



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



JAMDA

journal homepage: www.jamda.com

Review Article

Social Connection in Long-Term Care Homes: A Scoping Review of Published Research on the Mental Health Impacts and Potential Strategies During COVID-19



Jennifer Bethell PhD^{a,b,*}, Katelynn Aelick MSc^c, Jessica Babineau MLIS^{d,e},
 Monica Bretzlaff BA, TRS^c, Cathleen Edwards MA^f, Josie-Lee Gibson BA^g,
 Debbie Hewitt Colborne RN, MScN^c, Andrea Iaboni MD, DPhil^{a,h}, Dee Lender BA^g,
 Denise Schon BAⁱ, Katherine S. McGilton RN, PhD, FAAN, FCAHS^{a,j}

^a KITE, Toronto Rehabilitation Institute, University Health Network, Toronto, Canada

^b Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, Canada

^c Behavioural Supports Ontario Provincial Coordinating Office, North Bay Regional Health Centre, North Bay, Canada

^d Library and Information Services, University Health Network, Toronto, Canada

^e The Institute for Education Research, University Health Network, Toronto, Canada

^f Family Councils Ontario, Toronto, Canada

^g Ontario Association of Residents' Councils, Newmarket, Canada

^h Department of Psychiatry, University of Toronto, Toronto, Canada

ⁱ Lakeside Long-Term Care Centre Family Council, Toronto, Canada

^j Lawrence S. Bloomberg Faculty of Nursing, University of Toronto, Toronto, Canada

A B S T R A C T

Keywords:

Social integration
 social networks
 social engagement
 social support
 social isolation
 social capital
 loneliness
 nursing homes
 long-term care

Objectives: Good social connection is associated with better health and wellbeing. However, social connection has distinct considerations for people living in long-term care (LTC) homes. The objective of this scoping review was to summarize research literature linking social connection to mental health outcomes, specifically among LTC residents, as well as research to identify strategies to help build and maintain social connection in this population during COVID-19.

Design: Scoping review.

Settings and Participants: Residents of LTC homes, care homes, and nursing homes.

Methods: We searched MEDLINE(R) ALL (Ovid), CINAHL (EBSCO), PsycINFO (Ovid), Scopus, Sociological Abstracts (ProQuest), Embase and Embase Classic (Ovid), Emcare Nursing (Ovid), and AgeLine (EBSCO) for research that quantified an aspect of social connection among LTC residents; we limited searches to English-language articles published from database inception to search date (July 2019). For the current analysis, we included studies that reported (1) the association between social connection and a mental health outcome, (2) the association between a modifiable risk factor and social connection, or (3) intervention studies with social connection as an outcome. From studies in (2) and (3), we identified strategies that could be implemented and adapted by LTC residents, families and staff during COVID-19 and included the articles that informed these strategies.

Results: We included 133 studies in our review. We found 61 studies that tested the association between social connection and a mental health outcome. We highlighted 12 strategies, informed by 72 observational and intervention studies, that might help LTC residents, families, and staff build and maintain social connection for LTC residents.

Conclusions and Implications: Published research conducted among LTC residents has linked good social connection to better mental health outcomes. Observational and intervention studies provide some evidence on approaches to address social connection in this population. Although further research is

This research was supported by a "Knowledge Synthesis: COVID-19 in Mental Health and Substance Use" operating grant from the Canadian Institutes of Health Research (CIHR). JB, AI, and KM are supported by the Walter & Maria Schroeder Institute for Brain Innovation and Recovery. They are also members of the Canadian Consortium on Neurodegeneration in Aging (CCNA). The study sponsors had no role in the design, methods, subject recruitment, data collections, analysis, and preparation of the article.

The authors declare no conflicts of interest.

* Address correspondence to Jennifer Bethell, PhD, KITE, Toronto Rehabilitation Institute, University Health Network, 550 University Ave, Toronto, ON M5G 2A2, Canada.

E-mail address: jennifer.bethell@uhn.ca (J. Bethell).

<https://doi.org/10.1016/j.jamda.2020.11.025>

1525-8610/© 2020 The Authors. Published by Elsevier Inc. on behalf of AMDA – The Society for Post-Acute and Long-Term Care Medicine. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

needed, it does not obviate the need to act given the sudden and severe impact of COVID-19 on social connection in LTC residents.

© 2020 The Authors. Published by Elsevier Inc. on behalf of AMDA – The Society for Post-Acute and Long-Term Care Medicine. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Coronavirus (COVID-19) has taken a disproportionate toll on people living in long-term care (LTC) homes. To protect LTC residents from COVID-19 infection, infection control measures have included prohibiting visitors and restricting activities and interactions with other residents and staff in the home. Although these measures may have reduced risk of infection, they have also presented their own health risks through the devastating impact on resident's social connection.^{1,2}

Social connection is good for health and well-being^{3–5} and important to quality of life in LTC homes.^{6–8} Social connection also has distinct considerations for those living in LTC homes. Most LTC residents are older adults, and many have complex health needs, including sensory, cognitive,⁹ or mobility impairment that can impact social connection.^{10–12} For many residents, families play an integral role, including participating in care, representing the resident's perspective and history, and maintaining family connections.^{13,14} Within LTC homes, residents share space, have daily interactions with staff and take part in congregate activities. Communities surrounding LTC homes, including volunteers and care professionals, also participate in the lives of many LTC home residents. Taken together, LTC residents are a population with unique needs and opportunities for building and maintaining social connection.

The current scoping review was undertaken to provide LTC residents, families, and staff with (1) a summary of research evidence linking social connection to mental health outcomes for LTC residents; and (2) strategies they may implement quickly, during COVID-19, to address social connection in this population. These objectives align with the needs of stakeholders representing or supporting LTC as well as COVID-19 research priorities identified internationally.^{15,16}

Methods

This is a substudy of a larger scoping review,¹⁷ conducted to address a broad set of research questions, with a flexible and iterative approach.¹⁸ We followed the 6-stage approach^{19,20} and report our results in accordance with the PRISMA Extension for Scoping Reviews.²¹

Step 1: Identifying the Research Questions

Our questions were developed to support a rapid knowledge synthesis and mobilization of current evidence on the needs of mental health services, delivery, and related guidelines in the COVID-19 context. Our questions were directed by stakeholders (see Step 6, below):

- (1) What mental health outcomes are associated with social connection for people living in LTC homes?
- (2) What interventions and strategies might support social connection for people living in LTC homes in the context of infectious disease outbreaks like COVID-19?

Step 2: Searching for Relevant Studies

We selected studies identified from the larger scoping review whereby published journal articles reporting results of observational

and intervention studies were eligible if they reported a quantitative measure of social connection in a population of adult residents of LTC homes.

We included research on aspects of social integration that have been identified specifically for research in LTC homes,²² including social networks,²³ social engagement^{23,24} and disengagement,²⁵ social support,²³ social isolation,²⁶ and social capital.^{22,27} The subjective experience of social integration, including loneliness,²⁸ perceived isolation²⁹ and social connectedness,³⁰ were also included. Given the diversity of terminology used in this area of research, our search strategy used a broad list of terms.¹⁷ In this article, we refer to all these above-listed concepts collectively as social connection.

We included studies reporting results specifically for residents of LTC homes, nursing homes or care homes (ie, adults living in residential facilities, whose staff provide help with most or all daily activities and 24-hour care and supervision). These terms reflect differences in terminology between countries, but were chosen for their overlap with the international consensus definition of nursing home.³¹ We hereafter refer to them collectively as LTC homes.

To identify studies, we developed a comprehensive search strategy¹⁷ with an experienced information specialist who first conducted the search in MEDLINE(R) ALL (in Ovid, including Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily) and then translated it into CINAHL (EBSCO), PsycINFO (Ovid), Scopus, Sociological Abstracts (ProQuest), Embase and Embase Classic (Ovid), Emcare Nursing (Ovid), and AgeLine (EBSCO). All searches were conducted from the databases' inception through to the date the search was executed (July 2019), limited to English language. Covidence (www.covidence.org) and Endnote were used to manage the review process, including the deduplication of database results.³²

Step 3: Selecting Studies

As part of the larger review, in the first and second phase of study selection, 2 reviewers independently screened article titles and abstracts then full articles to identify potentially relevant studies (ie, studies that quantified social connection in an adult population living in LTC homes). In both selection steps, any disagreements were resolved by a third reviewer. For the current subanalysis, 2 reviewers independently analyzed the full-text articles to identify the subset that reported the:

- (1) association between any measure of social connection and a mental health outcome,
- (2) association between a modifiable risk factor(s) and any measure of social connection, or
- (3) results of intervention study (randomized and non-randomized) whereby the outcome was any measure of social connection.

We also checked our list against 3 recent systematic reviews of interventions to address social connection in LTC homes.^{33–35} No formal quality assessment of the studies was undertaken. To be more inclusive of studies of residents with dementia, we included articles that reported social interaction as a measure of social connection, but we did not include measures of social response,³⁶ social behavior,³⁷ social interest,³⁸ social communication (eg, eye contact, facial expressions, body language, etc)³⁹ or engagement⁴⁰ that was not explicitly characterized as social.

Step 4: Charting the Data

Two reviewers then independently extracted data from these studies.¹⁷ We summarized studies according to study characteristics and reported a narrative synthesis and mapping of the results.^{19,20} We reported the results in 2 parts, in alignment with the 2 questions guiding the review.

Step 5: Collating, Summarizing, and Reporting the Results

We took an iterative approach to reporting our results. The first author reported consolidated results back to the study team who reviewed the results, suggested refinements, and provided insights on the findings. From the studies identified in criteria (2) and (3) (see Step 3, above), the study team identified strategies that were seen to be potentially quick and relatively low-cost to implement and adapt by LTC residents, families, and staff in the COVID-19 pandemic; the articles informing these strategies were included in our review.

Step 6: Consulting With Stakeholders

In our initial protocol,¹⁷ we had described opportunities to present to LTC residents, families, and staff in a LTC home. COVID-19 made these consultations impractical. However, community participation is critical in the COVID-19 context⁴¹; communities can help identify solutions and are well placed to devise collective responses.⁴² Thus, for this review, we worked with partners from organizations who represent these stakeholder groups: Behavioral Supports Ontario,

Family Councils Ontario, and the Ontario Association of Residents' Councils. These members of our study team were involved in priority-setting (defining the review questions), analyzing data, interpreting and contextualizing the results, and coauthoring the current review and related reports and presentations.

Results

Our initial search yielded 20,291 titles, which reduced to 11,653 after deduplication. We distilled this list to 133 articles after full-text review (Figure 1). The characteristics of the included studies are described in Table 1. More than half (n=81; 61%) of the studies were published after 2010. The largest proportion of studies were from North America (n=52; 39%), mostly the United States (n=46). Overall, roughly one-third (n=49; 37%) of studies included fewer than 100 LTC residents in the sample; however, smaller studies made up a larger proportion of intervention studies (n=32; 65%) compared with observational studies in question 1 (n=13; 21%) and question 2 (n=4; 17%). The most commonly investigated aspects of social connection were social engagement (n=41; 31%), social support (n=34; 26%), and loneliness (n=32; 24%), and some studies investigated multiple measures.

What Mental Health Outcomes Are Associated With Social Connection for People Living in LTC Homes?

