DIGITAL HEALTH

Leveraging Digital Technology for Social Connectedness among Adults with Chronic Conditions: A Systematic Review

Journal:	*Digital Health*
Manuscript ID	DHJ-23-0586
Manuscript Type:	Review Article
Date Submitted by the Author:	18-May-2023
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Keywords:	Digital < General, Digital health < General, Chronic < Disease, Social Connectedness, Technology < General, Systematic reviews < Studies
Abstract:	Purpose: To review the evidence about the impact of digital technology on social connectedness among adults with one or more chronic health conditions. Methods: PubMed, Embase, Social Sciences, CINAHL, and Compendex were systematically searched for full-text, peer-reviewed empirical evidence published between 2012-2023 and reported using the PRISMA flow diagram. Articles were critically appraised applying the Joanna Briggs Institute checklists. Specific data were extracted based on the framework for social identity and technology approaches for health outcomes and then analyzed and synthesized. Results: Thirty-four studies met study criteria. Evidence showed heterogeneity among research methodology, chronic health conditions, digital technology, and health outcomes. Technology use was influenced by factors such as usability, anonymity, availability, and control. More advanced digital technologies require higher digital literacy and improved accessibility features/modifications. Social support was the most measured aspect of social connectedness. The emotional and informational forms of social support were most reported; instrumental support was the least likely to be delivered. Self-efficacy for using technology was considered in seven articles. Sixteen articles reported health outcomes: 31.2% (n=5) described mental health outcomes only, 18.8% (n=3) reported physical health outcomes only, 31.2% (n=5) detailed both physical and mental health outcomes, whereas 18.8% (n=3) denoted well-being or quality-of-life outcomes. Most often, health outcomes were positive, with negative outcomes for selected groups also noted. Conclusion: Leveraging digital technology to promote social

	connectedness has the potential to affect positive health outcomes. Further research is needed to better understand the social integration of technology among populations with different contexts and chronic health conditions to enhance and tailor digital interventions.

Leveraging Digital Technology for Social Connectedness among Adults with Chronic Conditions: A Systematic Review

Short Title: Digital Technology for Social Connectedness

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Social connectedness is an innate psychological need for belonging to an individual and/or a group (Lee et al., 2018). Social connectedness refers to the perceived quality of a social interaction rather than the number of social interactions (Neves et al., 2019). Although social connectedness and its related components (such as social support) have been studied extensively in human interactions, little is known about how digital technology is being used to promote social connectedness and positive health outcomes for individuals with at least one chronic health condition. In the current systematic review, we addressed this gap by exploring how digital technology has been leveraged to promote social connection among individuals living with chronic health conditions. We evaluated the recent and limited body of research on digital interventions designed to support social connectivity among this population. Research and practice considerations regarding the feasibility of using digital technology to improve the quality of social interactions and health outcomes for individuals with chronic conditions are discussed.

Background

In today's digital age, communication technologies, such as the internet, can contribute to social connectedness for individuals. As such, internet communities called social networking sites have emerged, and online social support groups have rapidly expanded (Utz, 2020). Digital technologies show potential for social connectedness because of certain benefits, such as anonymity, control, visibility, and availability (Evans et al., 2016). These perceived benefits of social networking offer the comfort, assistance, and assurances of engaging in social relationships with little personal risk of embarrassing or compromising situations (Raines et al., 2015). Additionally, digital

technology enables asynchronous access to a larger group of individuals who may share similar life experiences or interests. For example, an individual with a specific chronic health condition may find digital based interventions effective and convenient for identifying others with similar health issues to share and receive supportive care and connection (Lee et al., 2018).

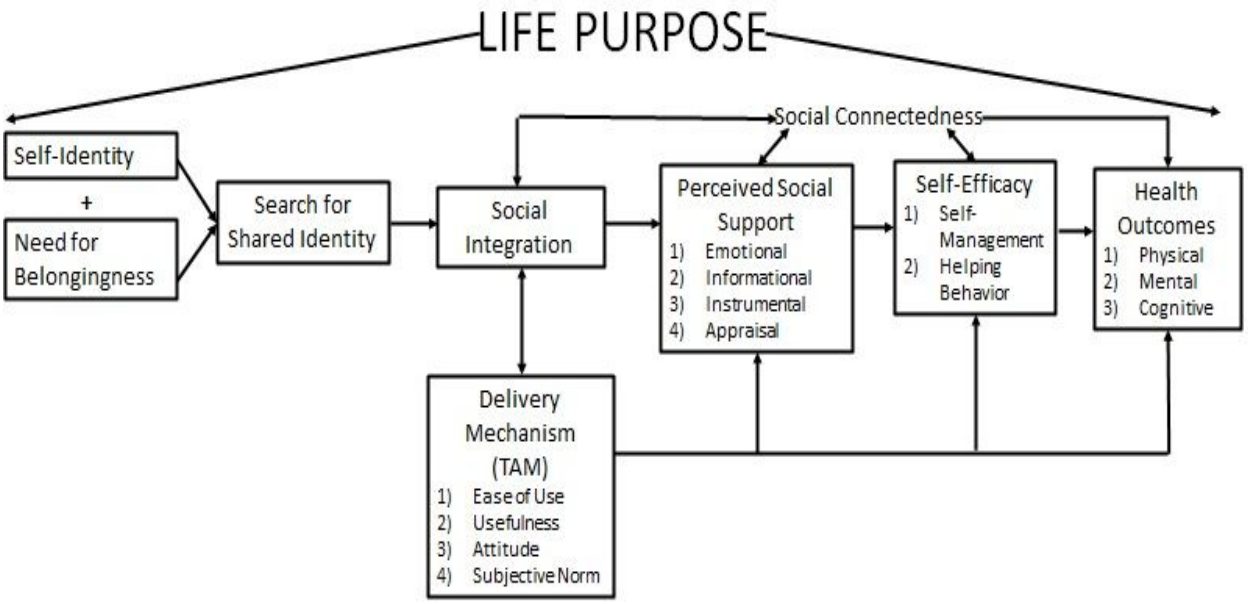
Chronic health conditions may cause debilitating physical symptoms that limit physical ability to leave one's home, as well as distressing psychological and social effects. In 2018, 51.8% of US adults were diagnosed with one chronic health condition, and 27.2% had two or more chronic health conditions (CDC, 2015). Individuals with chronic health conditions are at a greater risk of social isolation and loneliness due to a compromised sense of self and stigma-related stress (Helgeson & Zajdel, 2017). Recently, researchers have become increasingly interested in computer-mediated support resources for individuals with chronic health conditions, as approximately 70% of US adults search the internet for information about a health issue (CDC, 2015). Thus, the purpose of this systematic review was to review and synthesize the evidence about the impact of digital technology on social connectedness among adults with one or more chronic health conditions.

