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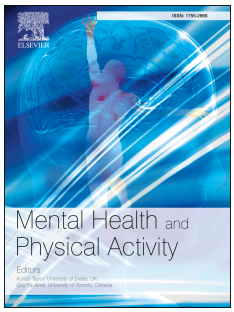

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Eva Rogers, Florence-Emilie Kinnafick, Anthony Papathomas

PII: S1755-2966(18)30143-1

DOI: https://doi.org/10.1016/j.mhpa.2018.11.004

Reference: MHPA 280

To appear in: *Mental Health and Physical Activity*

Received Date: 17 September 2018

Revised Date: 9 November 2018

Accepted Date: 17 November 2018

Please cite this article as: Rogers, E., Kinnafick, F.-E., Papathomas, A., Physical activity in secure settings: A scoping review of methods, theory and practise, *Mental Health and Physical Activity* (2018), doi: https://doi.org/10.1016/j.mhpa.2018.11.004.

Physical Activity in Secure Settings: A Scoping Review of Methods, Theory and Practise

Eva Rogers*[a b], Florence-Emilie Kinnafick[a] & Anthony Papathomas[a]

[a] *National centre for Sport and Exercise Medicine, School of Sport, Exercise and Health Sciences, Loughborough University, Loughborough, United Kingdom*

[b] *Honorary Researcher, St Andrews Healthcare, United Kingdom*

Declarations of interest: None

Correspondence concerning the article should be addressed to Eva Rogers, School of Sport, Exercise and Health Sciences, Loughborough University, United Kingdom. Email: e.n.rogers@lboro.ac.uk

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Abstract

Evidence suggests that individuals with severe mental illness (SMI) engage in considerably less exercise and significantly more sedentary behaviour than the general population. It has been suggested that inactivity is likely to be exacerbated in secure services. The purpose of this scoping review was to explore and synthesise the existing literature with a view to facilitate discussion on methods, theory and practise used in current studies investigating exercise in secure settings. Additionally, this review aimed to identify gaps in the existing literature and highlight recommendations for future studies. Sixteen studies met the review inclusion criteria. Pre and post measurement was the most common study design. Only three studies utilised psychological or behaviour change theory to underpin their design. Self-report physical activity (e.g. attendance) and clinical measures (e.g. positive and negative symptomology) were the most commonly reported outcome. Length, type and intensity of sessions varied. Recruitment, attrition and limited staff involvement were noted as major challenges in data collection. Despite several uncertainties with methodology (design, validated scale and use of self-report data) and noted challenges with data collection (recruitment and attrition), the emerging data warrants future research into physical activity in secure settings.

Keywords; physical activity, secure setting, psychosis, psychiatric inpatient, exercise, scoping review

Introduction

Individuals with severe mental illness (SMI) engage in considerably less exercise (Soundy et al. 2013) and significantly more sedentary behaviour (Schuch et al. 2017) than their counterparts in the general population. A recent global meta-analysis revealed that individuals with SMI engage in significantly less moderate and vigorous physical activity per week, and have a significantly reduced likelihood of meeting recommended moderate to vigorous physical activity guidelines per week (Vancampfort et al., 2017). Additionally, individuals with SMI experience a premature mortality of around 10-20 years (Firth et al. 2016). A large proportion of these premature deaths are attributed to potentially modifiable risk behaviours (Walker et al., 2015) due to physical health inequalities (Ribe et al. 2014). These behaviours, combined with the obesogenic effects of anti-psychotic medication, lead to an increased risk of obesity (De Hert et al. 2011), diabetes (Stubbs, Vancampfort, De Hert & Mitchell, 2015), respiratory disease (Schoepf, Uppal, Potluri & Heun, 2014) and metabolic syndrome (Riordan, Antonini & Murphy, 2011; Vancampfort et al., 2016a) all of which contribute to the development of cardiovascular disease (CVD) (Correll et al. 2017; Gardner-Sood et al. 2015). A recent meta-analysis showed that SMI patients have a significantly increased risk of developing CVD, alongside an 85% increased risk of death from CVD in comparison to regionally matched participants in the general population (Correl et al., 2017).

An increasing body of evidence demonstrates that exercise interventions can improve physical health and reduce psychiatric symptoms in those with SMI (Firth, Cotter, Elliott, French & Yung, 2015). Reviews have highlighted the potential for exercise in both treatment and prevention of mental illness (Rosenbaum et al. 2014; Schuch et al. 2018); a notion well supported by health professionals in community and secure settings (Burton, Pakenham & Brown, 2010; Morgan, Jorm & Reavley, 2013). Recent meta-analyses have shown that physical activity, particularly structured exercise, has numerous benefits including; improvements in social functioning (Dauwan, Begemann, Heringa & Sommer, 2016; Firth,

Carney, French, Elliott & Yung, 2017), psychotic symptoms (Bredin, Warbuton & Lang, 2013), functional capacity and recovery (Firth et al., 2016; Zschucke, Gaudlitz & Strohle, 2013), general brain health (Vancampfort et al. 2014) and cognition (Sommer & Kahn, 2015). Benefits in schizophrenia and depression are particularly encouraging; considerable reduction in positive symptoms (Kim & Jin, 2015) and clinical depression symptomology (Cooney et al. 2013) alongside significant improvements in negative symptoms (Dauwan et al., 2016) have been observed in response to increases in physical activity. A recent meta-review and position statement stated physical activity should be utilised as treatment for mild-moderate depression to improve both physical fitness and diagnosis symptomology, alongside an adjunctive treatment for schizophrenia spectrum disorders to improve symptoms, cognition and quality of life (Stubbs et al., 2018). This is particularly encouraging for the promotion of physical activity in secure settings as social cognition has been recognised as the best predictor of real world functioning following discharge from residential psychiatric care (Fett, Viechtbauer, Dominguez, Penn & Van Os Krabbendam, 2011).

Forensic mental health services, or secure hospitals, include high, medium and low secure psychiatric inpatient care in which participants are detained under the Mental Health Act and may be restricted on legal grounds (NHS Federation, 2012). These services aim to provide a safe environment with both occupational and recreational opportunities and links to community facilities. Secure mental health services are geared towards providing assessment, treatment and rehabilitation of individuals that require residential psychiatric care (Galappathie, Tamim Khan & Hussain, 2017). Secure wards are occupied by patients with complex mental health needs in an environment where staffing demands are high and staff turnover is frequent (Cleary, Hunt, Horsfall & Deacon, 2011). Studies have shown that over 50% of individuals in secure services are overweight (Long et al., 2014) due to unrestricted access to high calorie food in an unstimulating environment (Long, Brillon,

Schell & Webster, 2009) alongside an increased sedentary lifestyle (Fraser, Brown, Whiteford & Burton, 2014) with restricted access to exercise and community facilities (Long, Rowell, Gayton & Hodgson, 2014). This environment, where patients' movement is limited due to restricted ward leave and staff available to escort (Kinnafick, Papathomas & Regoczi, 2018), can impact behaviour by intensifying barriers to exercise, facilitating sedentary behavior (Robertson et al. 2000) and reducing the propensity to undertake physical activity (Lake, Townsend & Alvanides, 2010). Exercise promotion is often of low priority in secure services (Stanton, Happell & Reaburn, 2015) and opportunities for patients to exercise are often hampered by competing staff priorities (Happell, Scott, Platania Phung & Nankivell, 2012), lack of time and resources (Happell, et al., 2012), inappropriate staff training and knowledge (Stanton et al., 2015) and the absence of a specific exercise environment (Soundy, Stubbs, Probst, Hemmings & Vancampfort, 2014).

Secure settings offer unique environments for SMI patients to engage in exercise, however, it is recognised that such programs are challenging to implement (Stanton & Happell, 2014). Generally, SMI provides individuals with considerable barriers that limit exercise participation, such as illness symptomology, medication side effects and physical comorbidities (Firth et al., 2016a; 2016b; Glover, Ferron & Whitley, 2013). Consistent with the effects of negative symptomology and low mood in SMI, this population often feel lethargic and struggle to initiate and maintain exercise motivation (Long et al., 2014). This is reflected by attendance rates; generally, attendance to exercise sessions in residential psychiatric settings has consistently shown to be around 50% (Long & Mason, 2014; Sailer et al. 2015). SMI community exercise sessions evoke similar responses; attendance is also low and attrition rates are high (Chen et al. 2009).

Consequently, multi-component strategies to engage SMI patients in exercise, manage weight gain, reduce cardiometabolic risk factors and reduce psychiatric symptoms in a secure

setting, are essential. Medication is widely accepted as first-line therapy for a range of mental illness (Goodwin et al., 2016; Lally & MacCabe, 2015), however there is a growing interest in the role of exercise in the treatment of mental illness (Happell et al. 2011b; Stanton & Happell, 2013), with consumers stating they often feel exercise is of equal or greater value than other established treatment (Reavley & Jorm, 2011). Despite evidence of efficacy in exercise interventions in SMI, there remains a gap in implementation of evidence to practise, and an urgent need to translate results from efficacy studies into routine care (Vancampfort, Stubbs, Ward, Teasdale & Rosenbaum, 2015).

The inpatient environment provides an opportunity to regulate physical activity into daily routine, however, the potential for exercise implementation is often not reached in this environment (Blythe & White, 2012). Consequently, there is a growing need to address the systemic barriers which have impeded widespread implementation of physical activity interventions (Lederman et al. 2017). Additionally, it has been recognised that the delivery of such interventions in inpatient settings is challenging, and the evidence, although promising, is limited (Stanton & Happell, 2014).

Due to the exploratory nature of the research area, a scoping review methodology was appropriate to address the gaps in current knowledge. Scoping reviews work to summarise research findings drawn from existing literature with the aim to offer practical recommendations and identify research gaps (Arskey & O'Malley, 2005; Seaton et al. 2017). This method represents an increasingly popular approach to reviewing health research evidence (Davis, Drey & Gould, 2009) and has been used previously to address unexplored topics within mental health (see Seaton et al. 2017). Physical activity in secure psychiatric settings represents a sparsely researched area with numerous unanswered questions that could not be addressed utilising a typical systematic review. Due to the dearth of knowledge in this area, a methodology in which the authors do not typically assess the

research quality (Grant and Booth, 2009), but utilise an approach that can collate and examine the extent of available information was needed.

