experiences **NET-R group**: a modified version of NET, the participants firstly constructed an earthquake narrative then an autobiography	All treatments were carried out by the first author and 1 female psychological counsellor, they both speak Chinese and have the Chinese national psychological counsellor certificate (master), also were trained in delivering NET and NET-R Weekly case and personal supervision were conducted, the counsellors were also supervised before they have contact with participants

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Zang, Y (2013)	NET vs. waiting list control group	Face-to-face sessions (individual)	**NET group:** 4 sessions, 60-90 minutes per session Duration of intervention: 2 weeks	NET group: created a chronological report of biography focusing on traumatic experiences. A written report of their biography was provided in the last session	The team was led by the first author, consisted of 3 female therapists, they all speak Chinese, and all have the Chinese national psychological counsellor certificate (Master) Therapists were trained for NET and they were tutored under supervision before they started working with participants. Weekly case and personal supervision were also carried out.

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Gawrysiak M (2009)	BATD vs. no treatment control	Face-to-face session (individual)	Single session lasted 90 minutes	**BATD intervention**: education, assessments of values and goals, construct an activity hierarchy, selection of value-based behaviours, establish structured behavioural goals and behavioural checkout form	One male doctoral students in clinical psychology was trained in BATD, and conducted the individualised interview
Bjorkman, T (2002)	The case management service vs. standard care	Face-to-face sessions (individual)	1.45 per week during the first 18 months, and the case manager spent averagely 1.9 hours in client contacts every week. Duration of intervention: unclear	The case management service: moderately focused on skills training, highly emphasised on consumer input	All staff had experience in working in social services, psychiatric services or vocational rehabilitation. The team consisted of 2 registered nurses and 2 social workers. Supervision was done by a psychiatrist and a psychologist.

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Mendelson T (2013)	Standard home visiting services + MB course vs. standard home visiting services + information on perinatal depression	Face-to-face sessions (group & individual)	6 weekly sessions, 2 hours each session Duration of intervention: 6 weeks	**Intervention group:** Sessions cover core cognitive behavioural concepts, including pleasant activities, thoughts, and contact with others	A licensed clinical social worker or clinical psychologist
O'Mahen H. A (2014)	NetmumsHWD vs. treatment-as-usual	Online and telephone support	12-session treatment online course, weekly telephone support sessions of 20-30 min Duration of each session and intervention: unclear	**NetmumsHWD:** a core BA model, a relapse prevention session, plus two optional modules. Also, a chat room that was moderated by peer supporters, and weekly supported phone call from mental health workers	Mental health supporters with undergraduate degrees and 1 year of clinical qualification in psychological therapies Peer supporters had previous training in low-intensity BA, received 5 days of training in high-intensity perinatal-specific BA approach

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Conoley C. W (1985)	Reframing vs. self-control vs. waiting list	Face-to-face sessions (individual)	2 sessions with 1 week apart, each session 30 minutes Duration of intervention: 2 weeks	**Intervention groups:** aimed to increase understanding in loneliness. First half of the interview consisted of loneliness and reflective responses, the second half included either 3-5 positive reframing directives for reframing subjects, and self-control directives for self-control subjects	Two male doctoral students with 3-year counselling experience, received training in both interventions

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Eggert L. L (1995)	PGCI vs. PGCII vs. an assessment protocol-only	Face-to-face sessions (group)	PGCI: met daily, 55 minutes per meeting Duration of intervention: 5 months or 90 class days in length PGCII: met daily, 55 minutes per meeting Duration of intervention: 10 months or 180 class days)	**Both PGCI and PGCII:** a small group work characterised by social support; weekly monitoring of activities; and life skills training **PGCI**: emphasised bonding to PGCI group, included training to give and receive social support; focused on motivating to change and acquire essential skills, and real-life issues rehearing **PGCII:** emphasised broader school bonding, included training to transfer skills to real life situations, providing and seeking social support.	The interventions were delivered by trained school staff who functioned as group leaders

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Masia-Warner C (2005)	Skills for Social and Academic Success vs. waiting list group	Face-to-face sessions (group and individual)	12 weekly group school sessions (40 min); 2 brief individual meetings (15 min); 2 monthly group booster sessions; and 4 weekend social events (90 min) Duration of intervention: 3 months	**12 group session**: 1 psychoeducational session, 1 realistic thinking session, 4 social skills training sessions, 5 exposure sessions and 1 relapse prevention session **Individual meetings**: met with group leaders at least twice, aim to identify individual treatment goals and problem solving **Social events** met and practiced programme skills with peers in their community	A behaviourally trained clinical psychologist and a clinical psychology graduate student co-led all groups Peer assistants: nominated by teachers and administrators, help with exposures and skill practice
Interian A (2016)	The Family of Heroes intervention vs. control group	Online	1-hour online intervention Duration of intervention: unclear	**The Family of Heroes Intervention:** provided psychoeducation and stimulated conservations regarding post-deployment stress and mental health treatment; and 3 conversation scenarios	N/A
Objective social isolation trials					

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Solomon, P (1995a)	Consumer management team vs. non-consumer management team	Face-to-face sessions (individual)	Unclear	Both consumer and non-consumer management team followed an assertive community treatment model 1) provided activities: housing, rehabilitation and social activities 2) case managers provided assistance and supported clients, supervised by consumer supervisor	**Consumer management team**: have major mental health problems, > = one previous psychiatric hospitalization, a minimum of 14 days of psychiatric hospitalization, or at least 5 psychiatric emergency service contacts within a year **Non-consumer case management team**: consisted of mental health professionals, recent college graduates

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Aberg-Wistedt, A (1995)	The intensive case management programme vs. standard services	Face-to-face sessions (individual)	1-hour individual meeting every other week, psychiatric nurse/nurse assistant met with patients at least 4 hours per week. Crisis intervention services were available 24 hours every day and 7 days a week. Duration of intervention: 2 years	Intervention group: 1) the team provided assertive outreach, patients received skill training and instruction in critical life task 2) specific services also provided based on individual needs and assessments 3) family psychoeducation and support	The team consisted of a psychologist/psychiatrist, a psychiatric social worker, a social service officer and a psychiatric nurse/nurse assistant

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Stravynski, A (1982)	Social skills training vs. Social skill training + cognitive modification	Face-to-face sessions (individual)	12 sessions, 90 minutes per session Duration of intervention: 14 weeks	**Social skills training**: focused on individual needs by discussing specific social targets; techniques included: instructions, modelling, role-rehearsal, feedback, self-monitoring and homework **Social skill training + Cognitive modification**: for cognitive modification, participants analysed a distressing event in 5 steps: 1) activating event with descriptions; 2) irrational beliefs; 3) emotional consequences; 4) dispute; 5) plan for new actions	Provided by one psychiatrist
Atkinson, J. M (1996)	The education group vs. waiting-list control	Face-to-face sessions (group)	1.5 hours per session Duration of intervention: 20 weeks	**The education group:** Sessions generally covered schizophrenia topics, and alternated between an information session and a problem-solving session	Led by CPNs, occupational therapist and registrar received training

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Terzian, E (2013)	Social network intervention + usual treatments vs. usual treatments	Face-to-face (individual)	Unclear Duration of intervention: 3-6 months	**Social network intervention:** participants were provided with identification of their possible areas of interest and social activities were suggested	Provided by a staff member or natural facilitators such as families, neighbours or volunteers
Hasson-Ohayon, I (2014)	Social Cognition and Interaction Training (SCIT) + social mentoring vs. social mentoring only	Face-to-face sessions (group)	SCIT intervention: 1-hour weekly session Social mentoring service: 3 weekly meetings Duration of intervention: unclear	Participants received social, leisure, support and employment services, as well as standard services. SCIT intervention group: besides intervention, they also received educational handouts, videos and slides. All received same social mentoring services to support practical steps toward achieving personally meaning goals	Social mentors were staff of psychiatric rehabilitation agencies Lead clinicians received training and ongoing supervision. All clinicians had experience providing psychiatric rehabilitation services and completed a SCIT workshop

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Rivera, J. J (2007)	Peer-assisted care vs. Nonconsumer assisted vs. standard care vs. clinic-based care	Face-to-face sessions (group & individual), and phone calls	Unclear But telephone coverage is 24 hours	**Peer assisted care group:** professionals provided conventional crisis management, therapeutic services and concrete services; paraprofessional consumers facilitated social networks and provided social support through activities, home visits and phone calls **Clinic based care group**: only provided office-based services	All professionals were licensed clinical social workers, also received training and supervisions Consumers had a history of multiple hospitalisation for mood or psychotic disorders, were eligible for disability benefits, relied on medication, but had 3-8 years of sobriety and stability. They had the same training as professional, and were supervised by social worker

Solomon P (1995b)	Consumer case management team vs. nonconsumer management team	Face-to-face sessions (individual)	**The consumer team**: 3 times per week **The nonconsumer team**: met biweekly Duration of the intervention: 2 years	Case managers offered individualized social support for community living, activities included goals related to income, living situation, social and family relations, and psychiatric treatment.	Requirements for consumer case managers: have a major mental disorder; at least one prior psychiatric hospitalisation and a minimum of 14 days of psychiatric hospitalisation, or at least 5 psychiatric emergency service contacts over a 1-year period; regular contact in community mental health services, psychosocial services, or another outpatient treatment **Consumer team**: 3 consumer managers and 1 nonconsumer case manager initially, later, the nonconsumer member was replaced by a consumer, a clinical director and a psychiatrist started involved. Consumer mangers received supervisions and support.

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
					Nonconsumer team: all nonconsumer managers, 2 specialists started involved at second year. Managers received supervision and support. **The interviewer**: a trained professional research worker independent of service providers. Intensive, experiential training was provided in both BPRS and ASI

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Marzillier J, S (1976)	Systematic Desensitisation (SD) vs. Social Skills Training (SST) vs. waiting list control	Face-to-face sessions (individual)	15 45-minute sessions, once a week, occasionally twice a week Duration of intervention: 3 and half months	**Systematic Desensitisation:** included relaxation training and hierarchy construction, practice in both imagination and reality. **Social Skills Training**: combined elements of both assertive and social skills training, included role playing, modelling, practice them in real life and with volunteers	Assessments were done by two independent assessors, one was trained psychologist, the other was a senior psychiatrist The therapist was a trained clinical psychologist with experiences in behavioural treatments
Bøen, H (2012b)	A preventive senior centre group programme vs. control	Face-to-face sessions (group)	Weekly group meetings, 3 hours per meeting, about 35-38 times totally duration of intervention: 1 year	**The experimental group**: included group meeting, physical training programme and a self-help groups, with transportation and warm meal.	The team consisted of volunteers, all completed a training course and were supervised by a registered nurse and an experienced senior centre leader

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Cole M (1995)	Home assessment group vs. clinic assessment group	Face-to-face sessions (individual)	Unclear	Unclear	Study psychiatrists (MC or DR) assessed participants
Trials for both subjective and objective social isolation					
Schene, A. H (1993)	Psychiatric day treatment vs. inpatient treatment	Varied, mostly face-to-face sessions or phone interview (group & individual)	Day treatment: length of programme varied Average duration of intervention: 37.6 weeks Inpatient treatment: length of programmes varied Average duration of intervention: 24.9 weeks	9 main groups of treatment programmes: 1) individual psychotherapy or supportive therapy; 2) individual counselling; 3) group psychotherapy; 4) sociotherapy; 5) family counselling; 6) occupational therapy; 7) psychomotor therapy; 8) drama therapy; 9) secondary environmental activities Extra care for day clinic participants after office hours	Social psychiatric nurses, psychiatrists, and psychologists

Study reference	Intervention name	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Castelein, S (2008)	Care as usual + GPSG vs. a waiting list condition	Face-to-face sessions (group)	90 minutes per sessions, 16 biweekly sessions Duration of intervention: 8 months	Peer support group: included about 10 patients, they decided the topic of each session, discussing daily life experiences in pairs and groups.	Nurses guided the peer groups with minimal involvement
Gelkopf M (1994)	Video projection of humorous movies vs. control group	Face-to-face sessions (group)	**The experimental group:** 4 times daily (5 days a week) Duration of intervention: 3 months	**The experimental group**: exposed exclusively to comedies **The control group**: 15% of the films were comedies, others are different types of films	A psychology student to answer questions during experimental testing
Ammerman, R. T (2013)	IH-CBT + home visiting vs. home visit alone	Face-to-face sessions (individual)	15 weekly sessions, 60 minutes per session with a booster session one month after treatment. Duration of intervention: about 5 months	**IH-CBT**: primarily targeted depression reduction, consisted of behavioural activation, identification of automatic thoughts and schemas, thought restructuration and relapse prevention	2 licensed master level social workers, received weekly supervision, a review of audiotaped sessions and a self-report checklist

Abbreviations: TREE = Toward Recovery, Empowerment and Experiential Expertise; NET = Narrative Exposure Therapy; NET–R = Narrative Exposure Therapy Revised; BATD = Behavioural Activation Treatment for Depression; BA = Behavioural Activation; NetmumsHWD = Netmums Helping with Depression; PGCI = Assessment protocol plus 1 semester Personal Growth Class; PGCII = Assessment protocol plus a 2-semester Personal Growth Class; SCIT = Social Cognition

and Interaction Training; SST = Social Skills Training; SD = Systematic Desensitisation; GPSG = Guided Peer Support Group; IH-CBT = In-home Cognitive Behavioural Therapy

Appendix 6.1. Descriptive data of the Short-Form of the UCLA Loneliness Scale (ULS-8) at baseline (N=399)

Item	Never N (%)	Rarely N (%)	Sometimes N (%)	Always N (%)
How often do you feel that you lack companionship?	40 (10.03%)	57 (14.29%)	204 (51.38%)	97 (24.31%)
How often do you feel that there is no one you can turn to?	60 (15.08%)	66 (16.58%)	194 (48.74%)	78 (19.60%)
How often do you feel that you are an outgoing person?	59 (14.79%)	108 (27.07%)	164 (41.10%)	68 (17.04%)
How often do you feel left out?	41 (10.28%)	73 (18.30%)	194 (48.62%)	91 (22.81%)
How often do you feel isolated from others?	32 (8.04%)	61 (15.33%)	198 (49.75%)	107 (26.88%)
How often can you find companionship when you want it?	37 (9.34%)	69 (17.42%)	178 (44.95%)	112 (28.28%)
How often do you feel unhappy being so withdrawn?	34 (8.59%)	56 (14.14%)	175 (44.19%)	131 (33.08%)
How often do you feel people are around you but not with you?	35 (8.79%)	55 (13.82%)	194 (48.74%)	114 (28.64%)

Abbreviations: number of participants; ULS-8 = the Short-Form of the UCLA Loneliness Scale

Appendix 6.2. Descriptive data of Lubben Social Network Scale (LSNS-6) at baseline (N=399)

Item	None (score 0)	One (Score 1)	Two (score 2)	Three or four (score 3)	Five – eight (score 4)	Nine or more (score 5)
How many relatives do you see or hear from at least once a month?	33 (8.27%)	56 (14.04%)	100 (25.06%)	119 (29.82%)	68 (17.04%)	23 (5.76%)
How many of your friends do you see or hear from at least once a month?	62 (15.54%)	65 (16.29%)	76 (19.05%)	90 (22.56%)	62 (15.54%)	44 (11.03%)

Abbreviations: N = number of participants; LNSN-6 = 6-item Lubben Social Network Scale

Appendix 6.3. Descriptive data of the Short-Form of the UCLA Loneliness Scale (ULS-8) at 4-month follow-up (N=251)

