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Perspective

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Perspective: Improving social connection and inclusion through equitable digital health solutions

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In this Perspective, we address the critical intersection of digital health, social connection, and health equity. Taking an interdisciplinary and complex adaptive systems perspective, we highlight evidence-based digital solutions to improve social connection and inclusion and, consequently, health outcomes. We describe actionable strategies for ensuring that digital health innovations benefit all, highlighting how user-centered design can address diverse needs, particularly for structurally disadvantaged populations.

Rationale: The impact of social connection and inclusion on health and wellbeing

Social connection describes how people relate to and interact with each other. It has three dimensions: structure (the number and types of relationships and roles, and how often and how long people interact); function (the type and amount of support exchanged); and quality (whether interactions are positive or negative)[1]. *Social inclusion* is the process of ensuring that all individuals, regardless of their background, abilities, or circumstances, have equal access to social, economic, and cultural opportunities, and are valued as active participants in society[2].

Social connection and inclusion overwhelmingly influence physical, mental, and emotional health[3]. Research consistently highlights that strong social ties and a sense of belonging are important for wellbeing, while social isolation and exclusion detrimentally affect health[4]. Individuals with robust social networks experience lower levels of stress, reduced risk of chronic illness, and increased independence in older age[5]. Social connection facilitates behaviors critical for health and longevity, such as regular physical activity and optimal nutrition. Conversely, social isolation and loneliness are linked to poor mental (e.g., depression, anxiety) and physical health (e.g., higher blood pressure, increased risk of cardiovascular disease)[6]. Social connection and inclusion are top priorities for equitable public health[3].

Social connection and inclusion are critical to address two key social health determinants: social isolation and loneliness. Given the widespread adoption of technology and its potential to enhance connectivity, digital solutions offer promising avenues to mitigate these concerns. *Social isolation* means having objectively few social relationships and infrequent social contact, while *loneliness* is defined as a subjective unpleasant or distressing feeling of a lack of connection to other people[7]. Loneliness and social isolation were public health concerns before the COVID-19 pandemic and have been exacerbated in subsequent years[8]. Social isolation and loneliness are a key focus of the United Nations Decade of Healthy Ageing (2021–2030)[9] and the WHO Commission on Social Connection (2024–2026), which aims to address loneliness as a pressing health threat, promote social ties as a global public health priority, and accelerate the equitable scale up of solutions in all countries. In today's digital-by-default world, access to health services and information is increasingly delivered online. As such, digital access and digital health literacy must be recognized not only as markers of inequality but also as universal human rights[10]. Now is the time to confront the growing pandemic of social isolation and loneliness through innovative, high-quality, and collaborative research that leverages novel and equitable digital health solutions.

A solution: Socially connected and inclusive communities supported by technology

Social connection and inclusion foster healthier communities. For instance, when individuals feel a sense of belonging, they are more likely to participate in community activities, to volunteer, and to support local initiatives[11], as well as work together to achieve a common purpose (i.e., social capital). This collective engagement can lead to stronger social support networks, better network efficacy (i.e., the capacity for networks to respond to members' needs), improved public health outcomes, and enhanced community resilience[12]. Inclusive societies that value diversity are thus often better

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Box 1: | Examples of digital programs that foster connection and inclusion and promote health equity

ConnectUp (2024–2027) is a digital platform that allows users to connect online to participate in physical activity opportunities in their local community. *ConnectUp* includes elements of Citizen Science. Users can identify activities and places where they can partake in physical activities and share their feedback regarding accessibility and inclusion. The digital platform was designed with people living with disability and with unpaid carers. The study design incorporates the Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework and other implementation science approaches.

Unique digital value: ConnectUp enables community members to map and crowdsource real-time data on inclusive physical activity opportunities, something that would be difficult to coordinate through traditional offline approaches.

User-centered example: A young adult living with a mental health condition uses *ConnectUp* to find a local tennis partner through the platform's matching feature. The ability to browse inclusive activities and connect with others online helps reduce anxiety around social interaction and builds confidence through shared interests.