The limited research conducted in psychiatric secure settings alongside conflicting knowledge surrounding the barrier and facilitators to physical activity in severe mental health populations allowed for a broad research scope. The overarching aim of this scoping review is to provide an overview of, and systematically map the literature on physical activity in secure settings.

Methodology

Currently, reporting guidelines for scoping reviews do not exist, however, a recent guidance on conducting a scoping review has been published (Peters et al., 2015) based on an earlier framework proposed by Arksey & O'Malley (2005) and Levac, Colquhon & O'Brien, 2010). Consequently, this scoping review adhered to that framework, and all items on the recently developed PRISMA checklist for scoping reviews were covered in this review (Tricco et al., 2018).

Stage One: Identify the Research Question

This scoping review has three main aims: (1) to identify the methodology used in studies aiming to increase or evaluate physical activity in a secure setting; (2) to explore the use of behavioral and psychological theory in these studies; (3) explore and identify the determinants of physical activity in secure settings.

Stage Two: Identifying Relevant Studies

Inclusion Criteria

We included studies that: (a) involved adult participants between the ages of 18 and 65. Studies including children, adolescents and elderly patients were excluded; (b) were recruited from a secure service. This included residential psychiatric care and the prison service. Studies conducted with patients in low, medium and high secure establishments were used.

Outpatient and community living participant-based studies were not included; (c) studies that involved patients in residential psychiatric care had a mental health diagnosis according to established criteria (e.g. DSM-IV, (American Psychiatric Association, 2000) or ICD-10 (World Health Organisation, 1993). Due to focus of this review being the inpatient setting, rather than the mental health diagnosis, participants diagnosed with 'severe mental illness' as an inclusive diagnosis term were included; (d) involved studies implementing or evaluating physical activity or exercise sessions for patients in secure settings. Physical activity was defined as any bodily movement produced by skeletal muscles and requiring energy expenditure (Caspersen et al. 1985). Exercise was defined as any structured and repetitive physical activity that has an objective of improving or maintaining physical fitness (Caspersen et al. 1985). Due to the paucity of studies in physical activity and secure settings, both exercise trials aiming to increase exercise, in addition to studies delivering structured exercise sessions were included. Although it is recognised that trials linking exercise to clinical outcomes and intervention studies including exercise as a primary outcome are conceptually different, the exploratory nature of the scoping review warranted the inclusion of both types of study. Multi-modal programmes that incorporated physical activity into a broader lifestyle or psychosocial intervention were included providing physical activity was measured as an individual outcome; (e) Were published in an international peer-reviewed journal in English language; (f) Were qualitative, quantitative or mixed method studies. Interventional (RCT's), observational (cross-sectional or prospective) or qualitative studies were included. This review also included mixed method studies. Systematic reviews and meta-analyses were excluded from data analysis.

Stage Three: Study Selection

As a scoping study, two specific search limitations were applied. First was the decision to search only three databases; Web of Science, PubMed and PsycINFO (ProQuest). These

databases were selected as their scope best fitted the aim of the review and have been used in a recent scoping review of similar nature (Machaczek et al. 2018). The second was to search for papers published between 2007 and 2018. Due to amendments in the 1983 Mental Health Act made in 2007 (Mental Health Act, 2007), studies conducted prior to 2007 were not included. The main changes to the 1983 act include; removal of categories of mental disorder and restructured definitions of mental illness, updated criteria for detention, and implementation of age and diagnosis appropriate services and accommodation. Additionally, changes in definition and application of medical treatment, clinical procedure and patient safeguarding were made in the 2007 document. Consequently, studies conducted prior to 2007 may have utilised different clinical practice, alongside occupying a patient population sectioned under different guidelines.

In order to draw meaningful conclusions relevant to current clinical practice, this current review aimed to incorporate studies that included settings adhering to current mental health legislature.

Search terms included: “secure setting” or “psychiatric inpatient” or “secure hospital” or “psychosis” or “severe mental illness” and “exercise” or “physical activity” or “walking” or “accelerometer*”. Individual diagnoses such as “schizophrenia” and “major depressive disorder” were not entered as search terms as the review focused on physical activity within secure services, rather than the effects on specific diagnosis. Entering specific diagnosis as search terms resulted in research focusing on mental illness in community settings and outpatients, which were not eligible for inclusion in this review. Furthermore, due to data protection guidelines and patient confidentiality, demographics defining specific diagnoses are often unavailable in research conducted in a secure setting and diagnostic demographics are often termed “severe mental illness” in the literature. Patients in residential secure settings are sectioned under the Mental Health Act, and consequently have an SMI diagnosis as

diagnosed by either ICD-10 or DSM-IV, therefore 'severe mental illness' as a broad term was sufficient to determine eligible papers.

Due to an active discouragement of physical activity for eating disorders within secure services, papers focusing on eating disorder populations were not included. The exclusion of these search terms is unlikely to have omitted appropriate papers for the scope of this review.

A search of Google Scholar was conducted to identify any other relevant articles. In addition, reference lists of all eligible articles, and related reviews found in previous searches were screened to identify potentially eligible articles. This procedure has been used in previous reviews (Soundy et al. 2013; Stubbs, Williams, Gaughran & Craig, 2016).

The initial search yielded 3178 articles. After removal of duplicates, the reviewer screened titles and abstracts of all potentially eligible articles. A second author confirmed included studies and a list of included studies was developed. Full texts meeting the inclusion criteria were sourced. Figure 1 illustrates the article selection process.

[INSERT FIGURE 1]

Stage Four: Charting the Data

In line with scoping review methodology, a formal assessment of study quality was not required (Grant & Booth, 2009). Previous protocol has recommended that charting be considered an iterative process (Levac et al., 2010) in which the researcher continually updates the charting form. Uncertainty surrounding the nature and extent of data was resolved by the researchers after becoming familiar with the data and refining the table.

After data extraction, the researchers i) mapped key concepts and evidence available, ii) summarized existing research findings and, iii) identified gaps in existing literature. The final chart involved recommendations from established review procedure (Arksey & O'Mallen, 2005) and included; number of included studies, type of design, year of publication,

intervention type, characteristic of study populations, exercise procedure, identification of psychological theory and a summary of key findings.

Stage five: Collating, Summarizing and Reporting the Results

Stage five followed three step procedures recommended by Levac et al. 2010. A descriptive analytical method was used to extract contextual and process related data from each study. This stage also included a thematic analysis to consider the wider qualitative content (Hsieh & Shannon, 2005). The qualitative analysis focused mainly on the study design, exercise protocol and wider exercise related findings. Determinants, barriers and facilitators were also mainly identified through qualitative analysis. Secondly, presentation of results was considered; due to the amount and diversity of information, themes were decided to be the best approach to articulate findings. This stage of the process also aimed to identify limitations in research, policy and practise were identified.

Results

Articles Retrieved

The search yielded a total of 3178 articles. After screening for the inclusion and exclusion criteria, 18 published studies were included in the review (see Appendix 1 for complete reference list of included articles). Appropriate data extracted from each article are presented in Table 1.

[INSERT TABLE 1]

Article Characteristics

Studies had been undertaken in a range of countries. Of the eighteen included studies, six were conducted in Australia (Bacon, Farnworth & Boyd, 2012; Fraser, Chapman, Brown, Whiteford & Burton, 2016; Ng, Dodd & Berk, 2007; Ng, Dodd, Jacka & Berk, 2007; Stanton,

Donohue, Garnon & Happell, 2015; Wynaden, Barr, Omari & Fulton, 2012), eleven across the UK and Europe (Bonsaksen, 2011; Cormac. Ferriter & Buchan, 2013; Deenik et al. 2017; Deenik et al. 2018; Firth et al. 2017; Long & Mason, 2014; Long et al. 2015; Ringen et al., 2018a; Ringen et al. 2018b; Sailer et al. 2015; Tetile, Heimsnes, Polit & Almvik, 2009), and one in the USA (Emory, Silva, Christopher, Edwards & Wahl, 2011).

The security levels of psychiatric hospital included varied across studies. Two papers utilized high secure facilities (Cormac, Ferriter & Buchan, 2013; Tetile et al. 2009), two studies used medium security (Long & Mason, 2014; Stanton et al. 2015) and three studies used hospitals including patients from a mixture of low, medium and high security (Long et al. 2015; Ringen et al., 2018a; Wynaden et al. 2012). Ten studies did not mention the security level of the hospital in the paper.

Length of stay of patients in hospitals also varied. The average length of stay in three studies was under a month (Emory et al. 2011; Ng, Dodd & Berk, 2007; Stanton et al. 2015), under two years in one study (Wynaden et al. 2012), whilst six studies involved patients from hospitals that had a varied length of average stay (Bacon et al. 2012; Bonsaksen, 2011; Deenik et al. 2017; Deenik et al., 2018; Ringen et al., 2018a; Ringen et al., 2018b). Nine studies did not report the average length of stay for patients at their facility.

Participants' age ranged from 18-65 years across studies and mental health diagnosis also varied. Some studies specifically stated the mental health diagnosis of their patients; schizophrenia or schizoaffective disorder (Bacon et al., 2012; Deenik et al., 2018; Sailer et al., 2015), personality disorder (Long & Mason, 2014) and bipolar disorder (Ng et al., 2007a). Five studies involved participants with a range of diagnoses (Bonsaksen, 2011; Cormac et al., 2013; Long et al., 2014; Ringen et al., 2018a; Ringen et al., 2018b). Four studies specified their inclusion criteria as a general 'severe mental health' diagnosis (Deenik et al., 2017; Firth

et al., 2017; Fraser et al., 2016; Tetile et al., 2009). Three studies did not state the mental health diagnosis of their participants (Emory et al., 2011; Ng et al., 2007b; Stanton et al., 2015). Most studies recruited both male and female patients (Bonsaken, 2011; Bacon et al., 2012; Cormac et al., 2013; Deenik et al., 2017; Deenik et al., 2018; Emory et al., 2011; Firth et al., 2017; Fraser et al., 2016; Ringen et al., 2018a; Ringen et al., 2018b; Sailer et al., 2015; Tetile et al., 2009; Wynaden et al., 2012), however two studies focused specifically on female inpatients (Long & Mason, 2014; Long et al., 2014). Four studies did not mention the gender of their participants (Ng et al., 2007a; Ng et al., 2007b; Stanton et al., 2015; Wynaden et al., 2012).