Guiding Frameworks

As we aimed to understand the use and benefit of digital technology as it relates to social connectedness among adults with one or more chronic health conditions, we combined and adapted the Social Identity Approach to Health (SIAH) (Haslam et al., 2015) with the Technology Acceptance Model (TAM) to include relevant concepts (Venkatesh et al., 2002; Figure 1).

Figure 1:

Adapted Framework for Social Identity and Technology Use Approaches to Health Outcomes (Haslam et al., 2015; Venkatesh et al., 2002)



According to SIAH, self-identity impacts how we socially connect to each other. As such, we desire connections to those whom we can socially integrate for support of shared knowledge, attitudes, beliefs, and behaviors. Social support, a critical component of social connectedness, may be frequently enacted or received and is deemed most valuable because it is required during need-based situations. When social support is needed and perceived, one's self-efficacy increases, such that there is more self-confidence to engage in purpose-driven behaviors (e.g., self-management). Perceived social support also results in an increased intention to help others who have experienced similar situations (i.e., voluntary reciprocal helping behaviors) (Haslam et al., 2015).

The TAM is an information systems theory that frames the major predictors of technology acceptance and use. The type of technology or "delivery mechanism" was explored alongside social integration based on the hypothesis that seeking technology is 1) a means to social connectedness and 2) involves associated characteristics that build social connections. The double arrow between delivery mechanism and social integration was used to suggest covariance between these actions. Acceptance and ultimate use of digital technology depends on its perceived ease of use, its perceived usefulness towards accomplishing a chosen purpose, one's attitude or evaluative judgment about technology in general, and subjective or cultural norms regarding acceptance and use of technology.

Methods

The research question guiding this systematic review was "Does digital technology improve social connectedness among adults with ≥1 chronic health condition." Inclusion criteria included full-text peer-reviewed articles of empirical evidence written in English and published from 2012 to 2023. Exclusion criteria were research articles targeting patient populations under 18 years, animals, and caregivers of people with chronic health conditions. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist and flow diagram were used to guide the protocol, document the search process, and report the final articles selected. Quality assessments of the selected articles were completed using the Joanna Briggs Institute (JBI) checklists.

Search Strategy

Using major concepts (i.e., digital technology, social connectedness, and chronic health conditions) from the research question, a table was created listing medical subject headings (i.e., MeSH) and title and abstract terms (i.e., TIAB) of each concept (see Appendix A). A search strategy was created by connecting all terms with Boolean operators. Using this search strategy and adapting based on specific search requirements of each database, we systematically searched five electronic databases: PubMed, Embase, Social Sciences, CINAHL, and Compendex in April 2022 and March 2023. All articles were downloaded into Excel.

Selection Process

Phase I: After duplicate articles were removed, our team of seven researchers split into three groups, and each group reviewed one-third of the articles based on title and abstract only. We met as a team to discuss and decide on any articles when there was uncertainty if the articles met selection criteria. If there was any doubt or a consensus was unable to be reached, we kept the article for the next round of review. To increase rigor and acquaint team members with all articles, the groups switched articles and once again reviewed based on title and abstract.

Phase II: New groups of three were formed to read the full text of their assigned articles and discussed each article based on the presence of all major components and the inclusion and exclusion criteria. If a group had a concern, it was discussed with the entire team for consensus. If undecided, the article was kept for the next round of review.

Phase III: The primary author (PJW) sorted and assigned articles by research design to the groups. Each group read the full text of their assigned articles and

assessed methodological quality using the JBI checklist. JBI offers checklists based on the type of study (e.g., randomized controlled trial, cross-sectional, qualitative, etc.). After group work, we all discussed results as a team. At this point, all researchers had read each article at least two times and discussed them in detail several times.

Phase IV: Several investigators searched their personal libraries and the bibliographies of published systematic reviews for articles that met inclusion/exclusion criteria. The team also searched for articles using Google Scholar. Three additional articles were incorporated into the sample, read by all, and assessed for quality.

Quality Assessment

Systematic reviews incorporate a critical appraisal process of the research evidence. The purpose is to promote the inclusion of higher quality studies and findings. The Joanna Briggs Institute (JBI), an international research organization and global leader in evidence-based healthcare, was chosen because it offers checklists and rigorous processes for diverse forms of evidence. JBI recommends that articles for inclusion be appraised by two people, with a third person to resolve conflict or disputes. Our team had two researchers assess each article, with five additional researchers to discuss concerns or discrepancies.