Equity lens: *ConnectUp* aims to promote digital health equity by proactively co-designing the platform with people with disability and carers and ensuring relevant accessibility features.

Active Women over 50 (AWo50) is an intervention for older women who would like to receive support to increase physical activity. The program has four components: (1) telephone-based health coaching, (2) access to the AWo50 website, (3) access to a private Facebook support group, and (4) email or SMS behavior change messages delivered by an automated system. The program was designed with input from stakeholders across urban, regional, and rural areas of New South Wales. Social connection is delivered through telephone coaching and an online group. The program is being evaluated via a Randomised Contolled Trial (RCT).

Unique digital value: The combination of online peer support and automated messaging allows for sustained engagement, asynchronous interaction, and wide geographic reach, features that would be hard to replicate in exclusively in-person formats.

User-centered example: A 68-year-old woman in a rural town, unable to attend in-person classes, joins the private Facebook group to share her walking progress, receive encouragement, and connect with others in similar life stages.

Equity lens: AWo50 advances digital health equity by offering multi-modal delivery tailored to different needs and preferences. The intervention was co-designed with input from women across urban, regional, and rural areas, recognizing that "women aged 50+" encompass distinct subgroups with varying needs, including women living alone, those with caregiving responsibilities, women experiencing employment or health transitions, and those facing socioeconomic disadvantage.

BEFRIENDING with GENIE (2023–2027) is an intervention to reduce loneliness and increase social support and service access for people living with dementia and their carers from culturally and linguistically diverse communities. This project combines two evidence-based interventions: "BEFRIENDING" which consists of informal conversations with a trained facilitator, and "GENIE", which is an online database of support services and activities tailored to participants' interests and needs together with a network mapping tool to measure social support over time. The study is a pragmatic RCT.

Unique digital value: The GENIE platform enables personalized, real-time mapping of support networks and services based on individual needs and, importantly, individual interests, something that would be highly resource-intensive to replicate manually. The digital tool enhances visibility and access to culturally appropriate services and resources that are most likely to result in sustained engagement.

User-centered example: A Mandarin-speaking carer uses GENIE with a facilitator to discover a nearby dementia-friendly sit-dance group that meets weekly at a local community hub, significantly reducing their sense of isolation and offering an activity that her husband living with dementia is motivated to attend because of his love of music.

Equity lens: This program advances digital health equity by combining personal support with a culturally tailored online platform, making social and service connections more accessible for people with dementia and their carers.

equipped to address public health challenges. We argue that advancing research on the role of social connection and inclusion is essential to improve health and health equity, and this can be achieved by harnessing the potential of digital technologies.

While digital technologies have the potential to enhance social connection by facilitating access to information, networks, and supports[13,14], they can also enable the spread of misinformation, unhealthy social comparison, and increased polarization[15,16]. In this Perspective, we focus on digital solutions that are intentionally designed to promote meaningful connection and social inclusion, particularly those that are evidence-based, moderated, or integrated into supportive services. While not without limitations, these tools may offer scalable and accessible ways to address social isolation and loneliness when thoughtfully implemented. Although this Perspective focuses on digital health solutions, we recognize that non-digital approaches remain essential, particularly for populations with limited digital access, and can complement digital interventions to maximize reach, accessibility, and impact.

This Perspective is written by a team working across disciplines, including psychology, behavioral medicine, computing and information systems, digital health, anthropology, sociology, urban planning, business, health economics, psychometrics, implementation science and public health. In our past work, we have designed, implemented and evaluated effective digital programs and toolkits that foster connection and inclusion and promote health equity (Box 1). In our work, we focus on three priority groups: people living with disability, carers, and older people, as they represent some of society's most structurally disadvantaged populations[17,18] experiencing significant barriers to social connection and inclusion, including digital access challenges[19–21]. We advocate for the use of a system change approach to drive impact at scale, fostering and building sustainable social connection ecosystems within communities, and