Participant medication was stated in six studies (Bacon et al., 2012; Deenik et al., 2017; Emory et al., 2011; Sailer et al., 2015; Ringen et al., 2018a; Ringen et al., 2018b). Five of these studies stated the use of 'antipsychotic' or 'psychotropic' medication (Deenik et al., 2017; Emory et al., 2011; Sailer et al., 2015; Ringen et al., 2018a; Ringen et al., 2018b), whilst one study stated that participants were medicated on clozapine (Bacon et al., 2012). Twelve studies did not mention participant medication (Bonsaksen, 2011; Cormac et al., 2013; Deenik et al., 2018; Firth et al., 2017; Fraser et al., 2016; Long & Mason, 2014; Long et al., 2014; Ng et al., 2007a; Ng et al., 2007b; Stanton et al., 2015; Tetile et al., 2009; Wynaden et al., 2012).

The main research objective of studies varied. Six studies aimed to increase exercise (Bacon et al., 2012, Cormac et al., 2013; Firth et al., 2017; Long & Mason, 2014; Long et al., 2015; Sailer et al., 2015). Four studies aimed to evaluate exercise as part of integrated care in their facility (Emory et al., 2011; Stanton et al., 2015; Tetile et al., 2009; Wynaden et al., 2012). Four studies sought to explore activity levels in secure settings (Bonsaksen, 2011; Deenik et al., 2017; Fraser et al., 2016; Ringen et al., 2018a). Two studies aimed to explore the benefits of exercise (Ng et al., 2007a; Ng et al., 2007b). Two studies incorporated physical

activity measurement as part of a broader lifestyle change intervention (Deenik et al., 2018; Ringen et al., 2018b).

Design and Data Collection

The most common study design (n = 10) was pre and post measurement of variables. The length of time between pre and post measures varied, with studies ranging from ten weeks (Firth et al., 2017) to eighteen months (Deenik et al., 2018). Seven studies used a cross sectional design (Bonsaksen, 2011; Deenik et al. 2017; Fraser et al. 2016; Ringen et al., 2018a; Stanton et al. 2015; Tetile et al. 2009; Wynaden et al. 2012). Three of these studies were considered pilot trials (Bonsaksen, 2011; Ng et al., 2007a; Sailer et al. 2015).

Self-report data was the most frequently used form of data collection- thirteen studies using validated questionnaires or specifically designed scales. Two studies used questionnaires measuring satisfaction levels and experience with current exercise programmes (Tetile et al. 2009; Wynaden et al. 2012), whilst another study evaluated an exercise programme following its implementation within the service. One study sought to assess levels of satisfaction with the physical activity programme, and how it compared to other therapies at the hospital (Stanton et al. 2015).

Three studies measured motivation to exercise (Firth et al., 2017; Long et al., 2015; Ringen et al., 2018b). Self-reported measures of self-efficacy, attitude towards physical activity and quality of life were used in two studies (Deenik et al. 2017; Firth et al. 2017). Attendance was measured in eleven studies (Bacon et al. 2012; Bonsaksen, 2011; Deenik et al., 2018; Emory et al. 2011; Firth et al. 2017; Long et al. 2015; Long & Mason, 2014; Ng et al. 2007a; Ng et al. 2007b; Ringen et al., 2018b; Sailer et al. 2015).

Nine studies collected objective data. Four collected objective physical activity via the use of accelerometers (Bacon et al., 2012; Deenik et al., 2017; Deenik et al., 2018; Fraser et

al., 2016), four measured weight and BMI (Deenik et al., 2018; Fraser et al., 2016; Ringen et al., 2018a; Ringen et al., 2018b) and one study collected strength and fitness measures alongside anthropometric data (Cormac et al., 2013). Six studies collected qualitative data. Three studies used interviews (Deenik et al., 2018; Firth et al., 2017; Ringen et al., 2018a), one study included questionnaires requiring open response (Wynaden et al., 2012). Two studies used two methods of data collection; one study used interviews and focus groups (Tetile et al., 2009), whilst another study used interviews and observations (Bacon et al., 2012).

Outcome Measures

Ten studies reported physical activity as a primary outcome measure (Bacon et al., 2012; Deenik et al., 2017; Deenik et al., 2018; Emory et al., 2011; Fraser et al., 2016; Long & Mason, 2014; Long et al., 2015; Ringen et al., 2018a; Ringen et al., 2018b; Sailer et al., 2015). Five studies used validated self-report physical activity scales to measure activity levels (Fraser et al., 2016); Long et al., 2015; Ringen et al., 2018a; Ringen et al., 2018b; Sailer et al., 2015). Ten studies used attendance to sessions as a measure of physical activity (Bacon et al., 2012; Bonsaksen, 2011; Emory et al., 2011; Firth et al., 2017; Fraser et al., 2016; Long & Mason, 2014; Long et al., 2015; Ng et al., 2007a; Ng et al., 2007b; Sailer et al., 2015). Three studies objectively measured levels of physical activity using accelerometers (Bacon et al., 2012; Deenik et al., 2017; Deenik et al., 2018). One study used both self-report and objective measures of activity (Fraser et al. 2016). Four studies used pre and post levels of attendance as outcome measures (Bonsaksen, 2011; Emory et al., 2011; Long et al., 2015; Sailer et al., 2015). One study measured changes in anthropometric measurements and fitness measures (Cormac et al., 2013). One study did not directly measure physical activity as an outcome (Stanton et al., 2015). Instead, this study reported patient satisfaction with the exercise session as a therapy.

Clinical outcome measures and assessments of symptomology were used in several studies. The Positive and Negative Symptoms Scale (PANSS) (Deenik et al., 2018; Firth et al., 2017; Ringen et al., 2018a; Ringen et al., 2018b; Sailer et al., 2015) and the Clinical Global Impression Scale (CGI) (Deenik et al., 2017; Ng et al., 2007; Ng et al., 2007) were most commonly used. Five studies collected depression data (Bonsaksen, 2011; Ng et al., 2007; Ringen et al., 2018a; Ringen et al., 2018b; Sailer et al., 2015) and two studies collected pre and post exercise mood measurements (Long & Mason, 2014; Long et al., 2015).

Use of Behavioural and Psychological Theory

Four studies implemented theories of behaviour change (Long & Mason, 2014; Long et al., 2015; Ringen et al., 2018b; Sailer et al., 2015). One study utilised two behaviour change therapies (Long et al., 2015). The intervention was underpinned by Reinforce Appropriate Implode Disruptive (RAID) (Davies, 2012) and positive behavioral support (PBS) utilizing nudge principles (Thaler & Sustein, 2008). This study also incorporated the use of environmental stimuli as behavioural prompts by increased proximity to exercise sessions, timetabling exercise as essential and conducting activities on ward. One study incorporated goal setting and personalized feedback into the exercise program (Long & Mason, 2014). Psycho-education was incorporated in two studies (Deenik et al., 2018; Long & Mason, 2014). One study used Mental Contrasting and Implementation Intentions (Oettingen and Gollwitzer, 2010) as an intervention strategy with a control group (Sailer et al., 2015). One study trained staff in motivational interviewing (Ringen et al., 2018b). Several studies did not use specific behaviour change principles but provided encouragement for participants throughout the program both during and outside of exercise sessions to maintain motivation (Bacon et al., 2012; Cormac et al., 2013; Firth et al., 2017; Stanton et al., 2015). Nine studies did not use psychological theory or behaviour change techniques (Bonsaksen, 2011; Deenik et

al., 2017; Emory et al., 2011; Fraser et al., 2016; Ng et al., 2007a; Ng et al., 2007b; Ringen et al., 2018a; Tetile et al., 2009; Wynaden et al., 2012)

Exercise Protocol within the Studies

Three studies incorporated exercise as a mandatory adjunctive treatment (Bonsaksen, 2011; Tetile et al., 2009; Wynaden et al. 2012). Most studies incorporated organized exercise sessions, but they were not considered mandatory (Bacon et al., 2012; Cormac et al., 2013; Deenik et al., 2018; Emory et al., 2011; Firth et al., 2017; Long & Mason, 2014; Ng et al., 2007; Ringen et al., 2018b; Sailer et al., 2015; Stanton et al., 2015).

Length, structure and type of exercise sessions were varied. Session lengths varied from thirty minutes (Long et al., 2015; Wynaden et al., 2012) to three hours (Tetile et al., 2009). Frequency of sessions was also diverse. Some studies sought to implement exercise sessions daily (Deenik et al., 2018; Emory et al., 2011; Long et al., 2015; Ng et al., 2007; Wynaden et al., 2012) whereas others several times a week (Bacon et al., 2012; Bonsaksen, 2011; Cormac et al., 2013; Firth et al., 2017; Ringen et al., 2018b; Sailer et al., 2015; Tetile et al., 2009).

Eight of the studies utilised group exercise sessions (Bonsaksen, 2011; Deenik et al., 2018; Emory et al., 2011; Long et al., 2015; Ng et al., 2007; Sailer et al., 2015; Stanton et al., 2015; Tetile et al., 2009), whilst five studies included group sessions with the option of additional individual sessions if the participants wished (Bacon et al., 2012; Cormac et al., 2013; Firth et al., 2017; Ringen et al., 2018b; Wynaden et al., 2012). Only one study utilised individual exercise sessions (Long & Mason, 2014).