Data Collection and Synthesis

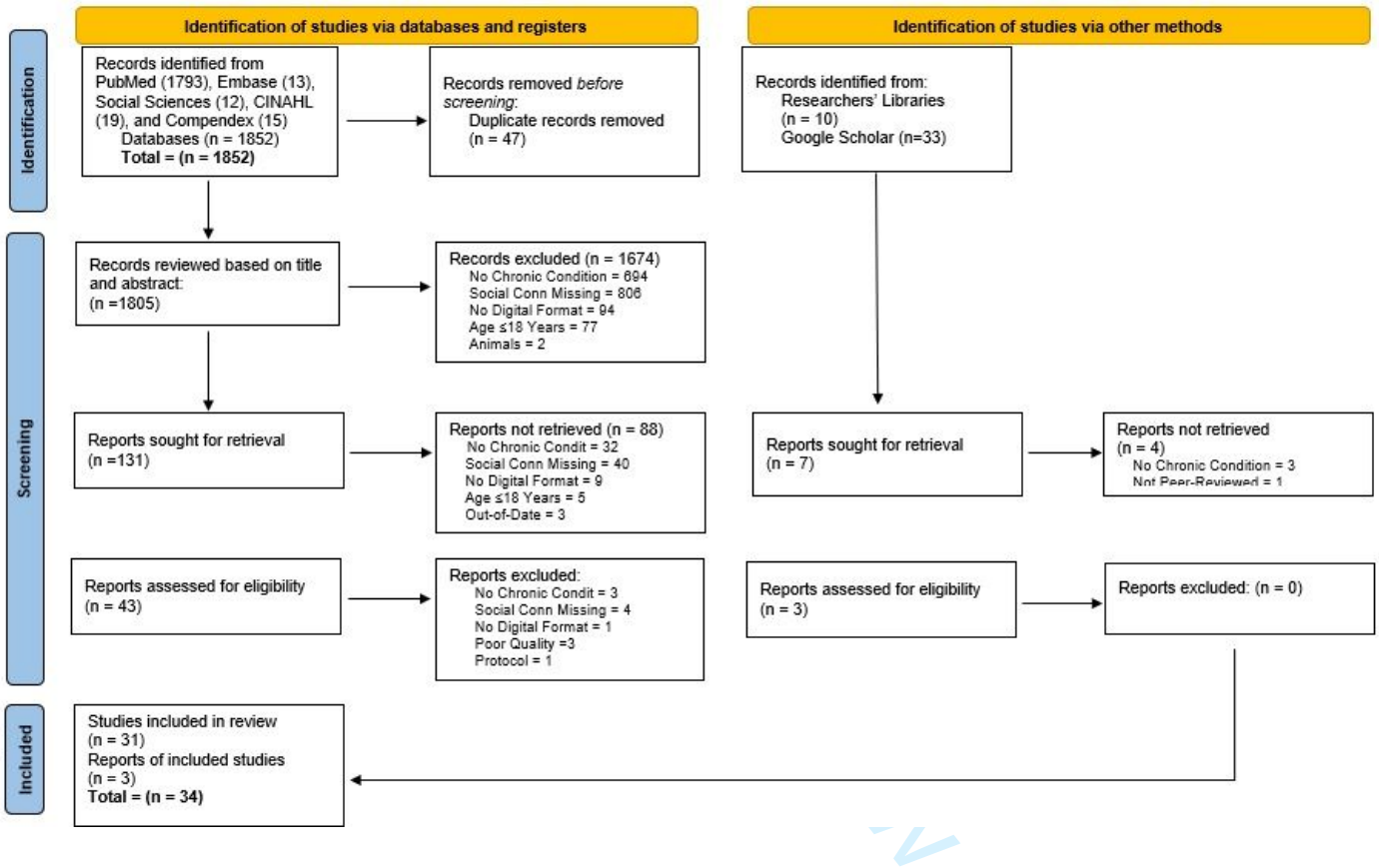
Each investigator was given a construct (i.e., social support, self-efficacy, etc.) from the guiding framework to gather results from all articles within the designated domain. The research team met several times to synthesize the results and construct the manuscript. The manuscript was iteratively reviewed and edited.

RESULTS

A systematic search revealed 34 articles that included key terms and met the inclusion and exclusion criteria (Figure 2).

Figure 2.

PRISMA Flow Diagram.



Articles included in the final search were compiled into a summary table. Information such as research design, technology, intended purpose, and study outcomes were included in the final summary table (Table 1).

Table 1.

Characteristics of the Studies.

All articles included in this systematic review met JBI criteria based on the questions for the specific research design of each article. Of the 34 studies, there were

17 different chronic health conditions featured, with cancer (n=8) being the most frequent, followed by type 2 diabetes (n=3). The other conditions are listed in Table 1 and include mental health conditions, chronic pain syndromes, diseases of organs (e.g., chronic kidney disease), and chronic intellectual and developmental conditions. Along with the heterogeneity of chronic health conditions, there was variability among study designs, with most being either qualitative (n=13) or randomized controlled trials (n=12). Sample sizes ranged from 12 to 1065, with the smallest sample sizes among populations with less prevalent chronic conditions (e.g., psychosis, intellectual disability) and the largest sample sizes among populations with common chronic physical health conditions (e.g., diabetes, cancer). In all studies, digital technologies were assigned as a component of an intervention and included hardware (e.g., computers, wearables, telephones) or software (e.g., Facebook, customized apps) and/or accessibility features (e.g., Siri).

Self and Shared Identity

All articles included a digital intervention focused on social connections among individuals with a similar or shared identity, thus incorporating peer support. Participants in qualitative studies also emphasized the need to connect with others with a shared identity.

"... it provided someone who had experience with depression … and someone to talk to, other than family and friends, that can relate …."

(Travis, et al., 2010, p. 5)

" … the ability to meet someone who knows exactly what I'm going through …."

(Travis, et al., 2010, p. 5)

In many articles (n=19), researchers elaborated that participants preferred online social support where they were able to connect with people through shared experiences. Participants expressed that they could relate to others because they felt heard, understood, and supported. Shared experiences included the physical or mental challenges experienced due to their chronic condition, along with social concerns and frustrations about the negative impact of their condition on their life domains. Sharing these experiences added value and meaning to virtual spaces and increased participants' sense of social connectedness:

"It's like … war veterans … where you have all the gatherings of people who have been through wars and they don't necessarily know each other personally, but they've all got that common war experience. And they can relate to each other, and they know what they've been through."

(Valentine et al., 2020, p. 5)

"I connected to them a lot more easier than I would with others … I felt like I was in a more calm relaxed space connecting with them …."

(Valentine et al., p. 6)

Richardson and colleagues (2010) reported that people with low baseline social support sought other people with similar experiences and context to receive emotional and informational social support. In a study among people with psychosis, several participants described "knowing" connections without a direct social relationship. The participants felt validated after sharing experiences:

"It helped sort of reinforce that some of my experiences and feelings are normal …."

(Valentine et al., 2020, p. 6)

Social Integration

Social integration is the point at which adults with ≥1 chronic condition incorporate digital technology to socially connect with others who share similar identities. Thus, digital technology was used as a strategy by which adults with ≥1 chronic health condition could expand social connection in a meaningful manner.

Digital technology used for social integration in this sample of articles included telephones/smartphones, computers, iPads, and videoconferencing technology. Large social media platforms such as Facebook, Instagram, YouTube, Skype, and TikTok were used for social networking in 15 studies, with Facebook (n=6) being the most frequently used. Customized digital applications were featured in eight of the studies. The use of telephones and smartphones were identified in nine (n=9) studies. Telephones/cellphones enabled social integration through calls, texts, digital applications, and social media (with internet capability features).

Usability and Usefulness

In this systematic review, six studies reported on usability (or ease of use), six studies reported on the usefulness of the digital technology, six studies discussed the user's attitude about the technology, and three studies accounted for subjective norms. Other features of digital technology that promoted its uptake included anonymity and unrestricted time of use.

" … appreciate the anonymity of the system … it's easier to be open and honest …. You don't feel afraid of judgement, and you don't have to censor yourself."

