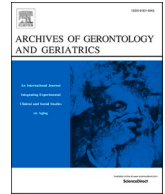


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A comprehensive overview of social network measures for older adults: A systematic review

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ABSTRACT

Objectives: The size and type of older adults' social networks is associated with health, mental and social outcomes. Investigators within many disciplines are now measuring social networks, but it is not always clear what they are assessing, or which measures may best meet their objectives. To undertake a systematic review to identify (i) social network measures used for older adults, (ii) variety of social network dimensions and (iii) how measures have developed over time.

Materials and Methods: The MEDLINE, EMBASE, CINAHL, PsycInfo and Cochrane Library databases were systematically searched to identify social network instruments, followed by categorization of the domains into quantitative, qualitative and alter domains.

Results: A total of 229 studies and 21 social network measures were included, with 11 quantitative dimensions (e.g., size, frequency), 5 qualitative dimensions (e.g., support satisfaction, emotional bond) and 7 alter members (e.g., family, neighbours) of social networks identified. Measures commonly clustered on quantifiable network size (n = 19), availability of supportive networks (n = 14) and presence of family ties (n = 21). The period between 1985 and 1995 produced the greatest number of newly developed social network measures (n = 10) with a stronger focus on qualitative features.

Discussion and Implications: This review provides researchers with an organized summary of measures and dimensions for consideration when appraising social connections in older adults. This can enable better study design through providing information that makes explicit inevitable trade-offs between survey length, comprehensiveness of dimension coverage, and utilization of the measure for researchers.

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Introduction

High quality social networks, connectivity, and social integration are valuable aspects to living a longer life and contribute to better mental and physical health (Cohen, Underwood, & Gottlieb, 2000). Older adults with limited social interactions have a higher prevalence of depressive symptoms (Choi & McDougall, 2007), and those who are socially isolated are more likely to experience functional decline, morbidity and premature death (Cacioppo & Cacioppo, 2014; Perissinotto, Cenzer, & Covinsky, 2012). To advance and promote healthy aging (World Health

Organization, 2015), social networks should be systematically and routinely measured in older adults.

With increasing research across academic disciplines on social networks and its effect on physical and mental health in both general and older populations (Greaves & Farbus, 2006), there has been a stronger focus on the measurement and definitions of social networks in the literature (Pomare, Long, Churrua, Ellis, & Braithwaite, 2019; Valente, 2010). Measurement has been poorly standardised due to disagreement over the definition and theoretical basis of social networks (Borgatti & Halgin, 2011). For instance, definitions of social networks often differ by

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discipline, and are frequently confused with related topics such as social support (Secco & Moffatt, 1994).

To address the issue of differing definitions in the literature, Berkman and colleagues provided some clarity of the terms describing social factors and behaviours (Berkman, Glass, Brissette, & Seeman, 2000). Traditionally, a social network is defined as the quantifiable relationships (i.e., ties) between individuals, families, groups, or corporations (i.e., nodes), that are held together by a common interest, goal, or need (Berkman et al., 2000; Cohen et al., 2000). This network then helps to facilitate engagement in social activities and promote access to social support (Berkman et al., 2000). Social networks can be further defined according to the type and frequency of interaction between nodes or the overall density of the network (Berkman et al., 2000; Wasserman & Faust, 1994). Examples of social activity, also known as social participation, interaction or engagement, may include meeting friends, attending events or functions, volunteering or participating in occupational duties or group recreational activities (Berkman et al., 2000).

On the other hand, social support, is often divided into three types (emotional, instrumental, and informational) which relates to how an individual perceives the availability of help or support from others in their social network (Berkman et al., 2000). Recent evidence highlights increasingly that quantifying social networks, which is more of an objective measure of the structural relationships, is more appropriate to understanding its association with critical health outcomes (e.g., cognitive function, Kuiper et al., 2015; Kuiper et al., 2016).

Certain theories are particularly well known in social network literature, for example, Granovetter's (Granovetter, 1977) strength of weak ties theory or Burt's (Burt, 2000) structural holes theory. Strength of weak ties refers to the advantages of having weak tie networks for access to novel information outside of the immediate network of strong ties (i.e., having links outside of your family and friends). Building on this, structural holes theory argues that the value in weak ties lies in the ability to bridge between networks and act as social resources that can lead to the development and accumulation of human capital. Together, these set of theories are referred to as the network flow model (Borgatti & Halgin, 2011). With the many definitions and theories underpinning social networks, there are also a plethora of options available for measuring social networks.

New measures of social networks continue to be developed to reflect different perspectives, changing clinical needs, and input from newly interested disciplines. A challenge for a researcher interested in social networks is selecting an approach for measurement, which may include choosing an established tool or developing a study-specific measure. Self-generated measures of social networks may include a name interpreter (i.e., providing a 'roster' of names for participants to indicate with whom they interact) or name generator (i.e., asking participants to generate a list of people, groups, or organisations they interact with). Previous reviews have highlighted available measures of social networks, for example, Siette, Gulea, and Priebe (2015) described eight instruments for assessing social networks in patients with psychotic disorders. However, no past review has specifically identified measures in assessing social networks for older adults. It is also important to better understand how measures have been applied across different academic disciplines, given that priorities for measuring social networks in one discipline, such as psychiatry (Siette et al., 2015), may not be a priority in another context, such as health systems (Masic, Sivic, Toromanovic, Borojevic, & Pandza, 2012). This review will address the gap in the literature in identifying social network measures for older adults, their evolution over time, and their theoretical underpinnings.