Three studies used gym-based sessions as the main exercise component (Long & Mason, 2014; Long et al., 2015; Stanton et al., 2015). These studies utilised gym equipment, circuit sessions and aerobic and resistance gym sessions. Several studies offered a choice of activities to patients or changed the choice of activity each session (Bonsaksen, 2011; Cormac

et al., 2013; Deenik et al., 2018; Firth et al., 2017; Ringen et al., 2018b; Tetil et al., 2009; Wynaden et al., 2012). These sessions included gym sessions, walking, jogging, swimming and team ball games. Walking was the chosen exercise in two studies (Ng et al. 2007; Ng et al., 2007), whereas other studies used jogging (Sailer et al., 2015) and dancing (Emory et al., 2011). One study used an active video game, wii fit (Bacon et al., 2012).

Exercise intensity varied across studies from low (Long et al., 2015) to vigorous (Firth et al., 2017). Several studies incorporated self-selected intensity for participants based on their fitness levels and tolerance of discomfort (Bonsaksen, 2011; Deenik et al., 2018; Long et al., 2014; Ng et al., 2007; Ng et al., 2007; Ringen et al., 2018b; Sailer et al., 2015; Stanton et al., 2015). Two studies stated session intensity varied depending on the type of session (Bacon et al., 2012; Tetile et al., 2009). Three studies did not discuss the intensity of exercise (Cormac et al., 2013; Emory et al., 2011; Wynaden et al., 2012).

Recruitment, Adherence and Attrition

Recruitment success rates varied; ranging from 27.5% (Firth et al., 2017) to 86% (Stanton et al., 2015). Attendance rates were similar at around 50% in several studies (Cormac et al., 2013; Tetile et al., 2009), with rates significantly lower at 28% in one study (Bonsaksen, 2011). One study had an average attendance of 62%, with 74% attending at least 1 session per week (Sailer et al., 2015). Adherence and attrition rates were identified as challenges to the incorporation of exercise interventions for secure settings in most studies. Attrition rates were also similar in those that reported it; 35% (Firth et al., 2017) and 42% (Cormac et al., 2013) in each respective study.

Study Efficacy

Of the five studies seeking to increase exercise, four were successful (Bacon et al., 2012; Firth et al., 2017; Long et al., 2014; Long et al., 2015). One study reported no changes

in attendance following the introduction of a structured exercise program (Cormac et al. 2015). Sailer et al., (2015) stated there were no differences in attendance between the intervention and control group, however attendance was higher in settings providing patients with more autonomy. Both studies incorporating exercise as part of a wider lifestyle change noted increases in exercise in participants following the intervention (Deenik et al., 2018; Ringen et al., 2018b).

Benefits of Physical Activity in SMI

Studies reported a range of participant perceived benefits. Stress management (Firth et al, 2017; Wynaden et al., 2012), enjoyment (Bacon et al., 2012; Firth et al., 2017; Wynaden et al., 2012) and improved physical health (Bacon et al., 2012; Cormac et al., 2013; Firth et al., 2017) were the most commonly reported benefits. Full list of benefits are shown in Table 2.

[INSERT TABLE 2]

Barriers and Facilitators

Only two studies directly explored barriers to physical activity within their design. Worries about current fitness level (Bacon et al., 2012) and low motivation (Firth et al., 2017) were identified as primary barriers. Several studies mentioned barriers to exercise in the discussion of the paper, following the intervention. These included; unsuitable environment to facilitate exercise, exercise not prioritized on ward and a lack of funding dedicated to physical activity (Long et al., 2014; Long et al., 2015). Staff related barriers were commonly reported. Lack of exercise knowledge (Cormac et al., 2013; Firth et al., 2017), insufficient training in exercise promotion (Long et al., 2015) and limited staff assigned to exercise promotion (Long

et al., 2014) were considered important barriers to physical activity. Sparse engagement and infrequent encouragement from staff regarding physical activity was also common (Bacon et al., 2012; Cormac et al., 2013). The importance of staff integration with patients as a facilitator for exercise was noted (Bacon et al., 2012; Cormac et al., 2013). This achieves a sense of shared experience between staff and patients alongside a feeling of likeness to decrease the differentiation in power (Tetile et al., 2009). Exercise instructors with specific exercise knowledge and practical competency in session delivery are considered helpful for patient adherence (Cormac et al., 2013; Tetile et al., 2009). Another identified facilitator was positive encouragement; this helps build rapport (Bacon et al., 2012) and strengthen relationships between patients and staff (Tetile et al., 2009) to sustain exercise motivation. Peer involvement and competition (Bacon et al., 2012), and the provision of self-regulatory and planning strategies (Sailer et al., 2015) were also considered useful for exercise engagement and adherence.

Staff involvement in Studies

Thirteen studies reported the involvement of hospital staff at some stage in the research (Bacon et al., 2012; Bonsaksen, 2011; Cormac et al., 2013; Deenik et al., 2018; Firth et al., 2017; Long & Mason, 2014; Long et al., 2014; Ng et al. 2007a; Ringen et al., 2018b; Sailer et al., 2015; Stanton et al., 2016; Tetile et al., 2009; Wynaden et al., 2012). Four studies did not state whether staff were involved (Deenik et al., 2017; Emory et al., 2011; Fraser et al., 2016; Ng et al., 2007b). In two studies, designated health and fitness instructors took the session (Stanton et al., 2016; Wynaden et al., 2012). In two studies, ward and nursing staff participated in the session and were responsible for the organization (Bacon et al., 2012; Ng et al., 2007a). Nine studies involved staff of several disciplines within the organisaton and delivery of the sessions (Bonsaksen, 2011; Cormac et al., 2013; Deenik et al., 2018; Firth et al., 2017; Long & Mason, 2014; Long et al., 2014; Ringen et al., 2018b; Sailer et al., 2015;

Tetile et al., 2009). The job roles of staff involved in the program included; clinical and nursing staff (Bonsaksen, 2011; Deenik et al., 2018; Firth et al., 2017; Long & Mason, 2014; Long et al., 2014; Sailer et al., 2015; Tetile et al., 2009), occupational therapists (Bonsaksen, 2011; Tetile et al., 2009), exercise and fitness instructors (Cormac et al., 2013; Firth et al., 2017; Long & Mason, 2014; Long et al., 2014; Tetile et al., 2009), dieticians (Cormac et al., 2013; Deenik et al., 2018; Long et al., 2014), therapists and psychiatrists (Deenik et al., 2018; Sailer et al., 2015) and physiotherapists (Long et al., 2014).

Challenges

Challenges associated with research in secure settings appeared to fall into two categories; the practical implementation of exercise programs in secure settings and conducting research in this environment. The main issues regarding practical implementation of the exercise programs largely involved staffing and the input from the wider multi-disciplinary team (MDT). Staff involvement was highlighted in multiple studies as important for patient engagement. This involved organization, promotion and involvement in physical activity sessions. All members of the health team are considered important for promoting the physical health of patients (Wynaden et al., 2012), however, this view is not consistent, and many staff members did not partake in physical activity sessions with patients (Bacon et al. 2011). Nurses and ward staff played a particularly important role in supporting patients with physical health needs and encouraging healthy lifestyle choices (Bacon et al., 2012; Wynaden et al., 2012). Staffing levels also posed a challenge to practical implementation of exercise programs in secure settings. Lack of staff available to escort patients to and from sessions, coupled with limited staff qualified to deliver physical activity sessions reduced the opportunities patients had to exercise (Cormac et al., 2013).

The most effective method to conduct research in this population is unclear, and there remains several unresolved queries in effective practise. Lengthy questions in both interviews and questionnaires were found to be difficult with patients with severe mental illness (Wynaden et al., 2012); it was suggested a structured question, or a short informal interview may be more effective. However, many standardized questionnaires are yet to be validated in this population (Deenik et al., 2017) raising issues in data validity.

Discussion

This scoping review aimed to address three main objectives; (1) to identify the methodology used in studies aiming to increase or evaluate physical activity in a secure setting; (2) to explore the use of behavioural and psychological theory in these studies; (3) explore and identify determinants of physical activity in secure settings. This review explored and synthesized the existing literature, with a view to facilitate discussion of challenges in conducting research, gaps in the current literature and aimed to identify factors before consideration in future studies.

Demographic Variables

Participants consisted mainly of a broad diagnostic group of mental illness. This may be problematic when comparing experimental groups, as disparity between symptomatology may confound results (Sailer et al., 2015; Wynaden et al., 2012). Differences in manifesting symptoms may present diagnosis specific barriers and facilitators to physical activity that may influence the significance of results. Lack of motivation and side effects of psychotropic medication are often noted as common barriers in schizophrenia (Soundy et al., 2014), however low mood and daytime fatigue are considered more prominent barriers in depression

(Glowacki, Duncan, Gainforth and Faulkner, 2017). Studies looking at barriers in SMI have often been inclusive of schizophrenia, schizoaffective disorder and other psychotic disorders, but few have included participants diagnosed with a mood disorder. For successful behaviour change to be sustained, it is vital to conduct a thorough behavioural analysis including diagnosis specific barriers and facilitators to exercise engagement (Vancampfort et al., 2013a).

Research has recently stated that physical activity research in specific groups can contribute to more advanced treatment (Deenik et al., 2017). In future studies, it would be useful to include diagnosis specific participant groups to minimize the confounding factors of illness symptomology and allow researchers to implement more detailed assessment of psychiatric symptom change. Additionally, multiple diagnosis in one group will involve disparities in medication between patients. It is well established that psychotropic medication produces considerable side effects, however, these differ profoundly between medication types and may impact an individual's ability and willingness to exercise differently. Whilst antipsychotics can lead to movement disorders (Lerner & Miodownik, 2011), antidepressants are generally not associated with this risk. However, excessive daytime sleepiness is considered a common side effect of high dosage anti-depressants (Cascade, Amir, Kalali & Kennedy, 2009).