Item	Never N (%)	Rarely N (%)	Sometimes N (%)	Always N (%)
How often do you feel that you lack companionship?	36 (15.93%)	39 (17.26%)	108 (47.79%)	43 (19.03%)
How often do you feel that there is no one you can turn to?	45 (19.91%)	51 (22.57%)	110 (48.67%)	20 (8.85%)
How often do you feel that you are an outgoing person?	24 (10.62%)	56 (24.78%)	114 (50.44%)	32 (14.16%)
How often do you feel left out?	28 (12.39%)	56 (24.78%)	105 (46.46%)	37 (16.37%)
How often do you feel isolated from others?	33 (14.60%)	42 (18.58%)	112 (49.56%)	39 (17.26%)
How often can you find companionship when you want it?	18 (8.00%)	39 (17.33%)	103 (45.78%)	65 (28.89%)
How often do you feel unhappy being so withdrawn?	24 (10.71%)	38 (16.96%)	106 (47.32%)	56 (25.00%)
How often do you feel people are around you but not with you?	17 (7.56%)	48 (21.33%)	127 (56.44%)	33 (14.67%)

Abbreviations: N = number of participants; ULS-8 = the Short-Form of the UCLA Loneliness Scale

Appendix 6.4. Descriptive data of Lubben Social Network Scale (LSNS-6) at 4-month follow-up (N=251)

Item	None (score 0)	One (score 1)	Two (score 2)	Three or four (score 3)	Five – eight (score 4)	Nine or more (score 5)
How many relatives do you see or hear from	17 (7.52%)	41 (18.14%)	49 (21.68%)	58 (25.66%)	44 (19.47%)	17 (7.52%)

Item	None (score 0)	One (score 1)	Two (score 2)	Three or four (score 3)	Five – eight (score 4)	Nine or more (score 5)
at least once a month?						
How many of your friends do you see or hear from at least once a month?	25 (11.06%)	32 (14.16%)	50 (22.12%)	55 (24.34%)	35 (15.49%)	29 (12.83%)

Abbreviations: N = number of participants; LNSN = 6-item Lubben Social Network Scale

Appendix 6.5. Descriptive data of the Short-Form of the UCLA Loneliness Scale (ULS-8) at 18-month follow-up (N=251)

Item	Never N (%)	Rarely N (%)	Sometimes N (%)	Always N (%)
How often do you feel that you lack companionship?	47 (18.88%)	46 (18.47%)	105 (42.17%)	51 (20.48%)
How often do you feel that there is no one you can turn to?	61 (24.60%)	47 (18.95%)	101 (40.73%)	39 (15.73%)
How often do you feel that you are an outgoing person?	37 (14.86%)	62 (24.90%)	117 (46.99%)	33 (13.25%)
How often do you feel left out?	36 (14.46%)	52 (20.88%)	111 (44.58%)	50 (20.08%)
How often do you feel isolated from others?	36 (14.52%)	43 (17.34%)	112 (45.16%)	57 (22.98%)
How often can you find companionship when you want it?	33 (13.25%)	38 (15.26%)	100 (40.16%)	78 (31.33%)

Item	Never N (%)	Rarely N (%)	Sometimes N (%)	Always N (%)
How often do you feel unhappy being so withdrawn?	28 (11.52%)	44 (18.11%)	110 (45.27%)	61 (25.10%)
How often do you feel people are around you but not with you?	31 (12.55%)	40 (16.19%)	120 (48.58%)	56 (22.67%)

Abbreviations: N= numbers of participants; ULS-8 = the Short-Form of the UCLA Loneliness Scale

Appendix 6.6. Descriptive data of Lubben Social Network Scale (LSNS-6) at 18-month follow-up (N=251)

Item	None (score 0)	One (score 1)	Two (score 2)	Three or four (score 3)	Five – eight (score 4)	Nine or more (score 5)
How many relatives do you see or hear from at least once a month?	24 (9.60%)	35 (14.00%)	47 (18.80%)	77 (30.80%)	43 (17.20%)	24 (9.60%)
How many of your friends do you see or hear from at least once a month?	31 (12.40%)	34 (13.60%)	51 (20.40%)	59 (23.60%)	47 (18.80%)	28 (11.20%)

Abbreviations: N = number of participants; LNSN = 6-item Lubben Social Network Scale

Appendix 6.7. Comparison of baseline variables between participants who completed and did not complete 18-month follow-up

Variables	**Completers**		**Non-completers**		
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**P value**
Age	39.98 (12.32)	248	40.59 (13.92)	150	0.65
Gender (%)					0.88
Male	39.92%	99	40.67%	61	
Female	60.08%	149	59.33%	89	
Ethnicity					0.93
White	62.75%	155	65.56%	99	
Black	21.05%	52	18.54%	28	
Asian /Chinese	7.69%	19	7.8%	11	
Mixed /other	8.50%	21	8.61%	13	
Marital status					0.09
Single/ Separated/ divorced/ widowed	74.60%	185	82.00%	123	
Married/ cohabiting	25.40%	63	18.00%	27	
UK born					0.99
No	22.63%	55	22.67%	34	
Yes	77.37%	188	77.33%	116	
Housing					0.88
Permanent/ supported accommodation	96.37%	239	96.67%	145	
Unstable accommodation	3.63%	9	3.33%	5	
Contact with children under 16					0.28
No contact	5.65%	14	7.28%	11	
Contact with dependent children	23.79%	59	29.80%	45	
Having no children	70.56%	175	62.91%	95	
Educational attainment					**0.002**

Variables	Completers		Non-completers		
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**P value**
No qualification	15.79%	39	24.50%	37	
Other qualification	51.01%	126	57.62%	87	
Degree	33.20%	82	17.88%	27	
Employment/education status					**<.001**
Not in employment/ education/full time caring role	44.90%	110	63.51%	94	
Yes	55.10%	135	36.49%	54	
Loneliness score	22.14 (4.48)	248	21.50 (5.75)	150	0.22
Social network size	4.92 (2.27)	248	4.87 (2.23)	151	0.86
Number of psychiatric inpatient hospitalisations					0.15
Never	61.29%	152	58.67%	88	
Once	16.94%	42	12.00%	18	
2 or more	21.77%	54	29.33%	44	
Number of years since first contact mental health services					0.34
Less than 3 months	14.92%	37	20.00%	30	
3 months – 2 years	15.73%	39	18.67%	28	
2-10 years	34.27%	85	27.33%	41	
More than 10 years	35.08%	87	34.00%	51	
Current diagnosis					0.99
Schizophrenia or schizoaffective disorder/bipolar affective disorder/other psychosis	31.25%	75	32.89%	49	
Depression/anxiety disorder/post-traumatic stress	25.83%	62	25.50%	38	

Variables	Completers		Non-completers		
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**P value**
disorder					
Borderline or emotionally unstable personality disorder/other personality disorder	12.50%	30	12.08%	18	
Other diagnosis	30.42%	73	29.53%	44	
BPRS total score	43.41 (10.94)	246	44.56 (13.11)	147	0.35
QPR total score	51.03 (17.96)	248	49.37 (20.33)	151	0.39

Abbreviations: N = numbers of participants; M = mean; SD = standard deviation; BPRS = the Brief Psychiatric Rating Scale; QPR = the Questionnaire about the Process of Recovery

Appendix 7.1. Comparison of baseline variables between participants who completed and did not complete loneliness and social network scale at 18-month follow-up

Variables	Completers		Non-completers		
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**P value**
Age	39.97 (12.54)	224	40.52 (13.44)	174	0.67
Gender (%)					0.83
Male	39.73%	89	40.80%	71	
Female	60.27%	135	59.20%	103	
Ethnicity					0.82
White	61.88%	138	66.29%	116	
Black	21.52%	48	18.29%	32	
Asian /Chinese	7.62%	17	7.43%	13	
Mixed /other	8.97%	20	8.00%	14	
Marital status					0.13
Single/ Separated/ divorced/ widowed	74.55%	167	81.03%	141	
Married/	25.45%	57	18.97%	33	

Variables	Completers		Non-completers		
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**P value**
cohabiting					
UK born					0.23
No	24.89%	55	19.77%	34	
Yes	75.11%	166	80.23%	138	
Housing					0.63
Permanent/ supported accommodation	96.88%	217	95.98%	167	
Unstable accommodation	3.13%	7	4.02%	7	
Contact with children under 16					0.15
No contact	6.25%	14	6.29%	11	
Contact with dependent children	22.32%	50	30.86%	54	
Having no children	71.43%	160	62.86%	110	
Educational attainment					**0.002**
No qualification	15.25%	34	24.00%	42	
Other qualification	50.67%	113	57.14%	100	
Degree	34.08%	76	18.86%	33	
Employment/education status					**<.001**
Not in employment/ education/full time caring role	43.89%	97	62.21%	107	
Yes	56.11%	124	37.79%	65	
Loneliness score	22.07 (4.50)	224	21.68 (5.57)	174	0.44
Social network size	4.97 (2.28)	224	4.81 (2.21)	175	0.49
Number of psychiatric inpatient hospitalisations					0.35
Never	62.50%	140	57.47%	100	
Once	15.63%	35	14.37%	25	

Variables	Completers		Non-completers		
	Mean (SD) or %	**N**	**Mean (SD) or %**	**N**	**P value**
2 or more	21.88%	49	28.16%	49	
Number of years since first contact mental health services					0.74
Less than 3 months	16.07%	36	17.82%	31	
3 months – 2 years	16.07%	36	17.82%	31	
2-10 years	33.93%	76	28.74%	50	
More than 10 years	33.93%	76	35.63%	62	
Current diagnosis					0.69
Schizophrenia or schizoaffective disorder/bipolar affective disorder/other psychosis	30.14%	66	34.12%	58	
Depression/anxiety disorder/post-traumatic stress disorder	26.94%	59	24.12%	41	
Borderline or emotionally unstable personality disorder/other personality disorder	11.42%	25	13.53%	23	
Other diagnosis	31.51%	69	28.24%	48	
BPRS total score	43.30 (10.67)	223	44.55 (13.13)	170	0.30
QPR total score	51.21 (17.61)	224	49.37 (20.40)	175	0.34

Abbreviations: N = numbers of participants; M = mean; SD = standard deviation; BPRS = the Brief Psychiatric Rating Scale; QPR = the Questionnaire about the Process of Recovery

Appendix 8. Chapter 3 systematic review: published paper

The effectiveness of interventions for reducing subjective and objective social isolation among people with mental health problems: a systematic reivew

Published in Social Psychiatry and Psychiatric Epidemiology

Novemeber 2019

https://doi.org/10.1007/s00127-019-01800-z

Social Psychiatry and Psychiatric Epidemiology
https://doi.org/10.1007/s00127-019-01800-z

REVIEW

The effectiveness of interventions for reducing subjective and objective social isolation among people with mental health problems: a systematic review

Ruimin Ma[1] · Farhana Mann[1] · Jingyi Wang[1] · Brynmor Lloyd-Evans[1] · James Terhune[1] · Ahmed Al-Shihabi[2] · Sonia Johnson[1,3]

Received: 13 November 2018 / Accepted: 17 October 2019

Abstract

Purpose Subjective and objective social isolation are important factors contributing to both physical and mental health problems, including premature mortality and depression. This systematic review evaluated the current evidence for the effectiveness of interventions to improve subjective and/or objective social isolation for people with mental health problems. Primary outcomes of interest included loneliness, perceived social support, and objective social isolation.

Methods Three databases were searched for relevant randomised controlled trials (RCTs). Studies were included if they evaluated interventions for people with mental health problems and had objective and/or subjective social isolation (including loneliness) as their primary outcome, or as one of a number of outcomes with none identified as primary.

Results In total, 30 RCTs met the review's inclusion criteria: 15 included subjective social isolation as an outcome and 11 included objective social isolation. The remaining four evaluated both outcomes. There was considerable variability between trials in types of intervention and participants' characteristics. Significant results were reported in a minority of trials, but methodological limitations, such as small sample size, restricted conclusions from many studies.

Conclusion The evidence is not yet strong enough to make specific recommendations for practice. Preliminary evidence suggests that promising interventions may include cognitive modification for subjective social isolation, and interventions with mixed strategies and supported socialisation for objective social isolation. We highlight the need for more thorough, theory-driven intervention development and for well-designed and adequately powered RCTs.

Keywords Loneliness · Perceived social support · Objective social isolation · Mental health · Systematic review · Intervention

Introduction

Subjective social isolation and objective social isolation are conceptually distinct [1] and often only moderately correlated [2]. The terms loneliness and perceived social support both refer to people's subjective perception of their social world (i.e. subjective social isolation) [1, 3]. Loneliness is defined as the unpleasant experience that occurs when there is a subjective discrepancy between desired and perceived availability and quality of social interactions [4]. Perceived social support is the self-rated adequacy of the social resources available to a person [5]. Well-established and widely used measures of loneliness are available, such as the UCLA Loneliness Scale [6]. Objective social isolation, meanwhile, involves having little social contact with other people [7] and can be objectively defined based on

This article is part of the focused issue 'Loneliness: contemporary insights on causes, correlates, and consequences'.

✉ Sonia Johnson
s.johnson@ucl.ac.uk

[1] Division of Psychiatry, University College London, 6th Floor, Maple House, 149 Tottenham Court Road, London W1T 7NF, England, UK

[2] UCL Medical School, University College London, 74 Huntley Street, London WC1E 6BT, England, UK

[3] Camden and Islington NHS Foundation Trust, St. Pancras Hospital, 4 St. Pancras Way, London NW1 0PE, England, UK

Published online: 19 November 2019

quantitative measures of social network size or the frequency of social contacts with others [8]. A summary table of commonly used measures of subjective and objective social isolation is provided in Appendix 1.

In a UK survey, approximately one in five of the general population reported being lonely in the preceding 2 weeks [9]. For people with mental health problems, the odds of being lonely were eight times greater than for the general population, and the odds were increased 20-fold for those with two or three diagnoses (e.g. depression and schizophrenia), compared to those without any diagnosis [10]. Objective social isolation, including having fewer friends [11] and being less likely to date [12], is also more common among people with mental health problems than in the general population. Loneliness has adverse health effects, such as an impaired immune system [13], elevated blood pressure [14], depression [15], and cognitive decline [16]. Moreover, loneliness is associated with poorer quality of life [17] and personal recovery [18], and with more severe mental health symptoms [19]. Similarly, a number of negative health outcomes have been found to be associated with objective social isolation, for example, increased all-cause mortality rate [20], poor physical health outcomes [21, 22], worse psychotic symptoms [23, 24], depressive symptoms [24], and higher risk of dementia [25]. Conversely, social support that is perceived as sufficient is associated with less severe psychiatric symptoms, higher functioning, better personal recovery, greater self-esteem and empowerment, and improved quality of life [26]. These associations between subjective and objective social isolation and poorer outcomes [27–30] make interventions designed to alleviate social isolation of high interest. Subjective social isolation has recently been increasingly recognised as a treatment priority for people with serious mental illness [31]. By targeting both subjective and objective social isolation as main outcomes in the current review, we aimed to establish the extent of the current evidence base for interventions for each of these potential treatment targets and to understand the similarities or differences between the characteristics of interventions that work for subjective and for objective social isolation.

Some authors have previously systematically reviewed interventions for subjective social isolation [30, 32–35] and objective social isolation [36–38] (Appendix 2). The most recent systematic review focused on subjective social isolation among people with mental health problems was published in 2005 [35]. Three more recent systematic reviews focused on aspects of objective social isolation: one reviewed interventions to increase network size in psychosis [37] and the other two examined interventions targeting social participation in people with mental health problems [36, 38]. Thus, there is no up-to-date systematic review of evidence for a full range of interventions to alleviate subjective and/or objective social isolation among people with a mental health diagnosis.

