Review

Social Prescription Interventions Addressing Social Isolation and Loneliness in Older Adults: Meta-Review Integrating On-the-Ground Resources

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Abstract

Background: Social prescription programs represent a viable solution to linking primary care patients to nonmedical community resources for improving patient well-being. However, their success depends on the integration of patient needs with local resources. This integration could be accelerated by digital tools that use expressive ontology to organize knowledge resources, thus enabling the seamless navigation of diverse community interventions and services tailored to the needs of individual users. This infrastructure bears particular relevance for older adults, who experience a range of social needs that impact their health, including social isolation and loneliness. An essential first step in enabling knowledge mobilization and the successful implementation of social prescription initiatives to meet the social needs of older adults is to incorporate the evidence-based academic literature on what works, with on-the-ground solutions in the community.

Objective: This study aims to integrate scientific evidence with on-the-ground knowledge to build a comprehensive list of intervention terms and keywords related to reducing social isolation and loneliness in older adults.

Methods: A meta-review was conducted using a search strategy combining terms related to older adult population, social isolation and loneliness, and study types relevant to reviews using 5 databases. Review extraction included intervention characteristics, outcomes (social [eg, loneliness, social isolation, and social support] or mental health [eg, psychological well-being, depression, and anxiety]), and effectiveness (reported as consistent, mixed, or not supported). Terms related to identified intervention types were extracted from the reviewed literature as well as descriptions of corresponding community services in Montréal, Canada, available from web-based regional, municipal, and community data sources.

Results: The meta-review identified 11 intervention types addressing social isolation and loneliness in older adults by either increasing social interactions, providing instrumental support, promoting mental and physical well-being, or providing home and

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community care. Group-based social activities, support groups with educational elements, recreational activities, and training or use of information and communication technologies were the most effective in improving outcomes. Examples of most intervention types were found in community data sources. Terms derived from the literature that were the most commonly congruent with those describing existing community services were related to telehealth, recreational activities, and psychological therapy. However, several discrepancies were observed between review-based terms and those addressing the available services.

Conclusions: A range of interventions found to be effective at addressing social isolation and loneliness or their impact on mental health were identified from the literature, and many of these interventions were represented in services available to older residents in Montréal, Canada. However, different terms were occasionally used to describe or categorize similar services across data sources. Establishing an efficient means of identifying and structuring such sources is important to facilitate referrals and help-seeking behaviors of older adults and for strategic planning of resources.

Introduction

Background

As in other nations, there is an increasing demand in Canada to incorporate social determinants of health (SDOH) into health assessments and address the social needs of citizens through primary care [1-6]. Evidence suggests that SDOH have sizable effects on disease onset and progression [7,8] and that greater spending on social services and public health is associated with improvements in health outcomes such as lower prevalence rates of obesity, asthma, lung cancer, acute myocardial infarction, and type 2 diabetes [9]. In the wake of COVID-19, health systems are grappling with the disproportionate impact of the pandemic on low-income, minority, and other vulnerable populations [10]. Currently, patient care and health information exist in silos across primary care, communities, and public health organizations, where the lack of coordination and limited flow of information hampers service access to those most in need [11]. Although medical and nonmedical issues are often intricately coupled, primary care providers are not always equipped to address SDOH and must rely on community resources to provide alternative personalized care and support [12]. Therefore, there is an urgent need for the synthesis and integration of knowledge surrounding SDOH and related evidence-based interventions. However, appropriate, whole-person care for patients is a function of the availability and accessibility of such interventions within the community and the ability of health professionals to draw from these resources.

To address these challenges, social prescription programs that enable primary care providers to refer patients to a range of local nonmedical services, including activities or resources provided by the local voluntary and community sectors, are receiving increasing attention [13]. Such programs not only have the capacity to provide personalized care but are also an effective solution for addressing lifestyle-related health concerns and nonbiomedical issues associated with SDOH [14]. Nevertheless, the intensive and time-consuming case management required for such coordination presents a significant challenge to such initiatives [15]. Connectors or link workers have provided a temporary solution, offering the knowledge, skills, and resources required to partner patients

with services [16]. However, as interventions advance, services expand, and patients seek increasingly personalized care, the role of link workers will become increasingly complex and labor intensive.

To facilitate this process, digital social prescription tools have surfaced, using a related approach to seamlessly integrate services of diverse, multisectoral organizations (often through different systems) and deliver high standards of interoperability. For example, Evergreen Life cloud software (Evergreen Solutions Ltd) [17] offers access to an in-app virtual link worker, where automated features allow for self-referral by linking medical records to a database of nonmedical services. Similarly, Egton Medical Information Systems (EMIS) Health's Elemental Social Prescription Connector (EMIS Group) [18] is a digital platform integrated into the computers of primary care providers, co-designed by local councils, community and voluntary sector organizations, and academic institutions, among others. These initiatives demonstrate promises in helping organize collaboration for improving social care delivery. However, their practical application and effectiveness rely on the development and maintenance of a comprehensive, up-to-date inventory of services that capture on-the-ground activities that address the specific social need initially identified. Likewise, the absence of a standardized approach for identifying and categorizing available services complicates their adaptation to other contexts.

The key enablers of these digital initiatives are ontological technologies, that is, knowledge organization systems that demonstrate the properties of a concept and the relationships that exist between those properties. Ontologies are an important tool for establishing a comprehensible knowledge network for managing data, enabling inferences on the relationship of said data, and promoting interoperability across data systems [19,20]. As dynamic entities, ontologies are likely to evolve alongside ongoing services [21] and require updating to reflect the incorporation of new evidence [22]. They provide a standardization for data entry and retrieval, are machine processable, and thus offer the potential for automation [23]. User-centered ontologies, specifically, provide a controlled vocabulary common to and agreed upon by a diverse set of stakeholders, thereby optimizing the interaction of users with the expert system [20]. These conceptual frameworks typically include additional information such as synonyms and use

examples as well as the relationship between entities, which are often more intricate and evolved than a simplistic hierarchical structure [22]. Incorporating artificial intelligence and machine learning techniques provides the means for real-time maintenance and updating of databases and can assist to optimally match patient needs to suitable services. Placed within the social prescription context, the development of an expressive ontology for organizing knowledge and resources could translate to a seamless navigation of diverse community interventions and services made accessible to the end user—whether patient, health care provider, policy maker, or researcher—based on identified needs. Investments are currently underway to standardize information related to social prescription and social determinants in an effort to facilitate their integration of such information into electronic health records [24,25]. However, these efforts are disproportionately concentrated on the identification of the social needs and less so on the classification and characterization of resources that could be used to address such needs.