Physical Activity Measurement

There is a general uncertainty around design, implementation and assessment of physical activity for SMI, evidenced by considerable variability in the identified studies in this review. Exercise recommendations around duration and type are also unclear for this population (Vancampfort et al. 2011); an appropriate ‘dosage’ for benefits remains unidentified. Due to the consequential effects of SMI symptomatology and medication,

alongside the restrictive environment of a secure setting, adhering to general WHO guidelines (World Health Organization, 2010) is unrealistic. Exercise guidelines for other clinical populations have been identified (Ginis et al. 2011; Rock et al. 2012), and a recent meta-review created guidance for physical activity in SMI populations based on current evidence; 2-3 sessions per week of moderate intensity aerobic and/or resistance of 45-60 mins duration (Stubbs et al., 2018). It would be useful provide service providers with similar guidelines for SMI within secure services.

Very few studies defined the intensity of the exercise sessions in their design. To date, there is limited evidence comparing type and intensity of exercise sessions in SMI, specifically secure settings. This deficit in knowledge precludes drawing definite conclusions surrounding the most effective format of an exercise sessions within secure settings, and the most beneficial intensity. Currently, knowledge on frequency, time, type and duration of exercise sessions is derived from intervention studies comparing physical activity to non-active controls (Stubbs et al., 2018), which limits the exploration of discovering the most effective physical activity design. Intensity is an important predictor of future exercise adherence (Ekkekakis, Parfitt & Petruzello, 2011), therefore, an important consideration. Self-selected or affect regulated exercise intensity has been shown to improve adherence in both general (Parfitt, Alrumh & Rowlands, 2012) and mental health populations (Rebar, Faulkner & Stanton, 2015). Additionally, affect regulated exercise has been shown to be of sufficient intensity to improve cardiovascular fitness (Parfitt et al., 2012). This is particularly encouraging for SMI groups in which adhering to physical activity guidelines for the general population may not be realistic or achievable. Exercise professionals have reported success when individualising duration, frequency and intensity of sessions to suit the individual (Firth et al. 2016; Stanton, Rosenbaum, Lederman & Happell, 2017), which may be appropriate in secure settings due to diversity in willingness, capacity and symptomology of patients.

Tailored sessions have also been shown to allow a degree of autonomy (Vancampfort et al., 2013b). Autonomous motivation has been repeatedly linked to exercise adoption and adherence in SMI (Vancampfort et al., 2013b; Vancampfort et al., 2015), therefore, research monitoring intensity in secure settings may be useful for exploring facilitators to exercise.

Sedentary behaviour is prolific in secure psychiatric settings (Janney et al. 2013) and produces high risk factors for cardiovascular mortality in SMI. However, all but one study either monitored current, or attempted to increase activity levels with no focus on reducing sedentary time. One study aimed to reduce sedentary behaviour as part of a wider lifestyle change intervention (Deenik et al., 2018), however a recent review documented that very few studies have been designed to tackle sedentary behaviour as an independent issue (Ashdown-Franks et al., 2018). Not only would this approach have significant benefit for patients, it may also be more feasible than attempting to incorporate moderate-vigorous physical activity into inactive populations. It has been suggested that long-term hospitalized patients with SMI may benefit from a gradual transition from sedentary behaviour to light intensity physical activity (Deenik et al. 2017). Therefore, it may be insightful for future research to explore levels of sedentary behaviour is secure services and encourage the design of interventions aiming to reduce this behaviour.

Use of Behavioural and Psychological Theory

Five studies used psychologically informed behaviour change theories to underpin their work, however, only one study offered a rationale as to why the theory they had chosen was appropriate to SMI (Sailer et al. 2015). Studies aiming to increase exercise in depressive populations have specifically used psychological theory that contains an element to address the motivational barrier (Mailey et al. 2010). Aiming to increase motivation, specifically autonomous motivation, has also been shown to be effective in schizophrenia (Vancampfort

et al. 2011; Vancampfort et al., 2015) and suggested to be useful for long term SMI patients (Beebe et al., 2011). Recently, there has been a considerable increase in studies that have developed and tested physical activity interventions; most of this work includes theories of motivation (Rhodes & Dickau, 2012). It has been stated that the inclusion of motivation theory in the development and testing of interventions aiming to change or maintain physical activity behaviours is important (Conner & Norman, 2015). However, despite strong evidence in the general population suggesting theory driven interventions are effective in encouraging behaviour change (Gourlan et al. 2016), studies utilising psychological or behavioural theory within secure settings, and SMI populations generally (Ashdown-Franks et al., 2018), are unexplored.

Additionally, behaviour change techniques were varied, and only offered tenuous explanatory links when explaining the effect of the intervention on the results. The theoretical explanations for the mechanisms the intervention was hypothesised to work through were unclear in the studies that utilised behaviour change theory. This problem has been identified in a previous study (Prestwich et al., 2014), which stated that the association between significant results and the use of theory is often unclear. Knowledge of appropriate theory used to change behaviour in SMI populations is limited, especially in secure settings, which creates difficulties when developing interventions. Utilising theory in behaviour change interventions provides a framework for falsification and evaluation of the process and proposed mechanisms responsible for change (Abraham & Michie, 2008). This is important in SMI and specifically secure settings due to the range of variables that could confound the attribution of behaviour change.

The Importance of Medication

Information on patient medication was sparse in most studies, despite being the most commonly administered treatment in SMI (Goodwin et al., 2016; Lally & MacCabe, 2015). A few studies noted baseline medication levels, however, did not reassess following completion of the exercise program. It is possible that patients may change their medication during the study, which may impact affect, volition and cognition (Savla, Vella, Armstrong, Penn & Twamley, 2013) and produce other undesirable side effects (Scheewe et al., 2013). It is consistently documented that most anti-psychotic drugs induce weight gain (Klemp et al., 2011) in both first episode and long-term patients (Parsons et al., 2009). Long term use of anti-depressants produces similar effects (Bet, Hugtenburg, Penninx & Hoogendijk, 2013). It is therefore reasonable to suggest that medication may impact both willingness and capacity to exercise, yet data documenting type, dosage and changes in patient medication is seemingly bypassed in most studies. Experimental studies aiming to infer causation to a mechanism of behaviour change need to document medication prior to and following the intervention to ensure any potential findings cannot be attributed to pharmacological side effects.

Recruitment, Adherence and Attrition

Small sample size was a commonly reported limitation throughout the review. This could be due to several reasons. Firstly, it is well documented that motivation of SMI patients to engage in exercise is limited (Verhaeghe, De Maeseneer, Maes, Van Heeringen & Annemans, 2013a). This is likely to be exacerbated in secure settings in which the environment is unstimulating (Long et al., 2014) and the propensity to undertake physical activity is low (Lake, Townsend & Alvanides, 2010). Additionally, several studies only incorporated one type of activity into their design. This may result in lower recruitment rates than if exercise options were diverse (Firth et al., 2017), as there may be patients that regularly exercise, whom however, are averse to the chosen activity.

As studies mainly rely on volunteers, it is probable that patients with no interest in physical activity will not participate (Fraser et al. 2016), yet these are the individuals that are necessary to target. Whilst recruitment remains a major challenge within research in secure settings, sustaining engagement in physical activity is also difficult. Several studies noted high attrition rates, alongside sporadic attendance in studies that offered multiple sessions. This is not dissimilar to exercise sessions for SMI individuals in the community (Chen, Chen & Huang, 2009). It would be useful for future research to explore ways to engage the majority of SMI inpatients who may typically opt out of regular physical activity (Soundy et al., 2013; Stubbs et al., 2016; Firth et al., 2017) and sustain engagement in those that participate.

As recruitment in this population is challenging, it is not uncommon for studies to integrate both male and female patients into one experimental group to gain a larger sample size. This may be problematic when inferring causation without controlling for the effects of gender. There are noted gender differences in psychosocial correlates of physical activity (Pan et al. 2009) with some studies suggesting women may engage in less activity than their male counterparts (Magoc, Tomaka, Gigi Shamaley & Bridges, 2016). Although research into gender differences and physical activity in SMI is sparse, an exercise study in a secure psychiatric hospital stated that highest attrition rates were among the female group (Cormac et al., 2013). Additionally, an evaluation of a high secure hospital exercise programme revealed that exercise adherence was worse for women (Cormac, Hallford, Hart, Geasey & Ferriter, 2008). This is hypothesized to be a result of a range of factors, including; more complex mental health needs (Cormac et al., 2008), higher rates of obesity in women with SMI than males (Dai, Wang & Morrison, 2014) and body image problems related to being self-consciousness and previous abuse (Long & Ritchie, 2007). This may explain inconclusive or unexpected results in studies with mixed participant groups; gender differences in physical

activity behaviour alongside diagnosis specific gender differences may indirectly influence results.

The Impact of Staff on Patient Physical Activity

Staff were identified as both a barrier and a facilitator to physical activity, indicating they play a pivotal role in both initiation and maintenance of patient exercise behaviour. Recent research has suggested the importance of integrating staff into the organisation and deliver of physical activity sessions, as part of facilitating a wider organisational change (Deenik et al., 2018b). Whilst exercise instructors with specific knowledge and experience in session delivery are useful (Cormac et al. 2013; Tetile et al. 2009), sessions are often sporadic or ad-hoc. It has been suggested that a ward environment conducive of exercise motivated staff would be useful to combat the obesogenic environment on a consistent basis (Long et al. 2014). Healthcare assistants (HCA's) who are intimately involved in patients' lives due to being on ward 24 hours a day (Cavendish, 2013) are well placed to support people with SMI in exercise participation due to having already established therapeutic relationships (Kinnafick et al., 2018; McAndrew et al. 2013).