(Travis, et al., 2010, p. 5)

"I liked being able to call whenever I needed some help."

(Travis, et al., 2010, p. 5)

"Social network sites allow me to interact with others on my own terms."

(Merolli, et al., 2014, p. 9)

The rapid and continuous growth of digital technology requires individuals to have certain skills and competencies (i.e., digital literacy) to use digital technology and navigate digital environments (Reddy et al., 2020). Digital literacy requires skills development, as it is not an innate ability. Barriers to computer use, such as computer anxiety and distress, were associated with low digital literacy (Lepore et al, 2019). Low digital literacy was found among certain population groups, such as those with intellectual and developmental disabilities (Paul et al., 2022).

Social Support

Theoretically, social connectedness draws from social capital (the network of social relationships). These resources include perceived social support from different domains: informational, emotional, appraisal, and instrumental (Lee et al., 2018). Social support was the most measured aspect of social connectedness (Table 2).

Table 2.

Number of Times Social Support Domains Appear in the Articles.

Social Support Domains (Langford et. al., 1997)	Definition	Number of Articles (n, %)	Possibly Included Could Not Verify (n, %)
Emotional	Empathetic listening	33, 94.3%	0, 0.0%
Informational	Facts, anecdotal evidence, and advice	34, 97.1%	0, 0.0%
Instrumental	Tangible goods	10, 28.6%	2, 6.3%

Appraisal	Appraisal and constructive feedback	30, 85.7%	1, 3.1%

Most of the articles (n = 25; 71.4%) included three domains of social support. All four domains of social support were included in six of the articles (17.1%). Two articles only included two domains (8.6%): Fujioka, et al. (2012) (information and appraisal social support) and Baldwin et. al. (2020) (emotional and informational social support). Toya and colleagues' (2019) study only included emotional support (3.1%). Informational, emotional, and appraisal support were each noted as being provided in over 93% of the studies. Instrumental support was the least common type of support offered. However, the components of the intervention or participants' reports of the types of social support they received were sometimes difficult to distinguish (e.g., Welch et al., Toija et al., 2015; Namkoong et al. 2016; Ghanberi et al., 2021).

Our definition of instrumental support also included the receipt of tangible goods or services after research completion. For example, there were situations where the participants were allowed to keep the smartwatch or device (i.e., smart speaker) after the study concluded. A few of the researchers did not indicate whether participants had access to the digital support intervention (i.e., tangible goods/services received) after study completions thus provision of instrumental support could not be determined. Nearly all studies in which instrumental support was provided were intervention studies, and the instrumental support was nearly always in the form of provided tangible goods (e.g., exercise equipment, personalized list of community resources) and not active hands-on assistance with self-management or assistance with activities of daily living or instrumental activities of daily living.

Non-interventional designs were used in six studies (18.8%). The purposes of those studies were to gather information from specific users about which online platforms were accessed for social support and participants' perceptions of the quality and types of social support received.

Perceived Positive Versus Negative Support

When digital social support interventions were evaluated by participants, negative and positive experiences were reported in seven studies (Horvath et. al., 2013; Merolli et. al., 2014; Lepore et. al., 2019; Valentine et al., 2020; Lazard et. al., 2021; Tan et. al., 2021; Paul et. al., 2022). Negative experiences included: (1) exposure to negative attitudes by other group participants (Horvath et. al., 2013); (2) concern about how others would use personal health information shared in online groups (Morelli et. al., 2014); and (3) fear of being stalked, a decrease in human connections, and interaction with false personas through social media (Paul et. al., 2022). Participants who used a smart speaker noted concerns about the lack of health information and the accuracy of health information (Corbett, et. al., 2022). In Valentine and colleague's (2020) study, researchers found that social anxiety, paranoia, internalized stigma, lack of autonomy, and social protocol confusion exacerbated psychotic symptoms for young people with first episode psychosis when chatting with each other in an online group. In another study focused on online social support for young people diagnosed with cancer, hearing about other group members' declining health or the death of web-based friends negatively impacted the hope of other users (Lazard et al., 2021). Also, reported in that same study was the uncertainty regarding the truthfulness of health information shared,

and the heavy burden of reliving and recounting painful experiences of other group users. Regarding participant burden, one participant stated:

"I was a mentor for a couple people, and I actually had to pull away because I kept reliving what I went through every time they were going through their next step, and it just, kind of pulled on my heartstrings. It would just bother me when I heard someone had a worse-case scenario than I did"

(Lazard et. al., 2021, p. 15).

In Tan and colleagues' (2021) study, contributing factors towards participants' negative experiences included: (1) confronting content; (2) misinformation; (3) preoccupation with symptoms; (4) social comparison; and (5) hopelessness about recovery prospects for individuals diagnosed with obsessive compulsive and related disorders. Lastly, digital literacy was negatively correlated with distress before and after online chats during the social support intervention for breast cancer survivors in an internet-based support group (Lepore et. al., 2019).

Self-Efficacy

Self-efficacy was described as the perceived confidence individuals have when performing specific behaviors. Within the reviewed studies, only a few (n=7) discussed self-efficacy. Two studies (n=2) measured self-efficacy: one study (n=1) with no significant changes and one study (n=1) with a non-significant positive change (Burner et al., 2018; Baldwin et al., 2020). However, the results of one study indicated that the intervention used was effective in developing self-efficacy (Fujioka et al., 2012). Three studies measured empowerment and adherence as domains of self-efficacy (Allam et

al., 2015; Blackstock et al., 2015; Horvath et al., 2013). However, many articles (n=21) did not mention self-efficacy.

According to Haslem and colleagues (2015), the original authors of the social identify and health outcomes framework, increased self-efficacy leads to improved self-management of one's chronic health condition and increased desire to help others (i.e., helping behaviors). Self-management was included as a measure in only six studies (n=6). In one article (n=1), researchers discussed an intervention which included a feedback component (Johnston et al., 2019). This component was framed by underpinnings of the self-determination-theory, which proposes that meeting a person's relatedness needs will improve adaptive functioning (Ryan & Decci, 2000). Enhancing a person's adaptive functioning may help build self-efficacy and, thus, improve self-management. Other ways of measuring self-management in the articles were through a social functioning survey, participant interviews, and content analysis of community discussions (Baldwin et al., 2020; Banbury et al., 2017; Young et al., 2018). However, most studies (n=21) did not include a self-management measure.