The aims of the current review were to: (1) systematically identify social network measures in studies of older adults; (2) describe the characteristics of the identified measures; (3) examine how the measurement of social networks has developed over time; and (4) organise the dimensions identified into a conceptual framework, highlighting key themes of networks, and the measures that assess them. Our wider objective was to provide researchers with a summary of a selection of

social network measures to assist with selecting the most appropriate domains in relation to their specific purposes.

Method

Search strategy

A protocol was developed using the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA; Moher, Liberati, Tetzlaff, Altman, & The Prisma Group, 2009) statement. Search terms were applied to electronic databases Medline, Embase, PsycInfo, Web of Science, British Nursing Index (BNI), Cumulated Index to Nursing and Allied Health Literature (CINAHL) and the Cochrane Library on 14 November 2020. Search terms were a mixture of social contact assessment descriptors and older adult descriptors; (*social contact OR social assessment OR social network*) AND (*aged OR older adult* OR older person**) AND (*instrument OR scale OR measure OR questionnaire OR interview*). In addition, screening of reference lists of eligible papers and contacting experts in the field was conducted. Relevant measures were also identified through citations from relevant study articles and literature reviews looking at social networks more generally.

Inclusion and exclusion criteria

Studies were included if they assessed social networks as an outcome (e.g., primary or secondary) by using a social network measure with an accompanying analysis of findings (e.g., score). Studies that explored any type of social contact assessment (defined as a social interaction occurring face to face or online in any setting), and on any type of network measurement (e.g., contact via telephone or social media) were included. Studies were excluded if their core focus was on social capital, social functioning and/or social support (i.e., there were no questions that asked about social networks or social contacts in the studies or scales) as our focus was on the objective quantification of network types and frequency. Studies that had unclear assessment measures, for example, study specific derived scales (e.g., self-developed instruments that did not undergo psychometric testing, theoretical backing, or were not developed from the ground-up) and/or the use of one question to assess networks (e.g., marital status) were included in the initial paper review stage, and excluded from the final review. Studies and measures were restricted to those in English and to older adults aged 55 years or more to capture the lower age limits among racial and ethnic population groups who are considered an older adult.

Study selection

All potential studies were exported into a reference citation manager and duplications removed. The primary author (JS) removed duplications and conducted the initial screening of titles and abstracts for inclusion. A random selection of 20% of the abstracts was then screened by the fourth and fifth author (LD, MJ). If there were any ambiguity on the abstract, the full paper article was obtained and reviewed with primary author JS. Inter-reviewer agreement was high with the 20% of articles screened (95%), with disagreement on the inclusion of only one paper, which was brought to the rest of the team for review. Selected full-text articles were then obtained for the final screening. Final study selection was completed by the primary author (JS) with 50% by two independent authors (LD, MJ) with another author (AG) available to resolve disagreements. The details of the selection procedure are displayed in the PRISMA diagram (Fig. 1).

Data extraction

Data extraction was completed independently by one reviewer (JS) and checked by an additional reviewer (LD) with the research team adjudicating in the event of disagreement (AG). The data extraction tool