The Case of Social Isolation and Loneliness

Extended social isolation and the experience of loneliness during the pandemic have been detrimental to people's well-being [26], marking an urgent need to mitigate social and mental health consequences [27]. Older adults are especially susceptible to social isolation and loneliness, which are often associated with adverse health outcomes such as depressive symptomatology [28,29], cognitive [30-32] and functional decline [33], cardiovascular disease [34], and an increased risk of mortality [35]. The relationship between social isolation and mortality has been compared in magnitude with that of traditional risk factors (smoking and high blood pressure) [36]. As the percentage of individuals aged >65 years will nearly double over the next 30 years [37], the need for evidence-informed guidance is even more pressing.

Although remote and in-person interventions have been proposed to reduce the impact of social isolation and to promote social connectedness in older adults [38,39], their implementation is often complex. A particular challenge pertains to matching services to patients' specific needs, given the need for input and coordination from a diverse set of siloed stakeholders [40]. Novel social prescription programs have the potential to bridge this gap, as primary care providers are well positioned to make referrals to local nonmedical services [13,16].

This study integrates scientific evidence, collected through an extensive meta-review, with on-the-ground evidence on real-world intervention, initiating the development of a social prescription ontology using social isolation and loneliness of older adults as a use case. The meta-review explores effective interventions for improving social isolation and loneliness in older adults and mitigating their impact on well-being, resilience, and coping. Concordance across intervention terms extracted from the literature and those identified within local community web-based resources of a sample population (Montréal, Canada) was explored. The cross-comparison of terms and initial syntactic integration (knowledge transfer) will provide the foundation for developing a social prescription

ontology, orchestrated through supplementary phases of semantic integration (knowledge translation) and pragmatic integration (knowledge transformation [41]). Importantly, we explored technology-enabled social prescribing as a viable approach to building a sustainable and scalable way of delivering interventions that are both precise and adaptable [14]. A more detailed and representative ontology for social prescription has the potential to provide more precise and accurate insight into the attributable outcomes of social prescribing [42].

Methods

Meta-Review

The search strategy entailed a review of reviews (meta-review) of studies reporting on social isolation and loneliness in older adults, developed in collaboration with an academic librarian and in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [43]. The search strategy (outlined in Multimedia Appendix 1) combined terms related to the (1) older adult population, (2) social isolation and loneliness, and (3) study types relevant to reviews, using the following databases: MEDLINE, Embase, PsycINFO, Social Work Abstracts, and CINAHL. Reviews were excluded if they did not clearly report on interventions directly related to social isolation or loneliness, focused on institutional settings only (eg, nursing homes) or caregivers, did not use a systematic search strategy [44], were not focused on an older adult population (defined as aged 50 years for the purpose of the review), did not include a full description of the study results (abstracts and protocols), were not published in French or English, or were published >20 years ago from the time of extraction (July 2020). No restrictions were imposed on the type of evidence reviewed within the reviews. Screening was performed in 2 steps by 2 reviewers, and discrepancies were resolved through discussion. As part of the larger project, extracted reviews reporting on interventions of social isolation or loneliness as well as risk and protective factors were selected [45]; the latter is beyond the scope of this study and is only briefly addressed in the *Discussion* section.

Data Extraction

Extraction tools were developed and piloted before use. Extractions were made by a single reviewer, whereas a random selection of 10% of reviews was systematically verified by another reviewer. The information extracted included the context, outcome, design of the studies reviewed, type of review, years covered, number of studies included, population, type of interventions reviewed, limitations of the studies reviewed, and conclusions. Select items from a quality appraisal tool [46] were used, related to the justification of the study design, completeness of the search strategy, duplication of study selection and extraction stages, appropriate discussion of included studies, and inclusion of a quality appraisal (Multimedia Appendix 2 [38,47-95]). The interventions were classified into groups of similar types, which were then grouped into overarching themes based on their intended outcomes.

To provide an accurate synthesis of information related to a given type of intervention, eligible primary studies (quantitative and qualitative) falling within each type of intervention were

identified from the reviews. Following the removal of duplicates, the following information was extracted from the primary studies: design type, intervention mode of delivery (in person or on the web), effect size (where available) and level of intervention (individual, group, or community), duration and frequency, organizations or professional body involved, quantitative and qualitative findings, presence of moderating or mediating factors, and undesirable consequences (refer to the study by Paquet et al [45]). Given the meta-review nature of the synthesis, effectiveness was based on the information reported in the reviews, which often provided limited information on effect size. Therefore, effectiveness was categorized into the following: (1) reported effect consistent with effectiveness, (2) reported effect providing mixed evidence for effectiveness (eg, trend toward significant effect, effect for subpopulation only, and a qualitative self-reported effect), and (3) reported effect not supporting effectiveness. Any discrepancies across reviews, primarily related to calculated effect sizes from meta-analyses, were indicated (*) in accordance with the multimedia appendices of the study by Paquet et al [45]. Effectiveness was compiled across intervention types and reported separately for social (eg, changes in social isolation, felt loneliness, social networks or connections, social support or social communication or participation) and mental health (eg, changes in mental health and well-being, depression, or anxiety) outcomes.

Community Resource Identification and Comparison of Intervention Terms

The investigation of available "on-the-ground" community interventions or services occurred with a focus on 2 boroughs of the city of Montréal, which offer access to a culturally diverse population, serving a mostly English-speaking or bilingual (French-English) population [96] and where social prescription efforts are being developed [97]. Montréal has Québec's largest number of older adults living in poverty and lacking social support, where the proportion of older adults living alone by borough ranges from 22% to 57% [98]. Two researchers independently extracted intervention terms from the meta-review corresponding to each type of intervention identified. The terms extracted by both the reviewers were included.

Data Sources

A finalized list of extracted intervention terms was used to search for and catalog corresponding community services for reducing social isolation and loneliness in directories of municipal and community resources, as well as websites of nonprofit organizations that serve older adults within the Montréal community (referred to hereafter as "data sources"). Data sources were included if the services offered matched the description of ≥1 intervention types identified during the meta-review process. Table 1 outlines the web-based data sources used, a description of the sources, and how each source was used to identify relevant intervention terms.

Table 1. Community data source identification and description.