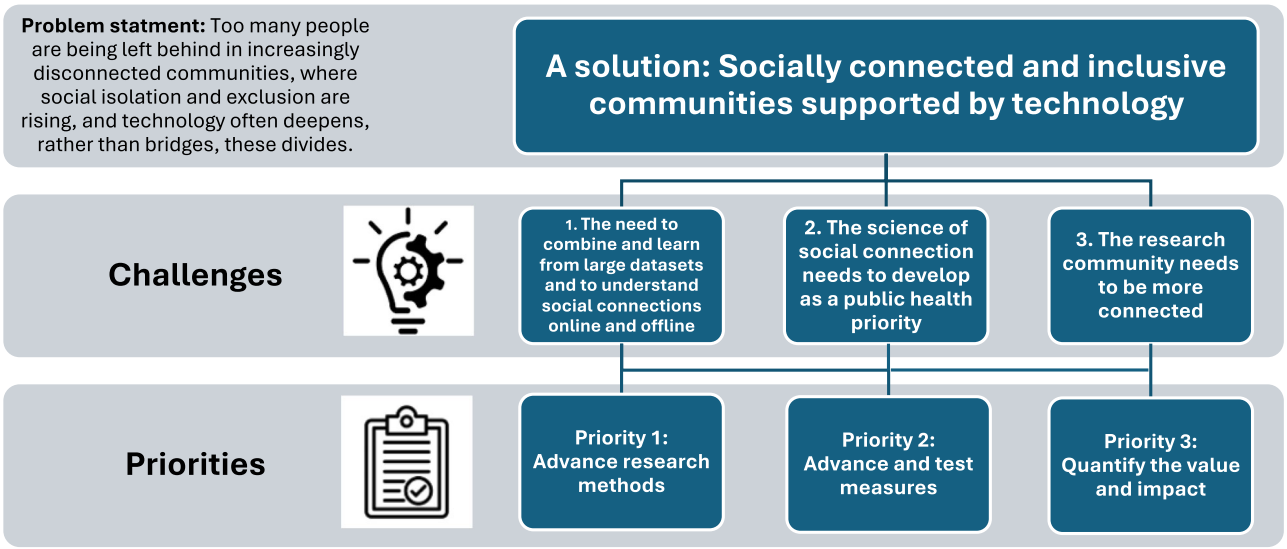

Fig. 1 | Challenges and research priorities.

raising awareness of social connection as a foundational health determinant, including through the digital realm.

Examples of effective social connection and inclusion programs supported by technology

In our collaborative research thus far, we jointly co-designed, delivered and evaluated equitable, digital programs for people living with disability and carers, for older women, and for people living with dementia and their carers from culturally and linguistically diverse communities, shown in Box 1. RCT designs and implementation science methodologies, have shown these programs have promising effects in improving social connection and inclusion and, consequently, improving health outcomes. Recognizing that health is influenced by factors beyond individual choices, including social, economic, and environmental conditions, we strive to promote health equity in all our projects. We use participatory design approaches to ensure that digital solutions are grounded in the lived experiences of end users. At the same time, we acknowledge important critiques from the field of Human Computer Interaction[22–24], which highlight the need to carefully consider who is involved, how they are engaged, and the degree of influence participants have throughout the design process. Without these considerations, participatory methods risk reinforcing inequities or becoming tokenistic in practice.

Drawing on recent literature, insights and learnings from our digital health projects focused on social connection, and from discussion among the authors who bring expertise in public health, digital health, and health equity, we identify three key challenges and three priority research areas that researchers, practitioners, and funders should address to advance health equity through digital health solutions (Fig. 1). While interconnected, these challenges and priorities are not intended as directly aligned pairs; rather, the challenges reflect broader systemic issues, and the priorities identify strategic areas for research investment and action.