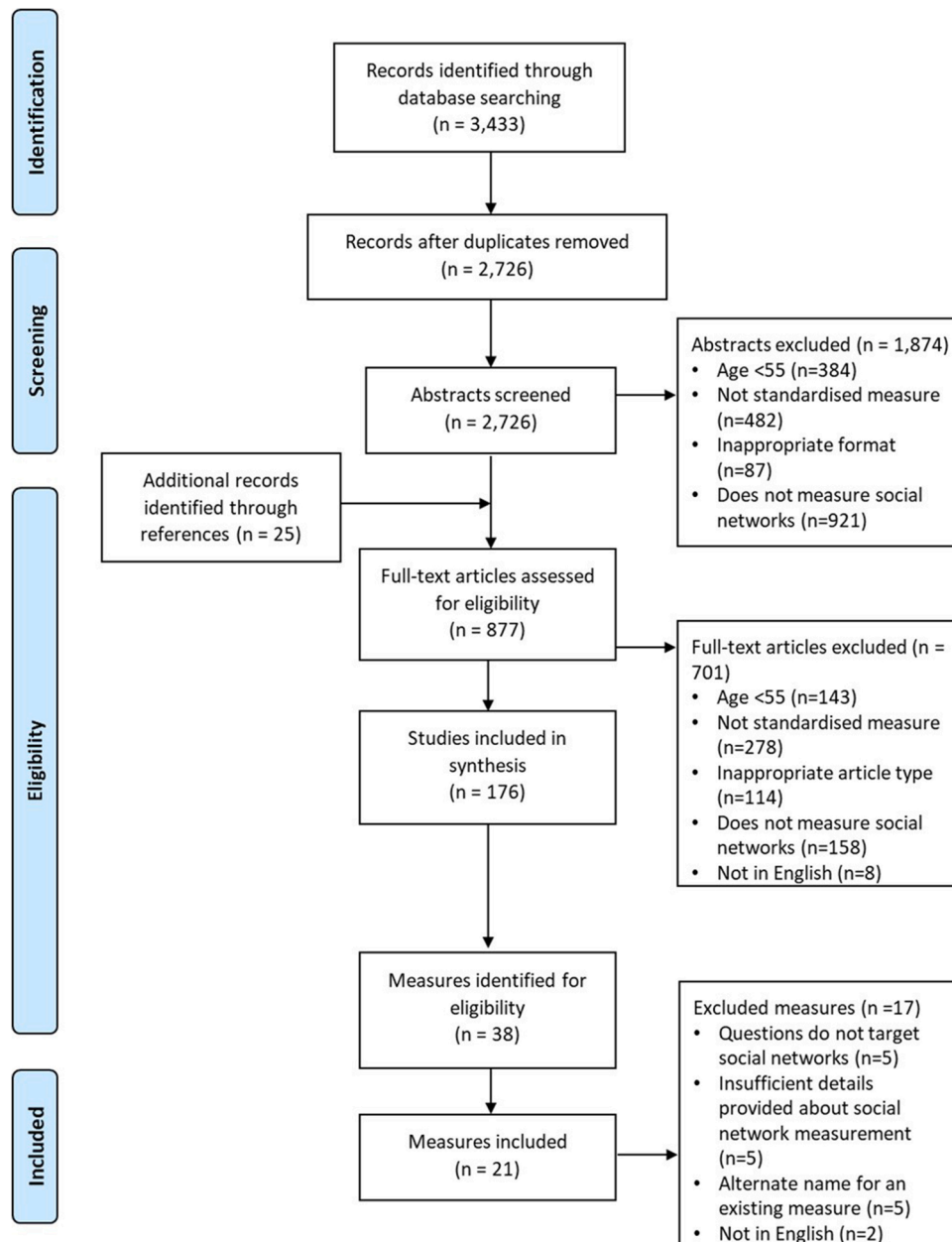


Fig. 1. PRISMA diagram.

was piloted to ensure proper documentation of the qualitative and quantitative components of the included studies. Once finalised, data were extracted on study general characteristics (e.g., year, country, participants, study design), patient characteristics, assessment method, and study findings.

Data specific to the social network measure were identified using a thematic analysis approach (Braun & Clarke, 2006). Aspects of social network (e.g., quantitative, qualitative, alters) addressed by the identified measures were coded under domain categories. Main domains emerging from the measures were identified independently by JS and LD and any discrepancies that arose were solved through discussion with the third member of the review team (AG). Themes were then gradually assembled into larger domains. Once these domains were reviewed and amended by the review team, they were further re-fined and defined. In addition to measure domains, the target populations of instruments were also recorded.

Utilising a phenomenological hermeneutical approach (Laverty, 2003), JS and LD interpreted the data excerpts in an iterative manner by

reading and critiquing each other's texts. Data was abstracted to form categories in the form of quantitative, qualitative and alter domains. These domains were then further condensed into subcategories and reviewed in a timeline perspective. JS, LD, and CP contributed to finalising the themes, categories and timeline. The review team included academics with backgrounds in psychology (JS), sociology (NH), health systems (CP), allied health (MJ) and health informatics (AG), helping to minimise disciplinary biases. Results were synthesised as a narrative review.

JS, LD and MJ were in 100% agreement for all papers and scales extracted, thus a third party (AG) was not consulted. For social network measures that could not be found, two authors (JS, LD) made direct contact requesting the necessary information to complete the synthesis. If the authors or relevant authority could not be contacted or did not respond, their papers and measures were not included in this review. There were only two articles in this category, however their measures were already included in the review.

Results

A total of 3,433 records were retrieved from database searching (Fig. 1). After the removal of duplicates and abstract screening, 877 full-text papers were examined for eligibility. Following full-text review, 176 studies fitted the inclusion and exclusion criteria and 38 social network measures for older adults were identified. After investigation and discussion, a further 17 measures were excluded leaving a final 21 measures presented in an organised toolkit in Table 1. Characteristics of the measures and domains assessed are summarised in Tables 1–4 and discussed hereafter.

Social network measures

The 21 included measures were originally published between 1978 and 2016, with most measures being produced between 1985 and 1995 (Fig. 2). The reported time taken to administer the social network measures ranged from five minutes (e.g., Lubben Social Network Scale, LSNS) to two hours (e.g., Network Analysis Profile, NAP). The number of items ranged from five (e.g., Cohen's Social Network Index, CSNI) to 35 (e.g., Duke Social Support Index, DSSI). The total number of older adults assessed in studies that used a measure was 5,860. The most used measure for assessing social networks in older adults was the LSNS, which was used in 106 studies (61.3%). The LSNS is a self-administered questionnaire measuring network size, closeness, and contact frequency. Other commonly used measures included: Berkman-Syme Social Network Index (BS-SNI) (researcher-administered questionnaire, in 24 studies; 13.9%) and the Convoy Model/Hierarchical Mapping Technique (HMT) (researcher led interview used in 16 studies; 9.3%).

The most common form of data collection method was questionnaires (n = 9/17, 52.9%), followed by interviews (n = 7/17, 41.2%). Of these, more than half were semi-structured (n = 4/7, 57.1%), 1 was structured, 1 was clinical and 1 was classified as semi-structured with questionnaire guidance. Uniquely, the Social Network Guide (SNG) was the only measure that used a guided worksheet to assess social networks. The identified measures varied in the time period covered when assessing the social network of older adults. For example, nine measures (52.9%) assessed the 'present' social network (e.g., LSNS) or the network on a general or regular basis (e.g., Courage Social Network Index, C-SNI), and others measured the network based on the previous month, previous six months, or previous 12 months. Only one measure (Social Network List, SNL) captured social networks across the entire lifetime.

Of the 21 measures, eight (47.0%) were rated by an interviewer that received training by the developers or research team, seven (41.2%) by a researcher, and one (5.9%) was self-administered (LSNS). The majority of measures (n = 13, 76.5%) produced a total score, with higher numbers indicating a higher-quality social network for older adults. Other measures, such as the ASSIS, summed the names of known individuals in the respondent's network, while the HMT produced a map of networks pictorially. Several measures also used sociograms to visually depict the social network (e.g., NAP).