We identified 61 studies that tested the association between social connection and mental health outcomes. The most commonly

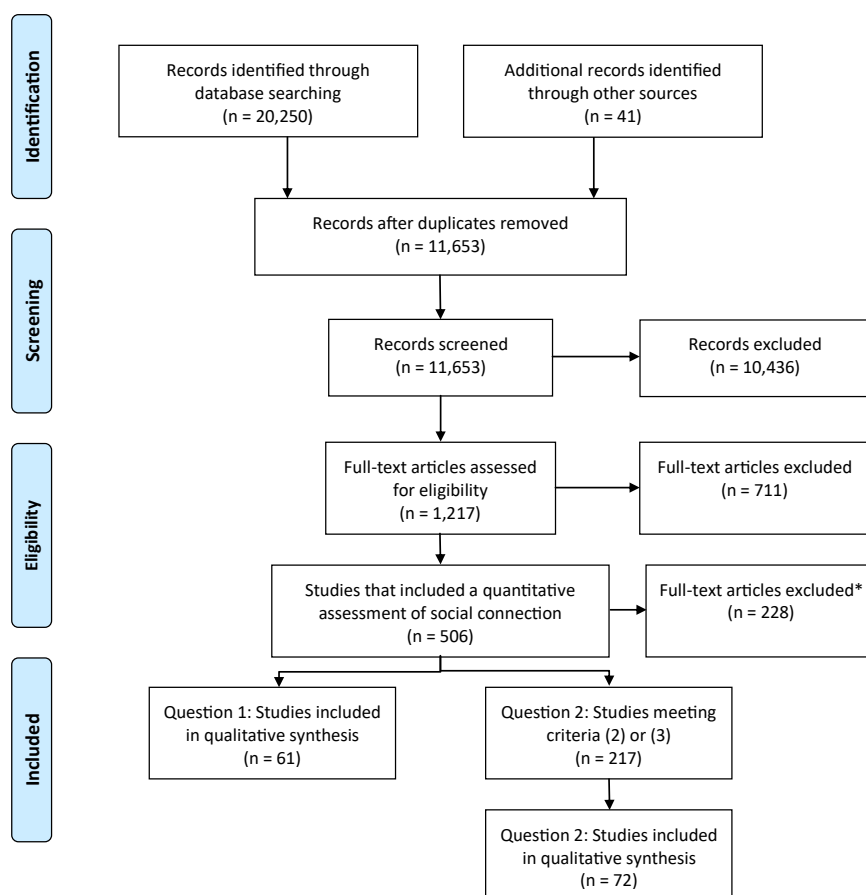


Fig. 1. Flow diagram that describes the flow of information through the review's study search and selection. * Exclusions: social connection assessed but descriptive or psychometric studies or studies with other outcomes (eg, physical health, quality of life, etc).

Table 1
Description of Published Research Articles Included in Scoping Review

Study Characteristics	Question 1 (N=61)		Question 2				Total (N=133)	
			Observational (N=23)		Intervention (N=49)			
	n	%	n	%	n	%	n	%
Year of publication								
Pre-1990	1	2	1	4	4	8	6	5
1990-1999	8	13	2	9	1	2	11	8
2000-2009	16	26	6	26	13	27	35	26
2010-2019	36	59	14	61	31	63	81	61
Region								
Asia	20	33	3	13	16	33	39	29
Europe	11	18	9	39	9	18	29	22
North America	24	39	10	43	18	37	52	39
Other/multiple	6	10	1	4	6	12	13	10
Study design								
Cross-sectional	47	77	20	87	NA	NA	67	50
Cohort	11	18	3	13	NA	NA	14	11
Other/not stated	3	5	0	0	3	6	6	5
Quasi-experimental	NA	NA	NA	NA	29	59	29	22
Randomized controlled trial	NA	NA	NA	NA	17	35	17	13
Sample size (LTC home residents)								
<100	13	21	4	17	32	65	49	37
100-249	26	43	5	22	11	22	42	32
250-499	10	16	4	17	3	6	17	13
≥500	12	20	10	43	2	4	24	18
Not stated	0	0	0	0	1	2	1	1
Aspect(s) of social connection*								
Loneliness	11	18	3	13	18	37	32	24
Social capital	1	2	0	0	0	0	1	1
Social engagement	23	38	12	52	6	12	41	31
Social interaction	6	10	1	4	10	20	17	13
Social isolation	0	0	1	4	4	8	5	4
Social network	10	16	0	0	4	8	14	11
Social participation	0	0	1	4	3	6	4	3
Social relations	0	0	5	22	8	16	13	10
Social support	26	43	1	4	7	14	34	26
Social withdrawal	1	2	2	9	1	2	4	3

NA, not applicable.

*Column percentage adds to more than 100% because some studies investigated multiple aspects of social connection.

investigated aspects of social connection were social support (n=26; 43%), social engagement (n= 23; 38%), loneliness (n= 11; 18%), and social network (n=10; 16%). We categorized these studies according to the reported mental health outcomes: depression; responsive behaviors; mood, affect, and emotions; anxiety; medication use; cognitive decline; death anxiety; boredom; suicidal thoughts; psychiatric morbidity; and daily crying (see Table 2 and Supplementary Table 1)—although we acknowledge overlap between these categories.

Depression

There were 35 studies that tested the association between social connection and depression. Most (n=28) of the studies were cross-sectional. Better social connection was associated with less depression in 28 studies.^{43–70} One study showed a cross-sectional association at baseline but not in the longitudinal (1-month follow-up) analysis.⁷¹ Five studies did not find statistically significant associations,^{72–76} and 1 found social support was associated with increased depression among new nursing home residents.⁷⁷

Responsive Behaviors

Nine studies tested the association between social connection and responsive behaviors, typically reporting physical and verbal expression outcomes. Six studies found that social connection was associated with a decrease in some responsive behaviors,^{50,78–82} but one study

found number of family visits was not associated with agitation⁸³ and another found high social interaction was associated with increased agitation.⁸⁴ One study found that social engagement was associated with a decrease in responsive behavior only among residents without dementia.⁸⁵

Mood, Affect, and Emotions

Eight studies tested the association between social connection and mood, affect, and emotion outcomes. All provide some evidence that social connection was associated with better mood, affect, and emotions^{45,86–91} although one study showed cross-sectional associations at baseline did not extend to longitudinal analysis (with 1-month follow-up)⁷¹ and 2 studies reported that, among residents with dementia, social interaction was associated with both positive and negative affect⁸⁸ and expressions (and the quality of interaction, positive, negative or neutral, may differentiate positive and negative expressions).⁸⁹

Anxiety

Three cross-sectional studies tested the association between social connection and anxiety. Two studies reported that better social connection was associated with less anxiety,^{43,46} whereas 1 study of new residents found that higher informational social support was associated with more anxiety.⁷⁷

Table 2
Summary of Studies Included in Question 1, Total Number of Studies Included and Number of Studies With Statistical Evidence of Positive Impact of 1 (or More) Measures of Social Connection on the Mental Health Outcome

Mental Health Outcome	Number of Studies Reporting	
	Mental Health Outcome	Positive Impact of Social Connection*
Depression	35	28
Responsive behaviors	9	7
Mood, affect, and emotions	8	7
Anxiety	3	2
Medication use	3	0
Cognitive decline	2	2
Death anxiety	2	2
Boredom	2	2
Suicidal thoughts	2	2
Psychiatric morbidity	1	1
Daily crying	1	1

Some studies included multiple outcomes; total does not reflect number of studies included in review.

*Where studies report unadjusted and adjusted estimates, classified by adjusted estimates; where studies report cross-sectional and longitudinal analyses, classified by longitudinal analysis.

Cognitive Decline

Two cohort studies, both using data from the Resident Assessment Instrument (RAI), tested the association between social engagement and cognitive performance; both found that more social engagement was associated with less cognitive decline.^{92,93}

Other Mental Health Outcomes

Three studies used RAI data to test the association between social engagement and (antipsychotic or hypnotic) medication use but produced mixed results.^{50,94,95} Two cross-sectional studies reported associations between social support and lower death anxiety.^{96,97} Two cross-sectional studies reported impacts of social support, loneliness, and social engagement in relation to suicidal ideation.^{98,99} Two cross-sectional studies reported that better social connection was associated with less boredom.^{100,101} Studies also linked social connection to daily crying¹⁰² and psychiatric morbidity.¹⁰³

What Interventions/Strategies Support Social Connection for People Living in LTC Homes in the Context of Infectious Disease Outbreaks Like COVID-19?

After reviewing the studies that met criterion 2 or 3, our team identified 12 interventions and strategies as potentially quick and relatively low-cost to implement and adapt in the current COVID-19 pandemic. There were 23 observational studies and 49 intervention studies that reported social connection outcomes and were relevant to these 12 strategies (see Table 3 and Supplementary Table 2). Among observational studies, the most commonly investigated aspect of social connection was social engagement (n=12; 52%), most often using health administrative data and the RAI index of social engagement. Among intervention studies, the most commonly investigated aspect of social connection was loneliness (n= 18; 37%), most often using the UCLA Loneliness Scale.

Manage pain

Eight observational studies tested the association between pain and social relationships or loneliness.^{104–111} Two studies found that pain was associated with reduced social relationships scores¹⁰⁶ and increased loneliness.¹⁰⁹ Another study showed that, among residents with persistent pain, analgesic use was associated with improved social engagement.¹¹¹ Five studies found no association between pain

and social connection.^{104,105,107,108,110} However, 3 of these studies reported that the association between pain and social connection only disappeared after adjusting for other variables,^{104,105,107} including in a study that suggested influence of pain on social engagement may depend on the level of cognitive impairment.¹⁰⁴ Of the 5 intervention studies addressing pain, 4 showed beneficial impact on social interaction and involvement,¹¹² social relations,¹¹³ and loneliness^{114,115} whereas 1 showed no impact on loneliness.¹¹⁶

Address vision and hearing loss

Seven observational studies, all using RAI-MDS data, consistently showed an association between visual impairment and lower social engagement.^{117–123} For residents with cataracts, cataract surgery was associated with improvements in social interaction.¹²⁴ One randomized controlled trial, assessing the effect of treating uncorrected refractive error (getting glasses), showed improved social interaction.¹²⁵ Although fewer studies linked hearing impairment to social engagement,^{122,123} and some find no association,^{117,119,121} taken in context with the apparent influence of dual sensory loss,¹²⁰ hearing loss should also be addressed.