Challenge 1. The need to combine and learn from large datasets and to understand social connections online and offline

In an increasingly digital age where traditional face-to-face interactions are being replaced or supplemented by digital communication, understanding how people form and maintain social connections has become more vital than ever before. The nature of social interaction is rapidly evolving, with technology playing a central role in how individuals connect, support one another, and interact in communities. Our team is focused on exploring these shifting dynamics by studying how digital technologies mediate and moderate these relationships[25–27], examining both its potential to facilitate connections and its role in exacerbating feelings of isolation. Digital platforms can facilitate connection, enabling people to maintain relationships across distances and offering new forms of support. However, the same technologies can contribute to isolation, disconnection, and misinformation, particularly when they are designed to replace rather than complement in-person contact or when users lack digital literacy[28].

Insights gained from our research will guide the development and implementation of programs that leverage technology to promote social engagement, particularly for structurally disadvantaged populations (Box 1). This prospect is even more attractive with the increasing potential of data linkage across different social connection studies to create large cross-context meta-studies. Countries are increasingly collecting wellbeing measures to assess progress beyond their Gross Domestic Product (GDP). For example, Australia now includes national indicators such as social connection, belonging, and trust in others[29]. To move the science of social connection forward, large and diverse datasets that capture both online and offline forms of interaction need to be explored. Combining data across studies and contexts through data linkage and harmonization will allow us to create large-scale, multi-dimensional datasets that provide a fuller picture of how social connections operate in different contexts and among different populations. Such comprehensive datasets would enable us to examine broader social patterns, systemic influences, and system changes. This is especially vital for designing effective interventions for structurally disadvantaged groups. However, while big data can reveal large-scale trends and disparities, it may overlook the nuanced, lived experiences of users. Integrating qualitative and mixed-methods approaches can enrich interpretation, uncover context-specific barriers, and ensure that insights reflect real-world complexity.

Challenge 2. The science of social connection needs to develop as a public health priority

To address the rising burden of loneliness, social isolation, and exclusion, the science of social connection must be recognized and resourced as a core public health priority. Despite growing awareness of the links between social relationships and health, investment in research and infrastructure in this area remains limited and fragmented. There is an urgent need for coordinated and multidisciplinary efforts to build the evidence base on how social connection and inclusion influence mental and physical health across populations and settings.

Future research must move beyond descriptive studies to apply rigorous and fit-for-purpose designs, including RCTs, pragmatic evaluations,

and real-world implementation studies, to understand what works for whom, and in what contexts. Importantly, this scientific area should not be confined to localized interventions; it should generate transferable models, frameworks, and methodologies that can inform both digital and non-digital programs globally. These tools should be designed with scalability, sustainability, and equity in mind, enabling adoption and adaptation by scientists, policymakers, and communities worldwide. Only through this shift can social connection be embedded as a measurable, actionable, and sustained component of public health policy and practice.

Challenge 3. The research community needs to be more connected

The advancement of social connection science can drive social change. We expect to establish, along with other researchers in the field, a clear link between social connection, inclusion, and health outcomes, which in turn will help to strengthen advocacy for policies that promote diversity, health equity, and support connected digital and non-digital environments. We believe that knowledge gain and translation can be accelerated, especially if multiple teams currently working in silos combine their learnings to advance agreed frameworks, methods, measures and best practices. As the evidence base grows, such work will empower communities and organizations to implement strategies that foster connection, ultimately contributing to a healthier, more cohesive society. Below, we list three core research priorities, including advancing research methods, advancing and testing measures, and quantifying the value and impact of this work.

Priority 1: Advancing research methods

We advocate for rigorous and fit-for-purpose designs, and for broader use of systematically developed participatory research methods. Our team, along with others, has successfully used participatory research designs to address health disparities, health promotion, and social inclusion[30,31]. Participatory research methods actively engage community members and other stakeholders in the research process[32]. These methods emphasize collaboration, mutual respect, and shared decision-making between researchers and those who are directly impacted by the issues being studied. *Co-design* is an example of participatory approach in which users, stakeholders, and designers work together throughout the entire research design and program development process to create solutions that are relevant, effective, and meet the needs of all involved.