Table 1 further provides available information about the psychometric properties of the instruments. Reliability and validity metrics for all populations types were searched for each included instrument and summarised according to the COSMIN-based Standards for the selection of health status Measurement Instruments (COSMIN) taxonomy (Amsterdam Public Health, 2021). Over half of the instruments were tested for both reliability (12/21; 57.1%) and validity (11/21; 52.3%), with good to excellent properties for LSNS and CIDI measures. There were 2 instruments (9.5%) that had been tested for responsiveness, with DSSI and Stroke-SNS able to adequately detect important interventional changes. A third (7/21; 33.3%) of instruments were available in another language with the CIDI and LSNS available in multiple languages.

Domains and Dimensions

The thematic analysis identified three domains with 23 subdomains, forming a conceptual framework that illustrates the breadth and depth of existing social network measures. Quantitative domains were focused on structural, observable and quantifiable factors that could be examined from the individual's viewpoint such as network size and contact frequency. Qualitative domains embodied latent constructs that could not be observed directly. This included the content of social relations which could be understood only through the individual's viewpoints such as perceived levels of social support and satisfaction with support. All measures used an ego-centric method which focused on the individual and their connections with other individuals, known as alters. Alters domains were classified by how the individual was tied to the alter, such as family member, neighbour. A summary of the quantitative, qualitative, and alters domains in the measures are outlined in Tables 2, 3, and 4, respectively.

Quantitative domains

The number of quantitative domains included in each social network measure varied. Name generator measures only assessed one domain (network size – the number of contacts in the network), whereas the Arizona Social Support Interview Survey (ASSIS) and the C-SNI explored five quantitative domains. All 21 measures included a quantitative social network domain of *network size* which focused on the structural size of the respondents' network. Other domains commonly included the rate at which the respondent was in touch with their network ties over a period of time (*contact frequency*; n = 9, 52.9%) and the proportion of social network connections between individuals amongst all social network ties (*network density*; n = 5, 29.4%). We found considerable inconsistency across other domains, for example, assessment of negative interaction (i.e., social ties that the respondent identified as social conflict, problematic social interactions, or difficulties maintain a long-lasting relationship) was only assessed in the ASSIS, and mode of contact (i.e., the type of communication method between the respondent and their network ties) was only included in the Composite International Diagnosis Interview (CIDI).

Qualitative domains

Regarding the qualitative social network domains, two (11.8%) measures did not assess any domain, and three (17.6%) measures only examined one domain each. The ASSIS explored three qualitative domains: support satisfaction (perceived levels of satisfaction with the social and emotional support received from network ties), social support/advice (the perception that the respondent is cared for and has available assistance from their ties), and positive feedback (available network members who provide information about the respondent's strengths and achievements). The most common qualitative domain across the included measures was social support/advice (n = 10, 58.8%). The least frequent domain examined was positive feedback and only included the ASSIS measure.

Alters domains

For alters domains, the included social network measures sought identification of specific network ties to family (n = 16 measures, 94.1%), friends (n = 14, 82.4%), partners (n = 9, 52.9%), colleagues (n = 3, 17.6%), group memberships (n = 2, 11.8%), neighbours (n = 6, 35.3%), and non-related individuals (n = 8, 47.1%). The C-SNI used all but one of the member domains (n = 6, 85.7%).

Across all domains (quantitative, qualitative, and alters) the ASSIS and the C-SNI were the most comprehensive social network measures covering 11 domains each. Name generator measures were the least comprehensive, with only one domain used (network size).

Table 1
 Characteristics of social network measures including full name, acronym, administration logistics and core focus.

Measure name	Measure acronym	No. of items	Nature of questions	Time period covered	Rater	Scoring method and total score ³	Time to administer (mins)	Studies using measure	Available in another language	Psychometric properties			Domain focus	Focus
										Reliability	Validity	Responsiveness		
Gijon's Social-Familial Evaluation Scale-Modified (Garcia-Caselles et al., 2004)	SFES	3	Clinical interview	At present	Trained interviewer	Score	45	7	Yes	Poor (Garcia-Caselles et al., 2004)	-	-	Quantitative	Availability of social relationships
Moore Position Generator (Moore et al., 2011)	-	-	Semi-structured interview	Previous 6 months	Researcher	Score	15	7	-	- (Wang, Chen, Gong, & Jacques-Tiura, 2014)	-	-		Position
Name Generator (Burt, 1984)	-	15	Semi-structured interview/Questionnaire	Previous 6 months	Researcher	Score, sociogram	15-20	9	-	- (Wang et al., 2014)	-	-		Size, relationship
Network Analysis Profile (Boissevain, 1979)	NAP	17	Semi-structured interview	Previous month	Researcher	Score, network map	120	7	-	Good (Barrera, 1981)	-	-		Structure of network
Practitioner Assessment of Network Type (Wenger, 1991)	PANT	8	Questionnaire	At present	Interviewer	Score	15-20	18	-	-	Fair-Good (Stephens, Alpass, Towers, & Stevenson, 2011; Szabo, Stephens, Allen, & Alpass, 2016; Thiyagarajan, Prince, & Webber, 2014; Wenger & Tucker, 2002)	-		Structure and proximity of supportive network
Social Network Guide (Forrester-Jones et al., 2012)	SNG	-	Questionnaire/ guided worksheet	At present	Interviewer	Score diagram	15	1	-	- (Rachel Forrester-Jones et al., 2006)	- (Rachel Forrester-Jones et al., 2006)	-		Structure and size
Social Network List (Antonucci et al., 1990)	SNL	21	Questionnaire, scale	Lifetime	Interviewer	Score	20	2	-	-	-	-		Breakup of relative for size, confidant allocation and density
Duke Social Support Index ¹ (George, Blazer, Hughes, & Fowler, 1989)	DSSI	35	Questionnaire	Past week/ present	Trained interviewer	Score	25-30	11	-	Good (Goodger, Byles, Higganbotham, & Mishra, 1999; Pan, Ma, Zhou, & Jia, 2018)	Good (Pan et al., 2018)	Good (Goodger et al., 1999; Pachana, Smith, Watson, McLaughlin, & Dobson, 2008)	Qualitative	Satisfaction with support, social interactions
International Mobility in Aging Study – Social Network Support Scale (Phillips et al., 2016)	IMIAS-SNSS	5	Questionnaire	At present	Researcher	Score	10-20	2	Yes	Good (Ahmed et al., 2018)	Good (Ahmed et al., 2018)	-		Social Support
Interview Schedule for Social Interaction (ISSI	50	Questionnaire	At present	Trained interviewer	Score	45	3	-	Fair to Good (Bengtsson-Tops, 2004; Eklund,	Fair to Good (Bengtsson-Tops, 2004; Eklund et al.,	-		Social interaction