Sleep at night, not during the day

One observational study found that sleep disturbances were associated with lower levels of social engagement¹²⁶ whereas another found no association between sleep difficulties and social relationships.¹⁰⁶ One intervention study tested the impact of a sleep intervention and reported increased participation in social activities.¹²⁷

Find opportunities for creative expression

Five intervention studies tested the impact of creative expression programs, such as art, music, and storytelling, on social connection; 3 reported improvements in social engagement¹²⁸ and social interaction,¹²⁹ but there were mixed results for social relations and social isolation.^{130–132}

Exercise

Two observational studies found the associations between physical activity or participation in physiotherapy and social connection were not statistically significant.^{133,134} Six intervention studies tested the impact of exercise programs. Of the 2 studies that tested the impact of tai chi, one reported improvement in social relationships¹³⁵ and the other found no impact on social support.¹³⁶ For other physical activity interventions, one study reported no change in social relations,¹³⁷ another reported improvements in social participation,¹³⁸ and the third, carried out among residents with chronic pain, found decreased loneliness.¹³⁹ Another study that tested the combination of qigong and art suggested that only the art intervention affected social relationships.¹³²

Maintain religious and cultural practices

Three observational studies tested associations between social connection and religious activities, spirituality, and faith. One reported that, for both African American and white nursing home residents, preference for religious activities and drawing strength from faith were associated with higher social engagement.¹¹⁹ Another showed that religious coping was positively associated with social support.¹⁴⁰ The third study reported that the association between spirituality and social engagement was not statistically significant.¹¹⁸

Garden, either indoors or outside

Five studies tested the effect of horticulture and indoor gardening programs for LTC residents. Three studies that compared the program to usual care found that the gardening programs were associated with improvements in social relationship and loneliness outcomes.^{141–143} However, the 2 studies that compared the programs with other interventions found no effect.^{144,145}

Table 3
Summary of Studies Included in Question 2, Total Number of Studies Included and Number of Studies With Statistical Evidence of Positive Impact of Strategy on 1 (or More) Measures of Social Connection, by Study Type (Observational or Intervention)

Question 2: Interventions or Strategies to Support Social Connection	Total (n _{studies})	Number of Observational Studies Reporting		Number of Intervention Studies Reporting	
		Exposure	Associated With Social Connection	Intervention	Positive Impact on Social Connection
Manage pain	13	8	3	5	4
Address vision and hearing loss	9	8	8	1	1
Sleep at night, not during the day	3	2	1	1	1
Find opportunities for creative expression	5	0	0	5	5
Exercise	8	2	0	6	3
Maintain religious and cultural practices	3	3	2	0	0
Garden, either indoors or outside	5	0	0	5	3
Visit with pets	14	1	1	13	10
Use technology to communicate	4	0	0	4	2
Laugh together	3	0	0	3	1
Reminisce about events, people, and places	7	0	0	7	6
Address communication impairments and communicate nonverbally	5	5	5	0	0

Some studies included multiple exposures/interventions; total does not reflect number of studies included in review.

Visit with pets

Twelve studies assessed the impact of pet interactions and animal-assisted therapy on social connection, and 2 more studied robotic animals. Pet interaction and animal assisted therapy studies showed beneficial impacts on social connection (including reducing loneliness,^{146–149} and social interaction)^{148,150–154} except in 2 studies.^{155,156} Another study suggested that any visits (ie, with or without pets) increased social interaction.¹⁵⁷ Two studies assessing the impact of robotic animals reported beneficial impacts on loneliness^{158,159} and 1 found that the impact of a robotic dog was similar to that of a live dog.¹⁵⁸

Use technology to communicate

Four studies assessed the impact of communication technology, but 2 were small-scale pilot studies.^{160,161} The 2 quasi-experimental studies that tested the effect of regular videoconferencing with family members showed beneficial effects for both social support and loneliness.^{162,163}

Laugh together

Three intervention studies reported the impact of humor therapy; one study of laughter therapy (using laughter and yoga breathing techniques) reported decreased emotional and social loneliness,¹⁶⁴ whereas the other 2 interventions were not found to reduce loneliness¹⁶⁵ or social disengagement.¹⁶⁶

Reminisce about events, people, and places

Seven interventions studies tested reminiscence therapy or programs. These studies showed increases in social participation,^{167,168} social engagement,^{169,170} social interaction,¹⁷¹ social network,¹⁷⁰ and decreases in loneliness¹⁷² but not social relationships^{167,168} or social support.¹⁷⁰ One study found no effect of the intervention on social engagement.¹⁷³

Address Communication Impairments and Communicate Nonverbally

Five observational studies showed that impaired receptive (understanding others) and/or expressive (making oneself understood) communication was associated with reduced social connection. Three studies used RAI-MDS data to examine communication among LTC residents overall^{118,122,123} whereas 2 studies used assessments of expressive and receptive communication in individuals with dementia.^{174,175}

Discussion

Our systematic search of published research on social connection in LTC residents identified 133 studies. We found 61 studies that assessed the association between social connection and mental health outcomes; overall, these studies suggest social connection is possibly associated with better mental health in LTC residents. We used 72 observational and intervention studies, combined with stakeholder experience and advice, to highlight 12 strategies that might be used and adapted by LTC residents, families, and staff to help build and maintain social connection in LTC residents.

Among the studies linking social connection to mental health outcomes, many had methodological limitations. In particular, some studies did not incorporate strategies to account for confounding and most were cross-sectional, making it impossible to establish temporal order. For example, with respect to the latter, studies included here considered social connection as a predictor of depression whereas others identified in our search considered it an outcome^{176–181}—in reality, bidirectional relationships are likely.¹⁸² Further, studies that described and compared populations within LTC were infrequent; few studies reported stratified results (eg, by race or ethnicity,^{119,122} age,⁹⁷ sex,⁹⁴ or level of cognitive impairment)^{48,85,92} or restricted to certain populations (eg, new residents).^{77,95} Research assessing differences by resident-level demographic and clinical factors and other characteristics (eg, distinguishing new and established residents) would inform the development of interventions, as would incorporating measures of home-level characteristics.

We identified 12 strategies that may help build and maintain social connection in LTC residents during COVID-19. Our review builds on previous reviews of interventions to address social connection among LTC residents^{33–35} by also considering observational research and contextualizing findings through consultation with organizations representing LTC residents, families, and staff. However, similar to those reviews, we found limited research evidence and that most intervention studies were not randomized and often excluded residents with cognitive impairment. We also found no studies conducted in the context of infectious disease outbreaks. Although our stakeholders provided insights into the applicability of these strategies during COVID-19, given the frequency of disease outbreaks in LTC homes, more research is needed to address the specific challenges such scenarios present to LTC.

We also note 2 important caveats to the strategies we identified. First, some represent fundamental aspects of resident care whereas others will not be relevant to every LTC resident or home. In particular, pain is reported as a measure of nursing home quality,¹⁸³ and the

importance of addressing sleep,¹⁸⁴ hearing,¹⁸⁵ and vision¹⁸⁶ have previously been highlighted for this population. For other strategies, each resident's needs, values, family situation and circumstances will be distinct just as every LTC home context will present unique challenges and opportunities for implementation; for example, some strategies rely partly or entirely on technology, which presents its own challenges to residents, families, and homes.¹ Second, enacted in the catastrophically common scenario of infection control measures that exclude families and isolate residents from others in the home, all strategies rely on a healthy, sustained LTC workforce. Without these vital interactions with families and other residents, problems of deteriorating mental health among residents are compounded by already-strained LTC staff who are now further challenged to provide care, including social connection, to residents. LTC homes worldwide must be supported to address problems of chronic understaffing¹⁸⁷ and a workforce crisis in LTC.¹⁸⁸

Our scoping review used a comprehensive search strategy to identify published literature that quantified aspects of social connection in LTC residents. Still, we acknowledge certain limitations. First, we did not review intervention studies using social connection as a means of addressing some other outcome (eg, responsive behaviors).^{189–192} Although we had intended to include such studies,¹⁷ in practice, categorizing interventions as targeting social connection was difficult to operationalize. We acknowledge that characterizing these studies would have been useful to delineate the associations between social connection and mental health. Second, we did not describe associations among the different social connection variables, that is, how concepts such as social networks, social support, social engagement, loneliness, and social capital relate to one another. Studies that clarify the conceptual underpinnings and relationships among these factors^{22,27} and the mechanisms by which interventions/strategies might impact social connection¹⁹³ will advance knowledge in this area. Third, our definition of social connection excluded outcomes such as eye contact, facial expressions, and body language and this may have disproportionately excluded studies of persons with advanced dementia. New measures of social connection, developed specifically for persons with dementia (and at different dementia severities),^{194,195} will be helpful for future research in this area. Finally, we initiated this scoping review, prior to the COVID-19 pandemic,¹⁷ to describe the literature but not to make recommendations for practice.¹⁹⁶ As such, we did not include an assessment of the quality of the studies included in our review,^{19–21} and this may limit interpretation for policy and practice.

Conclusions and Implications

Our study underscores the importance of social connection for the mental health of residents of LTC homes and identifies strategies that may help build and maintain social connection in this population during COVID-19. Although these findings rely on incomplete evidence, this apparent limitation does not diminish the imperative to address social connection within LTC homes—both during COVID-19 and beyond. Still, further research is needed to explore the role of social connection over time and for different populations within LTC homes as well as in the context of infectious disease outbreaks.

Acknowledgments

Our thanks to Ellen Snowball, Kaitlyn Lem, Omar Farhat, Jenny Jing, Souraiya Kassam, and David Jagroop for their assistance selecting the studies and charting the data. Ellen Snowball also created the infographic art summarizing results available at <http://www.encoarteam.com/index.html>.

References

1. Chu CH, Donato-Woodger S, Dainton CJ. Competing crises: COVID-19 countermeasures and social isolation among older adults in long term care. *J Adv Nurs* 2020;76:2456–2459.
2. Stall NM, Johnstone J, McGeer AJ, et al. Finding the right balance: An evidence-informed guidance document to support the re-opening of Canadian nursing homes to family caregivers and visitors during the coronavirus disease 2019 pandemic. *J Am Med Dir Assoc* 2020;21:1365–1370. e1367.
3. Holt-Lunstad J, Smith TB, Baker M, et al. Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspect Psychol Sci* 2015;10:227–237.
4. Kelly ME, Duff H, Kelly S, et al. The impact of social activities, social networks, social support and social relationships on the cognitive functioning of healthy older adults: A systematic review. *Syst Rev* 2017;6:259.
5. Valtorta NK, Kanaan M, Gilbody S, et al. Loneliness and social isolation as risk factors for coronary heart disease and stroke: Systematic review and meta-analysis of longitudinal observational studies. *Heart* 2016;102:1009–1016.
6. Bradshaw SA, Playford ED, Riazi A. Living well in care homes: A systematic review of qualitative studies. *Age Ageing* 2012;41:429–440.
7. Moyle W, Fetherstonhaugh D, Greben M, et al. Influencers on quality of life as reported by people living with dementia in long-term care: A descriptive exploratory approach. *BMC Geriatr* 2015;15:50.
8. Cahill S, Diaz-Ponce AM. "I hate having nobody here. I'd like to know where they all are": Can qualitative research detect differences in quality of life among nursing home residents with different levels of cognitive impairment? *Aging Ment Health* 2011;15:562–572.
9. Ontario Long Term Care Association. This is long-term care 2018. Available at: <https://www.oltpca.com/OLTCA/Documents/Reports/ThisIsLongTermCare2018.pdf>. Accessed June 29, 2020.
10. Mick P, Parfyonov M, Wittich W, et al. Associations between sensory loss and social networks, participation, support, and loneliness: Analysis of the Canadian Longitudinal Study on Aging. *Can Fam Physician* 2018;64:e33–e41.
11. Schroll M, Jónsson PV, Berg K, et al. An international study of social engagement among nursing home residents. *Age Ageing* 1997;26:55–59.
12. Pinquart M, Sörensen S. Influences on loneliness in older adults: A meta-analysis. *Basic Appl Soc Psych* 2001;23:245–266.
13. Puurveen G, Baumbusch J, Gandhi P. From family involvement to family inclusion in nursing home settings: A critical interpretive synthesis. *J Fam Nurs* 2018;24:60–85.
14. Bern-Klug M, Forbes-Thompson S. Family members' responsibilities to nursing home residents: "She is the only mother I got". *J Gerontol Nurs* 2008;34:43–52.
15. Holmes EA, O'Connor RC, Perry VH, et al. Multidisciplinary research priorities for the COVID-19 pandemic: A call for action for mental health science. *Lancet Psychiatry* 2020;7:547–560.
16. O'Connor DB, Aggleton JP, Chakrabarti B, et al. Research priorities for the COVID-19 pandemic and beyond: A call to action for psychological science. *Br J Psychol*; 2020:e12468.
17. Bethell J, Babineau J, Iaboni A, et al. Social integration and loneliness among long term care residents: Protocol for a scoping review. *BMJ Open* 2019;9:e033240.
18. Munn Z, Peters MDJ, Stern C, et al. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med Res Methodol* 2018;18:143.
19. Arksey H, O'Malley L. Scoping studies: Towards a methodological framework. *Int J Soc Res Meth* 2005;8:19–32.
20. Levac D, Colquhoun H, O'Brien KK. Scoping studies: Advancing the methodology. *Implement Sci* 2010;5:69.
21. Tricco AC, Lillie E, Zarin W, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. The PRISMA-ScR Statement. *Ann Intern Med* 2018;169:467–473.
22. Leedahl SN, Sellon A, Chapin RK. Assessment of multiple constructs of social integration for older adults living in nursing homes. *J Gerontol Soc Work* 2018;61:526–548.
23. Berkman LF, Glass T, Brissette I, et al. From social integration to health: Durkheim in the new millennium. *Soc Sci Med* 2000;51:843–857.
24. Glass TA, de Leon CM, Marottoli RA, et al. Population based study of social and productive activities as predictors of survival among elderly Americans. *BMJ* 1999;319:478–483.
25. Bassuk SS, Glass TA, Berkman LF. Social disengagement and incident cognitive decline in community-dwelling elderly persons. *Ann Intern Med* 1999;131:165–173.
26. Machielse A. The heterogeneity of socially isolated older adults: A social isolation typology. *J Gerontol Soc Work* 2015;58:338–356.
27. Leedahl SN, Chapin RK, Little TD. Multilevel examination of facility characteristics, social integration, and health for older adults living in nursing homes. *J Gerontol B Psychol Sci Soc Sci* 2014;70:111–122.
28. De Jong Gierveld J, Van Tilburg T. The De Jong Gierveld short scales for emotional and social loneliness: Tested on data from 7 countries in the UN generations and gender surveys. *Eur J Ageing* 2010;7:121–130.