Masi's meta-analysis in 2011 [34] has been considered one of the most comprehensive reviews to date examining interventions for loneliness, identifying four main types of intervention. However, Masi's review included only 20 RCTs and included all populations, not only people with mental health problems. Thus, our paper adds to knowledge from Masi's review by providing an up-to-date synthesis of interventions for loneliness in people with mental health problems, using a typology of interventions targeting loneliness and related constructs recently developed by Mann and her team [39]. This typology distinguishes among the following: (1) interventions involving changing maladaptive cognitions about others (e.g. cognitive-behavioural therapy or reframing); (2) social skills training and psychoeducation programmes (e.g. family psychoeducation therapy); (3) supported socialisation (e.g. peer support groups, social recreation groups); and (4) wider community approaches (e.g. social prescribing and asset-based community development approaches). These community approaches maximise individuals' engagement with social resources and/or aim to develop social resources at the level of whole communities.

Methods

We conducted the current systematic review to evaluate the evidence for the effectiveness of interventions designed to alleviate subjective social isolation (including loneliness and perceived social support) and/or objective social isolation among people with mental health problems.

Inclusion criteria

Types of study

Only randomised controlled trials (RCTs) were included, with no restrictions on publication dates, the country of origin or language.

Participants

People primarily diagnosed with mental health conditions were included, including depression, anxiety, post-traumatic disorder, psychosis/schizophrenia or bipolar disorders. Any method of identifying or diagnosing people as mentally ill was acceptable. There was no restriction on the age of the participants. However, studies where the samples were people with a primary diagnosis of intellectual disability, autistic spectrum disorders, dementia, any other organic illnesses, substance misuse or physical health problems were excluded, even if some had comorbid mental health diagnoses.

Interventions

This review included interventions which were designed to alleviate subjective or/and objective social isolation for people with mental health problems. Papers were included if subjective or objective social isolation was a primary outcome and excluded if they were secondary outcomes, with another clearly specified primary outcome. Trials were also included if a clear distinction was not made between primary and secondary outcomes, with subjective and/or objective social isolation as one of a number of main outcomes.

Comparison

We included trials where the control group received treatment-as-usual, however defined, no treatment or a waiting-list control. We also included trials which compared different active treatment groups.

Outcomes

The primary outcomes were subjective social isolation (including loneliness and perceived social support) and objective social isolation. End-of-treatment outcomes, medium-term outcomes (i.e. up to one year beyond the end-of-treatment time point) and longer-term follow-up outcomes (i.e. more than one year beyond the end-of-treatment time point) were reported separately. The following secondary outcomes were also examined: health status, quality of life, and service use.

Search strategy

Three databases were systematically searched for relevant literature: Medline, Web of Science and PsycINFO. Three groups of search terms were combined: (1) subjective and objective social isolation (e.g. loneliness); (2) mental disorders (e.g. psychosis, depression, post-traumatic stress disorder) and (3) trials (e.g. RCT). For detailed search terms, please see Appendix 3. Reference lists from included studies, relevant systematic reviews, and meta-analyses were hand-searched. Grey literature was searched through OpenGrey by using keywords 'loneliness', 'perceived social support' and 'social isolation'.

Data extraction

RM and FM reviewed all titles and abstracts, AA screened half of the papers we retrieved, and final decisions regarding whether a paper should be included or not were made by all three independent reviewers. The primary reviewer (RM) reviewed all full-text papers retrieved, and inter-rater reliability was also evaluated as good between reviewers during the screening process. The final list of included papers was confirmed only when RM, FM, and AA agreed on all papers. Any differences were resolved in consultation with a further independent reviewer (SJ). Data were extracted by RM and FM by using a standardised form developed for the review, including items related to publication year and country, study design, experimental settings, participants, the nature of the intervention, follow-up details, primary and secondary outcomes, any exclusions of participants, and the reasons for these, confounders, and risk of bias.

Quality assessment

The Cochrane Risk of Bias tool [40] was used for the quality assessment. Each included paper was assessed by two reviewers (RM and FM/JT) regarding the following domains: sequence generation, allocation concealment, blinding of participants, personnel and outcome assessors, incomplete outcome data, selective outcome reporting and other sources of bias. For each paper, a final decision for each domain was made only if both assessors agreed. If there was disagreement, a third independent assessor (SJ) was consulted.

Synthesis plan

A narrative synthesis was conducted for this systematic review based on the principles from the ESRC's Guidance on the Conduct of Narrative Synthesis in Systematic Reviews [41]. The included trials were grouped into three categories: (1) trials that included subjective social isolation as an outcome (primary or one of several, with none specified as primary); (2) trials that included objective social isolation as an outcome; and (3) trials that included both outcomes. Due to the expected heterogeneity in samples and intervention types from this broad review, meta-analysis was judged to be inappropriate.

Results

The initial literature search retrieved 5220 papers in total, of which 30 were found to be eligible for inclusion. The PRISMA flow diagram (Fig. 1) shows details of the screening process.

The 30 trials involved 3080 participants in total, with individual trial sample sizes ranging from 21 to 357. Nineteen trials had fewer than 100 participants. The median number was 88, and the interquartile range (IQR) was 104. Authors from nine trials specified sample size calculations. The search was conducted in July 2017 and all trials were published between 1976 and 2016. Thirteen trials were conducted in the US, 11 in Europe, 3 in Israel, 2 in China, and 1 in Canada. Thirteen interventions were conducted

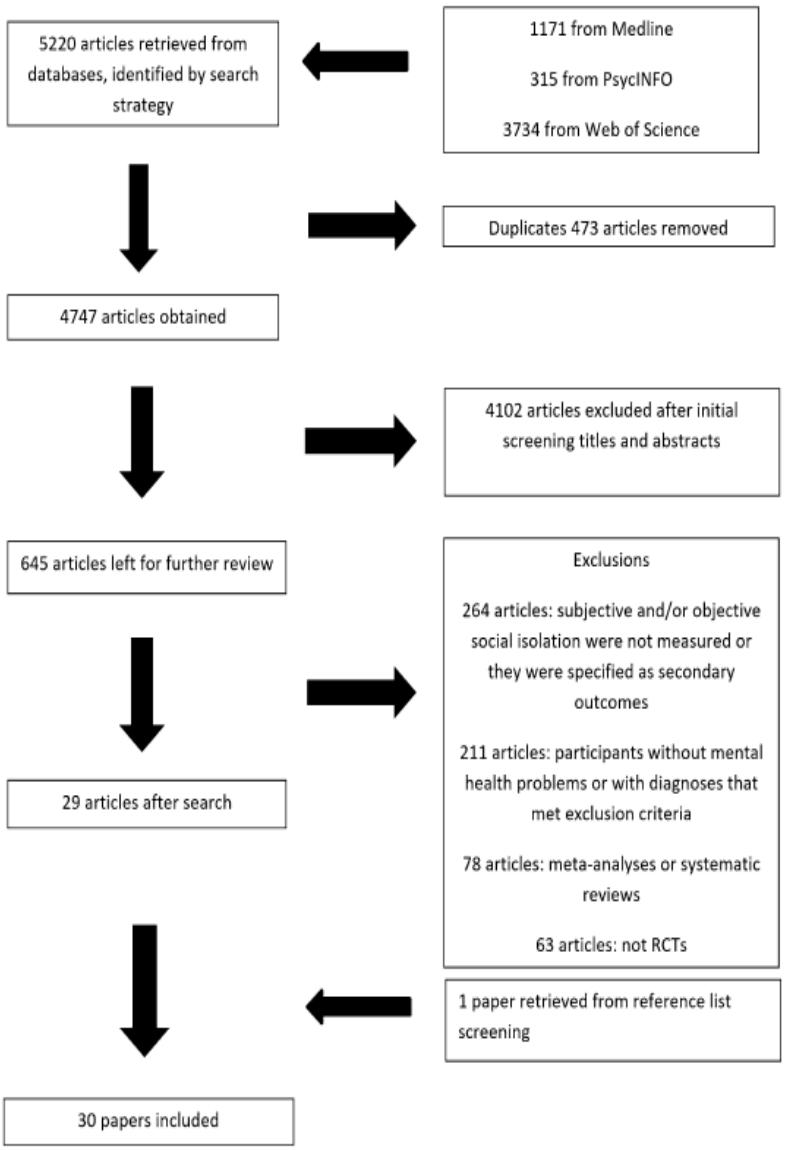

Fig. 1 PRISMA diagram for literature search

individually, nine interventions were delivered in groups, four involved individual and group support, and four were implemented online. Ten trials compared different active treatments, four of which had no control group. The remaining 20 trials compared intervention groups with a control group: 13 involved treatment-as-usual groups, 5 involved waiting-list controls, and 2 involved no-treatment controls.

Interventions to reduce subjective social isolation

Fifteen trials included subjective social isolation as primary outcome, or as one of several outcomes with none specified as primary (Table 1).

Two trials included only end-of-treatment outcomes [42, 43]. The follow-up period of the other 13 trials ranged from 1 week to 36 months beyond the end of treatment. The Multidimensional Scale of Perceived Social Support (MSPSS) and UCLA Loneliness Scale were frequently administered. The measures used in 14 trials have been shown to have good validity and reliability, but one trial [44] did not use a well-established scale. Nine trials involved people with common mental illnesses (e.g. depression), three involved people with severe mental illnesses (e.g. schizophrenia), and three included people with a variety of mental health diagnoses. The majority of the trials had small sample sizes (< 100); only four trials had more than 200 participants. Five trials included a sample size calculation.

Three trials involved online interventions, one trial combined online intervention and telephone support, four trials implemented face-to-face group intervention, five used face-to-face individual therapy, and the remaining two

Table 1 Trials that included subjective social isolation as outcome

Main author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Group-based intervention					
Hasson-Ohayon [42]—210 adults with severe mental illness Psychiatric community rehabilitation centre in Israel (secondary care setting)	Psychoeducation, social skills training	Illness Management and Recovery Programme vs. treatment-as-usual control group Duration: 8 months	End-of-treatment follow-up (8 months)	Subjective social isolation outcome: the Multidimensional Scale of Perceived Social Support (MSPSS) [57] Other outcome: personal recovery	No significant changes in perceived social support for either group. $p > 0.05$[a]
Silverman [43]—96 adults with varied Axis I diagnoses Acute care psychiatric unit in a University hospital, the Midwestern region in the US (secondary care setting)	Psychoeducation	Live educational music therapy (condition A), recorded educational music therapy (condition B), education without music (condition C), recreational music therapy without education (condition D) Duration: 24 weeks	End-of-treatment follow-up (24 weeks)	Subjective social isolation outcome: the MSPSS [57]	No significant between-group difference in total perceived social support for condition A vs. B, condition A and B vs. condition C, as well as for condition A and B vs. D (all $p > 0.05$) ($F(3.87) = 1.50$, $p = 0.22$) Partial effect size = 0.028 for support from significant other, 0.015 for support from family, 0.094 for support from friends, and 0.049 for total support Only a significant between-group difference between condition A vs. D on a friend subscale, 95% CI (0.47, 10.40), adjusted $p = 0.02$, mean difference = 5.34
Boevink [44] - 163 adults with mental illness Mental health care organisations (community treatment team and sheltered housing organisations) in the Netherlands (secondary care setting)	Supported socialisation	Toward Recovery, Empowerment and Experiential Expertise (TREE) + care-as-usual vs. care-as-usual control group Duration: 104 weeks for early starters and 52 weeks for late starters	1 medium-term follow-up: 12 months (post-baseline) 1 long-term follow-up: 24 months (post-baseline)	Subjective social isolation outcome: the De Jong-Gierveld Loneliness Scale [58] Other outcomes: quality of Life; psychiatric symptoms	No between-group difference in loneliness, 95% CI (−0.31, 0.30) (effect size linear tread $B = -0.053$, $p = 0.98$), standardised effect size was −0.001 for each year of exposure to TREE programme

Table 1 (continued)

Main author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Eggert [45]—105 high school students with poor grades (moderate or severe depression) 5 urban high schools in the US (general population setting)	Supported socialisation, social skills training and wider community approaches	Assessment protocol plus 1-semester Personal Growth Class (PGCI) vs. Assessment protocol plus a 2-semester Personal Growth Class (PGCII) vs. an assessment protocol-only Duration: 5 months or 90 class days in length for PGCI, and 10 months or 190 class days in length for PGCII	2 medium-term follow-ups: 5 and 10 months (post-baseline)	Subjective social isolation outcomes: perceived social support was measured by calculating average ratings across 6 network support sources. Instrumental and expressive support provided by each network support source (e.g. family, friends) was also rated on a scale Other outcome: depressive symptoms	All 3 groups showed increased network social support F linear $(1,100) = 32.08$, $p < 0.001$ No significant between-group difference between all groups F linear $(1,100) = 1.98$, $p = 0.143$
Individual-based intervention					
Zang [46]—30 adults aged 28–80 with post-traumatic stress disorder (PTSD) Beichuan County in China (general population setting)	Changing cognitions	Narrative Exposure Therapy (NET) vs. Narrative Exposure Therapy Revised (NET-R) vs. waiting-list control group Duration: 2 weeks for NET and 1 week for NET-R group	End-of-treatment follow-up (2 weeks for NET, 1 week for NET-R) 2 medium-term follow-ups: 1 week (for NET) or 2 weeks (for NET-R), and 3 months	Subjective social isolation outcome: the MSPSS [57] Other outcomes: anxiety and depressive symptoms; PTSD symptoms	Both NET and NET-R showed effects on perceived social support after treatment, but no significant between-group difference between the two groups $(F\ (2,26) = 0.14$, $p > 0.05)$ No significant between-group difference between either treatment group (NET and NET-R) and the waiting-list control in perceived social support (both $p > 0.05$)
Zang [47]—22 adults aged 37–75 with PTSD Beichuan Country in China (general population setting)	Changing cognitions	NET intervention vs. waiting-list control group Duration: 2 weeks	End-of-treatment follow-up (2 weeks) 2 medium-term follow-ups: 2 weeks, and 2 months	Subjective social isolation outcome: the MSPSS [57] Other outcomes: subjective level of distress; depressive symptoms	No significant between-group difference in perceived social support $(F\ (1,19) = 4.25$, $p = 0.05$, $d = 0.33)$
Gawrysiak [48]—30 adults aged ≥ 18 with depression A public Southeastern University in the US (general population setting)	Psychoeducation, social skills training and supported socialisation	Behavioural Activation Treatment for Depression (BATD) vs. no-treatment control group Duration: single session lasted 90 min	1 medium-term follow-up: 2 weeks	Subjective social isolation outcome: the MSPSS [57] Other outcomes: depressive symptoms; anxiety symptoms	No significant between-group difference in perceived social support $(F\ (1,28) = 3.11$, $p = 0.08$, $d = 0.70)$

Table 1 (continued)