However, lack of exercise knowledge and effective training were identified as barriers in several studies (Cormac et al. 2013; Firth et al. 2017; Long et al., 2015). Studies have shown that formal training for ward staff in exercise and mental health is limited (Stanton, Happell & Reaburn, 2015). Whilst members of staff recognise the benefits of exercise in SMI (Kinnafick et al., 2018; Robson, Haddad, Gray & Cournay, 2012), confidence to deliver exercise sessions is low (Verhaeghe, De Measeneer, Maes, Van Heeringen & Annemans, 2011). It has been suggested that it would be useful to incorporate exercise training for psychiatric staff into professional development sessions (Stanton et al., 2015) and focus on behaviour change in SMI to target barriers unique to mental health consumers (Arbour-

Nicitopoulos, Duncan, Remington, Cairney & Faulkner, 2014). It may be beneficial for future research to investigate the effectiveness of training other staff members to deliver physical activity sessions, due to limited availably of exercise professionals within secure services (Stubbs et al., 2018). However, this is challenging; due to lack of knowledge in the wider MDT, exercise is given low priority on inpatient wards (Stanton et al. 2015) creating difficulties to incorporate physical activity into daily care.

Limitations and Future Directions of Research Conducted in Secure Settings

Due to considerable variation in research design and intervention delivery, research limitations are both extensive and diverse. Very few studies used an experimental design; some studies only collected baseline measurements (Sailer et al., 2015; Wynaden et al., 2012), whilst others did not use a control group when implementing a change in practise (Cormac et al., 2013; Long et al., 2014; Long et al, 2015). Pre-post design provides more rigorous testing evaluation and are more useful to focus on conclusions of causality that are not permitted by cross sectional designs (Deenik et al., 2017). Additionally, secure settings offer a novel environment in which length of stay can vary hugely and both staff and patient changes occur regularly (Cleary et al., 2011; Haw and Rowell, 2011), therefore, it can be difficult to draw conclusions from cross sectional surveys. Future studies would benefit from taking both pre and post measures to ensure that any changes can be accurately identified.

Heterogeneity in patient populations, intervention design and studied outcomes provide considerable challenges when attempting to compare intervention results and draw conclusions relevant for clinical practice. The evidence base for increasing physical activity levels in SMI populations remains unclear (Ashdown-Franks et al., 2018), with considerably more uncertainty in secure settings. Therefore, it is difficult to infer specific clinical implications referring to the increase of physical activity, or how it should be implemented.

Further interventions focusing primarily on the increase of physical activity and reduction of sedentary time in secure services is necessary to reduce the ambiguity surrounding these questions. A recent review stated that the limited number of well designed, controlled interventions in this area prevents reaching definitive conclusions regarding both the superiority of different forms of physical activity (Stubbs et al., 2018), alongside the most appropriate 'dosage' for SMI in secure services.

Several studies within this review documented physical health or anthropometric measures (Cormac et al., 2013; Deenik et al., 2018; Fraser et al., 2106; Ringen et al., 2018a; Ringen et al., 2018b), evidencing the undeniable importance of physical health within SMI populations. A higher prevalence of obesity exists in secure settings than in comparison to the general population (Haw & Rowell, 2011; Long et al., 2014), undeniably exacerbated by the psychotropic medication used in the treatment of SMI, leading to weight gain (Rylance, Chapman & Harrison, 2012). It is now recognised that physical disease accounts for a considerable proportion of premature mortality in SMI (Walker, McGee & Druss, 2015), however, the evidence base for reducing obesity and physical health risks in mental health secure units is limited (Johnson, Day, Moholkar, Gilluley & Goyder, 2018). Reviewing the literature on physical health within secure settings was beyond the scope of this review, however the importance of physical health inequality within SMI and secure settings holds clinical implications. A future direction for secure setting research may be to investigate physical health in secure services as a potential barrier, facilitator or determinant of physical activity.

The use of psychometric tests in SMI inpatients provides several issues. Validated instruments to assess several psycho-social correlates of physical activity are unavailable in SMI populations, such as attitudes to exercise and self-efficacy (Deenik et al. 2017). Due to complexity of psychopathology and impaired cognitive abilities of long-term inpatients

(Basset, Troiano, McClain & Wolff, 2015), the use of existing measures is challenging. Currently there is no pre-exercise screening tool for mental health populations, however, the behavioural regulation in exercise questionnaire 2 (BREQ-2) has been increasingly used in research examining exercise motivations of people with SMI (Vancampfort et al., 2013a; Vancampfort et al., 2016b).

Most studies used self-reported measures of physical activity. There are concerns that self-report data may lead to inaccurate estimates of physical activity in people with SMI (Green, 2006); self-reported physical activity is commonly over-reported, and sedentary behaviours under-estimated (Long et al., 2015). It is also noted there has been little work conducted aiming to validate physical activity measures in SMI populations (Soundy, Roskell, Stubbs & Vancampfort, 2014). Consequently, self-report measures that are validated in other populations may not be as sensitive to accurately predict activity in SMI, as it is likely the activity performed in secure settings will be unstructured and of low intensity. Additionally, SMI individuals may have a shorter attention span and errors in comprehension (Prince et al., 2008) resulting in inaccurate recall. Objective measures of physical activity are associated with less estimation errors (Soundy et al., 2014), higher accuracy at distinguishing time spent in different intensities (Yamamoto et al., 2011) and have better registration of the lower spectrum of intensity (Basset et al. 2015), therefore, may be more appropriate to use in settings where activity is sporadic. Additionally, accelerometery data is considered more reliable than self-report in this population due to complexities of symptomology and cognitive deficits (Basset et al. 2015). There is a need for the development of clinically valid physical activity measures tested in SMI patients if physical activity is to be documented in routine care (Rosenbaum & Ward, 2016). The Simple Physical Activity Questionnaire (SIMPAQ) (Rosenbaum & Ward, 2016) was recently designed to assess physical activity in populations

at high-risk of sedentary behaviour, however, the validity data for this measure is yet to be published.

A further limitation of the current literature is the lack of research investigating barriers to exercise in secure settings. Considering it is well established that SMI individuals are inactive and there are noted barriers in SMI community populations (Soundy et al. 2014), it would be useful to know if these are consistent with barriers to exercise in secure settings. To implement a successful intervention to induce and sustain behaviour change, identification of barriers relevant to the setting is imperative.

Strengths and Limitations of Review

This study aimed to achieve validity by providing details of the research process including study selection, data extraction and analysis, and ensuring the inclusion and exclusion criteria was applied to each study. Articles were also reviewed by two independent researchers. Additionally, the author followed a well-established procedure for scoping review format (Levac et al., 2010; Murray et al. 2016). Three identified limitations are appropriate for the objectives of a scoping review. Firstly, the research question was broad which allowed for lifestyle interventions and studies evaluating current procedure to be included, rather than a specific focus on increasing exercise. Secondly, the setting of studies varied, with psychiatric settings of varying security and prison services included. Although all settings offer a 'secure' environment, it can be argued that opportunity and access would differ between institutions. Lastly, the quality of study design was not assessed. Although this is inclusive of the nature of the review, the dearth of information in secure psychiatric services, and now the potential value of the literature has been established, it may have also been beneficial to further assess the quality of included studies.

Acknowledgments

We would like to thank St Andrews Healthcare Charity for supporting the ongoing collaboration with the wider project, aiming to increase physical activity to improve both physical and mental health of patients in a secure setting.

Declaration of interest statement

The authors can declare there are no declarations of interest.

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Appendices

Appendix 1 – List of included studies

Bacon, N., Farnsworth, L., & Boyd, R. (2012). The use of the Wii Fit in forensic mental health: exercise for people at risk of obesity. *British Journal of Occupational Therapy, 75*(2), 61-68

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Tables

Table 1 – Table showing Study Data

Author and year of publication	Participant demographics, setting and medication information	Study design and measures	Study procedure and exercise variables	Use of Psychological or Behavioural Theory	Key Findings	Limitations
Bacon et al. 2012	2 participants: 1 male aged 28, 1 female aged 43. Diagnosis: schizophrenia (1) and schizoaffective disorder (1). Medicated on Clozapine. Secure forensic mental health hospital.	Cross sectional, mixed methods. Objective PA measurement via Accel. Individual semi-structured interviews.	Participants wore accel for 1-4 days. Interviewed at the end of study. Participants engaged in twice weekly group session on the Nintendo Wii Fit.	No theory applied.	Increased activity. Weight loss. Qualitative findings stated the use of Wii Fit facilitated engagement and enjoyment.	Small participant number. Limited timescale. Exercise levels not as vigorous as required for optimal functioning.
Bonsaksen, 2011	18 participants: 12 male, 6 female. Mean age 44. University psychiatry department. No medication information stated.	Cross sectional, quantitative. Depression and anxiety measured by HADS. Attendance collected.	Staff registered attendance to hospital exercise program. Exercise part of hospital treatment. Walking most common activity. 2 weekly group sessions lasting 1 hour. Self-report questionnaire administered to all participants.	No theory applied.	Mean level of attendance: 28.4%. 78% of sample attended less than 50% of sessions. Age and participation positively correlated. Depression and anxiety more severe in females.	No limitations stated

Cormac et al. 2013	120 participants: 96 male, 24 female. Age range 20-63. All participants overweight/obese. High secure psychiatric hospital.	Pre-post measures. Quantitative. Weight, pulse rate, blood pressure, strength, flexibility, peak expiratory flow, aerobic capacity and BMI.	Before and after service evaluation procedure. Education and fitness session. 10-12-week duration. Measures taken pre and post. Information given on healthy lifestyle. Encouraged to attend fitness sessions; range of activities. 1 hour per week. Extra sessions available.	No theory applied.	63% lost weight, 5% stayed the same, 32% gained weight. Improvements in weight, BMI, waist size and fitness measures. Adherence problems lowered effectiveness. Staff commitment and enthusiasm important facilitators. Female group had highest attrition.	No data collected on reasons for participant dropout.
Deenik et al. 2017	184 participants: 109 male, 76 female. SMI diagnosis. All participants; >18 years of age, hospitalised for >1-year, treatment history >2 years. Psychiatric Hospital. Medication split into 1st, 2nd and mixed generation antipsychotics.	Cross sectional. Quantitative. Accel measured PA. Gender, age, hospitalisation duration, illness, medication. Clinical Global Impression Scale, EuroQol 5D, Brief WHO QOL, PA Enjoyment Scale, MD Self Efficacy Questionnaire.	Wore accel for 5 days. Participants administered questionnaires following the accel procedure.	No theory applied.	PA positively associated with QOL. PA predictor of physical, psychological and social QOL. Most QOL improvement changing from sedentary behaviour to light activity. Patients with positive attitude no more active than patients with a less positive attitude and lower SE.	No limitations stated