29. Cornwell EY, Waite LJ. Social disconnectedness, perceived isolation, and health among older adults. *J Health Soc Behav* 2009;50:31–48.
30. O'Rourke HM, Sidani S. Definition, determinants, and outcomes of social connectedness for older adults: A scoping review. *J Gerontol Nurs* 2017;43:43–52.
31. Sanford AM, Orrell M, Tolson D, et al. An international definition for "nursing home". *J Am Med Dir Assoc* 2015;16:181–184.
32. Bramer WM, Giustini D, de Jonge GB, et al. De-duplication of database search results for systematic reviews in EndNote. *J Med Libr Assoc* 2016;104:240–243.
33. Mikkelsen ASB, Petersen S, Dragsted AC, et al. Social interventions targeting social relations among older people at nursing homes: A qualitative synthesized systematic review. *Inquiry* 2019;56:46958018823929.
34. Quan NG, Lohman MC, Resciniti NV, et al. A systematic review of interventions for loneliness among older adults living in long-term care facilities. *Aging Ment Health*; 2019:1–11.
35. Brimelow RE, Wollin JA. Loneliness in old age: Interventions to curb loneliness in long-term care facilities. *Act Adapt Aging* 2017;41:301–315.
36. Ejaz FK, Rose MS, Jones J. Restraint removal and changes in social response among nursing home residents. *Res Soc Work Pract* 1998;8:47–62.
37. Smith-Marchese K. Effects of participatory music on the reality orientation and sociability of Alzheimer's residents in a long-term-care setting. *Act Adapt Aging* 1994;18:41–55.
38. Sauer PE, Fopma-Loy J, Kinney JM, et al. "It makes me feel like myself": Person-centered versus traditional visual arts activities for people with dementia. *Dementia* 2016;15:895–912.
39. Phillips LJ, Reid-Arndt SA, Pak Y. Effects of a creative expression intervention on emotions, communication, and quality of life in persons with dementia. *Nurs Res* 2010;59:417–425.
40. Cohen-Mansfield J, Dakheel-Ali M, Marx MS. Engagement in persons with dementia: The concept and its measurement. *Am J Geriatr Psychiatry* 2009;17:299–307.
41. McMahon M, Nadigel J, Thompson E, et al. Informing Canada's health system response to COVID-19: Priorities for health services and policy research. *Healthc Policy* 2020;16:112–124.
42. Marston C, Renedo A, Miles S. Community participation is crucial in a pandemic. *Lancet* 2020;395:1676–1678.
43. Ahmed D, El Shair IH, Taher E, et al. Prevalence and predictors of depression and anxiety among the elderly population living in geriatric homes in Cairo, Egypt. *J Egypt Public Health Assoc* 2014;89:127–135.
44. Chau R, Kissane DW, Davison TE. Risk factors for depression in long-term care: A prospective observational cohort study. *Clin Gerontol*; 2019:1–14.
45. Cheng ST, Lee CK, Chow PK. Social support and psychological well-being of nursing home residents in Hong Kong. *Int Psychogeriatr* 2010;22:1185–1190.
46. Drageset J, Eide GE, Ranhoff AH. Anxiety and depression among nursing home residents without cognitive impairment. *Scand J Caring Sci* 2013;27:872–881.
47. Farber HJ, Brod M, Feinbloom RI. Primary family contacts and emotional health in the institutionalized elderly. *Fam Pract Res J* 1991;11:309–317.
48. Fessman N, Lester D. Loneliness and depression among elderly nursing home patients. *Int J Aging Hum Dev* 2000;51:137–141.
49. Gan P, Xie Y, Duan W, et al. Rumination and loneliness independently predict six-month later depression symptoms among Chinese elderly in nursing homes. *PLoS One* 2015;10:e0137176.
50. Hjaltadóttir I, Ekwall AK, Nyberg P, et al. Quality of care in Icelandic nursing homes measured with Minimum Data Set quality indicators: Retrospective analysis of nursing home data over 7 years. *Int J Nurs Stud* 2012;49:1342–1353.
51. Hollinger-Smith L, Buschmann M. Failure to thrive syndrome: Predicting elderly nursing home residents at risk. *Clin Gerontol* 2000;20:65–88.
52. Hsu YC, Wright CL. The association between participation in social activity and depressive symptoms in institutionalized elders in Taiwan. *Geriatr Nurs* 2014;35:31–36.
53. Jongenelis K, Pot A, Eisses A, et al. Prevalence and risk indicators of depression in elderly nursing home patients: The AGED study. *J Affect Disord* 2004;83:135–142.
54. Kim O, Byeon Y, Kim J, et al. Loneliness, depression and health status of the institutionalized elderly in Korea and Japan. *Asian Nurs Res* 2009;3:63–70.
55. Krohn B, Bergman-Evans B, Mezey M. Research brief. An exploration of emotional health in nursing home residents: making the pieces fit. *Appl Nurs Res* 2000;13:214–217.
56. Kwok SY, Yeung DY, Chung A. The moderating role of perceived social support on the relationship between physical functional impairment and depressive symptoms among Chinese nursing home elderly in Hong Kong. *ScientificWorldJournal* 2011;11:1017–1026.
57. Lin PC, Wang HH, Huang HT. Depressive symptoms among older residents at nursing homes in Taiwan. *J Clin Nurs* 2007;16:1719–1725.
58. Leedahl SN, Chapin RK, Little TD. Multilevel examination of facility characteristics, social integration, and health for older adults living in nursing homes. *J Gerontol B Psychol Sci Soc Sci* 2015;70:111–122.
59. Lou VWQ, Chi I, Kwan CW, et al. Trajectories of social engagement and depressive symptoms among long-term care facility residents in Hong Kong. *Age Ageing* 2013;42:215–222.
60. Nikmat AW, Hashim NA, Omar SA, et al. Depression and loneliness/social isolation among patients with cognitive impairment in nursing home. *ASEAN J Psychiatry* 2015;16:222–231.
61. Patra P, Alikari V, Fradelos EC, et al. Assessment of depression in elderly. Is perceived social support related? A nursing home study: Depression and social support in elderly. *Adv Exp Med Biol* 2017;987:139–150.
62. Somporn D, Neeser KJ, Iamsupisit S. Factors influencing depression among elderly in Ban Bangkhay nursing homes, Bangkok, Thailand after flooding. *J Health Res* 2012;26:313–316.
63. Tank Buschmann M, Hollinger, LM. Influence of social support and control on depression in the elderly. *Clin Gerontol* 1994;14:13–28.
64. Tiong WW, Yap P, Koh GCH, et al. Prevalence and risk factors of depression in the elderly nursing home residents in Singapore. *Aging Ment Health* 2013;17:724–731.
65. Tosangwan S, Clisett P, Blake H. Predictors of depressive symptoms in older adults living in care homes in Thailand. *Arch Psychiatr Nurs* 2018;32:51–56.
66. Tsai YF, Chung JWY, Wong TKS, et al. Comparison of the prevalence and risk factors for depressive symptoms among elderly nursing home residents in Taiwan and Hong Kong. *Int J Geriatr Psychiatry* 2005;20:315–321.
67. Tu YY, Lai YL, Shin SC, et al. Factors associated with depressive mood in the elderly residing at the long-term care facilities. *Int J Gerontol* 2012;6:5–10.
68. Yeung JWK, Ching KLY, Chung A. Correlates and prevalence of depression in Chinese residents of nursing homes in Hong Kong and implications for services and intervention policies. *Ljetopis Socijalnog Rada* 2011;17:445–460.
69. Zhao X, Zhang D, Wu M, et al. Loneliness and depression symptoms among the elderly in nursing homes: A moderated mediation model of resilience and social support. *Psychiatry Res* 2018;268:143–151.
70. McCurren C, Dowe D, Rattle D, et al. Depression among nursing home elders: testing an intervention strategy. *Appl Nurs Res* 1999;12:185–195.
71. Kroemeke A, Gruszczynska E. Well-being and institutional care in older adults: Cross-sectional and time effects of provided and received support. *PLoS One* 2016;11:e0161328.
72. de Guzman AB, Jurado JBN, Juson AJA. Examining the structural relationship of chronic illness, physical function, life satisfaction, and social support in the development of depression among Filipino elderly in institutionalized settings. *Educ Gerontol* 2015;41:193–206.
73. Potter R, Sheehan B, Cain R, et al. The impact of the physical environment on depressive symptoms of older residents living in care homes: A mixed methods study. *Gerontologist* 2018;58:438–447.
74. Pramesona BA, Taneapanichskul S. Prevalence and risk factors of depression among Indonesian elderly: A nursing home-based cross-sectional study. *Neurol Psychiatry Brain Res* 2018;30:22–27.
75. Segal DL. Relationships of assertiveness, depression, and social support among older nursing home residents. *Behav Modif* 2005;29:689–695.
76. Van Beek APA, Frijters DHM, Wagner C, et al. Social engagement and depressive symptoms of elderly residents with dementia: A cross-sectional study of 37 long-term care units. *Int Psychogeriatr* 2011;23:625–633.
77. Keister KJ. Predictors of self-assessed health, anxiety, and depressive symptoms in nursing home residents at week 1 postrelocation. *J Aging Health* 2006;18:722–742.
78. Chen YL, Ryden MB, Feldt K, et al. The relationship between social interaction and characteristics of aggressive, cognitively impaired nursing home residents. *Am J Alzheimers Dis Other Dement* 2000;15:10–17.
79. Cohen-Mansfield J, Werner P, Marx MS. Screaming in nursing home residents. *J Am Geriatr Soc* 1990;38:785–792.
80. Draper B, Snowdon J, Meares S, et al. Case-controlled study of nursing home residents referred for treatment of vocally disruptive behavior. *Int Psychogeriatr* 2000;12:333–344.
81. Cohen-Mansfield J, Marx MS. The social network of the agitated nursing home resident. *Res Aging* 1992;14:110–123.
82. Marx MS, Cohen-Mansfield J, Werner P. A profile of the aggressive nursing home resident. *Behav Health Aging* 1990;1:65–73.
83. Livingston G, Barber J, Marston L, et al. Prevalence of and associations with agitation in residents with dementia living in care homes: MARQUE cross-sectional study. *BJPsych Open* 2017;3:171–178.
84. Kolanowski A, Litaker M. Social interaction, premorbid personality, and agitation in nursing home residents with dementia. *Arch Psychiatr Nurs* 2006;20:12–20.
85. Choi H, Jung YI, Kim H. Factors related to aggressive behaviors among older adults in nursing homes of Korea: A cross-sectional survey study. *Int J Nurs Stud* 2018;88:9–15.
86. Beerens HC, Zwakhalen SM, Verbeek H, et al. The relation between mood, activity, and interaction in long-term dementia care. *Aging Ment Health* 2018;22:26–32.
87. Gilbert EE, Hirdes JP. Stress, social engagement and psychological well-being in institutional settings: Evidence based on the Minimum Data Set 2.0. *Can J Aging* 2000;19:50–66.
88. Jao YL, Loken E, MacAndrew M, et al. Association between social interaction and affect in nursing home residents with dementia. *Aging Ment Health* 2018;22:778–783.
89. Lee KH, Boltz M, Lee H, et al. Does social interaction matter psychological well-being in persons with dementia? *Am J Alzheimers Dis Other Dement* 2017;32:207–212.
90. Sherer M. Interactions with friends in a nursing home and residents' morale. *Act Adapt Aging* 2001;26:23–40.