Helping behaviors were not identified directly in any article; however, helping behaviors were discussed in the articles as applicable to participants after social integration had occurred. For example, des Bordes and colleagues (2020) recognized that providing informational and emotional support was as important as receiving those types of social support. As people become more confident with their identities and knowledge, they were willing to share their knowledge and experiences with other people with similar experiences.

"I feel valued sharing my resources with others."

(Merolli, et al., 2014, p. 9)

"I wanted to support them …. Actually gave them my experience …."

(Valentine et al, 2020, p. 6)

"I focus on sharing what knowledge or information I have …, this mitigates the constant feeling of failure that comes along with ill health and the inability to be more active."

(Merolli, et al., 2014, p. 9)

Health Outcomes

Out of the 34 studies included in this systematic review, 52.9% (*n*=18) did not have a health outcome measure, whereas 47.1% (*n*=16) did have a health outcome measure. In terms of the type of health outcomes, 18.8% (*n*=3) were physical health outcomes only, 31.3% (*n*=5) were mental health outcomes only, 18.8% (*n*=3) were well-being or quality of life, and 31.3% (*n*=5) were both physical and mental health outcomes. Regarding physical outcomes, Fujioka et al. (2012) measured carbon monoxide exhalation levels, Owens et al. (2015) measured fatigue, and Richardson et al. (2010) measured walking distance. Regarding mental health outcomes, 80% (*n*=4) measured anxiety levels as one of the dependent variables and 40% (*n*=2) measured levels of depressive symptoms. Regarding well-being and/or quality of life, Han et al. (2013) measured functional well-being, Heisler et al. (2013) measured heart failure quality of life, and Toija et al. (2019) measured quality of life. Among studies that included both physical and mental health outcome measures, 60% (*n*=3) had depressive symptom measures and another 60% (*n*=3) included quality of life measures.

The social connectedness components of the digital interventions and the resultant impact on health outcomes varied. Most researchers who measured health outcomes reported positive results (56.3%, *n*=9) (e.g., decreased depressive symptoms, improved glycemic control). However, 18.8% (*n*=3) reported negative results (e.g., increased anxiety, confusion due to misinformation), with 12.5% (*n*=2) finding results that trended towards positive results but didn't reach statistical significance, and another 12.5% (*n*=2) who found no statistically significant results. The variable that was most measured and had positive outcomes within these studies was depressive symptoms at 55.5% (*n*=5). Other outcomes included: reductions in anxiety levels, other psychiatric symptoms, diabetes symptoms, and carbon monoxide exhalation levels, and improvements in functional well-being, physical health, quality of life, well-being, and psychological health (Baldwin et al., 2020; Fujioka et al., 2012; Ghanbari et al., 2021; Han et al., 2013; Richardson et al., 2010; Travis et al., 2010; Wise et al., 2018; Yu et al., 2020).

Discussion

The purpose of this systematic review was to evaluate the use of digital technology to influence social connectedness among adults with ≥1 chronic health condition. A growing body of evidence demonstrates the criticality of social connectedness on health (Haslam et al., 2015; Yang et al., 2016; Health Affairs, 2020). Robust evidence has emerged over the last four decades, and especially during the COVID-19 pandemic, that lack of social connectedness is associated with a significantly increased risk of premature mortality independent of age (Rico-Uribe et al., 2018; Holt-Lunstad, 2021). Physical distancing imposed by the COVID-19 pandemic created an

exponential surge in digitalization. Whereas social networks and video conferencing became a norm, individuals with low digital literacy were challenged and experienced greater social isolation and loneliness (De et al., 2020). Low digital literacy is a consequence of social and economic inequalities that result in a limited ability or inability to effectively use and access digital technologies (Lythreatis et al., 2022). Thus, it remains critical to address the role of digital literacy and evaluate the potential efficacy of digital technology to impact social connectedness, including both positive and negative attributes and outcomes.

Most participants reported ease of use and increased satisfaction with digital technology because it eliminated geographic barriers, especially for individuals with mobility impairment, and times constraints for social connectedness. Anonymity features commonly found in digital applications and websites were perceived as providing safety from invasion of privacy, thereby increasing acceptance. The use of passwords on social networks increased the level of security and privacy, allowing for increased comfort in sharing personal thoughts and information. Negative aspects of digital technology use were the access to technology due to costs, internet availability, and/or physical limitations which impacted the accessibility of digital social support for some populations. However, overall, the attitude toward the use of digital technology was positive.

Our findings were consistent with the “helper effect” (Reissman, 1965), a principle that states people use the wisdom gained through living with a problem to help others with the same or similar problem, and in return their own recovery is strengthened. Selected articles that addressed the helper effect found increased social

connectedness, a commitment to personal contribution, life satisfaction, improved wellbeing, and a higher life meaning when helping others.

Social support is often conceptually linked to social connectedness. Emotional, informational and appraisal support were commonly provided through digital technology whereas instrumental support was apparent in less than thirty percent of the studies. The limited delivery of instrumental support through digital technology is not surprising because the digital platforms were primarily information and communication technologies (mobile phones, smartphones, computers, laptops, and iPads). Further, while we included the receipt of goods or services in the domain of digital support, instrumental support is more commonly associated with assisting someone to perform activities of daily living, which would be more challenging to provide with information and communication types of technology. However, apps such as medication reminders, physical activity tracking, or symptom monitoring are commonly used with information and communication digital technology platforms and would be considered instrumental support (Khosravi et. al., 2016). While research on those types of apps, which could be considered instrumental support, is fairly common (e.g., Liu, Xie, & Or, 2020; McLean et al, 2016; Shaw et al., 2020), studies that included digital self-management interventions were rarely identified in our search. Similarly, the research identified in this systematic review did not include studies involving robotic platforms, which have the potential to promote social connectedness and to provide instrumental support for activities of daily living (Khosravi et al., 2016). Based on the findings, one could argue that instrumental social support is not as highly emphasized as the informational, emotional, and

appraisal domains. Further, instrumental support may not be captured by authors in key words for studies that involve social connectedness or social support.