Data source and description	Identification and use of the relevant terms
Regional or municipal	
211 Grand Montréal [99]: web-based and phone service aiming to connect citizens to community organizations and services within Greater Montréal. The database contains detailed contact, location, and services information about public, para-public, and community organizations that may serve the "senior" population.	The database was filtered for "seniors," "Montréal" location, and "English" as the service language. The output included a list of subcategories containing pertinent community organizations, of which some overlapped across subcategory offering a broad range of services. The organizations with service descriptions relevant to reducing loneliness or social isolation were identified, and keywords were extracted from these descriptions and keyword tags.
Données Montréal [100]: open-access data to services and events provided by the city of Montréal and offered within the Montréal area, several of which have the potential to improve mental well-being. Données Montréal data sets are not necessarily specific to older adults, and they do not explicitly state interventions or services to reduce loneliness and isolation.	Nine data sets were extracted from Données Montréal owing to their potential for providing information on infrastructure aimed at reducing loneliness and isolation in Montréal. Only databases that offered information regarding ≥1 intervention types were extracted. Four of these data sets were relevant, providing information on cultural activities, lists of parks, seasonal recreational activities, and museums, libraries, or recreational activities in Montréal. The data sets were reported in French and were translated into English for the extraction. Each data set varied with respect to how the information or events were reported. For example, some provided geolocations, time, and events, whereas others offered description of events. Keywords relating to events or places that one could visit for reducing loneliness and social isolation were extracted. None of the events and places were specific to older adults but were evidently accessible to them and were primarily related to recreational activities.
Neighborhood-specific resources	
Centraide of Greater Montréal [101]: directory of community agencies in Montréal, as separated by boroughs, that receive financial support from the Centraide of Greater Montréal Foundation. Centraide aims to reduce poverty and exclusion in the city of Montréal and funds community organizations to achieve this objective. Two specific neighborhoods or boroughs in Montréal were investigated, Côte-des-Neiges and Notre-Dame-de-Grace, where organizations serving older individuals with services relevant for reducing loneliness and social isolation were included.	The directory of supported agencies and projects were searched on the Centraide website. The 2 target boroughs were searched for through the filter "Territory served," providing a list of organizations that Centraide supports specific to these regions. Each organization had a list of activities offered, where activities that compared with those identified in the meta-review for reducing loneliness and isolation and accessible to older adults were extracted.
Community outreach worker: a comprehensive list of community organizations available in the region of Notre-Dame-de-Grace, as collected by a community outreach worker for the same period. Several organizations offer services aimed at reducing loneliness and social isolation and supporting older adults in the community.	The database was obtained from the community outreach worker, and relevant organization services were identified that reflected the meta-review intervention types. Keywords were extracted from the service descriptions, as formulated by the outreach worker.
Population-specific resources (older adults)	
Contactivity Centre [102]: a community center (nonprofit) serving older adults in Montréal that offers resources, referrals, and activities to improve the mental, emotional, and physical well-being of its members. It maintains a large database of organizations that offer a variety of services.	The "Resource and referrals" page of the Contactivity Centre website provides categories of services offered, listing community organizations and the corresponding websites that can provide access to those services. The relevant categories identified included "Recreational and Community Services," "Friendly Visits," "Daily Phone Calls," and "Senior Advocacy." Under each category, the listed organization websites were searched, and keywords were extracted from the services that compared with those identified in the meta-review.
AMI-Québec [103]: a nonprofit organization providing access to courses, workshops, interest groups, activities, and services in person or on the web as well as a database of external community organizations providing comparable services for the older adult population. Some of the external organizations are specific to older adults and offer services to reduce loneliness and social isolation.	The "Resource List" on the AMI-Québec website included a "Special Populations" category and a "Seniors" subcategory, which listed relevant community organizations with a short description of services offered. These lists were searched and relevant keywords were extracted from the services descriptions.
FADOQ[a] [104]: The largest older adult organization in Canada, whereby membership provides access to hundreds of clubs and programs designed for older adults.	FADOQ is a network of older adult clubs and groups promoting active and healthy aging. They offer programs and activities related to recreational, physical, and ICT[b] intervention types through their clubs. Information available from their website was mostly about individual clubs, web-based resources, and provincial older adult events.
RIAQ[c] [105]: a nonprofit Québec Seniors Information Network, run by older adults, to offer members knowledge resources, workshops, and services related to information technology, health, and travel.	RIAQ is an information network for older adults and offers workshop in technology-related fields, which were identified as relevant for reducing loneliness and isolation through the ICT intervention type.

[a]FADOQ: Réseau Fédération de l'âge d'or du Québec.

[b]ICT: information and communication technology.

[c]RIAQ: Réseau d'information des aînés du Québec.

Terms were primarily identified within the description of services provided by the community organizations or from a list of services keywords (if one was provided) available through the data source. If information regarding an organization's services was not provided through the data source, the organization's website was searched, and keywords were extracted from the relevant service descriptions. As Données Montréal [100], Réseau Fédération de l'âge d'or du Québec (FADOQ) [104], and Réseau d'information des aînés du Québec (RIAQ) [105] did not list community organizations, keywords were instead identified based on the activities and services listed. Intervention keywords were only extracted if they described activities, services, or infrastructure that supported the reduction of loneliness or social isolation and if they were relevant for or directed to older adults. 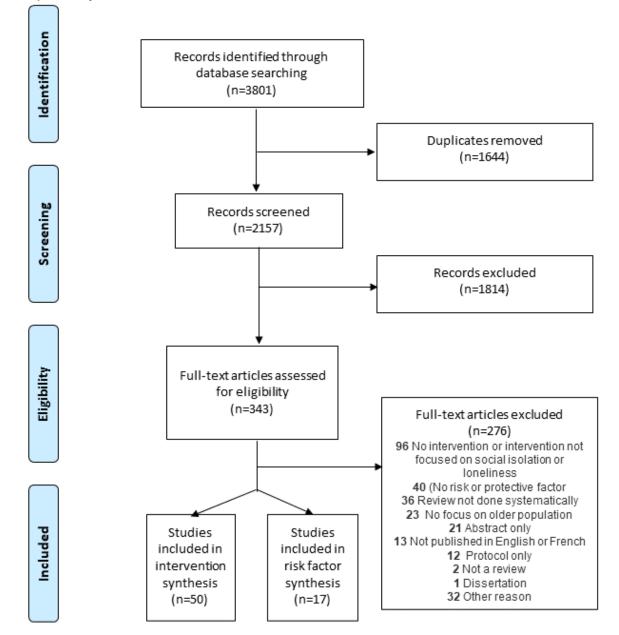Terms that fell under an intervention type but were not extracted from the meta-review were reported as "terms present in community resources only."

Results

Meta-Review Search Outcomes

A total of 3801 reviews were identified (MEDLINE: n=1012, Embase: n=1383, PsycINFO: n=664, Social Work Abstracts: n=5, and CINAHL: n=737). After removing duplicates, 2157 studies were screened based on abstract and title. Of the 2157 reviews, 343 (15.9%) full-text reviews were assessed for eligibility. Of 343 reviews, 50 (14.6%) met the eligibility criteria as interventions to reduce social isolation or loneliness (Figure 1).

Figure 1. Study selection process.