91. Cohen-Mansfield J, Marx MS. Pain and depression in the nursing home: Corroborating results. *J Gerontol* 1993;48:P96–P97.
92. Freeman S, Spigriene L, Martin-Khan M, et al. Relationship between restraint use, engagement in social activity, and decline in cognitive status among residents newly admitted to long-term care facilities. *Geriatr Gerontol Int* 2017;17:246–255.
93. Yukari Y, Denking MD, Onder G, et al. Dual sensory impairment and cognitive decline: The results from the Shelter Study. *J Gerontol A Biol Sci Med Sci* 2016;71:117–123.
94. Foebel A, Balloková A, Wellens NI, et al. A retrospective, longitudinal study of factors associated with new antipsychotic medication use among recently admitted long-term care residents. *BMC Geriatr* 2015;15:128.
95. Saleh N, Penning M, Cloutier D, et al. Social engagement and antipsychotic use in addressing the behavioral and psychological symptoms of dementia in long-term care facilities. *Can J Nurs Res* 2017;49:144–152.
96. Azaiza F, Ron P, Shoham M, et al. Death and dying anxiety among elderly Arab Muslims in Israel. *Death Stud* 2010;34:351–364.
97. Mullins LC, Lopez MA. Death anxiety among nursing home residents: A comparison of the young-old and the old-old. *Death Educ* 1982;6:75–86.
98. Zhang D, Yang Y, Sun Y, et al. Characteristics of the Chinese rural elderly living in nursing homes who have suicidal ideation: A multiple regression model. *Geriatr Nurs* 2017;38:423–430.
99. Zhang D, Yang Y, Wu M, et al. The moderating effect of social support on the relationship between physical health and suicidal thoughts among Chinese rural elderly: A nursing home sample. *Int J Ment Health Nurs* 2018;27:1371–1382.
100. Ejaz FK, Schur D, Noelker LS. The effect of activity involvement and social relationships on boredom among nursing home residents. *Act Adapt Aging* 1997;21:53–66.
101. Slama CA, Bergman-Evans B. A troubling triangle. An exploration of loneliness, helplessness, and boredom of residents of a veterans home. *J Psychosoc Nurs Ment Health Serv* 2000;38:36–43.
102. Palese A, Simeoni A, Zuttion AR, et al. Daily crying prevalence and associated factors in older adult persons living in nursing homes: Findings from a regional study. *Int J Geriatr Psychiatry* 2018;33:e85–e93.
103. Andrew MK. Social capital, health, and care home residence among older adults: A secondary analysis of the Health Survey for England 2000. *Eur J Ageing* 2005;2:137–148.
104. Almenkerk S, Depla MFIA, Smalbrugge M, et al. Pain among institutionalized stroke patients and its relation to emotional distress and social engagement. *Int J Geriatr Psychiatry* 2015;30:1023–1031.
105. Klapwijk MS, Caljouw MAA, Pieper MJC, et al. Characteristics associated with quality of life in long-term care residents with dementia: A cross-sectional study. *Dement Geriatr Cogn Disord* 2016;42(3–4):186–197.
106. Lai CK, Leung DD, Kwong EW, et al. Factors associated with the quality of life of nursing home residents in Hong Kong. *Int Nurs Rev* 2015;62:120–129.
107. Lood Q, Björk S, Sköldunger A, et al. The relative impact of symptoms, resident characteristics and features of nursing homes on residents' participation in social occupations: Cross-sectional findings from U-Age Swenvis. *J Occup Sci* 2017;24:327–337.
108. Tse MM, Wan VT, Vong SK. Health-related profile and quality of life among nursing home residents: Does pain matter? *Pain Manag Nurs* 2013;14:e173–e184.
109. Tse M, Leung R, Ho S. Pain and psychological well-being of older persons living in nursing homes: An exploratory study in planning patient-centred intervention. *J Adv Nurs* 2012;68:312–321.
110. van Kooten J, van der Wouden JC, Sikkes SAM, et al. Pain, neuropsychiatric symptoms, and quality of life of nursing home residents with advanced dementia in the Netherlands: A cross-sectional study. *Alzheimer Dis Assoc* 2017;31:315–321.
111. Won A, Lapane KL, Vallow S, et al. Long-term effects of analgesics in a population of elderly nursing home residents with persistent nonmalignant pain. *J Gerontol A Biol Sci Med Sci* 2006;61:165–169.
112. Chibnall JT, Tait RC, Harman B, et al. Effect of acetaminophen on behavior, well-being, and psychotropic medication use in nursing home residents with moderate-to-severe dementia. *J Am Geriatr Soc* 2005;53:1921–1929.
113. Husebo BS, Ballard C, Aarsland D, et al. The effect of a multicomponent intervention on quality of life in residents of nursing homes: A randomized controlled trial (COSMOS). *J Am Med Dir Assoc* 2019;20:330–339.
114. Tse MM, Vong SK, Ho SS. The effectiveness of an integrated pain management program for older persons and staff in nursing homes. *Arch Gerontol Geriatr* 2012;54:e203–e212.
115. Tse MM, Ho SS. Pain management for older persons living in nursing homes: A pilot study. *Pain Manag Nurs* 2013;14:e10–e21.
116. Tse MMY, Yeung SSY, Lee PH, et al. Effects of a peer-led pain management program for nursing home residents with chronic pain: A pilot study. *Pain Med* 2016;17:1648–1657.
117. Achterberg W, Pot AM, Kerkstra A, et al. The effect of depression on social engagement in newly admitted Dutch nursing home residents. *Gerontologist* 2003;43:213–218.
118. Bliss D, Harms S, Eberly LE, et al. Social engagement after nursing home admission: Racial and ethnic disparities and risk factors. *J Appl Gerontol* 2017;36:1306–1326.
119. Branco KJ. Religious activities, strength from faith, and social functioning among African American and White nursing home residents. *J Relig Spiritual Aging* 2007;19:3–20.
120. Guthrie DM, Davidson JG, Williams N, et al. Combined impairments in vision, hearing and cognition are associated with greater levels of functional and communication difficulties than cognitive impairment alone: Analysis of interRAI data for home care and long-term care recipients in Ontario. *PLoS One* 2018;15:13. e0192971.
121. Kang H. Correlates of social engagement in nursing home residents with dementia. *Asian Nurs Res* 2012;6:75–81.
122. Li Y, Cai X. Racial and ethnic disparities in social engagement among US nursing home residents. *Med Care* 2014;52:314–321.
123. Resnick HE, Fries BE, Verbrugge LM. Windows to their world: The effect of sensory impairments on social engagement and activity time in nursing home residents. *J Gerontol B Psychol Sci Soc Sci* 1997;52:S135–S144.
124. Owsley C, McGwin G Jr, Scilley K, et al. Impact of cataract surgery on health-related quality of life in nursing home residents. *Br J Ophthalmol* 2007;91:1359–1363.
125. Owsley C, McGwin G Jr, Scilley K, et al. Effect of refractive error correction on health-related quality of life and depression in older nursing home residents. *Arch Ophthalmol* 2007;125:1471–1477.
126. Garms-Homolová V, Flick U, Röhnisch G. Sleep disorders and activities in long term care facilities—A vicious cycle? *J Health Psychol* 2010;15:744–754.
127. Alessi CA, Martin JL, Webber AP, et al. Randomized, controlled trial of a nonpharmacological intervention to improve abnormal sleep/wake patterns in nursing home residents. *J Am Geriatr Soc* 2005;53:803–810.
128. Fritsch T, Jung K, Grant S, et al. Impact of TimeSlips, a creative expression intervention program, on nursing home residents with dementia and their caregivers. *Gerontologist* 2009;49:117–127.
129. Weiss W, Schafer DE, Berghom FJ. Art for institutionalized elderly. *Art Ther* 1989;6:10–17.
130. Boersma P, van Weert JCM, Lissenberg-Witte BI, et al. Testing the implementation of the Veder contact method: A theatre-based communication method in dementia care. *Gerontologist*; 2018:08.
131. Van Dijk AM, Van Weert JCM, Droes RM. Does theatre improve the quality of life of people with dementia? *Int Psychogeriatr* 2012;24:367–381.
132. Roswiyani R, Hiew CH, Witteman CML, et al. Art activities and qigong exercise for the well-being of older adults in nursing homes in Indonesia: A randomized controlled trial. *Ageing Ment Health*; 2019:1–10.
133. Vitorino LM, Girardi Paskulin LM, Carneiro Vianna LA. Quality of life among older adults resident in long-stay care facilities. *Rev Lat Am Enfermagem* 2012;20:1186–1195.
134. Wójcik A, Nowak A, Polak M, et al. Physiotherapy and quality of life of patients in long-term care. *Rehabil Med* 2017;21:19–24.
135. Hsu CY, Moyle W, Cooke M, et al. Seated Tai Chi versus usual activities in older people using wheelchairs: A randomized controlled trial. *Complement Ther Med* 2016;24:1–6.
136. Lee LYK, Lee DTF, Woo J. The psychosocial effect of Tai Chi on nursing home residents. *J Clin Nurs* 2010;19(7–8):927–938.
137. Castilho-Weinert LV, Sibebe Yoko Mattozo T, Bittencourt Guimãraes AT, et al. Functional performance and quality of life in institutionalized elderly individuals. *Top Geriatr Rehabil* 2014;30:270–275.
138. Barthalos I, Dorgo S, Kopkane Plachy J, et al. Randomized controlled resistance training based physical activity trial for central European nursing home residing older adults. *J Sports Med Phys Fitness* 2016;56:1249–1257.
139. Tse MMY, Tang SK, Wan VTC, et al. The effectiveness of physical exercise training in pain, mobility, and psychological well-being of older persons living in nursing homes. *Pain Manag Nurs* 2014;15:778–788.
140. Koenig HG, Weiner DK, Peterson BL, et al. Religious coping in the nursing home: A biopsychosocial model. *Int J Psychiatry Med* 1997;27:365–376.
141. Chu HY, Chen MF, Tsai CC, et al. Efficacy of a horticultural activity program for reducing depression and loneliness in older residents of nursing homes in Taiwan. *Geriatr Nurs* 2019;18:18.
142. Tse MM. Therapeutic effects of an indoor gardening programme for older people living in nursing homes. *J Clin Nurs* 2010;19:949–958.
143. Chen YM, Ji JY. Effects of horticultural therapy on psychosocial health in older nursing home residents: A preliminary study. *J Nurs Res* 2015;23:167–171.
144. Lai CKY, Kwan RYC, Lo SKL, et al. Effects of horticulture on frail and prefrail nursing home residents: A randomized controlled trial. *J Am Med Dir Assoc* 2018;19:696–702.
145. Brown VM, Allen AC, Dwozan M, et al. Indoor gardening older adults: Effects on socialization, activities of daily living, and loneliness. *J Gerontol Nurs* 2004;30:34–42.
146. Calvert MM. Human-pet interaction and loneliness: A test of concepts from Roy's adaptation model. *Nurs Sci Q* 1989;2:194–202.
147. Banks MR, Banks WA. The effects of animal-assisted therapy on loneliness in an elderly population in long-term care facilities. *J Gerontol A Biol Sci Med Sci* 2002;57:M428–M432.
148. Sollami A, Gianferrari E, Alfieri M, et al. Pet therapy: An effective strategy to care for the elderly? An experimental study in a nursing home. *Acta Biomed* 2017;88:25–31.
149. Vrbanc Z, Zecevic I, Ljubic M, et al. Animal assisted therapy and perception of loneliness in geriatric nursing home residents. *Coll Antropol* 2013;37:973–976.