(continued on next page)

Table 1 (continued)

Henderson, Duncan-Jones, Byrne, & Scott, 1980)										Bengtsson-Tops, & Lindstedt, 2007{ Henderson, 1980}	2007; Henderson et al., 1980)			
Arizona Social Support Interview Survey (Barrera, 1980)	ASSIS	27	Semi-structured interview	Previous month	Researcher	Sum of names	15-20	2	-	Good (Barrera, 1981; M. Barrera, Jr. & Garrison-Jones, 1992)	-	-	Quantitative and Qualitative	Structure of network, need for and satisfaction with support Structure and quality of network
Berkman-Syme Social Network Index (Berkman & Syme, 1979)	BS-SNI	11	Questionnaire	Previous 12 months	Researcher	Score	15-20	24	-	-	-	-		Quantity, structure and diversity of social networks Structure and function of social support
Cohen's Social Network Index (Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997)	C-SNI	13	Questionnaire	Generally/regular basis	Researcher	Score	15-20	5	-	-	-	-		Presence and quality of social relationships
Courage Social Network Index (Zawisza et al., 2014)	CSNI	5	Questionnaire	Previous 12 months	Trained interviewer	Score	15	2	Yes	Fair (Zawisza, Galaś, & Tobiasz-Adamczyk, 2014)	Fair (Leonardi et al., 2014; Zawisza et al., 2014)	-		Structure and function of social support
Composite International Diagnosis Interview (Robins et al., 1988)	CIDI	16	Questionnaire/rating scale	At present	Interviewer	Score	15	2	Yes	Good to Excellent (Wittchen, 1994)	Good to Excellent (Wittchen, 1994)	-		Structure and function of social network
Convoy Model/Hierarchical Mapping Technique (Antonucci & Akiyama, 1987a, 1987b)	HMT	-	Semi-structured interview	At present	Researcher	Network mapping	20	16	-	-	-	-		Size, closeness and contact frequency
Lubben Social Network Scale ² (Lubben, 1988)	LSNS	12	Questionnaire	At present	Self-administered	Score	5-10	106	Yes	Good to Excellent (Jang et al., 2020; Kuru Alici & Kalanlar, 2021; Lubben et al., 2006)}	Excellent (Jang et al., 2020; Lubben et al., 2006)	-		Social connection and isolation
Social Disconnectedness and Perceived Isolation (Cornwell & Waite, 2009b)	SDPI	17	Questionnaire	At present	Interviewer	Score	15	1	Yes	Fair (Cornwell & Waite, 2009a)	Fair (Cornwell & Waite, 2009a)	-		Size and quality
Social Networks in Adult Life Questionnaire (Antonucci, Fuhrer, & Dartigues, 1997)	SNALQ	-	Structured interview	At present	Interviewer	Score	60	2	==	-	-	-		Frequency and quality of social support
Social Network Questionnaire (SNQ	15	Questionnaire	Past two months	Interviewer	Score	20	1	Yes	Fair (Magliano et al., 1999)	Fair (Magliano et al., 1999)	-		

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Table 1 (continued)

Magliano et al., 1998)	Stroke Social Network Scale (Northcott & Hlilari, 2013)	19	Questionnaire	At present	Interview	Score	15	1	Good (Northcott & Hlilari, 2013)	Good (Northcott & Hlilari, 2013)	Good (Northcott & Hlilari, 2013)	Size, proximity and quality of social support
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¹ DSSI has a 35, 28 item and 11 item version. This table reports on the 35 version.
² LSNS has a LSNS- 12 and LSNS-6 version. This table reports on the 12-item version.
³ With higher scores indicating better networks for all measures.

Application of measures across context

Measures were used in specific contexts and for groups with various chronic health conditions (Table 5). The LSNS was most frequently used, particularly for community-dwelling settings as well as for individuals with mental illness. While shown to be a popular tool (Table 5), LSNS does not cover social support and positive feedback, which could be important measures for sustaining social connection within a community-dwelling or mental illness context. For example, for an older adult with depression, aspects of available social support and positive feedback may be extremely important to them, yet the LSNS excludes this critical information. However, the LSNS has a minimal administration time (5-10 min), which can be beneficial for practitioners during short appointment times or for research with limited resources. The LSNS has also been used within a variety of study types including longitudinal and randomised control trials, making it a useful tool for researchers wanting to make population comparisons. The Berkman-Syme Social Network Index (BS-SNI) is also popular across a variety of population groups, including those living in the community and for various health conditions including cancer, depression and neurological conditions.