Main author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Conoley [49]—57 female psychology undergraduate students with moderate depression University Psychology department in the US (general population setting)	Changing cognitions	Reframing vs. self-control vs. waiting-list control group Duration: 2 weeks	End-of-treatment follow-up (2 weeks) 1 medium-term follow-up: 2 weeks	Subjective social isolation outcome: the Revised University of California Los Angeles (UCLA) Loneliness Scale [59]; The Causal Dimension Scale [60] Other outcome: depressive symptoms	No significant treatment effect was found (F (2,108) = 0.60, $p > 0.05$[b])
Bjorkman [50]—77 adults aged 19–51 with severe mental illness Case management service in Sweden (secondary care setting)	Social skills training	The case management service vs. standard care Duration: unclear	2 long-term follow-ups: 18 and 36 months	Subjective social isolation outcome: the abbreviated version of the Interview Schedule for Social Interaction (ISSI) [61] Other outcomes: psychiatric symptoms; quality of life; use of psychiatric services	No significant between-group difference between two groups in social outcomes ($p > 0.05$)[c]
Mixed-format (group- and individual-based)					
Mendelson [51]—78 depressed women aged 14–41 who were either pregnant or had a child less than 6 months old Home visiting programme in Baltimore City in the US (general population setting)	Changing cognitions	Standard home visiting services + The Mother and Babies (MB) course vs. standard home visiting services + information on perinatal depression Duration: 6 weeks	End-of-treatment follow-up (6 weeks) 2 medium-term follow-ups: 3 and 6 months	Subjective social isolation outcome: the Interpersonal Support Evaluation List (ISEL) [62]	No significant between-group difference in perceived social support, $\beta = 6.67$, SE = 0.03, $p < 0.10$[d]
Masia-Warner [52]—35 high school students with social anxiety disorder 2 parochial high schools in New York, US (general population setting)	Psychoeducation/social skills training, supported socialisation and changing cognitions	Skills for Social and Academic Success vs. waiting-list control group Duration: 3 months	End-of-treatment follow-up (3 months) 1 medium-term follow-up: 9 months	Subjective social isolation outcome: Loneliness Scale [63] Other outcomes: anxiety symptoms; social phobic symptoms; depressive symptoms	No significant treatment effect, effect size = 0.20[e], $p > 0.05$
Online intervention					
Kaplan [53]—300 adults with schizophrenia spectrum or affective disorder Online in the US (general population setting)	Supported socialisation	Experimental peer support listserv vs. experimental peer support bulletin board vs. waiting-list control group Duration: 12 months	2 medium-term follow-ups: 4 and 12 months (post-baseline)	Subjective social isolation outcome: the Medical Outcomes Study (MOS) Social Support Survey [64] Other outcomes: personal recovery; quality of life; psychiatric symptoms	No significant between-group difference on MOS (F (1,298) = 0.08, p = 0.93), also not significant when two experimental groups compared to the control group separately ($p > 0.05$)

Table 1 (continued)

Main author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Social isolation and other outcome measures	Subjective social isolation outcomes
Rotondi [54]—30 patients aged ≥ 14 with schizophrenia or schizoaffective disorder In- and out-patient psychiatric care units and psychiatric rehabilitation centres in Pittsburgh, Pennsylvania (secondary care setting)	Psychoeducation	Telehealth intervention vs. usual care group Duration: unclear	2 medium-term follow-ups: 3 and 6 months (post-baseline)	Subjective social isolation outcome: the informational support and emotional support subscales of the instrument that was developed by Krause and Markides [65]	No significant between-group difference on perceived social support (F (1,27) = 3.79, p = 0.062)
O'Mahen [55]—83 women aged > 18 with major depressive disorder (MDD) Online in the UK (general population setting)	Psychoeducation and supported socialisation	Netmums Helping with Depression (HWD) vs. treatment-as-usual control group Duration: unclear	End-of-treatment follow-up (unclear) 1 medium-term follow-up: 6 months	Subjective social isolation outcome: the Social Provision Scale [66] Other outcomes: depressive symptoms; anxiety symptoms	No significant between-group difference in perceived support between the intervention and control group (95% CI 1.02, − 0.02), medium effect size = 0.50 (p = 0.27)
Interian [56]—103 veterans with PTSD Online in the US (primary care setting)	Psychoeducation and changing cognitions	The Family of Heroes intervention vs. no-treatment control group Duration: unclear	1 medium-term follow-up: 2 months (post-baseline)	Subjective social isolation outcome: the family subscale of the MSPSS [57]	Intervention group reported a higher chance of having a decreased perceived family support over time than the control group (p = 0.04)[f]

[a]Effect size, confidence interval and actual p value not available in the paper

[b]Confidence interval and actual p value not available in the paper

[c]Effect size, confidence interval and actual p value not available in the paper

[d]Effect size and confidence interval not available in the paper

[e]Confidence interval and actual p value not available in the paper

[f]Effect size not available in the paper

combined both group and individual formats. Interventions in two trials involved supported socialisation, four trials evaluated psychoeducation/social skills training, four had cognition modification elements, and five trials mixed different intervention types. The duration of the interventions ranged from 1 week to 104 weeks, while such information was missing in four trials and one trial involved only a single intervention session (Appendices 4 and 5).

Regarding quality assessment, method of randomisation was mentioned in half of the trials. Information on allocation concealment, missing data, and blinding were not sufficiently described in most trials. For detailed quality assessments, please see Appendix 6.

Of the ten trials that compared an active intervention with a control group [42, 44, 47, 48, 50–52, 54–56], none of the authors reported a significant between-group difference. In the five trials comparing at least two different active interventions [43, 45, 46, 49, 53], only Silverman and colleagues [43] found significant between-group differences, reporting a greater improvement in perceived social support from friends (measured by MSPSS friend subscale) in an intervention group involving both music therapy and psychoeducation than in other treatment groups (e.g. music alone). However, differences were not found in other outcomes and this trial did not involve a waiting-list or treatment-as-usual control. As most trials had small samples and lacked sample size calculations, clear conclusions cannot be drawn from negative results.

Eleven out of 15 trials included measures of other relevant outcomes [42, 44–50, 52, 53, 55]. Of these 11 trials, positive outcomes were reported by authors of seven trials. Improved depressive symptoms were reported in trials of interventions with mixed strategies with the following participant groups: adults in the community [48], urban high schoolers [45], and women with major depressive disorders [55]. Another mixed intervention had an effect on social avoidance and social phobia among high school students [52]. A diagnostically mixed participant group exhibited improved progress towards personal recovery and personal goals with psychoeducation/social skills training [42], and a mixed sample who received supported socialisation [44] also reported an improvement in quality of life. However, results on some outcomes in some of the trials did not show significant differences: an intervention with positive results for depression did not improve anxiety [48]; a case management service was not associated with any change in quality of life [50]; an online intervention for people with schizophrenia did not lead to any differences in quality of life or symptoms [53].

Interventions to reduce objective social isolation

Eleven trials included objective social isolation as primary outcome, or as one of several outcomes with none identified as primary (Table 2).

Of 11 trials, one trial [67] only included end-of-treatment outcomes. The follow-up period of the other ten trials ranged from 4 weeks to 2 years beyond the end-of-treatment. In eight trials, validated objective social isolation scales were used. In one trial, objective social isolation was measured by summarising the number, frequency, and type of social connections [73], one trial combined both methods [70], and we could not establish the validity of the measure used in another trial because too little detail was provided [71]. Three trials included people with common mental health problems, six trials involved people with severe mental illnesses, and two trials included diagnostically mixed populations. Most trials involved fewer than 100 participants, and only two had more than 200. Three trials included a sample size calculation.

Seven trials were implemented in an individual format, three were group-based interventions, and one involved both group and individual sessions, plus telephone support. Two trials involved a psychoeducation component/social skills training, one included supported socialisation opportunities, the intervention type of another trial was unclear, and the other seven trials involved interventions with multiple components. The duration of the interventions ranged from 12 weeks to 2 years where this was specified, but such information was not given in four trials (Appendices 4 and 5).

A description of the randomisation process was only included in three trials. Allocation concealment detail was described in five trials. Authors of seven trials did not report how they dealt with missing data. For detailed quality assessments, please see Appendix 6.

Of the six trials that compared an active treatment group with a control group [67–69, 71, 73, 76], findings of four trials suggested superior outcomes for their intervention groups over their control groups on objective social isolation measures: a psychoeducation programme for adults with schizophrenia [67], a social network intervention for people diagnosed with schizophrenia spectrum disorders [73], a preventive senior centre group for seniors with mild depression [69], and Social Cognition and Interaction Training (SCIT) for patients with various diagnoses [68]. One trial involving social education for people with schizophrenia and one trial involving home assessment teams for people with mood disorders did not lead to any improvements in objective social isolation [71, 76].

Of the five trials that compared different active interventions [70, 72, 74, 75, 77], positive findings were reported in two trials. One trial included systematic desensitisation and social skills training interventions: both were found to be superior to the control group for increasing social contacts in

Table 2 Trials that included objective social isolation as outcome

Main author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Objective social isolation and other outcome measures	Objective social isolation outcome
Group-based intervention					
Atkinson [67]—146 registered patients with schizophrenia Community clinic in south Glasgow, UK (secondary care setting)	Psychoeducation	The education group vs. waiting-list control group Duration: 20 weeks	End-of-treatment follow-up (20 weeks) 1 medium-term follow-up: 3 months	Objective social isolation outcome: a modified Social Network Schedule (SNS) [78] Other outcomes: quality of life; psychiatric symptoms; overall functioning	Significant between-group difference in the total number of contacts after the intervention ($t=4.4$, $p<0.001$) and at follow-up ($t=3.6$, $p<0.001$). Significant between-group difference in the number of confidants after the intervention ($t=3$, $p=0.004$) and at follow-up ($t=2.8$, $p=0.006$) Significant between-group difference over time from post-group ($t=2.8$, $p=0.007$) to follow-up ($t=2.5$, $p=0.02$)
Hasson-Ohayon [68]—55 adults aged 21–62 with various mental illness 3 psychiatric rehabilitation agencies and the University Community Clinic in Bar-Ilan University, Israel (secondary care setting)	Wider community approaches, psychoeducation/social skills training and changing cognitions	Social Cognition and Interaction Training (SCIT) + social mentoring vs. social mentoring only Duration: unclear	1 medium-term follow-up: 6 months	Objective social isolation outcome: the socio-engagement and interpersonal-communication subscales of the Social Functioning Scale (SFS) [79]	Experimental group showed significantly more improvement in social engagement than the controls (F (1,53) = 28.9, $p<0.001$, effect size = 0.35), but no significant between-group difference for the interpersonal communication subscale (F (1,53) = 0.55, $p=0.464$, effect size = 0.01)
Bøen [69]—138 seniors with mild depression 2 Municipal districts in eastern and western Oslo, Norway (general population setting)	Supported socialisation and wider community approaches	A preventive senior centre group programme vs. waiting-list control Duration: 1 year	End-of-treatment follow-up (1 year)	Objective social isolation outcome: the Oslo-3 Social Support Scale [80][a] Other outcomes: depressive symptoms; life satisfaction	Both groups had an increased level of social support, but greater improvement in the intervention group than the control group, $d=0.12$, 95% CI (−0.47, 0.81).
Individual-based intervention					
Solomon [70]—96 adults with schizophrenia or major affective disorders A community mental health centre in the US (secondary care setting)	Supported socialisation and wider community approaches	Consumer management team vs. non-consumer management team Duration: unclear	2 medium-term follow-ups: 1 month and 1 year (post-baseline)	Objective social isolation outcomes: family and social contacts; Pattison's Social Network Scale [81] Other outcomes: use of services; quality of life; psychiatric symptoms	No significant between-group difference in social networks ($p>0.05$)[b] On average, participants identified 2.72 persons in their social network, 1.55 positive network members and 1.60 family members
Aberg-Wistedt [71]—40 adults with schizophrenia or long-term psychotic disorder The Kungsholmen sector in Stockholm, Sweden (secondary care setting)	Psychoeducation/social skills training	The intensive case management programme vs. standard services Duration: 2 years	One long-term follow-up: 2 years (post-baseline)	Objective social isolation outcome: the number of people in participants' social life was measured by a standardised procedure developed from work with child psychiatric patients [82] Other outcomes: quality of life; service use	Social network of the experimental group increased, while it decreased for the control group, but no significant between-group difference ($p>0.004$)[c]

Table 2 (continued)

Main author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Objective social isolation and other outcome measures	Objective social isolation outcome
Stravynski [72]—22 adults aged 22–57 with diffuse social phobia and avoidant personality disorder The Maudsley hospital in London, UK (secondary care setting)	Social skills training and changing cognitions	Social skills training vs. Social skill training + cognitive modification Duration: 14 weeks	End-of-treatment follow-up (14 weeks) 1 medium-term follow-up: 6 months	Objective social isolation outcome: objective social isolation subscale of the Structured and Scaled Interview to Assess Maladjustment (SSIAM) [83] Other outcome: depressive symptoms	No significant between-group difference in social isolation, all groups reported less experience of social isolation over time $p > 0.05$[d]
Terzian [73]—357 adults aged < 45 diagnosed as on the schizophrenia spectrum by the ICD-10th 47 community mental health services (SPT) in Italy (secondary care setting)	Supported socialisation and wider community approaches	Social network intervention + usual treatments vs. usual treatments Duration: 3–6 months	1 medium-term follow-up: 1 year (post-baseline) 1 long-term follow-up: 2 years (post-baseline)	Objective social isolation outcome: social networks measured by different parameters of relationships were assessed, all were summarised into a score Other outcomes: psychiatric symptoms; hospitalisation over the follow-up year	In this paper, a social network improvement was defined as an increase in the number, frequency, importance or closeness of relationships, and an overall social network improvement was definied as an improvement in intimate or working relationships. Significant between-group differences in the improvement of social network and overall social network improvement were found An improvement in social network was found at year 1 in 25% of patients in control group and 39.9% of patients in the experimental group (OR 2.0, 95% CI 1.3–3.1; AOR 2.4, 95% CI 1.4–3.9) At year 1, an overall social network improvement was reported for 30.8% of the routine group and 44.5% of the experimental group (OR 1.8, 95% CI 1.2–2.8; AOR 2.1, 95% 1.3–3.4) These differences remained significant at year 2 for social network improvement (31.5% in the control group and 45.5% in the experimental group, OR 1.8, 95% CI 1.1–2.8; AOR 2.1, 95% CI 1.3–3.5) and for overall social network improvement (33.3% for routine group, 47.9% for the experimental group, OR 1.8, 95% CI 1.2–2.9; AOR 2.2, 95% CI 1.3–3.5)

Table 2 (continued)