Findings from studies in this review indicated positive aspects of each domain of social support, but a few of the studies, particularly those that sought qualitative feedback from participants, noted potential or actual negative aspects of digital social support. Mistrust and fear were especially noted when the study participants had stigmatizing health conditions (e.g., behavioral health conditions, substance use disorders) or were highly vulnerable (e.g., intellectually disabled) populations. Mistrust issues were reported about whether information received was accurate, including the possibility of others in the group claiming to have expertise or credentials (e.g., being a physician) that they did not possess. Fears involved the potential misuse of shared information or lack of confidentiality of personal information and vulnerability to stalking or exploitation. Similarly, in a study involving older adults, Cotton et al. (2022) noted that older adults sometimes felt an increased risk when they shared self-identifying information on social media. This “technophobia” is attributed to the digital divide, as older adults have been introduced to digital technology later in life than digital natives (Di Giacomo et al., 2019).

Different aspects of technology and the characteristics of individual participants were also found to impact the usefulness of attaining social support using digital platforms. Technologic glitches or complexity can reduce efficacy and engagement to attain social support. Individual participants’ lack of technological literacy may present a barrier for some participants. Studies where users engaged with the app through automatic messaging or message algorithms sans engagement with other participants

generally were less successful as compared to those where individuals could communicate directly with each other whether synchronously or asynchronously (Baldwin, 2020; Blickem, 2014). Finally, people need to feel that the social support intervention is relevant and applicable to their lived experience to engage in digital social support (Blickem, 2014; Valentine, 2020; Lazard, 2021).

The efficacy of peer support for social connection was mixed. Peer support success may depend on contextual health factors such as the specific health condition, time since diagnosis, prognosis, and severity. For example, peer support was ineffective in Toija, and colleagues' (2019) study due to the shock and anxiety of a recent diagnosis of breast cancer. In Heisler et al.'s (2014) program for patients with heart failure, peer support was ineffective due to the patients' poor health and fatigue, reducing their desire to engage. This finding is like that of a meta-analysis of psychosocial support interventions that revealed social support interventions were less effective when patients had relatively greater disease severity (Smith et al., 2021). The use of peer leaders or role models facilitates more meaningful conversations among participants in online social support groups, as opposed to blindly entering an online social support group. All studies recommended further research with a focus on tailoring to the needs of the specific population. Depression and quality of life were a few of the most common variables measured in the examined articles. Other articles outside of the scope of this review also evaluated the associations between social connectedness and depression and quality of life outcomes and many found connectedness to be positively related to depression and quality of life (Armstrong & Oomen-Early, 2010; Creavan et al., 2017; Dorji et al., 2017; Morris et al., 2014; Rogers & Mitzner, 2017; Williams &

Galliher, 2006). Although there were three studies that found negative health outcomes associated with social connectedness in this systematic review (Tan et al., 2021; Toija et al., 2018; Valentine et al., 2020), there is little in the literature that supports this phenomenon. Findings from studies outside the scope of this review indicated that social connectedness had a positive correlation with health outcomes (Bethell et al., 2021; Hudson, 2017; Lem et al., 2021). However, Yan (2017) who conducted a study with people who were obese, found that it is important for individuals to receive the right type of social support, or it may negatively impact their health outcomes (i.e., weight gain).

Strengths and Limitations

Whereas we designed a comprehensive literature search and consulted additional sources such as author libraries, Google, and the references of published systematic reviews, there still exists the possibility that relevant studies could have been overlooked. However, the use of these additional resources helped validate our original search. Another limitation is the exclusion of terms for specific domains of social support. Our team had seven members which strengthened the rigor when reviewing and discussing acceptable articles, quality assessment, and data extraction and analysis.

Conclusion

Evidence from most of the selected studies supports the positive impact of social connectedness through digital technology in providing greater access to social support for many individuals with chronic health problems. The studies varied in the types of digital technology, research methodology, population, and health outcomes.

Heterogeneity existed within and among chronic health conditions. Factors that increased acceptance and usability by individuals with chronic conditions were the ease of use and usefulness of digital technology, the added protection of privacy, and the lack of geographic and time constraints. However, individuals who were chronically and severely mentally ill or those with intellectual developmental disorders were challenged by more complex digital technology. More advanced digital technologies require higher levels of digital literacy and cognitive functioning. Thus, there is a need for digital training and greater accessibility features (e.g., screen readers, assistive software) for individuals with chronic health conditions that involve sensory and/or cognitive deficits. Access could be improved among those living in areas with inadequate internet connectivity. Leveraging digital technology to promote social connectedness has the potential to effect positive health outcomes. Further research is needed to better understand the social integration of technology among populations with different contexts and chronic health conditions to enhance and tailor digital interventions.

DECLARATIONS

Conflicting interests: PR received funding from the National Institute of Drug Abuse (1K23DA051626-01A1). All authors declare no potential conflicting interests with respect to the research, authorship, and/or publication of this article.

Funding: Research reported in this publication was supported by the National Institute on Drug Abuse under award number 1K23DA051626-01A1. The content expressed in this publication is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Ethical approval: The systematic review did not require prior ethics approval.

Guarantor: PJW

Contributorship: PJW conceived of the idea and created the search. All authors iteratively reviewed articles and assessed methodological quality. All authors extracted and analyzed data. All authors contributed to the first draft. PJW and PR revised the first draft and all authors reviewed and edited the manuscript and approved the final version of the manuscript.

Acknowledgements: The authors would like to acknowledge the **A**dvancing **C**hronic Care **O**utcomes through **R**esearch and i**N**novation (**ACORN**) Center for its support.