Discussion

The present review provides a comprehensive investigation of 21 measures for social network published between 1978 and 2020, comparing different domains assessed in social networks by quantitative and qualitative constructs, and across alter types and study context in 176 studies. Structural social network components that were consistently measured over time included network size, density, and frequency. In the last decade, measures assessing availability and satisfaction of support from different social network members was increasingly included.

Our results highlight that various authors have developed methods for measuring or assessing social support and support networks over time (Antonucci, Fuhrer, & Jackson, 1990; Berkman & Syme, 1979; Cornwell & Waite, 2009b; Lubben, 1988; Marsden, 1990; Moore et al., 2011; Phillips, Auais, Belanger, Alvarado, & Zunzunegui, 2016; Wenger, 1991). We found that earlier assessment methods were based on subjective responses of respondents to a series of unrelated questions about the perceived availability of others (and/or the numbers of others available) to provide companionship and emotional support (Boissovain, 1979; Burt, 1984). Subsequent methods involved the aggregation of factors to approximate measurement of the network per se rather than aspects of the network (Lubben, 1988). All these approaches tended initially to be more appropriate for research than practitioner use and all emphasized social scientific theory rather than practice. However, more recently, the Lubben Social Network Scale (LSNS) was adapted for use by practitioners (Lubben & Gironde, 2000) and we have seen an increase of its use in primary care in the last decade, including its translation to multiple languages and establishment of its psychometric properties.

Overall, the current review identified substantial heterogeneity in how social networks was defined and used. Taken together, however, social networks should be understood as a multidimensional construct, reflecting themes that often overlap. It contains more ‘objective’, structural elements such as size and frequency, and evaluative elements such as support, subjective feelings and perceptions. Given its breadth, and the field’s inability to establish an agreed definition (e.g., Siette et al., 2015; Ayalon and Levkovich, 2019; Secco and Moffatt, 1994), it may be more advantageous to use ‘social networks’ as an umbrella term reflecting the above concepts, instead of as a distinct unitary concept.

The review also raises an important point about the interlocking nature between measures of social networks and measures of social support. Many of the multidimensional measures of social networks strongly resemble measures of social support. Drawing a distinction between general social networks and general social support may be too

Table 2
Summary of quantitative domains used in social network measures.

Measure	Quantitative											Total
	Demographics ¹	Network size ²	Network density ³	Network structure ⁴	Material aid ⁵	Social participation ⁶	Negative interaction ⁷	Membership ⁸	Relationship ⁹	Contact frequency ¹⁰	Mode of contact ¹¹	
ASSIS		✓	✓		✓	✓	✓					5
BS-SNI		✓				✓		✓		✓		4
C-SNI		✓	✓					✓	✓	✓		5
CIDI										✓	✓	2
HMT	✓	✓							✓	✓		4
CSNI				✓						✓		2
DSSI		✓				✓				✓		3
IMIAS-SNSS		✓		✓					✓	✓		4
SFES		✓						✓	✓	✓		4
ISSI		✓										1
LSNS		✓							✓			2
Moore Position Generator ¹²	✓	✓ ¹³				✓						3
Name Generator		✓ ¹⁴										1
NAP		✓	✓	✓					✓			4
PANT		✓				✓				✓		3
SDPI		✓	✓			✓				✓		4
SNG		✓		✓								2
SNL		✓	✓	✓								3
SNALQ		✓	✓									2
SNQ										✓		1
Stroke-SNS		✓								✓		2

¹Refers to the age of the respondent.
²Refers to the number of network ties or the geographic scope of network for the respondent (e.g. number of network connections within an environment).
³Refers to the number of ties present, expressed as a proportion of all potential social network ties between individuals nominated.
⁴Refers to the hierarchy or the relationships between relatives/families.
⁵Refers to networks that provide the respondent aid in the form of money or other physical objects.
⁶Refers to the respondent’s involvement in organised and voluntary community activities that require interpersonal interaction with others (e.g. church attendance, volunteering).
⁷Refers to social ties that the respondent identified as social conflict, problematic social interactions or difficulties maintaining a long-lasting relationship.
⁸Refers to the state of being a member in an organisation/group.
⁹Refers to the type of connection the respondent may have with their network ties (e.g. relationship to focal person).
¹⁰Refers to the rate at which the respondent is in touch with their network ties over a period of time.
¹¹Refers to the type of communication method between the respondent and their network ties.
¹²Demographics for this measure include residential status and occupation of contacts.
^{13,14}Measure instructs respondent to provide up to 3 network members only.

subtle as social support inherently targets how individuals think and feel about the quality of their own network (i.e., the functions) which act to support the structure and processes of social relationships.

Our conclusions are similar to previous reviews for different populations (e.g., Siette et al., 2015; Ayalon and Levkovich, 2019), in that issues in measuring social networks, particularly in delineating mechanisms of both negative and positive social influences on an individual level, are also present in our review. Our work also similarly conclude that older measures generally lacked inter-rater and test-retest reliability and further validation is required (Siette et al., 2015). Despite this, our results provide new insights for a wide range of stakeholders to utilize appropriate measures according to their purpose.

Several factors will inform the suitability of the identified measures for use with older adults. Such decisions will need to consider the alignment of the measure’s purpose in the context of research or clinical hypotheses (e.g., how the social environment might influence health and other outcomes), consideration of the characteristic of the population under study (e.g., older adults in long-term care), logistical factors associated with administration (e.g., available duration to perform the assessment) and whether the measures have been psychometrically tested. Our review firstly established a much needed ‘master-list’ of social network measures for older adults. By breaking down frequently used measures through different quantitative and qualitative domains, future researchers can select previously developed measures based on what factors apply to their situation (e.g., administration time, availability of funding).