To enhance health equity, we also advocate for the development of a robust infrastructure for social connection programs deploying community-engaged citizen science at scale[31]. In the health domain, "citizen science" refers to the involvement of non-professional individuals (often referred to as "citizens", traditionally defined as inhabitants of a particular locale without regard to legal status[31]) in the collection, analysis, and interpretation of data related to health. This approach empowers the public to contribute to scientific research, particularly in areas where large-scale data collection from diverse populations is needed. This approach is still relatively underused in a number of health areas. We need to continue to develop and deploy methods for advancing the use of participatory research methods, specifically co-design and citizen science, to ensure inclusion of participants from structurally disadvantaged groups and to improve the design of equitable digital health solutions supporting social connection.

Priority 2: Advancing and testing measures of key constructs

Concepts such as social connection, belonging, inclusion, social capital, isolation and loneliness are often used interchangeably and/or assumed to be at opposite ends of a continuum[33,34]. To quantify and assess the economic value of improved health and wellbeing through social connection and inclusion and to ensure health equity, conceptual clarity and accurate measurement are essential. Current measures of social connection, community integration and inclusion are not always fit for purpose for evaluating the health benefits linked to such constructs nor improving these constructs at scale. Psychometrically sound measures of social connection often tend to be too lengthy and deficit-focused, which are generally not well-accepted by participants[35,36]. Measures of community integration and inclusion tend to be developed for use with specific populations (e.g., those with a specific chronic disease) and have not generally demonstrated responsiveness to change[33,37].

Recently, a consortium of researchers from Australia (2024) has developed a useful framework[38] for measuring the impacts and quality of social connection programs and initiatives. In addition, a team from the US has assembled more than 50 measures of social connection that include information about measurement properties and psychometrics[39]. Whilst these represent important developments in the measurement of social connection, they are not yet a panacea to the problems outlined above. Building on this work, we need to refine and, where necessary, further develop measures of social connection, community integration, and inclusion that are robust across different populations, psychometrically sound, and responsive to change.

It is highly unlikely that a single measure will be able to serve all intended objectives for measurement of social connection and inclusion. To advance this field, we need to document trends, such as what are the optimal measures of social connection and inclusion for specific population groups or under specific circumstances. We also need to examine which measures are best delivered online versus offline to support equitable access. Through this participatory approach, we expect to identify extant measures that serve these needs, along with modify measures or co-creating new ones as indicated. The critical and much-needed outcome of this work could be the development of a toolkit containing a set of common measures of social connection, inclusion, and related constructs (such as community integration). The main impact of this work would be the ability to geographically map levels of social connection and inclusion, identify the needs of specific population groups, and generate an accelerating evidence base and more accurate indicators of the true health, social, and economic impacts of both digital and non-digital community-based programs aimed at improving social connection and inclusion.

Priority 3: Quantify the value and impact

Evaluating the impact of interventions that aim to strengthen social connection and inclusion requires methodologies that can capture both tangible and intangible benefits across social, economic, and health domains[40,41]. A variety of approaches may be appropriate, including grounded qualitative methods of assessing impact, critical realist evaluation, contribution analysis, and economic evaluation. Economic evaluation of interventions compares the costs of the intervention against the outcomes. Cost-effectiveness analysis compares differential outcomes in own unit terms against differential costs, while cost-benefit analysis seeks to provide a financial value of outcomes.

Cost offset analysis is an area of cost-benefit evaluation where measurement of impact in economic terms is the most precise. In cost offset analysis, the health system cost impact of interventions is measured by comparing the costs for a cohort receiving the intervention relative to a control group eligible for the intervention but not receiving the intervention using either an RCT design or a quasi-experimental design. The Social Return on Investment (SROI) framework provides a broader cost-benefit approach to measuring the monetary value of an intervention which goes beyond the cost offset measure. SROI offers a structured framework to assess the broader value generated by both digital and non-digital community-based interventions, particularly where outcomes are complex, long-term, and difficult to quantify.

SROI[42,43] aims to quantify and account for the wider social, environmental, and economic impacts of interventions; it can help highlight how enhanced social connection may lead to reductions in healthcare utilization, improved wellbeing, and increased community resilience. Box 2 provides an illustrative example of the five stages involved in applying an SROI framework. This approach can be useful in contexts where a holistic valuation of outcomes is desired.