Main author, sample and setting	Intervention categorisation	Intervention name and duration	Follow-up	Objective social isolation and other outcome measures	Objective social isolation outcome
Solomon [74]—96 adults with schizophrenia or major affective disorders A community mental health centre in the US (secondary care setting)	Supported socialisation and wider community approaches	Consumer case management team vs. nonconsumer management team Duration: 2 years	2 medium-term follow-ups: 1 month and 1 year (post-baseline) 1 long-term follow-up: 2 years (post-baseline)	Objective social isolation outcome: Pattison's Social Network [81] Other outcomes: quality of life; psychiatric symptoms	No significant between-group difference in social outcome; also no significant time and condition effect (F (12,78) = 1.19, p > 0.05[e])
Marzillier [75]—21 adults aged 17–43 with a diagnosis of personality disorder or neurosis The Maudsley Hospital in London, UK (secondary care setting)	Social skills training and changing cognitions	Systematic Desensitisation (SD) vs. Social Skills Training (SST) vs. waiting-list control Duration: 3.5 months	End-of-treatment follow-up (3.5 months) 1 medium-term follow-up: 6 months	Objective social isolation outcome: Revised-Social Diary and Standardised interview Schedule [75] Other outcomes: anxiety disorders; mental state; personality assessment	No between-group difference between SST and SD in social activities and social contacts (p > 0.05) SST had a greater improvement in the range of social activities (F (1,18) = 7.56, p < 0.025) and social contacts (F (1,18) = 9.47, p < 0.0.01) than the waiting-list group SD had a greater increase in social contacts than the waiting-list group (F (1,18) = 12.46, p < 0.001)
Cole [76]—32 adults with major depression, dysthymic disorder or other affective disorder St. Mary's Hospital in Montreal, Canada (primary care setting)	Nonspecific type (intervention group received a psychaitric assessment at home, compared to a standard treatment group who received an assessment at clinic)	Home assessment group vs. clinic assessment group (treatment-as-usual) Duration: unclear	3 medium-term follow-ups: 4, 8 and 12 weeks (post-baseline)	Objective social isolation outcome: Social Resources (SR) subscale from The Older Americans Research and Service Centre Instrument (OARS) [84] Other outcomes: mental state; psychiatric symptoms	No significant between-group differences in social resources (p > 0.05)[f]
Mixed format (group- and individual-based)					
Rivera [77]—203 adults with a psychotic or mood disorder on axis I An inpatient unit in a city hospital in New York, US (secondary care setting)	Supported socialisation	Peer-assisted care vs. Nonconsumer assisted vs. standard care vs. clinic-based care Duration: unclear	2 medium-term follow-ups: 6 and 12 months (post-baseline)	Objective social isolation outcome: a modification of the Pattison Network Inventory [85] Other outcomes: quality of life; psychiatric symptoms	Only peer-assisted group showed an increase in social contacts from baseline to 12-month follow-up (F (2, 118) = 7.25, p < 0.01, effect size = 0.11) No significant between-group difference in other network measures (p > 0.05)

[a]Due to the fact that the Oslo-3 scale focuses primarily on the practical aspects of social support, Bøen's study was considered as a study only of objective social isolation

[b]Effect size, confidence intervals, and actual p value not available in the paper

[c]Effect size, confidence intervals, and actual p value not available in the paper; the significant level used in this study was p < 0.004

[d]Effect size not available in the paper

[e]Effect size, confidence interval, and actual p value not available in the paper

[f]Effect size, confidence interval, and actual p value not available in the paper

a sample with personality or mood disorders, although there was no between-group difference between the two active treatment groups [75]. Rivera and colleagues [77] reported an increased contact with staff for participants receiving a consumer-provided programme, compared to non-consumer support. However, Solomon and colleagues [70, 74] also compared consumer versus non-consumer provided mental health care in their two studies and found no significant differences between the groups, or compared to a control group, in social network size or clinical outcomes. Stravynski and colleagues examined whether adding a cognitive modification component to social skills training for people with social phobia and/or avoidant personality disorders improved its effectiveness [72], but found no significant difference between groups. Therefore, the overall evidence regarding the effectiveness of consumer-provided intensive case management for objective social isolation is unclear.

Other relevant outcomes were included in 10 out of 11 trials [67, 69–77]. Of these ten trials, positive findings were reported in four trials: improved mental state was reported by Rivera and his team, who evaluated a supported socialisation intervention for adults with schizophrenia, other psychotic disorders or mood disorders [77]; reduced depression and social avoidance were reported by Stravynski and colleagues, who evaluated a mixture of strategies for people with social phobia and/or avoidant personality disorder [72]. Atkinson and colleagues also reported a greater quality of life when psychoeducation/social skills training was offered to people with schizophrenia [67], and fewer emergency visits were also reported for a cohort of people with schizophrenia and psychotic symptoms receiving psychoeducation/social skills training [71]. However, Solomon and her team found no differences in psychiatric symptoms or service use for participants who received consumer-led case management [70, 74], and no clinical differences were reported by Terzian and colleagues in a social network intervention for people with schizophrenia [73].

Interventions targeting both subjective and objective social isolation

Four trials included both subjective and objective social isolation as outcomes (Table 3).

One trial [86] only included end-of-treatment outcomes. The follow-up period was between 2 weeks and 6 months in the other three trials [87–89]. Measures with established reliability and validity were used in three trials, but the measure in one trial [86] was developed by the team and not clearly described. One trial included people with common mental health problems, two included people with severe mental illness, and one included people with a variety of different mental health diagnoses. Two trials had fewer than 100 participants and only one had more than 200. A sample size calculation was included in one trial.

One trial involved an individual intervention, two trials involved group interventions, and one trial combined individual, group and phone elements. The length of interventions ranged from 3 to 8 months. One trial was of a supported socialisation intervention, two of cognitive modification, and another used a mixture of strategies (Appendices 4 and 5).

Two trials were judged as at low risk of bias for sequence generation, two trials were at low risk for allocation concealment, and only one trial included a strategy for missing data. All trials were at high risk of bias for their blinding process and other sources of bias, but all were at low risk for selective outcome reporting (Appendix 6).

In all four trials, an intervention group was compared to either a waiting-list or a treatment-as-usual control group. Significant between-group differences in subjective social isolation were demonstrated in three out of four trials: a peer support group for adults with psychosis [86], a group-based intervention involving showing humorous movies for adults with schizophrenia [87], and in-home cognitive behavioural therapy for women with major depressive disorders [88]. Of the three trials in which a significant effect on subjective isolation was reported, significant effects on objective social isolation were also reported in two trials [86, 87]. Schene and colleagues [89] did not find any significant between-group differences for either outcome in a diagnostically mixed sample receiving psychiatric day treatment, compared to standard inpatient care.

In terms of other relevant outcomes, reduction in symptoms were reported by authors in three out of four trials: by Schene and colleagues who examined a mixture of strategies for people with a range of diagnoses [89], by Ammerman and his team who evaluated an intervention with a cognitive modification component for women with depression [88], and by Castelein and colleagues, who evaluated a supported socialisation intervention for people with schizophrenia [86]. Castelein and colleagues also reported additional benefits for quality of life.

Overall results

Table 4 summarises the results for each type of intervention for subjective and objective social isolation, including the ones targeting both subjective and objective social isolation.

Of all the trials that included a subjective social isolation measure (i.e. combining 15 trials including only a subjective social isolation measure and the four trials targeting both subjective and objective social isolation—19 trials in total), positive results were reported in two out of the six trials that examined interventions with a cognition modification component, one out of the three trials of supported socialisation, and one out of the four trials of social skills

training/psychoeducation programmes. Authors who evaluated mixed intervention strategies found no significant positive results. None of the trials evaluated wider community approaches alone.

Regarding all the trials which included an objective social isolation measure (i.e. 15 trials), findings from one out of the two trials that involved changing cognitions, one out of the two trials that examined social skills training and psychoeducation, three out of the eight trials with a mixed intervention strategy, as well as all trials (i.e. two trials) that provided supported socialisation, suggested improvements in objective social isolation. No included trials for objective social isolation involved wider community approaches alone. Small samples and lack of sample size calculations need to be borne in mind throughout.

In many of the included trials, subjective and/or objective social isolation was one of several outcomes (with no clearly specified primary outcome), and for some trials, strategies to reduce social isolation were part of an often much broader service improvement approach (e.g. [70, 74, 76, 89]). Just six trials [43, 72, 73, 75, 86, 87] had a measure of social isolation as the clearly stated primary outcome. Four out of these six trials included either a waiting-list or a treatment-as-usual control group [73, 75, 86, 87], and findings from all of these indicated a superior effect of their intervention compared to the control condition on the trials' objective social isolation outcomes. In these trials, one intervention involved mixed strategies for adults with schizophrenia [73]; one involved supported socialisation for adults with schizophrenia/psychosis [86]; one compared two treatment groups (i.e. systematic desensitisation and social skills training) to a waiting-list control in a sample of people with personality disorders or neurosis [75]; and another trial investigated an intervention with a cognitive modification component for adults with schizophrenia [87]. Similar to Marzillier's trial [75], Stravynski and colleagues [72] also offered cognitive modification and social skills training to a comparable sample. Stravynksi's trial involved a very small sample and the authors failed to find any additional improvement when a cognitive modification element was added to their social skills training. In one trial of four active conditions without a control group, for people with varied Axis I mental health diagnoses (e.g. depression, bipolar disorders) [43], the authors reported a positive effect of its psychoeducation component over other intervention groups (e.g. music alone), though only on one outcome: perceived social support from friends. In most trials in which subjective or objective social isolation was specifically targeted as the primary outcome, and interventions were tailored accordingly, positive results were reported: this specific focus may be important for intervention effectiveness.

Discussion

With growing interest in tackling subjective and objective social isolation due to the negative health impact of both issues, we conducted the current systematic review to summarise evidence from RCTs for interventions with subjective and/or objective social isolation as main outcome(s) in people with mental health problems. Given the quality and sample size of many included studies, conclusions need to be cautious. The strategies found were extremely diverse. A tendency not to clearly specify primary outcomes in earlier trials meant that some of the trials meeting our criteria were broad socially oriented programmes in which social isolation measures were among a number of outcomes. The great diversity of interventions and low quality of reporting in some trials made meta-analysis inappropriate.

A small number of mainly small trials (in a mixture of populations) provided some evidence that perceived social support may be increased by interventions that involve cognitive modification (e.g. [88]), although there were also some trials, generally with short follow-ups in which an effect was not found (e.g. [46, 47]). Small sample sizes and lack of sample size calculations make it difficult to draw firm conclusions from the negative studies. In terms of psychoeducation/social skills training programmes (e.g. [42, 43]), no clear supporting evidence was found for subjective social isolation, although an evaluation of one educational intervention found positive results on one subscale [43]. Again, the lack of large well-powered trials with clearly focused interventions makes definitive conclusions hard to draw.

There is also evidence supporting some of the interventions targeting objective social isolation (e.g. [67–69]). However, studies included a wide range of types of intervention, none of which can be identified as clearly more effective than others. Group-based interventions and interventions involving supported socialisation appeared to have more evidence supporting their effectiveness in reducing objective social isolation than they do for subjective social isolation. All objective social isolation interventions delivered in a group format demonstrated effectiveness, compared to only two out of eight individual-based interventions, though again, lack of power and of clear theory-driven methods for alleviating isolation diminish our confidence in making firm negative conclusions. For people with mental health problems (especially people with psychosis), initiating and maintaining good social relationships can be disrupted by several difficulties, including self-stigma, psychiatric symptoms, and societal discrimination [94]. Therefore, group-based interventions may offer a pathway to initiating social contacts and practising social skills in a relatively safe environment. It is of note that a good quality multicentre trial of peer support groups from the Netherlands, in which the

Table 3 Trials that included both subjective and objective social isolation as outcomes

Main authors, sample and setting	Intervention categorisation	Intervention name	Follow-up	Subjective/objective social isolation and other outcome measures	Subjective social isolation outcomes	Objective social isolation outcomes
Group-based intervention						
Castelein [86]—106 adults aged≥ 18 with schizophrenia or related psychotic disorders 4 mental health centres in the Netherlands (secondary care setting)	Supported socialisation	Care as usual + Guided Peer Support Group (GPSG) vs. a waiting-list (WL) condition Duration: 8 months	End-of-treatment follow-up (8 months)	Subjective social isolation outcome: the Social Support List (SSL) [90] Objective social isolation outcome: Personal Network Questionnaire (PNQ) [86] Other outcomes: quality of life; screening for psychosis	Experimental group had a significantly greater increase in esteem support ($p=0.02$), compared to WL[a]	Experimental group had a significantly greater improvement in social contacts with peers after the sessions ($p=0.03$), compared to WL
Gelkopf [87]—34 adults with chronic schizophrenics by DSM-III-R 7 chronic schizophrenia wards in Israel (secondary care setting)	Changing cognitions	Video projection of humorous movies vs. treatment-as-usual control group Duration: 3 months	1 medium-term follow-up: 2 weeks	Subjective social isolation outcome: the Social Support Questionnaire 6 (SSQ6) [91] Objective social isolation outcomes: 2 measures of social network sum up the size and dispersion; 4 measures assess the source of the support	A significantly greater improvement in the experimental group than the control group, in perceived amount of support from staff ($F=7.90, p<0.01$), emotional support ($F=4.80, p<0.05$), and instrumental support, ($F=4.94, p<0.05$) No significant results in satisfaction towards the support ($F=1.90$, $p>0.05$[b])	A significantly greater improvement in the experimental group than the control group in the number of supporters ($F=4.87, p<0.05$)
Individual-based intervention						
Ammerman [88]—93 females aged from 16–37 with MDD A community-based home visiting programme in Southwestern Ohio and Northern Kentucky in the US (general population setting)	Changiing cognitions	In-Home Cognitive Behavioural Therapy (IH-CBT) + home visiting vs. home visit alone Duration: about 5 months	End-of-treatment follow-up (5 months) 1 medium-term follow-up: 3 months	Subjective social isolation outcome: Interpersonal Support Evaluation List (ISEL) [62] Objective social isolation outcome: Social Network Index (SNI) [92] Other outcome: psychiatric symptoms	IH-CBT group reported a greater increase in social support ($p<0.001$) than SHV. Small effect size for social support (0.38) at post-treatment, and moderate effect size (0.65) at follow-up	No significant between-group difference in network size ($F=1.88$, $p>0.05$), network diversity ($F=0.63, p>0.05$), and embedded networks ($F=2.23, p>0.05$)[c]

Table 3 (continued)

Main authors, sample and setting	Intervention categorisation	Intervention name	Follow-up	Subjective/objective social isolation and other outcome measures	Subjective social isolation outcomes	Objective social isolation outcomes
Mixed format (group- and individual-based)						
Schene [89]—222 adults aged > 60 with various mental disorders University Psychiatric Clinic of the Academic Hospital in Utrecht, the Netherlands (secondary care setting)	Psychoeducation/social skills training, and supported socialisation	Psychiatric day treatment vs. inpatient treatment (treatment-as-usual) Duration: on average 37.6 weeks for day treatment, and 24.9 weeks for inpatient treatment	End-of-treatment follow-up (on average 37.6 weeks for day treatment, 24.9 weeks for inpatient treatment) 1 medium-term follow-up: 6 months	Subjective and objective social isolation outcomes: Social Network and Social Support Questionnaire (SNSS) [93] Other outcomes: mental state; psychiatric symptoms; social dysfunction	No significant between-group difference in social support ($F = 0.20, p > 0.05$), and no change over time ($F = 1.25, p > 0.05$)[d]	No significant between-group difference in network scope ($F = 0.05$, $p > 0.05$) and network contacts ($F = 0.02$, $p > 0.05$)

[a]Effect size and confidence interval not available in the paper
[b]Effect size, confidence interval and actual p value not available in the paper
[c]Effect size, confidence interval and actual p value not available in the paper
[d]Effect size, confidence interval and the actual p value not available in the paper

supported socialisation intervention led to increased social contact, did not improve subjective social isolation [8]. The supported socialisation interventions in our review did not have clear effects on subjective social isolation either. It thus seems possible that supported socialisation is more effective in reducing objective than subjective social isolation. There are two possible explanations: first, a lack of social relationships may not be the only factor contributing to subjective social isolation: social cognitions may also play a significant role [95]; second, organised groups may simply not be an effective way to help lonely people initiate meaningful friendships, start intimate relationships, or maintain or improve current relationships. However, most included studies were small and not informed by power calculations, so few definite conclusions can be drawn.