Three measures (LSNS, DSSI and CIDI) stood out as best suited for use for older adults. These measures had strong psychometric properties, were relatively short and logistically feasible for use for older adults in multiple settings. However, these instruments tend to focus purely on quantitative measures, meaning that potentially context-rich qualitative measures have been excluded that could supplement the ‘how’ and ‘why’ questions behind outcomes (Ayalon & Levkovich, 2019). As older adults’ networks and social needs differ across settings, conditions and contexts, the selection of an appropriate measure should consider how the measure could obtain the most relevant and accurate information during its administration.

Our review highlights that current social network measures focus on both objective (i.e. C-SNI) and subjective (i.e. ASSIS) measures. While there are some limitations to subjective self-reported social network tools (e.g., biases and memory lapses), observational-based methods provide promising opportunities to collect objective behaviours of social networks (e.g., time spent with member, frequency of contact) (Ho et al., 2020). These methods may be particularly useful in situations where self-report methods are likely to be inaccurate, such as in estimating amount of time spent with a contact. For example, following the recent trend of wearable devices to track fitness, there is potential for the development of a new device to track social networking [e.g. Surian et al. (2019)]. When multiple devices are used throughout a social network group, each device could essentially ‘track’ quantitative measures such as frequency of contact, proximity and network size. This is one way data can be collected more objectively without relying on

Table 3
Summary of qualitative domains used in social network measures.

Measure	Qualitative					Total
	Support satisfaction ¹	Social support/advice ²	Positive feedback ³	Emotional bond ⁴	Proximity ⁵	
ASSIS	✓	✓	✓			3
BS-SNI		✓		✓		2
C-SNI						0
CIDI		✓		✓		2
HMT		✓			✓	2
CSNI		✓		✓		2
DSSI	✓	✓				2
IMIAS-SNSS	✓	✓				2
SFES		✓				1
ISSI	✓			✓		2
LSNS	✓				✓	2
Moore position Generator	✓ ⁶			✓		2
Name Generator						0
NAP		✓		✓	✓	3
PANT					✓	1
SDPI		✓				1
SNG		✓				1
SNL	✓			✓		2
SNALQ	✓	✓				2
SNQ		✓				1
Stroke-SNS	✓	✓				2

¹Refers to the respondent’s perceived levels of satisfaction with the social and emotional support received from their network ties.

²Refers to the perception that the respondent is cared for and has available assistance from the respondent’s network ties.

³Refers to available network members who provide the respondent with information about their strengths and achievements.

⁴Refers to the subjective emotional feelings that the respondent identifies with their network ties (e.g. during arguments).

⁵Refers to the state of being close with a family or friend.

self-report methods. These techniques, however, may be less adequate in measuring the psychological aspects of social network use, such as emotional connection to the member or the motivations underlying social network behaviours (Orosz, Tóth-Király, & Bóthe, 2016).

Limitations

The current review does come with its limitations. Firstly, ‘social support’ was removed as a search term during the identification stage of the review and may have excluded other critical social network measures. Secondly, the study did not include articles in English nor explore the associations of the network measures outcome with other factors (e.g., mental health) as this was beyond the scope the current study, but is a potential topic for future research. Thirdly, a summary of the psychometric properties of the measures was not described in detail, as these are summarized elsewhere (Siette et al., 2015). Briefly, this systematic review identified 8 instruments which assessed multiple aspects of social networks (e.g., their size, structure, depth and quality). It highlighted limitations in inter-rater and test-retest reliability and a need for similar definitions and consistency across time scales for measuring social networks, which was consistent with our findings. However, more recent developments in this field indicate that newer measures are undergoing robust psychometric testing, which is promising [e.g., (Nicholson, Feinn, Casey, & Dixon, 2019)].

Implications

The value and use of the measures will vary. Short measures of social networks, such as the Lubben Social Network Scale (LSNS) provide quick global snapshots on current networks, while taking up very little time

from participants and have excellent psychometric properties. In comparison, broader scoped instruments such as the Network Analysis Profile (NAP) assess social networks separately across themes and are thus able to provide a more comprehensive assessment. Other instruments assess more specific dimensions such as mode of contact or proximity. These instruments are conceptually narrower and, as a result, are better equipped to facilitate more focused assessment.

Using the correct social network measures in the right context can influence the development and assessment of interventions targeting loneliness and social isolation for older adults. For people with chronic conditions such as dementia, the emphasis on structure and quality of the network will be more appropriate than a focus on network size of contact frequency through the provision of emotional support (Murata, Saito, Saito, & Kondo, 2019). For situations where size of the social network is an emphasis or where time or allocation of resources are sparse, measures such as name generators can be utilized. Evidently, different measures are more appropriate for specific contexts, meaning that researchers are encouraged to consider what they or their participants value in measuring social context and the basis for their research questions.

Measures could also be used to explore older adults’ social networks and begin to establish correlates and predictions to influence the development of social environments, funding and policy. Capturing social networks and isolation within aged care is on many countries’ agendas, as identifying where more social support programs are needed, or measuring the effectiveness of organizational services would be vital in supporting older adults’ needs (Siette, Georgiou, Jorgensen, O’Donnell, & Westbrook, 2018). By uncovering these relationships, we can begin to improve social capital for older adults and as a result improve overall wellbeing for older adults.

Table 4
Summary of alter domains used in social network measures.