Characteristics of the Included Studies

Included reviews covered publications up to 2018. The reviews varied in quality, as reflected by the number of the selected AMSTAR (A Measurement Tool to Assess Systematic Reviews) criteria met by each review (Multimedia Appendix 2). The criteria that were less often met were double extraction of information (17/50, 34% of reviews) and assessment (24/50, 48%) and consideration of risk of bias (25/50, 50%).
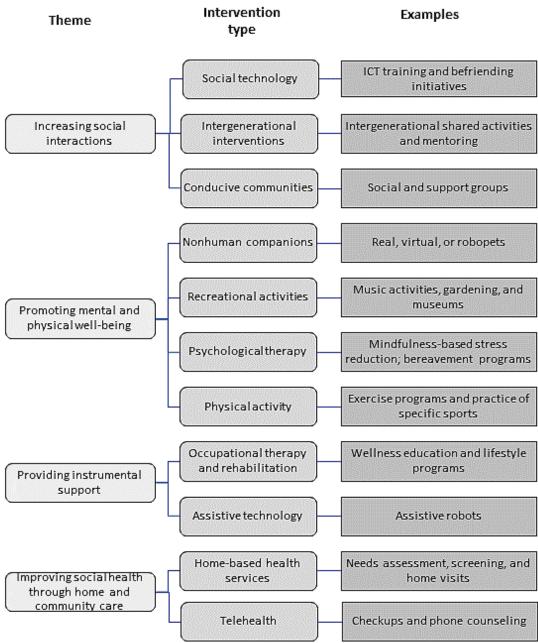
Intervention Type and Characteristics

Overview

Eleven intervention categories were identified that were grouped into four themes reflecting their objectives: (1) *increasing social interactions*, including social technology, intergenerational interventions, and conducive communities; (2) *promoting mental and physical well-being*, including nonhuman companions, recreational activities, psychological therapy, and physical activities; (3) *providing instrumental support*, that is, offering lifestyle changes through occupational therapy (OT) or rehabilitation or assistive technology to target sources of social-based deficiencies; and (4) *providing home and community care*, including home-based health services and telehealth, which are primarily one-on-one interventions provided by a regulated health care professional, based outside of an institutional setting, and aimed at directly or indirectly addressing social care needs. The division of the 11 intervention categories generally reflected the approach taken within the reviews themselves. Some refinement was conducted to minimize the overlap of categories (ie, reduced redundancy of intervention term or keyword extracts) and ensure that our analyses had sufficient granularity to produce informative insights. The 11 intervention categories and their respective themes along with selected examples are shown in Figure 2. Information related to interventions under each theme is presented in Multimedia Appendix 3 and is summarized in the following section.

Figure 2. Representation of the identified intervention types (with examples) and their associated themes. ICT: information and communication technology.

Increasing Social Interactions

Interventions with the intended outcome of increasing social interactions functioned through developing opportunities and providing platforms where new relationships could be formed and social networks could flourish. The first type of intervention was intergenerational interventions that aimed at connecting older adults with youth to establish valuable partnerships and mutual responsibility through shared (1) recreational activities [106-116]; (2) activities led by older adults, such as those incorporating education and skills development [117-121], reading activities [122-125] or mentorship [126,127]; and (3) therapy-focused interventions, such as reminiscence therapy [128-130]. The second type of intervention under this theme aimed to provide older adults with a virtual space to foster new relationships and reinforce existing ones (social technology). These interventions were primarily composed of information

and communication technology (ICT) training or networking sessions with older adults [131-149] as well as telephone or video call befriending initiatives [150-156] or radio programs [157], most commonly taking place at home on a weekly basis. The final type of intervention under this theme aimed to provide older adults access to supportive and conducive environments or communities (labeled "conducive communities"). These included social and support groups [158-167], interventions centered around providing social services [168-171], education-based groups [172-175], and peer mentoring [176-178]. Most support groups were geared toward subpopulations, including older adult migrants, low-income or frail older adults, those with new or chronic disabilities, and those facing specific difficulties in community mobility. Many groups were also tailored specifically for men or women, such

as men's social groups [164] or support groups for older single women [174] or widows [161,167].

Promoting Mental and Physical Well-being

The second theme grouped interventions promoting mental and physical well-being through activities that support the adoption and maintenance of healthy living for older adults. These interventions included regular physical and recreational activities, often group based and offered at a community activity center and facilitated by trained instructors. Psychological therapy facilitated by trained professionals, such as psychologists, counselors, social workers, or nurses, was another common intervention [179-184]. These programs were offered in person, primarily in group settings at older adult centers on a weekly basis, and were either focused on a particular therapeutical approach (eg, reminiscence group therapy [182] or mindfulness-based stress reduction) or specific populations (eg, bereaved widows [179] or older adults living with mental health issues [183]). Interventions under this theme also included programs offering companionship and comfort with nonhuman companions, such as domestic or virtual animals or robopets.

Providing Instrumental Support

The third theme grouped interventions that offered instrumental support to older adults requiring an extra level of functional support, such as those with visual or hearing impairments, dementia, or other chronic disabilities, with the objective of enabling independent functioning and the capacity to engage with available social services. These interventions included personalized support and linkage to services provided by occupational therapists and allied health care professionals as well as the use of assistive technologies. OT interventions included programs engaging older adults to adjust their lifestyle and target the source of their social deficits, such as holistic lifestyle programs and wellness educational courses [185-201]. Assistive technology solutions aimed to provide older adults reliable daily support through user-friendly tools such as assistive robots to maintain or improve their quality of life, given cognitive or functional impairments [202], and to meet their social needs independently.

Providing Home and Community Care

Several interventions included at-home care services provided by a clinician, allied health professional, or support worker that directly or indirectly targeted social isolation and loneliness and facilitated healthy independent living for older adults. These services included home-based health services [203-207] as well as professional telehealth care provided through phone [208-212] or web-based [213-215] systems. These interventions primarily targeted the outcomes of social isolation and loneliness through one-on-one services. Some visits combined the screening with referral services [216-218].
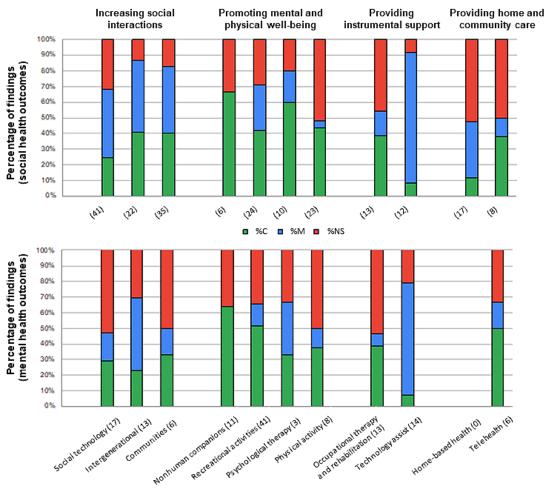
Effectiveness

Figure 3 presents the proportion of effective interventions (ie, convincing, mixed, or no evidence for effectiveness) per intervention category for each type of outcome (mental or social health). The number of individual findings used to calculate each effectiveness is also shown in the figure. Interventions falling under >1 intervention type were classified according to the primary focus of the intervention (eg, recreation-based support groups are categorized under recreational activity interventions as opposed to interventions focusing on conducive communities). As numerous primary studies were cited and described across several reviews concurrently, each paper was accounted for only once and classified based on the targeted outcomes of the intervention reported (ie, addressing social or mental health outcomes).