Some (e.g. [68, 69]), but not all (e.g. [70, 72]), interventions with multiple components appeared to have substantial impacts on improving objective social isolation. Solomon and her colleagues [70, 74] failed to find any significant between-group difference in their two trials, which demonstrated comparable effectiveness of consumer-provided and non-consumer provided support in terms of clinical and psychosocial outcomes. However, it must be noted that multi-component interventions often had multiple outcomes and multiple aims extending beyond alleviating social isolation: they met our inclusion criteria because social isolation was among a number of outcomes, with no specified primary outcome. Psychoeducation programmes/social skills training were evaluated in only two trials [67, 71]: only Atkinson found a significant change on their social isolation outcome, so the effectiveness of this type of intervention remains unclear. It is possible that, as suggested by Mann and colleagues [39], social skills training is more suitable for client groups who are preparing to attend wider community groups, or that it works best when combined with other types of interventions (e.g. [68]).

Cognitive modification has not been shown to be effective for objective social isolation: of the two trials using this technique to target objective social isolation [87, 88], significant changes were only observed in one trial [87] with a short follow-up period and a small sample size. In another trial [72], cognitive modification showed no additional benefits when added to social skills training, but the sample was very small and firm conclusions could not be drawn.

We did not find any relevant trial on interventions focusing on the wider community approaches alone, such as the social prescribing and community asset-development approaches described by Mann and her team [39]. It is possible that interventions where the focus is at community-level are difficult to evaluate via individually randomised trials, but such trials are potentially feasible for individual-level approaches such as social prescribing.

Table 4 Summary of different types of intervention and results: objective and subjective social isolation

Type of intervention	Comparison	Outcomes for subjective isolation	Outcomes for objective isolation
Changing cognitions	Intervention versus TAU or no treatment	2/4 studies found significant positive results	1/2 studies found significant positive results
	two or more active treatments	0/2 studies found significant positive results for one form of intervention over others	N/A
Social skills training and/or psychoeducation	Intervention versus TAU or no treatment	0/3 studies found significant positive results	1/2 studies found significant positive results
	Two or more active treatments	1/1 studies found significant positive results for one form of intervention over others	N/A
Supported socialisation	Intervention versus TAU or no treatment	1/2 studies found significant positive results	1/1 studies found significant positive results
	Two or more active treatments	0/1 studies found significant positive results for one form of intervention over others	1/1 studies found significant positive results for one form of intervention over others
Wider community approaches	Intervention versus TAU or no treatment	N/A	N/A
	Two or more active treatments	N/A	N/A
Mixed approaches (interventions with mixed components)	Intervention versus TAU or no treatment	0/5 studies found significant positive results	3/4 studies found significant positive results
	2 or more active treatments	0/1 studies found significant positive results for one form of intervention over others	0/4 studies found significant positive results for one form of intervention over others

Limitations

To the best of our knowledge, this systematic review is the first to provide an overall synthesis of evidence on the effectiveness of interventions for subjective and/or objective social isolation across a range of mental health diagnoses. But it has important limitations. First, we included trials in which subjective and/or objective social isolation was either a primary outcome or one of a list of outcomes with none specified as primary. This means that we have excluded some trials which might offer relevant evidence based on secondary outcomes, and we have included trials where social isolation is one of a list of outcomes, but may not have been clearly the principal target of the intervention. Few of the included trials involved theory-driven interventions for which social isolation was the clear main target. Second, the conclusions we have drawn are limited by the heterogeneity of the intervention types and patient groups, and the low methodological quality of many included trials. Each type of intervention was only evaluated in a small number of trials and the content of programmes varied greatly. Factors such as lack of information on randomisation processes and allocation concealment resulted in high ratings for risk of bias in many of the studies. Many studies were essentially feasibility or pilot trials, with small sample sizes and no underpinning power calculations: thus no clear conclusions could be drawn from either positive or negative results from these studies, including several trials comparing two or more active interventions. As expected, variations between studies regarding interventions, study participants and outcomes measurement methods precluded meta-analysis. Additionally, four trials did not include a well-established outcome measure (e.g. [45, 73]). Last, although there were no restrictions on the language of the included trials and no filter of language was used during the literature search, no eligible trials in other languages were retrieved. Great efforts were made to retrieve all relevant papers, but some trials in other languages may have been missed.

Research implications

Compared with objective social isolation and social support, the concept of loneliness has only recently been subjected to scientific research. This review identified few trials that included loneliness as their main outcome, and none yielded positive results. Recently published pilot trials have established that loneliness is a feasible target for intervention in severe mental illness, either through face-to-face or digital programmes [31, 96]. However, there is still a pressing need to evaluate interventions for loneliness scientifically in large-scale RCTs, given growing enthusiasm for these approaches. We have thus identified an important gap in the literature.

Some trials focusing on objective social isolation and perceived social support were retrieved, but some advances need to be made to develop a substantial body of evidence in this area. First, most trials were vague in articulating

a theoretical basis. The development of a clear theory of change is now regarded as an important step in the development of complex health interventions [97, 98]. Developing such theoretical models could helpfully be informed by a richer understanding of experiences of subjective and objective social isolation among people with mental health problems and their views about what may alleviate these. Thus a co-produced approach to intervention development may result in interventions with a more robust theoretical basis and a closer fit to recipients' needs. Second, greater advances are likely to be made in this area if future trials can specify interventions in greater detail, and if future systematic reviews use clear systems, such as those applied in this review, to categorise interventions. We found that the descriptions of most interventions were typically vague, and most involved several components and delivery methods. Thus the main components of each intervention were often unclear, and exactly which elements contributed to any positive outcomes was difficult to determine. However, this should not limit the development of future interventions with multiple components (e.g. interventions combining cognitive modification with addressing social/environmental barriers to social participation and developing social relationships). Cacioppo and colleagues [99] proposed that loneliness is a multi-dimensional concept, and there is a clear distinction between intimate, relational, and collective loneliness. Thus, as a complex multi-faceted phenomenon, loneliness may well need to be addressed through multiple means.

Computer/mobile technology has become a popular format for the implementation of interventions in the medical field. Online interventions, including online support groups or chatrooms, may potentially be an effective way to provide social support [100]. However, only four trials targeting online interventions were retrieved in the current review and none has shown positive effects. Authors from existing systematic reviews [101, 102] conclude that there is great future potential for the development and utilisation of mobile apps in the mental health field. Meta-analyses have also demonstrated the use of online interventions as an acceptable and practical method to deliver healthcare for people with depression and anxiety [103, 104]. Another systematic review examined the feasibility of web- and phone-based interventions for people with psychosis: authors supported the feasibility of such interventions, and reported a range of positive outcomes in some of the studies included, including improved social connectedness and socialisation [105]. However, only few trials included in this review were RCTs and social isolation was not generally a primary outcome so that studies were not eligible for inclusion in the current review. One pilot trial has also investigated a novel online intervention called HORYZONS for young people with First Episode Psychosis (FEP), and participants became more socially connected after using HORYZONS [106]. Currently, a full trial utilising a single-blind RCT design to evaluate the effectiveness of this intervention over an 18-month follow-up period is taking place for young people with FEP [107]. In another recent feasibility trial [96], authors developed a digital smartphone application (app) named +Connect, which sought to utilise a positive psychology intervention (PPI) for young adults with early psychosis. The programme was found to be effective in reducing loneliness from baseline to 3-month post-intervention follow-up. Programme users also highlighted the benefits in their social lives of positive reinforcement provided by the app. Thus, although digital interventions have been insufficiently tested in substantial RCTs to date, it is feasible to implement such interventions for people with severe mental health problems in order to reduce loneliness, and there is a need for future research to develop and further examine digital interventions on a larger scale. Additionally, the successful implementation of interventions involving positive psychology in the two pilot trials from Lim and her colleagues [31, 96] supports the idea that subjective social isolation is increasingly recognised as a primary treatment outcome for people with psychosis in the mental health field, and future research should also focus on the development and examination of new types of intervention that target loneliness directly for people with mental health problems.

Other forms of intervention that are so far untested but with potential to have effects on loneliness and social isolation include "friends interventions", which involve patients' friends in treatment with the aim of strengthening relationships [108] and other interventions aimed at reinvigorating or restoring existing relationships [109]. By focusing on existing social networks, this type of intervention has potential to improve the quality of social relationships already established prior to mental health diagnosis. Beyond the individual level, there is also potential for the development and robust evaluation of the impact on people with mental health problems of interventions on a larger scale, for example, aimed at developing social connections within groups, communities or neighbourhoods, or at maximising the use of existing community assets [39]. Interventions involving wider communities have been seen as crucial in providing social opportunities for people with mental health problems to engage with their local communities and increase their sense of belonging and self-confidence [39]. Indirect interventions targeting upstream factors that contribute to social isolation [110–113] are potentially effective, such as programmes to improve housing and reduce poverty.

Clinical implications

There is substantial evidence demonstrating the significant impact of objective and subjective social isolation on health. However, lack of empirical evidence on the efficacy

of targeted interventions means that we cannot yet make clear recommendations for interventions. As argued in a recent Lancet editorial [114], there is a need for life science funding prioritising under-researched social, behavioural, and environmental determinants of health. Subjective and objective social isolation are among the social determinants of health that have received insufficient attention. Some of the research we report does provide a starting point for further work: in a few studies there is some evidence of effectiveness, while other studies with small samples have at least demonstrated that interventions are feasible and acceptable.

To conclude, based on this systematic review, current evidence does not yet clearly support scaled-up implementation of any types of intervention for subjective or objective social isolation in mental health services. Even though cognitive modification shows some promise for subjective social isolation, and interventions with mixed approaches and supported socialisation have also demonstrated their effectiveness for objective social isolation, quality of these trials limited our confidence in publicising their effectiveness. Therefore, innovation in intervention development and more high-quality research is needed. We also note that there is much innovative and interesting practice in this field that is not currently underpinned by research, especially in the voluntary sector: defining, establishing the theoretical premises for and evaluating existing models may thus be a promising direction.

Acknowledgements SJ and BLE are partly supported by the NIHR Mental Health Policy Research Unit the UKRI Loneliness and Social Isolation in Mental Health Cross-Disciplinary Network, the UCLH NIHR Biomedical Research Centre and the NIHR Collaboration for Leadership in Applied Health Research and Care (CLAHRC) North Thames. FM is a Wellcome Clinical Research Training Fellow.

Author contributions SJ, BLE and RM conceived the review. SJ and BLE commented on search strategy and review protocol, JW recommended search terms. RM developed the search strategy and created review protocol, conducted the literature search, wrote and co-ordinated the drafts. RM, FM and AA independently contributed to the screening process. RM and FM extracted data. RM, FM and JT independently assessed the methodological quality of each included paper. RM screened reference lists of included studies and relevant systematic reviews and meta-analyses. SJ involved in any disagreement between reviewers in the screening process. SJ, BLE, FM and JW contributed comments to the drafts. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest The authors state that they have no conflicts of interest.

Appendix 1: Measures and scales for subjective and objective social isolation

	Measures	Description	For which populations
Subjective social isolation	The University of California at Los Angeles (UCLA) Loneliness Scale [115]	A unidimensional scale to assess the frequency and intensity of one's lonely experiences, 20 items	General population (e.g. elderly, lonely students, immigrants) People with mental health problems (e.g. psychiatric inpatients, people with depression)
	UCLS-8 [6]	A short-form of UCLA Loneliness Scale, 8 items	General population (e.g. university students, adolescents, elderly sample) People with mental health problems (e.g. people with depression, mixed sample with various diagnoses)
	The De Jong-Gierveld Loneliness Scale [116]	A 11-item scale measures the feeling of severe loneliness, contains 5 positive and 6 negative items A short-form contains 6 items of the original De Jong-Gierveld Loneliness Scale (3 items for emotional loneliness and 3 items for social loneliness)	General population (e.g. national survey samples from several countries, elderly Chinese) People with mental health problems (e.g. mixed samples with various diagnoses)
	Multidimensional Scale of Perceived Social Support (MSPSS) [57]	A 12-item scale to measure perceived overall amount of social support and support from significant other/friends/family	General population (e.g. Chinese university students, young adults, adults with physical disabilities) People with mental health problems (e.g. people with post-traumatic stress disorder, women with severe depressive symptoms)

	Measures	Description	For which populations
Objective social isolation	Social Network Index (SNI) [92]	A 12-item scale, measures the number of people one has regular contact with	General population (e.g. women with breast cancer, people with severe traumatic brain injury, African-Americans in urban area) People with mental health problems (e.g. old adults with depressive symptoms, people with post-traumatic stress disorder)
	The Pattison Psychosocial Kinship Inventory (PPKI) [117]	Measures the number of people and relationships one considers as important	General population (e.g. dysfunctional families) People with mental health problems (e.g. adults with schizophrenia, people with psychosis)
Measures focus on both domains	Lubben Social Network Scale (LSNS-6)	A revised version, contains 6 items, evaluates the quantity and quality of one's relationship with family and friends	General population (e.g. community-dwelling elderly, Korean American caregivers) People with mental health problems (e.g. mixed samples with different diagnoses, depressed immigrants)
	Social Network Schedule (SNS) [78]	A 6-item scale, measures both quantitative (i.e. the size of one's social network, the frequency of social communication and the time one spent on socialisation) and qualitative (i.e. quality and intimacy of one's social relationships, the intensity of social interactions) aspects of one's social connections	People with mental health problems (e.g. people with non-organic psychosis, people with intellectual disability)
	Medical Outcomes Study (MOS) Social Support Scale [64]	A 19-item survey measures dimensions of social support: emotional/informational, tangible, affectionate and positive social interactions	General population (people with heart failure in Hong Kong, mothers with children in treatment) People with mental health problems (e.g. adults with schizophrenia spectrum or affective disorder)
	Interview Schedule for Social interaction (ISSI) [61]	50 items, measures the availability and perceived adequacy of attachment and social integration	General population (e.g. patients with rheumatoid arthritis, people from Canberra suburbs) People with mental health problems (e.g. outpatients with schizophrenia, inpatient male offenders)

Appendix 2: Existing systematic reviews and meta-analyses

Authors (published years)	Published years of included studies	Review method	Included participants	How interventions were categorised	Number of studies	Types of study included
Subjective social isolation interventions						
Findlay [30]	1982–2002	Systematic review	Older people	(1) Increase social support (2) Psychoeducation/social skills training	17	RCTs, non-randomised comparison studies
Cattan et al. [32]	1970–2002	Systematic review	Older people	(1) Social skills training (2) Provide social support (3) Psychoeducation/social skills training	30	RCTs, non-randomised comparison studies
Dickens et al. [33]	1976–2009	Systematic review	Older people	(1) Increase social opportunities (2) Provide social support (3) Psychoeducation/social skills training (4) Address maladaptive social cognitions	32	RCTs, non-randomised comparison studies

Authors (published years)	Published years of included studies	Review method	Included participants	How interventions were categorised	Number of studies	Types of study included
Masi et al. [34]	1970–2009	Meta-analysis	Adults, adolescents and children	(1) Increase social opportunities (2) Provide social support (3) Address maladaptive social cognitions (4) Provide social skill trainings	50	RCTs, non-randomised comparison studies
Perese and Wolf [35]	Unclear	Narrative synthesis	People with mental health problems	Social network interventions: include support groups, psychosocial clubs, self-help groups, mutual help groups and volunteer groups	36	Unclear
Objective social isolation interventions						
Newlin et al. [36]	Up to September 2014	Systematic Review and modified narrative synthesis	People with mental health problems	All types of psychosocial interventions	16	RCTs, non-randomised comparison studies and qualitative studies
Anderson et al. [37]	2008–2014	Systematic review	People with psychosis	All types of social network interventions	5	RCTs
Webber and Fendt-Newlin [38]	2002–2016	Narrative synthesis	People with mental health problems	Social participation interventions: include social skills training, supported community engagement, group-based community activities, employment interventions and peer support interventions	19	RCTs, non-randomised comparison studies, and qualitative studies

Appendix 3: Search terms in Medline and PsycINFO

Same terms were used for the search in Web of Science with minor changes.