Deenik et al. 2018	108 participants: 66 male, 42 female. SMI diagnosis: schizophrenia and other psychotic disorders. All participants >18 years of age, hospitalised for >1 year. Long term inpatient psychiatric care. Medication not stated.	Pre-post measures. Quantitative. Accel measured PA and sedentary behaviour, weight, abdominal girth, blood pressure, metabolic blood measures, PANSS.	Took baseline measures and evaluated changes 18 months after implementation of intervention. Compared 3 wards receiving intervention to 3 wards receiving treatment as usual (TAU).	No theory applied.	Intervention shown to improve PA and metabolic health. 13.5% increase in total activity. Non-significant decrease in sedentary behaviour and increase in PA compared to TAU group. Improvements in weight, abdominal girth and systolic blood pressure and HDL cholesterol. No significant improvement in psychotic symptoms. Organisational change considered main factor to influence change.	Wards not randomised. Limited group size. Relatively large amount of missing baseline PANSS scores.
Emory et al. 2011	Male and female participants. >18 years of age. All admitted for stabilisation of mood disorder of behavioural disturbance. All participants on psychotropic medication. Adult psychiatric inpatient unit.	Pre-post measures. Quantitative. Retrospective review of attendance and falls data 6 months before and after program. Barriers to implementation evaluated.	Pre-post design to assess feasibility and impact of introduction of line dancing added to current exercise program. 40 minutes daily. Warm up, session and cool down procedure.	No theory applied.	Attendance and participation in exercise sessions higher following introduction of line dancing. Common reasons for non-participation was inability to be safe in less secure area	Not sufficient power to detect small difference of proportion of patients with falls in the two conditions. Sample size too small for sufficient power.

Firth et al. 2017	Male and female participants. SMI diagnosis. Aged 18-65. 4 residential secure units.	Pre-post measures. Mixed methods. Primary measure feasibility; recruitment, retention, exercise achieved. International Physical Activity Questionnaire, 10 item tick box assessing desired outcomes of PA, BREQ, PANSS, Social and Occupational Functioning Assessment Scale, Neurocognitive tasks, body weight. Semi structured interviews.	Pre-post pilot trial. 10-week intervention period. Interviews conducted within 2 weeks of intervention completion. 90 mins structured exercise per week. 2 weekly sessions – 1 organised group session, 1 organised with patient carer.	No theory applied.	Increase in activity from baseline to post intervention. Autonomous motivation strongly correlated with PA post intervention. Average exercise: 87 minutes vigorous, 141 minutes low intensity exercise per week. Increase in PA correlated with decrease in psychiatric and negative symptoms (shown by PANSS). Physical health, weight loss, enjoyment and distraction common exercise incentives. Low motivation primary barrier. Professional support important.	No limitations stated.
Fraser et al. 2016	101 participants. 18-75 years old. SMI diagnosis. Private	Cross sectional. Quantitative. Accel data	Wore accel for 7-day period. Questionnaires administered to	No theory applied.	Self-reported PA indicated 32 mins per day MVPA, 12.7 hours sedentary time.	Possible response bias – not all eligible individual were invited

	secure hospital. Medication not stated.	collected. Active Australia Survey, Questionnaire on sedentary behaviour. Kessler scale of psychological distress. 5 explanatory variables correlated considered to identify possible correlates of MVPA – gender, education, BMI, age, psychological distress.	participants.		Accel data indicated 115 minutes of light activity, 37 mins MVPA, 11 hours sedentary. Approximately 50% reported no vigorous exercise. 65% adult inpatients can be physically active. Weekday sedentary time higher than weekend.	to participate.
Long & Mason, 2014	6 female patients. Mean age 33. Medium secure admission ward unit at a psychiatric facility. Medication not stated.	Pre-post measures. Quantitative. Post study evaluation of service user's views. Semantic differential scale (mood monitoring) after each	Personal training sessions conducted over a 12-week period by exercise professional. Program focused on psycho-education, personalised assessment and incentives to engage. Emphasis given to mood and wellbeing.	No theory applied.	Positive mood changes following sessions. Increased attendance. Development of active ward checklist. Areas of improvement; need for environmental change to facilitate PA, lack of funding, PA co-ordinator, minority of staff training in motivational strategies.	No limitations stated.

		session. Post study evaluation of attendance records.			Strategies to increase exercise; training staff in motivational strategies, prioritising activity, environmental nudges, increasing proximity and health feedback.	
Long et al. 2015	32 female participants. Age range 18-48. Personality disorder (n=25), schizophrenia or schizoaffective disorder (n=5), depressive disorder (n=2). Psychiatric tertiary referral centre. 1 low secure and 1 medium secure ward. Medication information not stated.	Pre-post measures. Quantitative. New Zealand Physical Activity Questionnaire Short Form, body fat, body muscle, expiratory flow, resting pulse rate, perceived exertion. Attendance categories at government guidelines of low, moderate and vigorous PA per week. BREQ, 2 ad-hoc questions on 1-10 Likert scale before and after	Baseline data collected over a 3-month period, recollected at 6 months. Ward requirement of 30 minutes of PA per day. Individualised sessions delivered by PA professional. Low level aerobics.	2 theories – environmental interventions and reinforcing activity. Underpinned by Reinforce Appropriate Implode Disruptive (RAID) and "nudge" principles. Environmental interventions included; ward prompts, increased proximity, PA essential, incentivising attendance. Staff motivated and reinforce PA – were	Increase in attendance following intervention – paralleled by increase in duration and frequency form questionnaire. Clinically significant changes in pre and post resting pulse rate and perceived exertion. Improvement in motivation as measured by BREQ. Positive pre and post mood changes.	No limitations stated.

		sessions. Mood monitoring.		trained in MECC. Biometric and mood feedback following session.		
Ng et al. 2007a	14 participants. Mean age 43. Bipolar disorder. Private psychiatric inpatient unit. Medication not stated.	Pre-post measures. Quantitative. Clinical Global Impression Severity Scale (CGI-S), Clinical Global Impression Improvement Scale (CGI-I) and the Depression Anxiety Stress Scale (DASS)	3 scales administered on admission and discharge. Walking group on weekday mornings, 40-minute walk on even terrain. Speed and distance depended on ability.	No theory applied.	Pilot study. Significant effects in favour of intervention. Walking group had intrinsic beneficial effects – no difference in CGI-I and CGI-S but participants had lower overall DASS and lower DASS subscales.	No limitations stated.
Ng et al. 2007b	84 participants. 35 in walking group, 49 in other. Private psychiatric inpatient unit. Medication not stated.	Pre-post measures. Quantitative. Clinical Global Improvement Scale (CGI) and Depression Anxiety Stress Scale (DASS)	2 scales administered on admission and discharge. Walking group for 40 minutes on weekday mornings. Speed and distance dependant on patient capabilities.	No theory applied.	No significant differences between groups on admission or discharge in almost all measures. Walking group participants had worse CGI on discharge. Study cannot support refute effectiveness of walking program.	Did not control for physical comorbidities, illness severity or treatment resistance. Did not collect patient demographics, psychiatric diagnosis or baseline activity levels. No group randomisation. Exclusion of patient

						data who participated irregularly.
Ringen et al. 2018a	83 participants, male and female. Mean age 40. Aged 18-65. ICD diagnosis of F20 (Schizophrenia, schizophreniform disorder, psychotic disorder), F25 (schizoaffective disorder) or F31 (bipolar disorder). Long term psychosis wards at psychiatric hospital. Psychopharmacological medication stated.	Cross sectional. Mixed methods. Height, weight, blood pressure, waist circumference, PANSS, depression (MADRS), global symptoms (GAF), self esteem, HUNT questoionaire assessing PA and life satisfaction, quality of diet, biochemical risk factors. Physical activity	Conducted cross sectional design. Analysis of baseline measures of intervention group as part of a wider study.	No theory applied.	Highly elevated levels of two main cardiometabolic risk factors: obesity and tobacco use. Low levels of daily PA. Unhealthy eating habits. Assocaition between lower frequency of PA and more symptoms of apathy and depression and lower levels of self-esteem. Significant associations between BMI and biochemical risk factors.	Small sample size. Missing data for several assessments in sub group analysis. Medication dosage not reported.

		assessed via interview with patients.				
Ringen et al. 2018b	83 patients, 47 male, 36 female, mean age 40.1, schizoaffective disorder, bipolar disorder and psychotic disorder. Median admission time 24 months (1-240). Antipsychotic medication. Private psychiatric inpatient care.	Pre-post measures. Baseline measures taken over 4 week period, follow up measures 6-7 months later. Cardiometabolic risk factors, weight, BMI, waist circumference, smoking habits, PA on HUNT questionnaire, life satisfaction HUNT, PANSS, depression (MADRS), global	Lifestyle change project. Intervention aimed at lifestyle change to reduce cardiometabolic risk. Intervention consisted of 3 components. 1) Motivational interviews – mandatory training for all staff to enhance physical activity, dietary improvement and smoking cessation, patients offered at least 15 mins MI per week. 2) Physical activity as part of	Motivational interviewing	Significant reduction in triglyceride level and smoking following intervention. No increase in PA level. Decrease in depression levels, PA positively associated with motivation and negatively associated with positive symptoms. Reduced level of positive symptoms associated with PA.	Incomplete implementation of parts of intervention – feasibility issues. Missing data. Failure to improve PA may suggest intervention weak or non-targeted. No control groups. Not able to control for effects of time. No objective measures of PA.

		functioning (GAF), apathy, motivation	individual treatment plans – patients offered program made with staff with goal of 30 mins PA three times per week. Continuous physical activity 3) Establishment of basic infrastructure for physical activity and diet. Established gym maintained by physiotherapist.			