Collectively, interventions under the themes of increasing social interactions and promoting mental and physical well-being were the most effective at improving social outcomes, with a higher proportion of interventions demonstrating clear effectiveness. Interventions targeting the promotion of well-being also showed the greatest success for improving mental health outcomes. Interventions under the theme of improving social health through home and community care were also effective in improving mental health, although fewer findings were available for this type of intervention.

A total of 80 primary studies reported on the first theme: *increasing social interactions*. These interventions primarily targeted social health outcomes, including reducing loneliness and increasing social networks and social support, and their effectiveness was reported as primarily consistent or mixed. Interventions aimed at increasing social interactions that took place outside the home or were group based appeared to be more effective at improving social health outcomes (refer to the summary findings in Multimedia Appendix 3). ICT interventions (reported in 30 studies) were found to be associated with increased social networks and reduced feelings of loneliness. Group sessions were more effective than one-on-one ICT training sessions for decreasing loneliness and increasing the mental well-being of participants [137]. Conducive communities (reported in 22 studies), including social and support groups with structured discussions on relevant topics, increased participant self-confidence, increased involvement, and reduced social isolation [159]. Examples of topics included information on personal safety, nutrition, general wellness, successful aging, coping strategies, the management of existing relationships, and strategies for building new relationships. Finally, intergenerational interventions (reported in 28 studies) showed greater effectiveness (consistent and mixed) with respect to reducing mental health outcomes, such as symptoms of depression or anxiety, compared with conducive communities or social technology (refer to the study by Paquet et al [45]).

Figure 3. Percentage of findings related to social (top part of figure) and mental health (bottom part of figure) outcomes for each of the 11 intervention subcategories evaluated as either consistent (C; green), mixed (M; blue), or not supporting (NS; red) effectiveness (numbers in the parentheses represent the number of findings considered to calculate the effectiveness of each type of intervention).

Interventions *promoting mental and physical well-being* were the focus of 80 primary studies. Among these, nonhuman companions (reported in 12 studies) were markedly effective in improving both mental and social health outcomes, primarily targeting depression, anxiety, and loneliness. Participants often received one-on-one contact with an animal [219-224] or robopet [225-230] through brief home visits or longer stays, demonstrating comparative effectiveness across companion types (ie, dogs, birds, crickets, aquarium animals, virtual pets, and robopets). Recreational activities (reported in 39 studies) were particularly effective in improving both mental and social outcomes. These primarily targeted mental well-being, depression, social isolation, and loneliness, with music-based interventions comprising a high percentage of the effective activities administered [231-242], followed closely by recreational activities with a social group focus [177,197,243-249]. Interventions that cultivate meaningful roles within a group were most effective [250]. Social groups involving leisure activities and interventions promoting autonomy by encouraging participants to select their own social activities were most effective in reducing social isolation and loneliness [177,247,248]. Cumulatively, physical activity interventions (n=23 studies) were effective in reducing loneliness and depression and increasing social networks and social support; however, outcomes appeared to fluctuate depending on the type of intervention administered. Physical activities such as exergames [251-257] and specialized exercise programs featuring a recreational or educational component were the most common and effective [168,258-261]. Specifically, studies that combined exercise with other activities provided greater benefits than those that offered exercise alone. Therapy-focused interventions (n=6 studies), such as reminiscence group therapy [182] or mindfulness-based stress reduction [180], were effective in reducing social isolation and loneliness. However, several studies reporting their effectiveness had small sample sizes, a high risk of bias, or were of poor quality [180-182].

Interventions under the *instrumental support* theme (n=39 studies) primarily targeted the mental well-being of older adults. OT interventions (n=23 studies) reported as effective primarily included holistic lifestyle programs and wellness educational courses [185-201]. For example, the Lifestyle Redesign program, an OT initiative encompassing education, discussions of personal experiences, and recreational activities was most effective in increasing social function and reducing depressive symptoms [187,195,196]. Most studies regarding assistive technology (n=16 studies) reported on assistive robots [262-270], such as the seal-like Paro robot, to facilitate social

interactions and aid in daily living activities [263,266,267,269,270], and significant improvements in psychological well-being were reported during group interactions [271]. Small humanoid robots were particularly effective at improving social engagement and providing a trusting, emotional relationship [265]. Nevertheless, most assistive technology interventions provided mixed effectiveness and required further investigation as most studies were pilot studies or had small sample sizes and few were randomized control trials.

Finally, for interventions related to *home and community care* (n=19 studies), home-based health services (n=11 studies), which encompassed screening for social isolation, were presented as an effective means of improving social health outcomes, including reducing social isolation or loneliness [216,272,273]. Cattan et al [47] and Gardiner et al [48] reported that intervention programs incorporating inputs from the target population during the planning, development, and execution stages were also more likely to be successful. With respect to telehealth, interventions focused on reducing the symptoms of depression, loneliness, and social isolation (n=8 studies) and only a few interventions were found to be effective. These included an internet-based health maintenance platform for patients with diabetes [213], which successfully decreased depression and improved social support, and a suicide crisis phone line for older adults, which was found to be effective in reducing loneliness and partially effective in reducing social isolation [212].

Additional characteristics contributing to the effectiveness of interventions across themes were extracted from review-level conclusions. Most consistently, reviews reported on the success of group interventions involving educational and social support input [47]. In agreement, Dickens et al [49] and Papageorgiou et al [50] noted the greater effectiveness of activity-based or social support groups and interventions with an educational or skill development focus [50,51]. However, Gardiner et al [48] and Cohen-Mansfield and Perach [51] state that the activity or purpose behind group gatherings is likely to play a major part in the effectiveness of improving outcomes. Other observations included the importance of participatory methods in which older people are involved in planning, developing, and delivering activities [47] and the use of theory-informed [49] and multistrategy approaches [38]. Finally, several reviews expressed support for the use and development of technology for tackling issues of social isolation and loneliness in older adults [38,51-53].