#	Search term
1	loneliness.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
2	Loneliness.mp. or Loneliness/
3	lonely.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
4	(social support adj5 (subjective or personal or perceived or quality)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
5	Confiding relationship*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
6	Social isolation.mp. or Social Isolation/
7	Social network*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
8	socially isolated.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
9	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10	Mental Disorders/
11	Alcoholism/or Middle Aged/or Child Behaviour Disorders/or Child/or Adolescent/or Stress Disorders, Post-Traumatic/or Adult/or Depression/or Mental Disorders/or mental health problems.mp. or Substance-Related Disorders/

#	Search term
12	Bipolar Disorder/or Psychotic Disorders/or Aged/or Stress, Psychological/or Middle Aged/or Community Mental Health Services/or Adult/or Mental Disorders/or mental illnesses.mp. or Schizophrenia/
13	mental.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
14	Psychiatr*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
15	Schizo*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
16	Psychosis.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
17	Depress*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
18	Suicid*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
19	Mania*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
20	Manic.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
21	Bipolar.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
22	Anxiety.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
23	Personality disorder*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
24	Eating disorder*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
25	Anorexia.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
26	Bulimia.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
27	PTSD.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
28	Post-traumatic stress disorder*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
29	10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28
30	9 and 29
31	Clinical trial.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
32	Controlled study.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
33	Randomized controlled trial.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
34	Randomised controlled trial.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
35	RCT.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
36	31 or 32 or 33 or 34 or 35
37	30 and 36

Appendix 4: Characteristics of included trials

Main author	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
Subjective social isolation trials						
Kaplan [53]	Online intervention, US	300 adults with a diagnosis of a schizophrenia spectrum or an affective disorder	2 medium-term follow-ups: 4 and 12 months (post-baseline)	The Medical Outcomes Study (MOS) Social Support Survey [64]	(1) Personal recovery (2) Quality of Life (3) Psychiatric symptoms	Supported socialisation
Hasson-Ohayon [42]	Psychiatric community rehabilitation centre, Israel	210 adults with severe mental illness	End-of-treatment follow-up	Multidimensional Scale of Perceived Social Support [57]	Personal recovery	Psychoeducation/social skills training
Rotondi [54]	In- and outpatient psychiatric care units and psychiatric rehabilitation centres, Pittsburgh, Pennsylvania	30 patients aged ≥ 14 with schizophrenia or schizoaffective disorder	2 medium-term follow-ups: 3 and 6 months (post-baseline)	The informational support and emotional support subscales of the instrument that was developed by Krause and Markides [65]	N/A	Psychoeducation
Silverman [43]	Acute care psychiatric unit, a university hospital, the Midwestern region, US	96 adults with varied Axis I diagnoses	End-of-treatment follow-up	The Multidimensional Scale of Perceived Social Support (MSPSS) [57]	N/A	Psychoeducation
Boevink [44]	Mental health care organisations, the Netherlands	163 adults with varied mental illness	1 medium-term follow-up: 12 months (post-baseline) One long-term follow-up: 24 months (post-baseline)	The De Jong-Gierveld Loneliness Scale [58]	(1) Quality of Life (2) Psychiatric symptoms	Supported socialisation
Zang [46]	Beichuan County, China	30 aged 28–80 with PTSD	End-of-treatment follow-up 2 medium-term follow-ups: 1 week or 2 weeks, and 3 months	The Multidimensional Scale of Perceived Social Support (MSPSS) [57]	(1) Anxiety and depressive symptoms (2) PTSD symptoms	Changing cognitions
Zang [47]	Beichuan County, China	22 aged 37–75 with PTSD	End-of-treatment follow-up 2 medium-term follow-ups: 2 weeks and 2 months	The Multidimensional Scale of Perceived Social Support (MSPSS) [57]	(1) Subjective level of distress (2) Depressive symptoms	Changing cognitions
Gawrysiak [48]	A public Southeastern university, US	30 aged ≥ 18 with depression	1 medium-term follow-up: 2 weeks	The Multidimensional Scale of Perceived Social Support (MSPSS) [57]	(1) Depressive symptoms (2) Anxiety symptoms	Psychoeducation/social skills training and supported socialisation

Main author	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
Bjorkman [50]	Case management service, Sweden	77 adults aged 19–51 with severe mental illness	2 long-term follow-ups: 18 and 36 months	The abbreviated version of the Interview Schedule for Social Interaction (ISSI) [61]	(1) Psychiatric symptoms (2) Quality of life	Social skills training
Mendelson [51]	Baltimore City, US	78 depressed women aged 14–41 who either were pregnant or had a child less than 6 months old	End-of-treatment follow-up 2 medium-term follow-ups: 3 and 6 months	The Interpersonal Support Evaluation List (ISEL) [62]	N/A	Changing cognitions
O'Mahen [55]	Online intervention, UK	83 women aged > 18 with MDD	End-of-treatment follow-up 1 medium-term follow-up: 6 months	The Social Provision Scale [66]	(1) Depressive symptoms (2) Anxiety symptoms	Psychoeducation and supported socialisation
Conoley [49]	Psychology Department, US	57 female psychology undergraduate students with moderate depression	End-of-treatment follow-up 1 medium-term follow-up: 2 weeks	The Revised UCLA Loneliness Scale [59] The Causal Dimension Scale [60]	Depressive symptoms	Changing cognitions
Eggert [45]	5 urban high schools, US	105 high school students with poor grades (moderate or severe depression)	2 medium-term follow-ups: 5 and 10 months (post-baseline)	Perceived social support: measured by calculating average ratings across six network support sources. The instrumental and expressive support provided by each support source was also rated	Depressive symptoms	Supported socialisation, social skills training, and wider community approaches
Masia-Warner [52]	Two parochial high schools, New York city, US	35 high school students with social anxiety disorder	End-of-treatment follow-up 1 medium-term follow-up: 9 months	Loneliness Scale [63]	(1) Anxiety symptoms (2) Social phobic symptoms (3) Depressive symptoms	Psychoeducation/social skills training, supported socialisation and changing cognitions
Interian [56]	Online intervention, US	103 veterans with PTSD	1 medium-term follow-up: 2 months (post-baseline)	The family subscale of the Multidimensional Scale for Perceived Social Support [57]	N/A	Psychoeducation and changing cognitions
Objective social isolation trials						
Solomon [70]	A community mental health centre, US	96 adults with schizophrenia or major affective disorders	2 medium-term follow-ups: 1 month and 1 year (post-baseline)	(1) Family and social contacts (2) Pattison's Social Network scale [81]	(1) Use of services (2) Quality of Life (3) Psychiatric symptoms	Supported socialisation and wider community approaches
Aberg-Wistedt [71]	The Kungsholmen sector, Stockholm, Sweden	40 adults with schizophrenia or long-term psychotic disorder, diagnosed by DSM-III-R schizophrenic disorders	1 long-term follow-up: 2 years (post-baseline)	The number of people in participants' social life was measured by a standardised procedure developed from work with child psychiatric patients [82]	(1) Quality of life (2) Service use	Psychoeducation/social skills training

Main author	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
Stravynski [72]	Maudsley Hospital, London, UK	22 adults aged 22–57 with diffuse social phobia and/or avoidant personality disorder	End-of-treatment follow-up 1 medium-term follow-up: 6 months	Structured and Scaled Interview to Assess Maladjustment (SSIAM) [83]	Depressive symptoms	Social skills training and changing cognitions
Atkinson [67]	Community clinic, South Glasgow, UK	146 registered patients with schizophrenia	End-of-treatment follow-up 1 medium-term follow-up: 3 months	A modified Social Network Schedule (SNS) [78]	(1) Quality of life (2) Psychiatric symptoms (3) Overall functioning	Psychoeducation
Terzian [73]	47 community mental health services (SPT), Italy	357 adults aged < 45 diagnosed as schizophrenia spectrum disorder by the ICD-10th	1 medium-term follow-up: 1 year (post-baseline) 1 long-term follow-up: 2 years (post-baseline)	Social network: different parameters of relationships were assessed, all were summarized into a score	(1) Psychiatric symptoms (2) Hospitalisation over the follow-up year	Supported socialisation and wider community approaches
Hasson-Ohayon [68]	3 psychiatric rehabilitation agencies and the University Community Clinic, Bar-Ilan University, Israel	55 adults aged 21–62 with various serious mental illness	1 medium-term follow-up: 6 months	Social Functioning Scale (SFS) [79]	N/A	Wider community approaches, psychoeducation/social skills training and changing cognitions
Rivera [77]	A city hospital, New York, US	203 adults with a psychotic or mood disorder on axis I	2 medium-term follow-ups: 6 and 12 months (post-baseline)	A modification of the Pattison Network Inventory [85]	(1) Quality of life (2) Psychiatric symptoms	Supported socialisation
Solomon [74]	A community mental health centre, US	96 adults with schizophrenia or major affective disorders	2 medium-term follow-ups: 1 month and 1 year (post-baseline) 1 long-term follow-up: 2 years (post-baseline)	Pattison's Social Network [81]	(1) Quality of Life (2) Psychiatric symptoms	Supported socialisation and wider community approaches
Marzillier [75]	The Maudsley Hospital, UK	21 adults aged 17–43 with a diagnosis of personality disorder or neurosis	End of treatment follow-up 1 medium-term follow-up: 6 months	Revised-Social Diary and Standardised Interview Schedule [75]	(1) Anxiety disorders (2) Mental state (3) Personality assessment	Social skills training and changing cognitions
Bøen [69]	2 municipal districts, eastern and western Oslo, Norway	138 seniors with mild depression	End-of-treatment follow-up	The Oslo-3 Social Support Scale [80]	(1) Depressive symptoms (2) Life satisfaction	Supported socialisation and wider community approaches
Cole [76]	St. Mary's hospital, Montreal, Canada	32 adults with major depression, dysthymic disorder or other affective disorder	3 medium-term follow-ups: 4, 8 and 12 weeks (post-baseline)	The Older Americans Research and Service Centre Instrument (OARS) [84]	(1) Mental state (2) Symptoms	N/A

Main author	Setting	Participants	Follow-up	Social isolation outcomes	Other outcomes	Intervention type
Trials for both subjective and objective social isolation						
Schene [89]	University Psychiatric Clinic of the Academic Hospital, Utrecht, the Netherlands	222 adults aged > 60 with various mental disorders	End-of-treatment follow-up 1 medium-term follow-up: 6 months	Subjective social isolation outcome: Social Network and Social Support Questionnaire (SNSS) [93] Objective social isolation outcome: Social Network and Social Support questionnaire (SNSS) [93]	(1) Mental state (2) Psychiatric symptoms (3) Social dysfunction	Psychoeducation/social skills training, and supported socialisation
Castelein [86]	4 mental health centres, the Netherlands	106 adults aged ≥ 18 with schizophrenia or related psychotic disorders	End-of-treatment follow-up	Subjective social isolation outcome: The Social Support List (SSL) Objective social isolation outcome: Personal Network Questionnaire (PNQ) [86]	(1) Quality of Life (2) Screening for psychosis	Supported socialisation
Gelkopf [87]	7 chronic schizophrenic wards, Israel	34 adults with a diagnosis of chronic schizophrenia, based on DSM-III-R	1 medium-term follow-up: 2 weeks	Subjective social isolation outcome: The Social Support Questionnaire 6 (SSQ6) [91] Objective social isolation outcomes: (1) 2 measures of social network sum up the size and dispersion (2) 4 measures assess the source of the support	N/A	Changing cognitions
Ammerman [88]	Southwestern Ohio and Northern Kentucky, US	93 females aged from 16 to 37 with MDD	End-of-treatment follow-up 1 medium-term follow-up: 3 months	Subjective social isolation outcome: Interpersonal Support Evaluation List (ISEL) [62] Objective social isolation outcome: Social Network Index (SNI) [92]	Psychiatric symptoms	Changing cognitions

Appendix 5: Characteristics of interventions

Main author	Intervention and control group	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Subjective social isolation					
Kaplan [53]	Experimental peer support listserv vs. experimental peer support bulletin board vs. waiting-list control group	Online	Unclear, overall duration of the study was 12 months	Experimental peer support listserv: participants communicated anonymously with each other via a group distribution email list Experimental peer support bulletin board: participants were instructed on how to create account and log in to board	The online communication of both listserv and bulletin board group were solely peer directed, but technical support was provided via phone or email
Hasson-Ohayon [42]	Illness Management and Recovery Programme vs. treatment-as-usual	Face-to-face sessions (group)	Weekly sessions, an hour each session Duration of the intervention was 8 months	Intervention group: Illness Management and Recovery Programme is a standarised curriculum-based programme, which provides essential information and skills to people with severe mental illness. The information and skills provided are designed to help patients manage their illness and work towards their personal recovery goals. In this study, educational handouts in Hebrew were provided to participants, focused primarily on self-management, personal goals, social support, medication use, relapse prevention, and coping with psychiatric symptoms	Interventions were led by two clinicians, one of whom had weekly training sessions. For the first 8 months of intervention, clinicians attended monthly supervision sessions
Rotondi [54]	Telehealth intervention vs. usual care group	Online	Unclear	Intervention group: including online therapy groups, ask questions and receive answers, a library of previous questions, activities in the community, news items, and educational reading materials	The 3 therapy groups were facilitated by master of social work and PhD clinicians, they were all trained in the monitoring and management of web-based interventions

Main author	Intervention and control group	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Silverman [43]	Live educational music therapy (Condition A) vs. recorded educational music therapy (Condition B) vs. education without music (Condition C) vs. recreational music therapy without education (Condition D)	Face-to-face sessions (group)	24 weekly sessions, 45 min per session Duration of intervention: 24 weeks	Condition A: live music, a scripted educational lyric analysis session using song lyrics that focused on social support Condition B: recorded music, a scripted educational lyric analysis session about lyrics that focused on social support Condition C: Without music, a scripted educational session without music concerning support and coping Condition D: investigator led the group in playing rock and roll bingo, no scripted educational session	A certified music therapist with more than 12 years of clinical psychiatric experience conducted therapy sessions
Boevink [44]	TREE + CAU vs. CAU (waiting-list control)	Face-to-face sessions (group)	The early starters: each session lasted 2 h, met every two weeks Duration of the intervention: 104 weeks The Late starters: each session lasted 2 h, met every two weeks; Duration of the intervention: 52 weeks	TREE model: (1) Training course 'start with recovery' (2) Developing strength (3) A one-day recovery training course	The recovery self-help working groups were facilitated by two senior peer workers, and two mental health care managers facilitated the training course
Zang [46]	NET vs. NET-R vs. waiting-list control	Face-to-face sessions (individual)	NET group: ≥ 4 sessions, 60–90 min per session, twice weekly Duration of intervention: 2 weeks NET-R group: ≥ 3 sessions, 60–120 min per session, and each session was 1–2 days apart; Duration of intervention: 1 week	For both groups, the narrative was recorded and corrected in subsequent reading sessions NET group: created a detailed biography that focused on traumatic experiences NET-R group: a modified version of NET; the participants first constructed an earthquake narrative and then an autobiography	All treatments were carried out by the first author and one female psychological counsellor; they both speak Chinese and have the Chinese national psychological counsellor certificate (master) and also were trained in the use of NET and NET-R Weekly case and personal supervisions were conducted; the counsellors were also supervised before they have contact with participants
Zang [47]	NET vs. waiting-list control group	Face-to-face sessions (individual)	NET group: 4 sessions, 60–90 min per session Duration of intervention: 2 weeks	NET group: created a chronological report of biography with a focus on traumatic experiences. A written report of their biography was provided in the last session	The team was led by the first author, consisted of 3 female therapists, and they all speak Chinese, and all have the Chinese national psychological counsellor certificate (Master) Therapists were trained for NET and they were tutored under supervision before they work with participants. Weekly case and personal supervisions were also carried out