Box 2 | An illustrative example: the five stages of the SROI evaluation

Stage 1 Mapping the value chain: involves developing a *value map*, a visual representation of the causal pathways linking intervention inputs to desired outcomes drawing on program logic designs. Through qualitative methods, such as interviews and focus groups, and through the extant relevant literature on interventions to support social connection and inclusion, we can identify the inputs, activities, outputs, outcomes, and impacts of the interventions. Delphi techniques (i.e., a structured method for gathering expert opinions and reaching consensus on complex issues, often used in research, policy development, and forecasting) can refine these elements and build consensus among stakeholders.

Stage 2 Evidencing and valuing outcomes: We need to develop measurable indicators to track the progress of the interventions and their impacts on key outcomes. These indicators should be informed by existing data and insights from various study priorities. By assigning monetary values or proxies to these outcomes, we can quantify the total social value generated by the interventions. One proxy of the value of a digital or non-digital intervention aimed at supporting social connection and inclusion is health system cost offsets, as previously identified, or the reduction in health system costs engendered by enhanced social connection and inclusion. Robust estimates of cost offsets can be obtained using treatment and control data on hospital and other health service use activity and relevant cost data. It is recognized that not all SROI studies have used robust proxies of outcomes (such as well-founded cost offset evidence), including of improved social connection and inclusion benefits.

Stage 3 Establishing impact: To gain a nuanced understanding of the interventions' impact, one should consider factors such as deadweight, displacement, and drop-off effects. Deadweight refers to outcomes that would have occurred regardless of the intervention, while displacement considers potential negative impacts on other groups. Drop-off examines how the benefits of the intervention may diminish over time. Again, it is recognized that some SROI studies have used conventions relating to deadweight, displacement, and drop-off effects based more on assumption than on robust data.

Stage 4 Calculating the SROI ratio: By combining the quantitative and qualitative data gathered in previous stages, one can calculate the SROI ratio. This ratio represents the total (discounted present value) social value generated by the digital and non-digital community-based interventions divided by the (discounted present value) total cost. A higher SROI ratio indicates a greater return on investment.

Stage 5 Disseminating and embedding the findings: The final stage involves sharing the SROI findings with stakeholders and facilitating their application to continuous service improvement. This collaborative approach ensures that the insights gained from the SROI analysis are used to maximize the impact of future digital and non-digital community-based interventions and social connection programs.

However, it should be seen as one possible approach among others in a broader impact evaluation strategy.

We need to quantify the total social value generated by the social connection and inclusion programs. The SROI ratio can be calculated to assess the return on investment. Ultimately, the findings, including any limitations in establishing the SROI estimate, should be disseminated to stakeholders, specifically to program funders and commissioners, and used to inform future investment in programs to improve social connection and inclusion. This, in turn, can help ensure health equity, leading to significant health improvements for individuals and communities. Finally, an equally important yet often overlooked area is understanding the costs of *not* investing in social connection programs. While such initiatives may require additional investment, the long-term social and economic costs of inaction may well be significantly higher[44].

Summary

Social isolation increases the risk of premature death comparably to other major risk factors like obesity, smoking, and lack of physical activity. However, the national and global public health investment in initiatives that support social connection and inclusion thus far has been modest. Advancing the science of social connection and demonstrating its quantifiable benefits for health can drive future investment and consequently health improvements. We need to accelerate current advancements in the science of social connection and inclusion as a health priority, including exploring the immense potential of digital health solutions in this area. To improve health and wellbeing in communities, we should further develop, evaluate, implement, and share digital and non-digital programs that support effective social connection and inclusion in structurally disadvantaged populations. We also need to improve definitions and measures to systematize the science of social connection and evaluate cost and impact. Finally, the field would benefit greatly from the advancement of research methods and implementation of translational research initiatives impacting both policy and practice. Doing so would provide further structure and tools to support national and international efforts in creating connected, inclusive, and thriving communities for all.

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Competing interests
The authors declare no competing interests.

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