Comparing Terms From the Literature Versus Community Data Sources

Considering that some degree of effectiveness was observed across all intervention types, the intervention terms were derived for all categories to investigate their presence and visibility within the selected data sources. In addition to the reviews included in the meta-review, we considered the available published taxonomies for social isolation or loneliness interventions. Of the 3 studies identified [274-276], only the findings from the study by Leung et al [274] were of relevance, given their classification of late-life leisure activities for increasing social participation. An average of 28 (SD 13.4) terms per intervention category were identified from the literature (Table 2).

For each intervention category, we extracted relevant terms and activities from the community data sources outlined in Table 1 and compared them with those derived from the literature. The objective was to characterize the nature and the proportion of terms that were either specific to the literature or the community sources or common across both (Figure 4; Table 2). Table 2 also reports the percentage of keywords extracted from each type of data source (ie, regional and municipal, neighborhood specific, and population specific). Interventions for which there was a stronger overlap (³30%) between the terms identified in the literature and services (and respective keywords) present in community data sources included psychological therapy, recreational activities, and telehealth. In contrast, there were relatively fewer terms related to ICT, assistive technology, OT services, and nonhuman companions in the selected community data sources, whereas a substantially larger proportion of terms related to physical activity interventions were extracted from the literature.

Most overlapping keywords that described primary health care interventions such as home-based health services and telehealth, occupational, and psychological therapies were extracted from regional data sources (ie, Données Montréal [100] or 211 Grand Montréal [99]). In contrast, interventions or services aimed at increasing social interactions (apart from intergenerational interventions) were offered primarily at the population level, that is, those specific to the older population within Montréal (eg, Contactivity Centre [102] and AMI-Québec [103]). This was consistent for interventions and services related to physical activity, whereas recreational activities were primarily offered at both the population and regional levels. "Conducive communities" was the only intervention subcategory that presented over half of the overlapping terms in sources at the neighborhood level (Table 2).

Table 2. Comparison of literature-based versus community-based intervention keywords or terms.

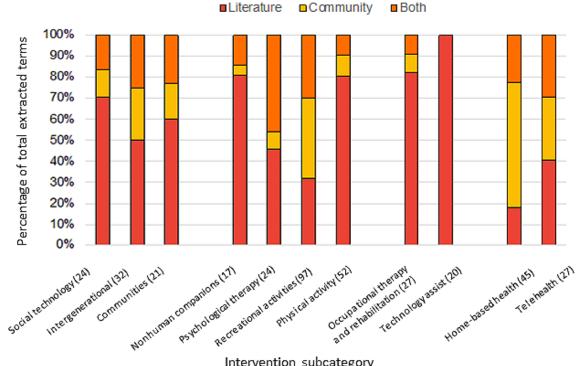| Intervention theme and subthemes	Terms present in			Data sources providing keywords ("Community Only" or "Both")
	Literature only	Community data sources only	Both	
Increasing social interactions				
Social technology	ICT, training, internet, social, network*, computer, telephone, befriending, videocall, group, internet-based, activit*, telecommunicat*, teleconference*, videoconferenc*, radio, Ipad	tech*, program, workshop	Support, friend*, call*, phone	100% (7/7) population
Intergenerational interventions	reminiscence, tutor*, mentor*, video, game, craft, physical activit*, retreat, model*, CARELINK, play*, volunteer*, life-skill, art*, music, talk*	workshop, listen*, support, book club, connect old* to young*, friend*, visit*	Intergeneration*, reading, sharing, discussion, educat*, story, recreation*, teach*	87% (13/15) regional, 7% (1/15) neighborhood, and 27% (4/15) population
Conducive communities	mentor*, befriending, education, social service, self-help, self-management, buddy, leisure, companion, discussion, bereavement, volunteer*, club, lesson, meeting, connect*, cultural*, health, promotion, peer, exchange	visit*, friend*, meeting, meal*, wellness, lunch*	centre, friendship, communit*, program, support, network, group, social	29% (4/14) regional, 57% (8/14) neighborhood, and 86% (12/14) population
Promoting mental and physical well-being				
Nonhuman companions	Robo-pet (IrobiQ, Cafero, AIBO, WOBOT, Gerijoy), animal, assist*, bird*, virtual, pet, companion, cricket*, care*, lifestyle, aquarium, robo*	Cat*	Therapy, dog*, visit*	100% (4/4) population
Psychological therapy	writing, rehab*, reminiscence, self-help, art, discussion, social support, mindfulness, stress-reduc*, self-practice, sharing	Follow-up, advice	support, group, consult*, referral, meeting, active listen*, listen*, psychotherap*, therap*, counsel*, psychosocial	77% (10/13) regional, 38% (5/13) neighborhood, and 31% (4/13) population
Recreational activities	Horticultur*, sing*, plant*, video, Wii, chorale, writing, paint*, day group, drama, group, reflect, choir, gender, meet*, friend*, outdoor, act*, solitair*, service, lay*, read*, forums, handicraft, fishing, shopping, facial, massage, concert, opera, religio*	Fit*, recreation*, literature, health*, education*, food, meal*, sport*, computer, lunch*, dinner, yoga, outing, library, cinema, auditorium, gallery, planetarium, insectarium, pool, mall, histor*, movie, market, ski, sound, nature, leisure, conference, socializ*, holiday, course*, trip, craft, entertainment, shows, hobb*	danc*, art, cultur*, music, class*, social, support, communit*, network, activit*, workshop, discussion, volunteer*, game, swim*, museum, exhibit*, perform*, theatre, centre, garden, park, walk*, cook*, picnic, program, club, bowling, bingo	76% (50/66) regional, 17% (11/66) neighborhood, and 52% (34/66) population
Physical activity	Exergame*, Wii, fit, martial art, qigong, walk*, health*, train*, breath*, strength*, flexibil*, aerobic, education*, resistance, pool, nutrition*, soccer, ski, at-home, group, tennis, bowling, baseball, boxing, nonaerobic, ton* (tone/toning), self-care, discussion, promotion, gym, balance, table tennis, golf, cycl*, Mind-body, jog*, run*, hiking, ballgame, calisthenics, danc*, stretch*	wellbeing, activit*, outdoor, viactive, centre	Physical, exercise, tai chi, yoga, sport*	40% (4/10) neighborhood and 80% (8/10) population
Providing instrumental support				
Occupational therapy and rehabilitation	Psychosocial, lifestyle, occupation*, self-management, discussion, education*, treatment plan, goal*, activit*, physical, train*, peer, shar*, exchange, assistive, device, client-centered, health promotion, recreation*, individualized, mobility, cognition, mood, behavior, nutrition, support, home	Direct intervention, consult*, health*	Group, therap*, program	100% (6/6) regional