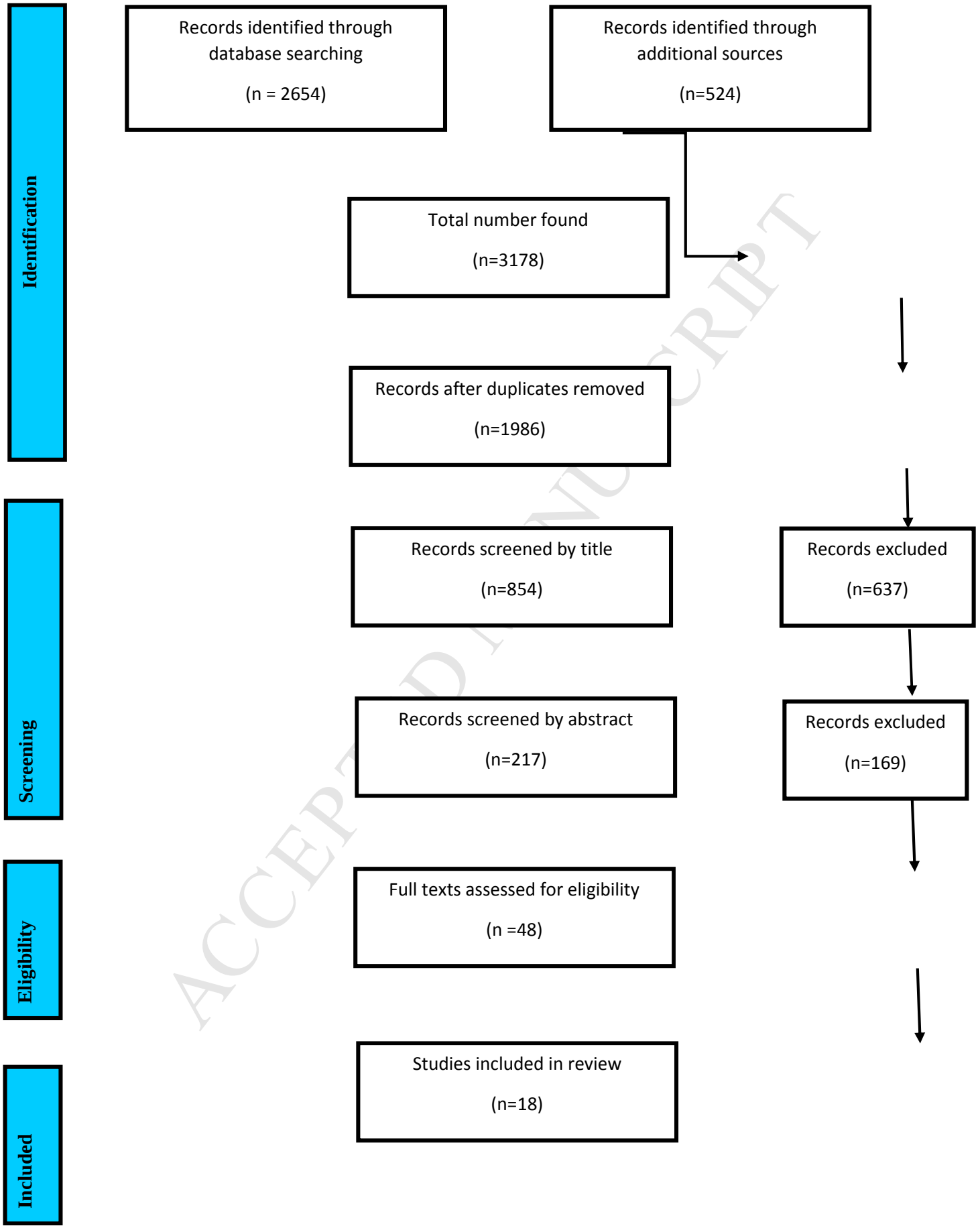
Sailer et al. 2015	36 participants: 25 male, 11 female. Mean age 30.89. Diagnosis of schizophrenia spectrum disorder. Medication information taken at baseline.	Pre-post 2x2 between subjects' pilot intervention. Quantitative. Specialist psychiatric wards. Attendance, persistence and commitment measured. Attention and comprehension rated by therapists after intervention using 3 item scale. Pre and post measures: PANSS, Beck Depression Inventory (BDI) and IPAQ	Participants assigned to experimental (MCII) or control. Control group focused on goal intentions. Jogging used as target behaviour. Sessions were 30 minutes and patients ran approximately 1000m. 2 sessions per week.	Implementation intentions theory and goal intentions.	Higher attendance and persistence in Autonomy focused MCII patients. PANSS and BDI scores decreased. MCII could increase PA in schizophrenia. MCII increased attendance and persistence over 4 weeks. Attendance reasonably high – 61.75%. PA interventions can benefit from adding self-regulatory and planning strategies. Easily be applied and are cost efficient.	Randomisation not perfect – intervention group older, higher BMI and more educated. Medication only assessed at baseline. MCII and control patients in same PA group – contamination of experimental conditions possible. Did not look at intensity. Only one type of activity
Stanton et al. 2015	Inpatients mental health consumers. Demographics unavailable. Medication not stated.	Cross sectional. Quantitative. Inpatient mental health ward in private hospital. Site evaluation. Questionnaire around group	Participants complete anonymous questionnaire on discharge. PA program led by experienced specialist. Group program using combination of aerobic/resistance	No theory applied.	Greater proportion of inpatients rated exercise as excellent compared with all other activities (57.1%). Exercise ranked considerably higher than relaxation.	Patient demographics and medication information unavailable.

		activities, satisfaction with activity. Response choices: excellent, very good, good, fair and poor.	training – 20 mins aerobic and body weight exercise.			
Tetile et al. 2009	5 nursing staff (2 male, 3 female. Age 34-48. Mean time working in hospital 12.4 years), 15 patients (12 male, 3 female. Age 20-51.) No medication information. High secure psychiatric hospital.	Cross sectional. Qualitative. Semi structured interviews and focus groups with all participants.	Interviews focused on views and experiences of PA program. Focus group with staff to discuss topics from interviews. PA is adjunctive mandatory therapy 3 times a week. All sessions group based. Each patient has assigned member of staff whom they exercise with. Recreational activity once a week for 3 hours.	No theory applied.	Four main themes identified: (1) Therapeutic relationships perceived as essential to facilitate recovery, (2) Mandatory exercise is necessary and helps to create a strong culture, (3) positive reinforcement is key for successful outcomes, (4) exercise instructors are important for adherence.	Small sample size
Wynaden et al. 2012	56 participants: 47 male, 9 female. Age range 19-50. No medication information. Small secure psychiatric hospital. Low, medium and high secure facilities.	Cross sectional. Quantitative. Questionnaire designed collaboratively by exercise specialist and MDT aiming to evaluate the current exercise	Questionnaire pilot tested on several participants to ensure content validity. Exercise incorporated as part of a healthy lifestyle initiative at the hospital. 30 minutes to one hour per day. Individual, group or team based. The questionnaire was self-	No theory applied.	5 benefits of exercise identified (1) managing stress and anxiety, (2) providing structure and meaning to the day, (3) building new relationships with patients and staff, (4) learning new skills e.g. aggression management, (5) being active in their	No limitations stated.

		program at the hospital.	report aiming to evaluate the current program. Involved demographic questions, perceived level of satisfaction with the program and suggested changes.		own care – allowed participants to take some control over their health. 41% enjoyed the program, 26% said it was useful and 22% said it made them feel better. Participants attended the gym for several reasons; 15% to stay healthy, 14.5% to get fit, 13.2% to reduce stress, 11.9% to pass the time, 11% routine, 9% assistance with symptoms.	

Table 2 – Perceived benefits of exercise

Perceived Benefit	**Article Benefit is Mentioned**
Stress and anxiety management	Firth et al. 2017; Wynaden et al., 2012
Improved physical health	Bacon et al., 2012; Cormac et al., 2013; Firth et al., 2017; Wynaden et al., 2012
Aggression management	Tetile et al., 2009; Wynaden et al., 2012
Building relationships	Bacon et al., 2012; Cormac et al., 2013; Tetile et al., 2009; Wynaden et al., 2012
Enjoyment	Bacon et al., 2012; Firth et al., 2017; Wynaden et al., 2012
Improvement in socio-occupational functioning	Firth et al., 2017
Improvement in fitness measures	Cormac et al., 2013; Long et al., 2015; Wynaden et al., 2012
Improvement in well-being and quality of life	Deenik et al., 2017; Wynaden et al., 2012
Improvement in motivation to exercise	Firth et al., 2017; Long & Mason, 2014; Long et al., 2015
Reduced aggression	Bacon et al., 2012; Long et al., 2015; Tetile et al., 2009
Learn new skills	Wynaden et al., 2012
Positive mood changes	Long & Mason, 2014; Long et al., 2015
Providing structure to the day	Firth et al., 2017; Wynaden et al., 2012
Reduction in symptomology	Firth et al., 2017; Ng et al., 2007a; Sailer et al., 2015; Wynaden et al. 2012
Weight loss	Bacon et al., 2012; Cormac et al., 2013; Firth et al., 2017



Highlights

- Use of psychological and behavioural theory shown to be successful in secure settings, however, use of theory was scarce and had limited rationale.
- Despite variation in structure and implementation, mandatory and voluntary exercise sessions show considerable clinical, psychological and physical benefits
- Recruitment, adherence and withdrawal offer challenges for study design
- Medication information overlooked or under reported
- Lack of staff training, and engagement considered a barrier to physical activity and offer important future research direction

Author Disclosure Statements

Statement 1:

No funding was provided for the conduct of the research or preparation of the manuscript.

Statement 2:

Author ER conducted the literature search, analysed the included studies and wrote the first draft of the manuscript. Author FK reviewed the included studies and all authors (ER, FK, AP) contributed to and approved the final manuscript.

Statement 3:

All authors declare that they have no conflicts of interest.