Measure	Alters							Total
	Family ¹	Friends	Partner	Colleagues	Group membership ²	Neighbours	Non-related individuals ³	
ASSIS	✓	✓					✓	3
BS-SNI	✓	✓	✓		✓			4
C-SNI	✓	✓	✓	✓	✓	✓		6
CIDI	✓	✓	✓					3
HMT	✓	✓	✓					3
CSNI	✓	✓	✓	✓		✓		5
DSSI	✓	✓					✓	3
IMIAS-SNSS	✓	✓	✓					3
SFES	✓	✓	✓			✓	✓	5
ISSI	✓	✓					✓	3
LSNS	✓						✓	2
Moore Position Generator	✓		✓			✓		3
Name Generator	✓	✓	✓	✓	✓	✓	✓	
NAP	✓	✓					✓	3
PANT	✓	✓	✓			✓		4
SDPI	✓	✓	✓		✓			4
SNG	✓	✓		✓		✓	✓	5
SNL	✓						✓	2
SNALQ	✓	✓	✓					3
SNQ	✓		✓					2
Stroke-SNS	✓	✓			✓			3

¹Refers to a socially recognised group of two or more individuals joined with kinship.

²Refers to members in a group who share the same interest, values, ethnic or religious background.

³Refers to any family relationship that does not have a shared descent.



Fig. 2. A historical depiction of social network measures and its coverage of the three different domains and emphasis (shaded).

Conclusions

Older adults’ networks are increasingly being measured by quantitative and qualitative means. Our list of measures and dimensions for measuring older adults’ social relationships encourages consistency in the use of tools and collection of data in future social network research.

This can ultimately assist with comparisons across different contexts, population, and outcomes.

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Table 5
Summary of contextual features used in social network instruments.

Measure	No.*	Total sample size	Health conditions													Context				Study design ⁵
			Cancer	Cardiovascular conditions	Chronic eye conditions	Diabetes	Endometriosis	Kidney disease	Musculoskeletal conditions ¹	Neurological conditions ²	Rare diseases	Lung and respiratory conditions ³	Mental illness	Other	Community-dwelling	Primary care	Secondary care	Tertiary care		
ASSIS	1	95	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	CS
BS-SNI	41	219,895	6	-	-	3	-	-	-	1	3	-	-	10	3	39	1	-	1	CS, L, Q
CIDI	2	4,301	-	-	-	-	-	-	-	-	-	-	-	2	-	2	-	-	-	CS, Q
C-SNI	12	53,354	-	-	1	-	-	-	-	1	1	-	-	1	1	9	3	-	-	CS, Q
Courage-SNI	2	1,663	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	CS
DSSI-10	1	5,506	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	L
DSSI-11	2	1,590	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	CS
DSSI-23	1	100	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	CS
DSSI-35	5	4,987	-	-	-	-	-	-	1	-	-	-	-	2	-	2	2	-	1	CS, L, Q, RCT
HMT	14	47,435	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	CS, L, Q
IMIAS-SNSS	2	1,925	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	-	-	CS
ISSI	3	277	3	-	-	-	-	-	-	-	-	-	-	-	-	0	1	-	2	CS, Q
LSNS-6	61	85,524	1	1	-	-	-	-	1	2	-	-	7	4	54	5	-	2	2	CS, L, Q, RCT
LSNS-9	1	2,449	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	L
LSNS-10	30	57,477	1	-	1	-	-	-	1	-	-	1	8	1	26	1	-	3	3	CS, L, Q
LSNS-18	11	4,394	-	-	-	-	-	-	-	1	-	-	4	-	9	-	-	2	2	CS
LSNS-R	23	42,174	-	-	-	-	-	-	1	3	-	-	3	4	19	2	-	2	2	CS, L, Q, RCT
Name Generator	29	185,986	-	1	-	2	-	-	-	1	-	1	2	2	27	1	-	1	1	CS, L, Q
NAP	6	3,749	-	-	-	-	-	-	-	-	-	-	-	1	6	-	-	-	-	CS, L, Q
NAP-17	1	1,073	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	Q
PANT	18	64,473	-	-	-	-	-	-	-	-	-	-	1	1	16	1	-	1	1	CS, L, RCT
Position Generator	3	8,156	-	-	-	-	-	-	-	-	-	-	1	-	3	-	-	-	-	CS, L
SDPI	1	2,623	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	L
SNG	1	128	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	Q
SNQ	1	100	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	CS
Stroke-SNS	1	106	-	-	-	-	-	-	-	1	-	-	-	1	1	-	-	-	-	CS
Total	273	799,540	11	2	2	5	-	-	6	13	-	2	43	20	238	19	-	16	-	-

*Refers to number of articles that used this measure. 1 Musculoskeletal conditions include tendonitis, osteoarthritis, rheumatoid arthritis.

²Neurological conditions include dementia.

³Lung and respiratory conditions include asthma, chronic obstructive pulmonary disease, chronic bronchitis.

⁴Refers to translation of the tool in languages other than English.

⁵CS = cross-sectional, L = longitudinal, RCT = randomised controlled trial; Q = qualitative.

agencies in the public, commercial, or not-for-profit sectors.

CRedit authorship contribution statement

Data statement

Summaries are available upon request to the corresponding author.

Joyce Siette: Conceptualization, Methodology, Investigation, Formal analysis, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision. **Chiara Pomare:** Data curation, Resources, Writing – review & editing. **Laura Dodds:** Formal analysis, Investigation, Writing – review & editing, Project

administration. **Mikaela Jorgensen:** Methodology, Formal analysis, Writing – review & editing. **Nicholas Harrigan:** Writing – review & editing. **Andrew Georgiou:** Methodology, Writing – review & editing, Supervision.

Declaration of Competing Interest

None.

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