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Author	Year	Purpose	Study Design	Chronic Condition	Digital Technology	Sample Size	Age of Sample	Outcomes
Richardson, et al.	2010	Measure impact of online community on average daily step count, motivation, & attrition	Randomized Controlled Trial	Obesity, Type 2 Diabetes, or CAD	Internet-mediated walking program with online community features	n=324 (113/211)	Mean Age 52.0 (±11.4)	↑ emotional & information social support; ↑ engagement from those with low baseline social support; No impact on average daily step count; ↓ Attrition
Travis, et al.	2010	Assess feasibility of a telephone-based, mutual peer support intervention to ↓ depressive symptoms & ↑ quality of life	Feasibility Study (12 Weeks)	Major Depressive Disorder	Telephone	n=54 (34/20)		Intervention feasible & acceptable. Small significant ↓ depressive symptoms, ↑functional ability
Fujioka, et al.	2012	Assess behavioral & mental changes of pregnant smokers who participated in an e-smoking cessation program during the first trimester	Nonrandomized One-Arm Controlled Trial	Tobacco Addiction	Cellphone: Internet: e-learning cessation program	n=48 (0/48)	Mean 25.9 (±4.7)	High participation & cessation rate with ↑ self-efficacy
Heisler, et al.	2013	Assess if NP-led goal setting sessions & weekly peer telephone calls would ↑ quality of life & ↓ hospitalization.	Randomized Controlled Trial	Heart Failure	Telephone	n=266 (128/138)	Mean 69.0	No or minimal engagement with peer support program; no improved outcomes.
Horvath, et al.	2013	Assess feasibility & acceptability of an online social support intervention to ↑ medication adherence	Randomized Controlled Trial	HIV	Computer: Interactive Website ("Thrive with Me")	n=123 (123/0)	Mean 42.7 (±10.3)	Internet social support acceptable to men who are HIV+ & may ↑ medication adherence.
Blakeman, et al.	2014	Explore perspectives of a telephone-based service to engage participants, ↑ social contacts, & link to community support & local health resources	Qualitative	Chronic Kidney Disease, Stage 3	Computer: Website Telephone	n=20 (5/15)	Mean 68.9	Engagement dependent on timing & stage of life. Health problems (e.g., fatigue) a barrier to physical participation.
Han, et al.	2014	Determine levels of engagement in social support groups among breast cancer survivors & what role types of engagement play in explaining psychosocial outcomes	Secondary Analysis	Breast Cancer	Computer: Internet: Social Support Groups	n=397 (0/397)	Mean 50.8 (±8.9)	Socio-demographic characteristics, psychosocial factors, & digital literacy predict engagement. Lurkers have ↑ perceived functional well-being than posters.
Merolli, et al.	2014	Explore what social media therapeutically affords people living with chronic pain who self-manage condition	Qualitative	Chronic Pain	Social Media	n=68 (10/58)	18.0 – 60.0+	Social media afforded exploration, connection, & emotional catharsis of shared experience

Pereira	2014	Assess use of Facebook with therapist as "friend" to ↑ treatment adherence	Randomized Controlled Trial	Treatment Resistant Major Depressive Disorder	Computer: Internet (Facebook)	n=57 (NR)	18.0 - 70.0	↓ depressive symptoms with Facebook use, even more with psychiatrist as "friend"
Allam, et al.	2015	Assess effects of online social support & gamification to ↑ physical activity, empowerment, & condition-specific knowledge & ↓ health care utilization & medication overuse	5-Arm Parallel Randomized Controlled Trial (6 Months)	Rheumatoid Arthritis	Internet: web-based including online social & informational support features & gamification ("ONESELF")	n=155 (84/71)	57.9 (±11.0)	Gamification alone or with social support ↑physical activity, ↓ healthcare utilization, ↓ medication overuse
Blackstock, et al.	2015	Assess perspectives of role & use of online groups to provide empowerment	Qualitative: Semi-Structured Interviews	HIV	Computer, mobile devices	n=27 (0/27)		↑ use but limited by access & digital literacy. Trust essential to building online connection.
Owen, et al.	2015	Characterize levels of & factors for engagement (e.g., time spent, # & length of messages, etc.) in a multi-component Internet intervention designed for social networking	Randomized Controlled Trial (12 Weeks)	Cancer	Internet-health platform with guided modules, live weekly chat, discussion board, personal profiles, & webchat.	n=296 (65/231)	Mean 54.0 (±10.8)	~80% engaged at beginning with steady decline over 12 wks; social networking used more often than structured education or facilitated discussion; previous social media users more engaged
Banbury et al.	2017	Examine impact of weekly videoconference group meetings on participants' social networks	Mixed Methods (Social Network Analysis + Surveys + Interviews)	Random: Elderly from a Health Clinic	Video Conferencing	n=45 (NR)	Mean 73.0 (±6.0)	↑ life engagement, ↑ self-management
Namkoong, et al.	2017	Examine the effect of existing offline social support & family relationship perceptions on patients' use of online communication networks	Randomized Controlled Trial	Cancer	Computer: social support groups	n=243(NR)	Mean 51.1 (±9.2)	A negative correlation exists between offline perceived social support & use of online social support groups.
Burner, et al.	2018	Assess feasibility of social support module integrated into an mHealth intervention to ↑ diabetes knowledge, self-efficacy, & subsequent disease management	13-Week Randomized Controlled Feasibility Trial	Diabetes	Telephone: text messaging	n=44 (19/25)		Intervention feasible. ↑ glycemic control. No significant difference on social support from family or other clinical outcomes.

Wise, et al.	2018	Assess effects of a narrative intervention with online resources & social networking on patients' well-being & explore intervention use & satisfaction	Randomized Controlled Trial	Cancer, Stage III or IV	Telephone & Internet (website with eHealth resources & social networking)	n=86 (18/68)	Mean 57.0 (±8.8)	↑ engagement that declined over time. ↑ sharing. Social networking use low because most participants already used another social network. Those with shorter time perspective were "trimming" social contacts.
Young, et al.	2018	Determine feasibility of an online support intervention (HOPE) to ↓opioid misuse & overdose	12-week Randomized Controlled Trial	Chronic (non-cancer) Pain	Facebook private community pages	n=51 (21/30)	Mean 43.5 (±14.6)	↑ online discussions about physical & mental health status, coping, pain management, & social support. No outcome measures reported.
Gavrila, et al.	2019	Examine role of an online community (Facebook) to impact peer support	Qualitative	Type 1 Diabetes	Internet: social media (Facebook)	n=21 (12/9)		Participants reported receiving and giving technical, emotional, & informational social support
Johnston, et al.	2019	Evaluate the evidence-based relapse-prevention smartphone system (A-CHESS: Addiction Comprehensive Health Enhancement Support System) to ↑ treatment retention among women in an impoverished rural setting.	Quasi-Experimental With Posttest Only	Substance Use Disorder	Cell phone; Wi-Fi Connection	98 (0/98)	18.0 - 40.0	↑ treatment retention
Lepore, et al.	2019	Examine effect of digital literacy on engagement in & psychological benefits from an internet-based peer support group	Secondary Analysis of a Randomized Controlled Trial	Breast Cancer	Internet: support group with facilitated discussion & chat room	n=183 (0/183)	29.0 - 65.0 (61% ≥ 52.0)	Low digital literacy associated with computer anxiety, leading to barriers in support group usage.
Toija, et al.	2019	Assess effectiveness of peer support on health-related quality of life	Randomized Controlled Trial	Breast Cancer	Telephone	n=260 (0/260)	60.0 (±10.5)	Marginal & transient effect on health-related quality of life
Baldwin, et al.	2020	Assess efficacy of web-based program to ↑psychosocial & occupational functioning	Randomized Controlled Trial	Type 2 Diabetes	Computer: Web-based public health program ("myCompass")	n=723 (286/437)	Mean 58.0 (±10.3)	↓ depressive symptoms & anxiety, ↑ self-management
des Bordes, et al.	2020	Assess participant engagement on a condition-specific online social support group	Single Arm Nonrandomized Controlled Trial	Rheumatoid Arthritis	Private social media Online Discussion Group (Facebook)	n=90 (5/85)	Median Age 54.0 (24-84)	↑ social support, specifically information seeking & sharing & emotional; ↓ participation over time