Intervention theme and sub-themes	Terms present in			Data sources providing keywords ("Community Only" or "Both")
	Literature only	Community data sources only	Both	
Assistive technology	Assist*, robot*, sensory, tech*, smart, phone, watch, system, PARO, aid, humanoid, mobile, remote, multimedia, tablet, cloud, personalized, communication, caregiver, TV	—[a]	—	—
Providing home and community care				
Home-based health services	screening, hospital-to-home, social, profession*, at-risk, needs, resource*, discharge	Caregiver, care, group, conference, information, transition (following hospital care), frontline, intervention, follow-up, long-term, check-up, emergency, security, hous*, accompan*, drop-in, respite, promotion, home, listen*, guid*, home care, transport*, education, news, service directory, fall prevention class	At-home, visit*, home, support, referral, service, outreach, assist*, health, hospital	65% regional (24/37), 38% (14/37) neighborhood, and 24% (9/37) population
Telehealth	Internet-based, maintain*, problem-solv*, goal*, web-based, telesupport, crisis, track*, educat*, computer, conference	referral, check-up, medication reminder call, consult*, active listen*, listen*, psychotherapy*	call*, telephone, phone, support, group, counsel*, therap*, health	100% (15/15) regional and 33% (5/15) population

[a]None of the included community sources reported relevant keywords that reflect assistive technology.

Figure 4. Percentage of keywords extracted from the literature-based resources only (red), community web-based data sources only (yellow), or both (orange), for each intervention subcategory.

Discussion

Principal Findings

This study identified and assessed the effectiveness of interventions designed to reduce social isolation and loneliness in older adults through a meta-review. Derived from this literature, it then compared key terms with those extracted from directories of municipal and community data sources serving the population of Montréal, a city in which over one-third of older adults live alone and two-thirds of those living with a disability report difficulties in participating in social activities

within their community [98]. These realities translate to significant strain on the health care system given the close association of social isolation with, for example, depression, dementia, poor general health, caregiver burden, and increased falls [277].

Key terms were further classified according to four intervention types emerging from the meta-review: (1) increasing social interactions, (2) promoting mental and physical well-being, (3) providing instrumental support, and (4) improving social health through home and community care, and each of these presented a unique strategy for improving social isolation and loneliness and mitigating the impact on well-being, resilience, and coping in older adults.

For interventions aimed at promoting mental and physical well-being, many key terms from the literature review related to these interventions overlapped with those extracted from web-based community data sources, specifically in the areas of recreational activities and psychological therapies. Overall, however, the process of comparing extracted intervention terms across literature and community-based data sources indicated an overlap in less than half of the total keywords within each category, emphasizing the need for greater consistency. A shared or common nomenclature for navigating community-based interventions would assist in identifying potential gaps in local services and in tracking the effectiveness of the current on-the-ground interventions. These functions can inform the development and sustainability of social prescription programs [42] that successfully address the social needs of older persons (refer to the reviews by Chatterjee et al [278] and Bickerdike et al [279]).

"Effective" Interventions for Reducing Social Isolation and Loneliness

The bulk of interventions reviewed in this study fell in the areas of increasing social interactions or promoting mental and physical well-being, where the former predominantly targeted social health outcomes. Intergenerational interventions and "conducive communities" interventions presented >70% consistent or mixed effectiveness for outcomes such as reducing loneliness and increasing social networks and social support. Comparably, psychological therapy and recreational activity interventions demonstrated positive outcomes for reducing loneliness and targeting mental health outcomes (>60% consistent or mixed), such as depression and mental well-being. Although fewer interventions reported on mental health outcomes, nonhuman companions and telehealth subcategories were effective (>60%) in improving mental health outcomes, particularly depression and anxiety.

Collectively, interventions were more successful when participants took a meaningful role within the group [250], when a collective purpose was evident [48,51], when participants experienced autonomy [246], and when participants contributed to the development of the intervention [47]. Participants also found value in interventions with an educational component [47] where new skills and insights could be integrated into their day-to-day living [172], as well as in interventions that implemented multiple strategies [38]. Many successful interventions incorporated some technology integration, such

as social cognitive training via telehealth, enabling social interactions through training and access to ICT, improving social support through online support groups, or accessing social robots and virtual pets. Digital infrastructure, along with other comparable smart technologies, has been shown to support aging, allowing individuals with disability to maintain a more social life. Digital interventions in social care have become increasingly valued and used on the heels of COVID-19, providing relief for the isolated and those living in remote areas. Nonetheless, improved digital literacy, greater economic and occupational access to technology, and measures to ensure privacy and security are crucial for enabling the uptake of digital interventions among older adults [280].

The study findings also emphasized the value of personalized services based on an assessment of patient social needs and risk factors. For example, environmental or situational factors, such as living alone; limited access to social support or social networks [33,170,281-311]; cognitive, mental or physical deficits (eg, chronic illness, visual or hearing impairments, and depression); and other demographic and socioeconomic attributes such as age, gender, marital status, immigration status, education, and income [33,170,286,289,292,294,298,299,302,304-306,308-310,312-375] were more likely to influence or be associated with loneliness [45]. Recognizing the diversity of needs and preferences of older populations and the importance of user participation in the development of interventions to address social isolation and loneliness, it is likely that tailored approaches will be more successful than "one-size-fits-all" solutions. Each of the 11 intervention categories may preferentially benefit one or more of these unique populations. For example, older adults with greater mobility may be more inclined to take part in recreational or physical activity interventions, whereas those requiring greater physical support may derive more benefit from home-based health services or OT and rehabilitation. Individual preferences and characteristics can be considered during the social prescription process through the use of a digital platform that integrates patient information captured in medical records with information on available services, their nature, and their effectiveness or relevance for different subgroups of the population. This path toward personalized care and patient engagement in care decision-making presents an opportunity to improve social health outcomes, reduce costs, and improve overall patient satisfaction [376].

Bridging the Gap Between Scientific and Community-Produced Evidence

In building decision tools that facilitate the delivery of personalized nonmedical care, a thorough inventory of interventions currently accessible to the community is needed to identify service gaps and assess the quality of services. A cross-comparison of intervention keywords extracted from web-based community databases in Montréal versus literature-based keywords demonstrated an overlap of nearly 50% for psychological therapies and substantial overlap (≥25%) for recreational activities, telehealth, and intergenerational interventions. Notably, many of these terms were extracted from regional sources, such as the 211 web-based directory [99],

where each organization's file includes details of services and programs offered, the targeted user, eligibility criteria, etc.