150. Bernstein PL, Friedmann E, Malaspina A. Animal-assisted therapy enhances resident social interaction and initiation in long-term care facilities. *Anthrozoos* 2000;13:213–224.
151. Martindale BP. Effect of animal-assisted therapy on engagement of rural nursing home residents. *Am J Recreat Ther* 2008;7:45–53.
152. Richeson NE. Effects of animal-assisted therapy on agitated behaviors and social interactions of older adults with dementia. *Am J Alzheimers Dis Other Demen* 2003;18:353–358.
153. Wesenberg S, Mueller C, Nestmann F, et al. Effects of an animal-assisted intervention on social behaviour, emotions, and behavioural and psychological symptoms in nursing home residents with dementia. *Psychogeriatrics* 2019;19:219–227.
154. Winkler A, Fairnie H, Gericevich F, et al. The impact of a resident dog on an institution for the elderly: effects on perceptions and social interactions. *Gerontologist* 1989;29:216–223.
155. Banks MR, Banks WA. The effects of group and individual animal-assisted therapy on loneliness in residents of long-term care facilities. *Anthrozoos* 2005;18:396–408.
156. Phelps KA, Miltenberger RG, Jens T, et al. An investigation of the effects of dog visits on depression, mood, and social interaction in elderly individuals living in a nursing home. *Behav Interv* 2008;23:181–200.
157. Wallace JE, Nadermann S. Effects of pet visitations on semiambulatory nursing home residents: Problems in assessment. *J Appl Gerontol* 1987;6:183–188.
158. Banks MR, Willoughby LM, Banks WA. Animal-assisted therapy and loneliness in nursing homes: Use of robotic versus living dogs. *J Am Med Dir Assoc* 2008;9:173–177.
159. Robinson H, Macdonald B, Kerse N, et al. The psychosocial effects of a companion robot: A randomized controlled trial. *J Am Med Dir Assoc* 2013;14:661–667.
160. Neves BB, Franz RL, Munteanu C, et al. Adoption and feasibility of a communication app to enhance social connectedness amongst frail institutionalized oldest old: An embedded case study. *Inf Commun Soc* 2018;21:1681–1699.
161. Siniscarco MT, Love-Williams C, Burnett-Wolle S. Video conferencing: An intervention for emotional loneliness in long-term care. *Act Adapt Aging* 2017;41:316–329.
162. Tsai HH, Tsai YF. Changes in depressive symptoms, social support, and loneliness over 1 year after a minimum 3-month videoconference program for older nursing home residents. *J Med Internet Res* 2011;13:e93.
163. Tsai HH, Tsai YF, Wang HH, et al. Videoconference program enhances social support, loneliness, and depressive status of elderly nursing home residents. *Aging Ment Health* 2010;14:947–954.
164. Kuru Alici N, Zorba Bahceli P, Emiroglu ON. The preliminary effects of laughter therapy on loneliness and death anxiety among older adults living in nursing homes: A nonrandomised pilot study. *Int J Older People Nurs* 2018;13:e12206.
165. Tse MMY, Lo APK, Cheng TLY, et al. Humor therapy: Relieving chronic pain and enhancing happiness for older adults. *J Aging Res* 2010;2010:343574.
166. Low LF, Brodaty H, Goodenough B, et al. The Sydney Multisite Intervention of LaughterBosses and ElderClowns (SMILE) study: Cluster randomised trial of humour therapy in nursing homes. *BMJ Open* 2013;3:11.
167. Siverová J, Bužgová R. Influence reminiscence therapy on quality of life patients in the long-term hospital. *Cent Eur J Nurs Midwifery* 2014;5:21–28.
168. Siverova J, Buzgova R. The effect of reminiscence therapy on quality of life, attitudes to ageing, and depressive symptoms in institutionalized elderly adults with cognitive impairment: A quasi-experimental study. *Int J Ment Health Nurs* 2018;27:1430–1439.
169. Serrani Azcurra DJL. A reminiscence program intervention to improve the quality of life of long-term care residents with Alzheimer's disease. A randomized controlled trial. *Braz J Psychiatry* 2012;34:422–433.
170. Schafer DE, Berghorn FJ, Holmes DS, et al. The effects of reminiscing on the perceived control and social relations of institutionalized elderly. *Act Adapt Aging* 1985;8:95–110.
171. Tabourne CES. The effects of a life review program on disorientation, social interaction and self-esteem of nursing home residents. *Int J Aging Hum Dev* 1995;41:251–266.
172. Chiang KJ, Chu H, Chang HJ, et al. The effects of reminiscence therapy on psychological well-being, depression, and loneliness among the institutionalized aged. *Int J Geriatr Psychiatry* 2010;25:380–388.
173. Lai CKY, Kayser-Jones J. Randomized controlled trial of a specific reminiscence approach to promote the well-being of nursing home residents with dementia. *Int Psychogeriatr* 2004;16:33–49.
174. Ballard C, O'Brien J, James I, et al. Quality of life for people with dementia living in residential and nursing home care: The impact of performance on activities of daily living, behavioral and psychological symptoms, language skills, and psychotropic drugs. *Int Psychogeriatr* 2001;13:93–106.
175. Potkins D, Myint P, Bannister C, et al. Language impairment in dementia: Impact on symptoms and care needs in residential homes. *Int J Geriatr Psychiatry* 2003;18:1002–1006.
176. Chang HT, Liu LF, Chen CK, et al. Correlates of institutionalized senior veterans' quality of life in Taiwan. *Health Qual Life Outcomes* 2010;8:70.
177. Carreiro-Martins P, Gomes-Belo J, Papoila AL, et al. Chronic respiratory diseases and quality of life in elderly nursing home residents. *Chron Respir Dis* 2016;13:211–219.
178. Drageset J, Espehaug B, Kirkevold M. The impact of depression and sense of coherence on emotional and social loneliness among nursing home residents without cognitive impairment—a questionnaire survey. *J Clin Nurs* 2012;21:965–974.
179. Honda Y, Meguro K, Meguro M, et al. Social withdrawal of persons with vascular dementia associated with disturbance of basic daily activities, apathy, and impaired social judgment. *Care Manag J* 2013;14:108–113.
180. Petrovsky DV, Sefcik JS, Hanlon AL, et al. Social engagement, cognition, depression, and comorbidity in nursing home residents with sensory impairment. *Res Gerontol Nurs* 2019;1–10.
181. Prieto-Flores ME, Forjaz MJ, Fernandez-Mayoralas G, et al. Factors associated with loneliness of noninstitutionalized and institutionalized older adults. *J Aging Health* 2011;23:177–194.
182. Santini ZI, Jose PE, York Cornwell E, et al. Social disconnectedness, perceived isolation, and symptoms of depression and anxiety among older Americans (NSHAP): A longitudinal mediation analysis. *Lancet Public Health* 2020;5:e62–e70.
183. Jones RN, Hirdes JP, Poss JW, et al. Adjustment of nursing home quality indicators. *BMC Health Serv Res* 2010;10:96.
184. Ye L, Richards KC. Sleep and long-term care. *Sleep Med Clin* 2018;13:117–125.
185. Meyer C, Hickson L. Nursing management of hearing impairment in nursing facility residents. *J Gerontol Nurs* 2020;46:15–25.
186. Campos JL, Höbner F, Bitton E, et al. Screening for vision impairments in individuals with dementia living in long-term care: A scoping review. *J Alzheimers Dis* 2019;68:1039–1049.
187. McGilton KS, Escrig-Pinol A, Gordon A, et al. Uncovering the devaluation of nursing home staff during COVID-19: Are we fuelling the next health care crisis? *J Am Med Dir Assoc* 2020;21:962–965.
188. Estabrooks CA, Straus S, Flood CM, et al. Restoring trust: COVID-19 and the future of long-term care. *Royal Society of Canada. FACETS* 2020;5:651–691.
189. Cohen-Mansfield J, Werner P. Management of verbally disruptive behaviors in nursing home residents. *J Gerontol A Biol Sci Med Sci* 1997;52:M369–M377.
190. Cohen-Mansfield J, Marx MS, Thein K, et al. The impact of stimuli on affect in persons with dementia. *J Clin Psychiatry* 2011;72:480–486.
191. Cohen-Mansfield J, Marx MS, Dakheel-Ali M, et al. The use and utility of specific nonpharmacological interventions for behavioral symptoms in dementia: An exploratory study. *Am J Geriatr Psychiatry* 2015;23:160–170.
192. Rajkumar AP, Ballard C, Fossey J, et al. Apathy and its response to antipsychotic review and nonpharmacological interventions in people with dementia living in nursing homes: WHELD, a factorial cluster randomized controlled trial. *J Am Med Dir Assoc* 2016;17:741–747.
193. O'Rourke HM, Collins L, Sidani S. Interventions to address social connectedness and loneliness for older adults: A scoping review. *BMC Geriatr* 2018;18:214.
194. Budgett J, Brown A, Daley S, et al. The Social Functioning in Dementia scale (SF-DEM): Exploratory factor analysis and psychometric properties in mild, moderate, and severe dementia. *Alzheimers Dement (Amst)* 2019;11:45–52.
195. Sommerlad A, Singleton D, Jones R, et al. Development of an instrument to assess social functioning in dementia: The Social Functioning in Dementia scale (SF-DEM). *Alzheimers Dement (Amst)* 2017;7:88–98.
196. Lockwood C, dos Santos KB, Pap R. Practical guidance for knowledge synthesis: Scoping review methods. *Asian Nurs Res* 2019;13:287–294.