Marshall, et al.	2020	Assess feasibility of delivering group social support via a multi-user, virtual reality platform (EVA Park) & measure wellbeing, communication, social connectedness, & quality of life	6-Month Randomized Controlled Trial	Aphasia s/p Stroke	Virtual Reality via Internet	n=34 (17/17)	Mean 53.5 (48.0-71.0)	Feasible. ↑ mental well-being.
Valentine, et al.	2020	Explore engagement & experience with a long-term social media-based mental health intervention to ↑ social connectedness	Qualitative	1st Episode Psychosis	Computer: Customized Online Social Network ("Horyzon's")	n=12 (5/7)	Mean 23.2 (19.0 - 28.0)	Themes: 1) shared identity, 2) social support, 3) upbeat environment, 4) barriers to use (social anxiety, paranoia, stigma, lack of autonomy, social protocol)
Welch, et al.	2020	Assess a social support tool to ↑participants' social network, thus ↑ health outcomes & quality of life to ↓ healthcare utilization & costs	Pilot Randomized Controlled Trial	COPD	"Generating Engagement in Network Support" (GENIE) - self management support service & database	n=60 (30/30)	Mean 70.5 (±7.2)	55% of participants ↑social network size & ↓anxiety levels.
Yi, et al.	2020	Assess impact of a survivorship-focused Internet program, with the option to use social media & texting, on mood, stress, & healthcare	Randomized Controlled Trial	Cancer with Hematopoietic Cell Transplantation	Computer: Internet (INSPIRE); Cellphone: texting	n=945 (488/457)	Mean 56.2 (±12.6)	Survivors with baseline limited support more likely to use INSPIRE program. Need strategies to reach younger male & African American HCT survivors.
Yu et al.	2020	Examine usage, patterns, endorsement, & association to clinical outcomes of WeChat-based mHealth program	Cross-Sectional	Schizophrenia	WeChat, social networking app in China	n=400 (200/200)	Mean 46.9 (±10.9)	Users younger, more educated, & more likely employed with fewer social connections. ↓ psychiatric symptoms & depression; ↑ functioning, recovery, & quality of life
Chen, et al.	2021	Explore online discussion posts for the impact of Covid-19 on daily life, reactions to it, information & technology use during, & social connectedness.	Qualitative	Frailty	Internet: online discussion forums	10 (3/7)	Mean 75.3 (±6.3)	Online websites used for information & social media (i.e., Facebook, Instagram) to educate others. Telephone, Internet, videoconferencing, & email for social connectedness.

Corbett, et al.	2021	Describe virtual home assistant use & usefulness from the perspective of older adults & their support persons.	Mixed Methods with Dyads	Random: obesity, hypertension, type 2 diabetes, depression, atrial fibrillation, fibromyalgia, & stroke	Virtual Home Assistant (i.e., Amazon Alexa)	10 (1/9)	Mean 75.0	VHA used regularly over time for information, entertainment, or prompts.
Ghanbari, et al.	2021	Assess satisfaction with mobile self-management app & online support group to ↓anxiety & ↑ self esteem	Randomized Controlled Trial (4 Weeks)	Breast Cancer	Cellphone: mobile self-management app & online group chat (WhatsApp)	n=82 (0/82)	Mean 46.4 (±9.3)	↓anxiety scores, ↑ self-esteem scores
Lazard, et al.	2021	Explore perspectives of social support via social media among young adults with cancer	Qualitative: semi-structured interviews	Cancer	Computer: Internet: social media; Cellphone: texting, apps	n=45 (12/33)	Mean 31.0 (±5.6)	Digital tech used: internet social support groups (Facebook, Caring Bridge, Snapchat, TikTok, YouTube), web-based forums (Caring Bridge, Gryt Health, American Cancer Society), and video chat platforms (Zoom, Webex). Also, cellphone for texting & meeting apps (e.g., WhatsApp)
Paul, et al.	2021	Explore what technologies individuals with intellectual disabilities use & how the technologies ↑ social connectedness	Qualitative	Intellectual and Developmental Disabilities	Wireless Technology	n=27 (7/20)	Mean 43.4 (±15.0)	Technology included cellphones (texting & calling), wearables, social media (Facebook, Instagram, messenger), digital assistants
Tan, et al.	2021	Identify predictors of negative experiences among people with obsessive-compulsive & related disorders who use social media peer support groups	Convergent Parallel Mixed Methods	Obsessive Compulsive & Related Disorders	Internet: social media peer support groups (Facebook & Reddit)	n=90 (6/84)	Mean 27.0 (±5.8)	Treatment barriers & lower levels offline support predicted negative experiences using social media. Predictors of negative experiences: 1) confronting content; 2) misinformation causing confusion; 3) preoccupation with symptoms because time reading about them; 4) social comparison; & 5) hopelessness about recovery prospects.

Appendix A.

Search strategy for systematic review.

(("digital platform" or "digital technology" or "digital intervention" or "web based digital health" or "web based interventions" [MeSH Major Topic]) OR ("wearables" or "mobile applications" or "apps" or "internet based" or "tracker" or "computers" or "social media" or "social network*")) OR ("Facebook" or "Twitter" or "instagram" or "TikTok" or "email" or "text" or "virtual" or "virtual reality" or "augmented reality" or "artificial intelligence AND (meta-analysis[Filter] OR randomizedcontrolledtrial[Filter] OR systematicreview[Filter])) AND (social connectedness" or "social connectivity" or "social connection" or "disengagement" or "loneliness" or "social cohesion" or "social isolation AND (meta-analysis[Filter] OR randomizedcontrolledtrial[Filter] OR systematicreview[Filter]))) AND (("chronic condition" or "chronic illness" or "disease" or "chronic disease" or "health conditions") AND (meta-analysis[Filter] OR randomizedcontrolledtrial[Filter] OR systematicreview[Filter]))