Main author	Intervention and control group	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Gawrysiak [48]	BATD vs. no treatment control	Face-to-face session (individual)	Single session lasted 90 min	BA intervention: education, assessments of values and goals, construct an activity hierarchy, selection of value-based behaviours, establish structured behavioural goals, and behavioural checkout form	One male doctoral students in clinical psychology was trained in BATD and conducted the individualised interview
Bjorkman [50]	The case management service vs. standard care	Face-to-face sessions (individual)	1.45 per week during the first 18 months, and the case manager spent on average 1.9 h in client contacts every week Duration of intervention: unclear	The case management service: moderately focused on skills training, strong emphasis on consumer input	All staff had experiences in working in social services, psychiatric services or vocational rehabilitation. The team consisted of two registered nurses and two social workers. Supervision was done by a psychiatrist and a psychologist
Mendelson [51]	Standard home visiting services + MB course vs. standard home visiting services + information on perinatal depression	Face-to-face sessions (group and individual)	6 weekly sessions, 2 h each session Duration of intervention: 6 weeks	Intervention group: Sessions cover core cognitive behavioural concepts, including pleasant activities, thoughts, and contact with others	A licensed clinical social worker or clinical psychologist
O'Mahen [55]	NetmumsHWD vs. treatment-as-usual	Online and telephone support	12-session treatment online course, weekly telephone support sessions of 20–30 min Duration of each session and intervention: unclear	NetmumsHWD: including a core behavioural activation (BA) model, a relapse prevention session, plus two optional modules. Also a chat room that was moderated by peer supporters, and weekly supported phone call from mental health workers	Mental health supporters with undergraduate degrees and 1 year of clinical qualification in psychological therapies Peer supporters had previous training in low-intensity BA, received 5 days of training in high-intensity perinatal-specific BA approach
Conoley [49]	Reframing vs. self-control vs. waiting list	Face-to-face sessions (individual)	2 sessions with 1 week apart, each session 30 min Duration of intervention: 2 weeks	Intervention groups: aimed to increase understanding in loneliness. First half of the session consisted of loneliness and reflective responses, the second half included either 3–5 positive reframing directives for reframing subjects, and self-control directives for self-control subjects	Two male doctoral students with 3-year counselling experience, received training in both interventions

Main author	Intervention and control group	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Eggert [45]	PGCI vs. PGCII vs. an assessment protocol-only	Face-to-face sessions (group)	PGCI: met daily, 55 min per meeting Duration of intervention: 5 months or 90 class days in length PGCII: met daily, 55 min per meeting Duration of intervention: 10 months or 180 class days in length	Both PGCI and PGCII: small group work focused on social support; weekly monitoring of activities; and life skills training PGCI: emphasised bonding to PGC group, included training to give and receive social support; focused on motivating to change and acquire essential skills, and rehearsing real-life issues in the group setting with a main focus on problems with friends, teachers and parents PGCII: emphasised broader school bonding, included training to transfer skills to real life situations, providing and seeking social support, and developing health-promoting social activities to reduce the negative impacts of suicidal thoughts and behaviours, anger and/or depression, and drug involvement	The interventions were delivered by trained school staff who functioned as group leaders
Masia-Warner [52]	Skills for Social and Academic Success vs. waiting-list group	Face-to-face sessions (group and individual)	12 weekly group school sessions (40 min); 2 brief individual meetings (15 min); 2 monthly group booster sessions; and 4 weekend social events (90 min) Duration of intervention: 3 months	12 group sessions: 1 psychoeducational session, 1 realistic thinking session, 4 social skills training sessions, 5 exposure sessions, and 1 relapse prevention session Individual meetings: met with group leaders at least twice, aim to identify individual treatment goals and problem solving Social events: met and practiced programme skills with peers in their community	A behaviourally trained clinical psychologist and a clinical psychology graduate student co-led all groups Peer assistants: nominated by teachers and administrators, help with exposures and skill practice
Interian [56]	The Family of Heroes intervention vs. control group	Online	1 h online intervention Duration of intervention: unclear	The Family of Heroes Intervention: provided psychoeducation and stimulated conversations regarding post-deployment stress and mental health treatment; and three conversation scenarios	N/A

Main author	Intervention and control group	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Objective social isolation trials					
Solomon [70]	Consumer management team vs. non-consumer management team	Face-to-face sessions (individual)	Unclear	Both consumer and non-consumer management team followed an assertive community treatment model (1) Provided activities: housing, rehabilitation and social activities (2) Case managers provided assistance and supported clients, supervised by consumer supervisor	Requirements for consumer management team: have major mental health problems, ≥ 1 previous psychiatric hospitalisation, a minimum of 14 days of psychiatric hospitalisation, or at least 5 psychiatric emergency service contacts within a year Requirements for non-consumer case management team: consisted of mental health professionals and recent college graduates
Aberg-Wistedt [71]	The intensive case management programme vs. standard services	Face-to-face sessions (individual)	1 h individual meeting every other week; psychiatric nurse/nurse assistant met with patients at least 4 h per week. Crisis intervention services were available 24 h every day and 7 days a week. Duration of intervention: 2 years	Intervention group: (1) The team provided assertive outreach; patients received skill training and instruction in critical life task (2) Specific services also provided based on individual needs and assessments (3) Family psychoeducation and support	The team consisted of a psychologist/psychiatrist, a psychiatric social worker, a social service officer, and a psychiatric nurse/nurse assistant
Stravynski [72]	Social skills training vs. Social skill training + cognitive modification	Face-to-face sessions (individual)	12 sessions, 90 min per session Duration of intervention: 14 weeks	Social skills training: focused on individual needs by discussing specific social targets; techniques included instructions, modelling, role-rehearsal, feedback, self-monitoring, and homework Social skill training + cognitive modification: previously described elements for social skills training. For cognitive modification, participants analysed a distressing event in five steps: (1) activating event with descriptions; (2) irrational beliefs; (3) emotional consequences; (4) dispute; (5) plan for new actions	Provided by one psychiatrist
Atkinson [67]	The education group vs. waiting-list control	Face-to-face sessions (group)	1.5 h per session Duration of intervention: 20 weeks	The education group: sessions generally covered schizophrenia topics, and alternated between an information session and a problem-solving session	Led by community psychiatric nurses, occupational therapists and registrars. Trainings were also provided

Main author	Intervention and control group	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Terzian [73]	Social network intervention + usual treatments vs. usual treatments	Face-to-face (individual)	Unclear information regarding intervention sessions Duration of intervention: 3–6 months	Social network intervention: participants were helped to identify their possible areas of interest, and social activities were suggested	Provided by a staff member or natural facilitators such as families, neighbours, or volunteers
Hasson-Ohayon [68]	Social Cognition and Interaction Training (SCIT) + social mentoring vs. social mentoring only	Face-to-face sessions (group)	SCIT intervention: 1 h weekly session Social mentoring service: 3 weekly meetings Duration of intervention: unclear	Participants received social, leisure, support, and employment services, as well as standard services SCIT intervention group: besides intervention, they also received educational handouts, videos, and slides All received the same social mentoring services to support practical steps toward achieving personally meaningful goals	Social mentors were staff of psychiatric rehabilitation agencies Lead clinicians received training and ongoing supervision. All clinicians had experiences in providing psychiatric rehabilitation services and completed a SCIT workshop
Rivera [77]	Peer-assisted care vs. Nonconsumer assisted vs. standard care vs. clinic-based care	Face-to-face sessions (group & individual), and phone calls	Unclear information regarding intervention sessions and duration But telephone coverage is 24 h	Peer assisted care group: professionals provided conventional crisis management, therapeutic services and concrete services; paraprofessional consumers facilitated social networks and provided social support through activities, home visits and phone calls Clinic based care group: only provided office-based services	All professionals were licensed clinical social workers, also received training and supervisions Consumers had a history of multiple hospitalisations for mood or psychotic disorders, were eligible for disability benefits, relied on medication, but had 3–8 years of sobriety and stability. They had the same trainings as professional, and were supervised by social worker

Main author	Intervention and control group	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Solomon [74]	Consumer case management team vs. nonconsumer management team	Face-to-face sessions (individual)	The consumer team: Three times per week The nonconsumer team: met biweekly Duration of the intervention: 2 years	Case managers offered individualised social support for community living, activities included goals related to income, living situation, social and family relations, and psychiatric treatment	Requirements for consumer case managers: have a major mental health disorder; at least one prior psychiatric hospitalisation and a minimum of 14 days of psychiatric hospitalisation, or at least 5 psychiatric emergency service contacts over a 1-year period; regular contact in community mental health services, psychosocial services, or other outpatient treatment Consumer team: 3 consumer managers and 1 nonconsumer case manager initially, later, the nonconsumer member was replaced by a consumer, and a clinical director and a psychiatrist started involved. Consumer mangers received supervisions and support Nonconsumer team: all nonconsumer managers, two specialists started involved at the second year. Managers received supervisions and support The interviewer: a trained professional research worker independent of service providers. Intensive, experiential training was provided in both the Brief Psychiatric Rating Scale (BPRS) and Addiction Severity Index (ASI)
Marzillier [75]	Systematic Desensitisation (SD) vs. Social Skills Training (SST) vs. waiting-list control	Face-to-face sessions (individual)	15 45-min sessions, once a week, occasionally twice a week Duration of intervention: 3 and half months	Systematic desensitisation: included relaxation training and hierarchy construction, practice in both imagination and reality Social skills training: combined elements of both assertive and social skills training, included role playing, modelling, and practice in real-life and with volunteers	Assessments were done by 2 independent assessors; one was a trained psychologist, and the other was a senior psychiatrist The therapist was a trained clinical psychologist with experience in behavioural treatments
Bøen [69]	A preventive senior centre group programme vs. control	Face-to-face sessions (group)	Weekly group meetings, 3 h per meeting, about 35–38 times totally; Duration of intervention: 1 year	The experimental group: included group meeting, physical training programme, and a self-help group. Transportation and warm meals were also provided	The team consisted of volunteers; all completed a training course and were supervised by a registered nurse and an experienced senior centre leader
Cole [76]	Home assessment group vs. clinic assessment group	Face-to-face sessions (individual)	Unclear	Unclear	Study psychiatrists (MC or DR) assessed participants

Main author	Intervention and control group	Mode of delivery	Number of sessions + duration of each session + duration of intervention	Intervention descriptions	Characteristics of intervention providers
Trials for both subjective and objective social isolation					
Schene [89]	Psychiatric day treatment vs. inpatient treatment	Varied: mostly face-to-face sessions or phone interview (group and individual)	Day treatment: length of programme varied Average duration of intervention: 37.6 weeks Inpatient treatment: length of programmes varied Average duration of intervention: 24.9 weeks	Nine main groups of treatment programmes: (1) individual psychotherapy or supportive therapy; (2) individual counselling; (3) group psychotherapy; (4) sociotherapy; (5) family counselling; (6) occupational therapy; (7) psychomotor therapy; (8) drama therapy; (9) secondary environmental activities Extra care for day clinic participants after office hours, such as phone call or face-to-face talks with resident on duty in the clinic, or use of clinical bed	Social psychiatric nurses, psychiatrists, and psychologists
Castelein [86]	Care as usual + GPSG vs. a waiting- list condition	Face-to-face sessions (group)	90 min per session, 16 biweekly sessions Duration of intervention: 8 months	Peer support group: included about 10 patients, patients decided the topic of each session, discussing daily life experiences in pairs and groups	Nurses guided the peer groups with minimal involvement
Gelkopf [87]	Video projection of humorous movies vs. control group	Face-to-face sessions (group)	The experimental group: four times daily (5 days a week) Duration of intervention: 3 months	The experimental group: exposed exclusively to comedies The control group: 15% of the films were comedies; others are different types of films	A psychology student was involved to answer questions during experimental testing
Ammerman [88]	IH-CBT + home visiting vs. home visit alone	Face-to-face sessions (individual)	15 weekly sessions, 60 min per session with a booster session 1 month after treatment Duration of intervention: about 5 months	IH-CBT: primarily targeted depression reduction, consisted of behavioural activation, identification of automatic thoughts and schemas, thought restructuration, and relapse prevention	2 licensed master level social workers, received weekly supervision, a review of audiotaped sessions and a self-report checklist

Appendix 6: Quality assessment

First author (publication year)	Sequence generation	Allocation concealment	Blinding	Incomplete outcome data	Selective outcome reporting	Other sources of bias
Kaplan [53]	Low risk	Unclear	High risk	Unclear	Low risk	Low risk
Hasson-Ohayon [42]	Low risk	Unclear	High risk	Unclear	Low risk	High risk
Rotondi [54]	Unclear	Unclear	High risk	Unclear	Low risk	High risk
Silverman [43]	Unclear	Unclear	High risk	Unclear	Low risk	Low risk
Boevink [44]	Low risk	Unclear	High risk	Unclear	Low risk	Low risk
Zang [46]	Low risk	Unclear	High risk	Unclear	Low risk	High risk
Zang [47]	Low risk	Unclear	High risk	Unclear	Low risk	High risk
Gawrysiak [48]	Unclear	Unclear	High risk	Unclear	Low risk	Low risk
Bjorkman [50]	Low risk	Low risk	High risk	Unclear	Low risk	High risk
Mendelson [51]	Unclear	Unclear	High risk	Unclear	Low risk	High risk
O'Mahen [55]	Low risk	Low risk	High risk	Low risk	Low risk	Low risk
Conoley [49]	Unclear	Unclear	High risk	Unclear	Low risk	High risk
Eggert [45]	Unclear	Unclear	High risk	Unclear	Low risk	High risk
Masia-Warner [52]	Unclear	Unclear	High risk	Low risk	Low risk	High risk
Interian [56]	Low risk	Unclear	High risk	Unclear	Low risk	High risk
Solomon [70]	Unclear	Unclear	High risk	Low risk	Low risk	High risk
Aberg-Wistedt [71]	Unclear	Unclear	High risk	Unclear	Low risk	High risk
Atkinson [67]	Unclear	Unclear	High risk	Unclear	Low risk	High risk
Terzian [73]	Unclear	Low risk	High risk	Unclear	Low risk	High risk
Hasson-Ohayon [68]	Unclear	Unclear	High risk	Unclear	Low risk	High risk
Rivera [77]	Unclear	Low risk	High risk	Low risk	Low risk	Low risk
Solomon [74]	Unclear	Unclear	High risk	Low risk	Low risk	High risk
Marzillier [75]	Low risk	Low risk	High risk	Unclear	Low risk	High risk
Stravynski [72]	Unclear	Unclear	High risk	Unclear	Low risk	High risk
Bøen [69]	Low risk	Low risk	High risk	Unclear	Low risk	High risk
Cole [76]	Low risk	Low risk	High risk	Low risk	Low risk	High risk
Schene [89]	Unclear	Unclear	High risk	Unclear	Low risk	High risk
Castelein [86]	Low Risk	Low risk	High risk	Unclear	Low risk	High risk
Gelkopf [87]	Low risk	Unclear	High risk	Unclear	Low risk	High risk
Ammerman [88]	Unclear	Low risk	High risk	Low risk	Low risk	High risk

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