Despite the observed overlap, some discrepancies were also observed, with terms related to certain types of interventions being overrepresented, either in the literature or in community resources. For instance, little evidence of interventions (and key terms) related to physical activity, OT, assistive technologies, nonhuman companions, or social technology was observed in the community databases. Many of these less accessible interventions are rooted in physical health and may not necessarily be covered by the sources examined. Moreover, some of these interventions incorporate some aspect of technology, which is a relatively novel means for addressing social isolation and loneliness, with related implementation challenges including cost or feasibility of adoption. In contrast, home-based health service terms were disproportionally fewer in the literature as compared with community services, likely reflecting the nature of our search strategy, where excluding reviews focused on institutional settings may have reduced the terminology related to the transition of care from hospital to home. However, these strategies have received more attention during the COVID-19 pandemic [280,377]. It should be noted, however, that our search did not investigate health care–specific community resources. Finally, in view of the inconsistent overlap between community data sources offered at the neighborhood level and the literature, investment in categorizing and advertising community services is needed and keeping service data up-to-date. The lack of up-to-date contact and service information has contributed to health care providers' reticence in making patient referrals to local community sources [378]. This information includes whether the services are available, financially accessible, and proximate to those in need. In general, data sources varied substantially in terms of the level of detail provided regarding service description, emphasizing the need for greater consistency in how information is captured [99]. Such information would also help support the activities of link workers who play a critical role in social prescription programs, offering service referrals and ongoing support to users as well as collecting data for intervention evaluation and analyses [40].

Road Map to a Common Language

Developing a social prescription ontology provides the framework for a clinical decision aid that could lessen the burden of link workers and provide increasing value to those in need. An ontology provides a means of sharing machine-interpretable domain information across stakeholders, whereby information is defined into concepts (also referred to as classes or entities) and attributes (ie, slot, roles, or properties) of said classes, and the relationships among them are specified [379,380]. The W3C Web Ontology Language is a computational logic-based language used to represent an ontology. The W3C Web Ontology Language formally structures and describes the semantics of ontology terms, such that computers can feasibly conduct reasoning tasks on ontologies and databases that use them [381]. The Open Biological and Biomedical Ontology Foundry is another initiative aiming to develop a family of interoperable ontologies that is logically organized and scientifically accurate [382]. A

key principle underlying these efforts is that ontologies be findable, accessible, reusable, and interoperable and consist of content that is both scientifically sound and meets community needs [383,384]. Of similar importance is accurate categorization for data acquisition, analysis, and interpretation [274] and the successful implementation and evaluation of interventions to reduce social isolation and loneliness in older adults. Accordingly, ontology development should engage domain experts to promote its accurate and impactful incorporation into practice [380,385]. For social prescription, this includes engaging a full spectrum of users in the development process so that the resultant ontologies enable and reflect their navigation and decision support needs [386]. Although efforts are underway to standardize information related to social needs from a clinical informatics perspective, similar efforts to organize knowledge about the resources required to meet these needs are still lagging. Given the range of multisectoral users requiring decision support for social prescription, user-centered design processes must engage input from not only health professionals but also community organizations, public health services, and older adult community partners and caregivers [387]. The involvement of users in ontology and decision tool development will also promote their use [388], deepen community ties [389], and encourage support and participation from those responsible for funding and promoting services within the community [390].

Likewise, it is important that decision support resources are comprehensive and intelligible and categorized using simple terms, given that a large proportion of users (directly or indirectly) will be older adults, often presenting comorbidities such as visual, hearing, and mild cognitive impairments [274]. The language used must be formal, shared, and broadly applicable [391] and have a structure that can be easily adopted by those designing future interventions [274]. With respect to the social prescription project, further development will involve extending, specializing, adapting, and unifying ontologies or taxonomies by merging multiple sets in a similar subject matter [392] to eliminate duplication [386,393]. The 211 database [99], a taxonomy of human needs covering a range of community services, provides a promising basis for this work. The content, design, and functionality of the decision support tool developed will be refined over time to improve performance or respond to needs as they evolve. The digital platform can, in real time, process data for service users, link workers, and health care professionals to monitor and manage use; measure outcomes; evaluate interventions; and integrate insights from experts in the field [388].

Limitations and Future Directions

Implicit in the use of existing reviews as a main source of information for the knowledge synthesis are uncertainties about the quality of the search strategies used and the level of details on primary studies reported in the individual reviews. Moreover, owing to time limitations, a search was not conducted to capture primary papers not covered by the reviewed studies, with the most recent review year being 2018. To address this limitation, we used an adapted quality appraisal tool to identify the shortcomings of these reviews. It is important to note that many of the studies did not report on effectiveness, and they did not

meet the quality appraisal criteria related to duplication of data extractions or consideration for risk of bias. Finally, as the number of outcomes varied across intervention subcategories, further analyses will be required to evaluate interventions with limited evidence. Once developed, the digital tool has the potential to provide better metrics for assessing such programs and integrating these assessments to improve performance. Furthermore, there is considerable potential for data mining, artificial intelligence, and data science techniques to not only prevent the occurrence of inaccurate, out-of-date, or missing information, thereby improving the profiling and clustering of users, but also predict patients' service preferences. Such a tool could include features that permit older adult needs assessments and tracking, incorporate social prescription referrals into primary care practice, and enable personalized matching of patient needs and locally available resources. Evergreen Life [17] and Elemental [18] are 2 early examples of software used in the United Kingdom to pair needs assessed from electronic patient records with nonmedical services offered within community directories.

Conclusions

Our findings demonstrate that a number of interventions have been shown to be effective at improving mental and social health outcomes of socially isolated or lonely older adults and that many of these interventions are already available services to the Montréal population, although terms to refer to such interventions or services might differ between the literature and the information sources provided to the community. Our findings also support the value and opportunity of developing a knowledge structure around interventions and resources to meet the identified social needs of individuals as part of an efficient social prescription ontology that describes all core processes of social prescription. These include the assessment of needs, participation in relevant community activities meeting those needs, and the outcomes of participation. This structure would also help in identifying and compiling relevant resources. As service gaps remain unaddressed, these tools and strategies are urgently required to address the changing social needs of older adults and support aging in place. Efforts to harmonize data sources and accurately identifying services that address the specific social needs of vulnerable individuals will inform ongoing efforts to develop digitally based social prescription tools to address SDOH, without further taxing an already overburdened health care system.

Conflicts of Interest

None declared.

Multimedia Appendix 1

Search terms.
[DOCX File , 13 KB-Multimedia Appendix 1]

Multimedia Appendix 2

List of reviews included with types of interventions reviewed.
[DOCX File , 23 KB-Multimedia Appendix 2]

Multimedia Appendix 3

Interventions and effectiveness.
[DOCX File , 26 KB-Multimedia Appendix 3]

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Abbreviations

AMSTAR: A Measurement Tool to Assess Systematic Reviews
EMIS: Egton Medical Information Systems
FADOQ: Réseau Fédération de l'âge d'or du Québec
ICT: information and communication technology
OT: occupational therapy
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RIAQ: Réseau d'information des aînés du Québec
SDOH: social determinants of health

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