Supplementary Table 1

Summary of Studies Used to Address Question 1, Presented According to Mental Health Outcome

First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Social Exposure	Mental Health Outcome	Study Finding
Depression (n=35 studies) Ahmed, 2014*	Egypt	Geriatric home residents (N=240)	Exclusion: cognitive impairment (MMSE score < 25)	Cross-sectional	Loneliness, using a 3-item loneliness scale	Depression, using the shorter version of the Geriatric Depression Scale (GDS-15)	Loneliness often (OR 5.02, 95% CI 1.96-12.90; <i>P</i> = .001) or sometimes (OR 3.79, 95% CI 1.35-10.66; <i>P</i> = .011) associated with depression
Chau, 2019	Australia	Long-term care residents (N=81)	Exclusion: moderate to severe cognitive impairment (MMSE score < 18)	Cohort	Social support, using the Multidimensional Scale of Perceived Social Support (MSPSS)	Depression, using Geriatric Depression Scale short form (GDS-15)	Worse perceived social support was associated with increased depression over time (<i>P</i> < .001)
Cheng, 2010	Hong Kong	Nursing home residents (N=71)	Exclusion: moderate to severe cognitive impairment (MMSE score < 18)	Cross-sectional	Social network, using the network mapping procedure Social support (received and provided) Social engagement (visits), using contact frequency	Depression, using the Geriatric Depression Scale (GDS)	Number of contacts with and social support from staff and fellow residents and support provided to all network members were all inversely associated with depression (<i>P</i> < .05)
deGuzman, 2015	The Philippines	Nursing home residents (N=151)	None specified	Cross-sectional	Social support, using the Social Support Scale and support from family and health care providers or from other personnel	Depression, using the Geriatric Depression Scale (GDS)	Social support, from either family or staff, was not associated with depression
Drageset, 2013*	Norway	Nursing home residents (N=227)	Inclusion: "cognitively intact" [0.5 or less on the Clinical Dementia Rating Scale (CDR)]	Cross-sectional	Social support, using the revised Social Provision Scale (SPS): attachment, social integration, opportunity of nurturance, and reassurance of worth	Depression, using the Hospital Anxiety and Depression Scale (HADS)	Social support subdimensions of social integration (OR 0.96, 95% CI 0.93-0.99; <i>P</i> = .02) and reassurance of worth (OR 0.95, 95% CI 0.91-0.99; <i>P</i> = .006) were associated with less depression
Farber, 1991	United States	Nursing home residents (N=70)	Exclusion: moderate-to-severe dementia	Cross-sectional	Social support, using the Quality of Relationship Scale Social engagement (visits and phone calls), using family-reported information on frequency of visits and phone calls	Depression, using Center for Epidemiological Studies-Depression (CES-D) scale	Quality of relationships (<i>P</i> = .001) but not frequency of interaction (<i>P</i> = .23) were inversely associated with depression

Fessman, 2000	United States	Nursing facility residents (N=170)	Inclusion: sufficient cognitive ability	Cross-sectional	Social network, using assessment of close friends Social engagement (visits), using who, and how often, outsiders visited them (number of visitors/month) Loneliness, using the UCLA Loneliness Scale	Depression, using the Zung depression scale	The number of visits per month from friends and relatives was unrelated to depression; however, the number of close friends was inversely associated with depression ($P < .01$). Loneliness was positively associated with depression, but statistically significant only for those with Alzheimer's disease.
Gan, 2015	China	Nursing home residents (N=71)	None specified	Cohort	Loneliness, using the UCLA Loneliness Scale	Depression, using the Center for Epidemiologic Studies Depression (CES-D) scale	Loneliness was associated with depression ($P < .05$); mediation analysis indicated that rumination did not mediate the relationship between loneliness and depression
Hjaltadóttir, 2012*	Iceland	Nursing home residents (N=3694)	None specified	Not stated	Social engagement, using the RAI Index of Social Engagement (ISE)	Depression, using RAI Depression Rating Scale (DRS)	Compared to residents with higher social engagement, moderate (OR 5.14, 95% CI 4.26–6.19; $P < .001$) and low (OR 2.19, 95% CI 1.80–2.67; $P < .001$) social engagement associated with depression symptoms
Hollinger-Smith, 2000	United States	Nursing home residents (N=130)	None specified	Cohort	Social support, using the Older Americans Resources and Services (OARS) social resources indicators Social support (affective), using the Perception of Touch Scale	Depression, using the Geriatric Depression Scale (GDS) Diagnosed depression, using clinical diagnosis on record	Using GDS, social resources and affective social support were inversely associated with depression ($P < .001$) Using diagnosed depression, only affective social support was associated with depression ($P < .001$)

(continued on next page)

Supplementary Table 1 (continued)

First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Social Exposure	Mental Health Outcome	Study Finding
Hsu, 2014	Taiwan	Long-term care (intermediate care facility and nursing home) residents (N=174)	Inclusion: cognitively intact as assessed by the Short Portable Mental Status. Exclusion: diagnosis of dementia	Cross-sectional	Social engagement, using the Socially Supportive Activity Inventory (SSAI) evaluating 9 different types of social activities and frequency, meaningfulness, and enjoyment	Depression, using the Chinese Geriatric Depression Scale (GDS-15)	In 8 of 9 social activities, the more meaningful and enjoyable the resident rated the activity, the more significant the correlation for fewer depressive symptoms ($P < .05$); of all the activities, only the "pleasure trips" showed no association with depressive symptoms
Jongenelis, 2004	The Netherlands	Nursing home residents (N=350)	Exclusion: moderate to severe cognitive impairment (MMSE score < 15)	Cross-sectional	Loneliness, using the de Jong Loneliness Scale Social support, using the shortened version of the Social Support List-Interaction (SSL12-I) scale	Depression, using the Geriatric Depression Scale (GDS) and the Schedule of Clinical Assessment in Neuropsychiatry (SCAN)	Loneliness was found to be associated with subclinical (OR 3.38, 95% CI: 1.72-6.63), minor depression (OR 4.52, 95% CI 2.06-9.90), and major depression (OR 22.32, 95% CI 2.55-195.66); lack of social support (OR 3.32, 95% CI 1.01-10.94) was associated with major depression
Keister, 2006*	United States	New nursing home residents (N=114)	None specified	Cross-sectional	Social support, using the Modified Inventory of Socially Supportive Behaviors assessing 4 dimensions of social support (informational, tangible, emotional, and integration support)	Depression, using the Geriatric Depression Scale (GDS)	One dimension of social support was positively associated with depressive symptoms; as tangible support increased, depressive symptoms increased ($P < .05$)
Kim, 2009	Korea and Japan	Nursing home residents (N=184)	None specified	Cross-sectional	Loneliness, using the Revised UCLA Loneliness Scale	Depression, using the shorter version of the Geriatric Depression Scale (GDS-15)	Loneliness was a significant predictor of depression for the Korean ($P < .01$) and Japanese residents ($P < .01$)

Kroemeke, 2016*	Poland	Nursing home residents (N=180)	Exclusion: diagnosis of dementia or mild cognitive impairments	Cross-sectional (at baseline) and longitudinal (after 1 mo)	Social support (received and provided), using the Berlin Social Support Scales (BSSS)	Depression, using Center for Epidemiological Studies–Depression (CES-D) scale	In cross-sectional analysis, there was an inverse relationship between receiving support and depression; in longitudinal analysis, neither received support nor given support were associated with depressive symptoms
Krohn, 2000	United States	Nursing home residents (N=29)	Inclusion: "cognitively intact"	Cross-sectional	Loneliness, using the UCLA Loneliness Scale	Depression, using the Geriatric Depression Scale (GDS)	There was a positive association between loneliness and depression ($P = .020$).
Kwok, 2011	China	Nursing home residents (N=187)	Exclusion: moderate to severe cognitive impairment (MMSE score < 18)	Cross-sectional	Social support (perceived institutional peer support and perceived family support), using modified version of the Lubben Social Network Scale	Depression, using the Geriatric Depression Scale (GDS)	No association between perceived family support and depressive symptoms; higher level of perceived institutional peer support was significantly correlated with a lower level of depressive symptoms ($P < .001$)
Leedahl, 2015	United States	Nursing home residents (N=140)	Exclusion: moderate to severe cognitive impairment (MDS 3.0 Brief Interview for Mental Status < 13 or MDS 2.0 Cognitive Scale score > 2)	Cross-sectional	Social network, using the concentric circle (ie, egocentric network) approach Social capital, using the indicators norms of reciprocity and trust Social support, using a modified version of the Inventory of Socially Supportive Behaviors Social engagement, using Likert scale questions about participation in various social activities within and outside the nursing home and a question about group/organization participation	Depression, using the Geriatric Depression Scale (GDS)	Social networks had a positive indirect relationship with mental health, primarily via social engagement; social capital had a positive direct relationship on mental health

(continued on next page)

Supplementary Table 1 (continued)

First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Social Exposure	Mental Health Outcome	Study Finding
Lin, 2007	Taiwan	Nursing home residents (N=138)	Inclusion: "cognitively intact" Exclusion: score of 4 or less on the Short Portable Mental Status Questionnaire (SMPSQ)	Cross-sectional	Social support, using the Social Support Scale to measure perceived social support from nurses, nurse aides, family, and roommates	Depression, using Center for Epidemiological Studies–Depression (CES-D) scale	Lack of social support from nurses ($P = .034$), family ($P < .001$), and roommates ($P = .012$) were correlated with depressive symptoms; in adjusted analysis, social support from family was inversely associated with depression ($P < .001$)
Lou, 2013	Hong Kong	Long-term care residents (N=1184)	None specified	Cohort	Social engagement, using the RAI Index of Social Engagement (ISE)	Depression, using the RAI Depression Rating Scale (DRS)	At baseline, social engagement was inversely associated with depressive symptoms; increases in social engagement had a significant inverse association with changes in depressive symptom scores over time
McCurren, 1999	United States	Nursing home residents (N=85)	Exclusion: diagnosis and symptom progression consistent with advanced irreversible dementia	Cross-sectional	Social network, using the Salamon-Conte Life Satisfaction in the Elderly Scale (LSES) social contacts subscale	Depression, using the Geriatric Depression Scale (GDS)	Social contact was inversely correlated with depression ($P = .001$)
Nikmat, 2015	Malaysia	Nursing home residents (N=149)	Inclusion: cognitive impairment (Short Mini Mental State Examination (SMMSE) < 11)	Cross-sectional	Loneliness/social isolation, using the Friendship Scale (FS)	Depression, using the Geriatric Depression Scale (GDS)	Loneliness/social isolation was associated with depression ($P < .001$)
Patra, 2017	Greece	Nursing home residents (N=170)	None specified	Cross-sectional	Social support, using the Multidimensional Scale of Perceived Social Support (MSPSS) Social engagement (visits), using frequency of visits by relatives	Depression, using the shorter version of the Geriatric Depression Scale (GDS-15)	Social support was inversely associated with depression ($P < .001$); fewer visits from relatives was associated with depression ($P < .001$)
Potter, 2018	United Kingdom	Care home residents (N=510)	None specified	Cohort	Social engagement, using the RAI Index of Social Engagement	Depression, using the shorter version of the Geriatric Depression Scale (GDS-15)	Controlling for home-level covariates, social engagement was not associated with depression

Pramesona, 2018	Indonesia	Nursing home residents (N=181)	Exclusion: diagnosed with severe cognitive impairment or dementia	Cross-sectional	Social support, using a classification: from spouse, family, staff or others or no one; and type of support, using a classification: psychological or financial or no support	Depression, using the Geriatric Depression Scale (GDS)	In univariate analysis, lack of social support was associated with depression (OR 2.11, 95% CI 1.15–3.87; $P = .15$) but not in adjusted analysis (OR 2.11, 95% CI 0.48–9.32; $P = .33$); type of support was not associated with depression
Segal, 2005	United States	Nursing home residents (N=50)	Exclusion: cognitive impairment	Cross-sectional	Social support, using Social Support List of Interactions (SSL12-1)	Depression, using the Geriatric Depression Scale (GDS)	Correlation between social support and depression was not statistically significant
Somporn, 2012	Thailand	Nursing home residents (N=237)	None specified	Cross-sectional	Loneliness, using the UCLA Loneliness Scale Social engagement, using scheduled social activities	Depression, using the Thai Geriatric Depression Scale (TGDS-30)	Loneliness ($P < .001$), and lack of social activity ($P < .001$) were associated with depressive symptoms
Tank Buschmann, 1994	United States	Nursing home residents (N=50)	None specified	Cross-sectional	Social support (affective), using the Perception of Touch Scale	Depression, using the Geriatric Depression Scale (GDS)	Affective social support was associated with reduced depression ($P < .001$)
Tiong, 2013	Singapore	Nursing home residents (N=375)	Exclusion: uncommunicative or unable to respond meaningfully (eg, dementia)	Cross-sectional	Social engagement (visits), using questions about frequency of visitors	Depression, using <i>Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)</i> criteria	Lack of social contact was associated with depression (OR 2.33, 95% CI 1.25–4.33)
Tosangwarn, 2018	Thailand	Care home residents (N=128)	Exclusion: severe cognitive impairment	Cross-sectional	Social support, using the Thai Version of Multidimensional Scale of the Perceived Social Support (MSPSS)	Depression, using the Thai Geriatric Depression Scale (TGDS-30)	Perceived social support was inversely associated with depression (OR 0.969, 95% CI 0.939–0.999; $P = .044$).
Tsai, 2005	Taiwan and Hong Kong	Nursing home residents (N=364)	Exclusion: moderate to severe cognitive impairment (MMSE score < 16 for participants with no formal education; MMSE score < 20 for primary school graduates or higher)	Cross-sectional	Social support, using the Social Support Scale (including social support network, quantities of social support, and satisfaction with social support subscales)	Depression, using the Chinese Geriatric Depression Scale—Short Form	Satisfaction with social support and social support network were significantly and negatively related to depressive symptoms ($P < .01$)
Tu, 2012	Taiwan	Long-term care residents (N=307)	None specified	Cross-sectional	Social support, using the Social Support Scale (assessing social companionship, emotional support, instrumental support, and informational support)	Depression, using Center for Epidemiological Studies—Depression (CES-D) scale	Among social support subscales, only social companionship was inversely associated with depression in adjusted analysis ($P < .05$); all were associated with depression in unadjusted analysis

(continued on next page)

Supplementary Table 1 (continued)

First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Social Exposure	Mental Health Outcome	Study Finding
Vanbeek, 2011	The Netherlands	Long-term care dementia unit (nursing and residential home) residents (N=502)	None specified	Cross-sectional	Social engagement, using the Index of Social Engagement (ISE)	Depression, using the MDS Depression Rating Scale (DRS)	Association between social engagement and depression was not statistically significant
Yeung, 2011	Hong Kong	Nursing home residents (N=187)	None specified	Cross-sectional	Social support, using a questionnaire about family support; residential social support; and residential social participation	Depression, using the Geriatric Depression Scale (GDS)	Only residential social support was associated with depression (OR 0.36, 95% CI 0.24-0.53)
Zhao, 2018	China	Nursing home residents (N=323)	Exclusion: severe cognitive impairment (MMSE score < 10)	Cross-sectional	Loneliness, using a Chinese version of the UCLA Loneliness Scale Social support, using the Multidimensional Scale of Perceived Social Support (MSPSS)	Depression, using the Hospital Depression Scale (HDS)	The association between loneliness and depressive symptoms was partially mediated by resilience; the indirect effect of the mediation model was moderated by social support
Responsive behaviors (n=9 studies)							
Chen, 2000	United States	Nursing home residents (N=129)	Exclusion: no cognitive impairment (MMSE score > 24)	Cross-sectional	Social interaction, using the Social Interaction Scale (SIS) subscales: Institutional Interaction and Family/Community Interaction	Aggressive behavior, using the Ryden aggression scale 2 (RAS2) with 3 subscales: physically aggressive behavior; verbally aggressive behavior; sexually aggressive behavior	Social interaction was inversely associated with physical aggression ($P < .05$) but not verbal or sexual aggression
Choi, 2018	Korea	Nursing home residents (N=1447)	None specified (but results stratified by dementia)	Cross-sectional	Social engagement, using the RAI Index of Social Engagement (ISE)	Aggressive behaviors, using RAI data on physical abuse, verbal abuse, socially inappropriate or destructive behaviors and/or resistance to care in the last 3 d	Social engagement was associated with less aggressive behavior among those without dementia (OR 0.31, 95% CI 0.15-0.62; $P < .001$) but not among those with dementia (OR 0.74, 95% CI 0.51-1.08)
Cohen-Mansfield, 1990	United States	Nursing home residents (N=408)	None specified	Cross-sectional	Social network (quality and size/density), using the Hebrew Home Social Network Rating Scale (HHSNRS)	Screaming, using the Cohen-Mansfield Agitation Inventory (CMAI)	Poor quality of the social network was associated with screaming ($P < .01$)

Cohen-Mansfield, 1992	United States	Nursing home residents (N=408)	None specified	Cross-sectional	Social network, using a questionnaire developed by research team—frequency of contact with staff, visitors, and others; intimacy with staff and visitors; frequency of visitors	Agitation, using the Cohen-Mansfield Agitation Inventory (CMAI): aggressive behavior, physically nonaggressive behavior and verbally agitated behavior	Intimacy of social network inversely associated with total number of agitated behaviors ($P < .01$), aggressive behavior ($P < .01$), and verbally agitated behavior ($P < .01$); the size and density of the social network did not differentiate agitated individuals from other residents
Draper, 2000	Australia	Nursing home residents (n=25 cases and n=25 controls)	None specified	Case-control	Social engagement, using the Social Activity Inventory (SAI) items on group activities, hobbies, independent ADL, physical activities, culture-specific programs, visitors, and the involvement of family and friends in the nursing home	Vocally disruptive behavior	Participation in group activities ($P = .005$), hobbies ($P = .004$), and culture-specific programs ($P = .005$) less common among cases
Hjaltadóttir, 2012*	Iceland	Nursing home residents (N=3694)	None specified	Not stated	Social engagement, using the RAI Index of Social Engagement (ISE)	Behavioral symptoms, using RAI	Compared to residents with higher social engagement, moderate social engagement was associated with behavioral symptoms (OR 1.38, 95% CI 1.15–1.66; $P < .001$) but not those with lowest social engagement (OR 0.89, 95% CI 0.73–1.09)
Kolanowski, 2006	United States	Nursing home residents (N=30)	Inclusion: dementia diagnosis that met DSM-IV criteria, and MMSE score < 24	Cross-sectional	Social interaction, using the Passivity in Dementia Scale (PDS) Social withdrawal, using the withdrawal subscale of the Multidimensional Observation Scale for Elderly Subjects (MOSES)	Agitation, using the Cohen-Mansfield Agitation Inventory (CMAI)	Agitation was significantly greater under high social interaction as compared with low social interaction ($P < .001$) regardless of the extraversion score
Livingston, 2017	England	Care home residents (N=1489)	Inclusion: diagnosis of dementia or screened positive for dementia	Cross-sectional	Social engagement (visits), using the number of family visits	Agitation, using the Cohen-Mansfield Agitation Inventory (CMAI) Neuropsychiatric symptoms (agitation), using the Neuropsychiatric Inventory (NPI)	Number of family visits was not associated with CMAI agitation caseness (OR 0.984, 95% CI 0.914–1.059) or NPI agitation caseness (OR 0.990, 95% CI 0.976–1.005)

(continued on next page)

Supplementary Table 1 (continued)

First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Social Exposure	Mental Health Outcome	Study Finding
Marx, 1990	United States	Nursing home residents (N=408)	None specified	Cross-sectional	Social network (quality and size/density), using the Hebrew Home Social Network Rating Scale (HHSNRS)	Aggression (physical, verbal, sexual, and self-abuse), using the Cohen-Mansfield Agitation Inventory (CMAI)	Poor quality of social network associated with aggression, including physical, verbal, and self-abuse ($P < .05$)
Mood, affect, and emotion (n=8 studies) Beerens, 2018	The Netherlands	Long-term care residents with dementia (N=115)	Inclusion: a formal diagnosis of dementia	Cross-sectional	Social interaction, using the Maastricht Electronic Daily Life Observation-tool (MEDLO-tool)	Mood, using the Maastricht Electronic Daily Life Observation-tool (MEDLO-tool)	Social interaction was associated with higher (positive) mood ($P < .001$)
Cheng, 2010*	Hong Kong	Nursing home residents (N=71)	Exclusion: moderate to severe cognitive impairment (MMSE score < 18)	Cross-sectional	Social network, using the network mapping procedure Social support (received and provided) Social engagement (visits), using contact frequency	Positive affect, using the Chinese Affect Scale	Network size, contact with family, support from family, support from staff and fellow residents, and support provided to all network members were all associated with positive affect ($P < .05$)
Cohen-Mansfield, 1993	United States	Nursing home residents (N=408)	None specified	Cross-sectional	Social network, using the Hebrew Home Social Network Rating Scale	Depressed affect, using the Depression Rating Scale.	Poor quality of social networks associated with depressed affect
Gilbart, 2000	Canada	Continuing care and long-term care residents (N=385)	None specified	Not stated	Social support, using questions about type and level of support provided by a number of possible significant others Social engagement, using the RAI Index of Social Engagement (ISE)	Affect, using the Short Happiness and Affect Research Protocol (SHARP) Positive and negative affectivity, using the Measure of the Intensity and Duration of Affective States (MIDAS) Mood state, using RAI Mood State Resident Assessment Protocols	Social engagement was positively associated with SHARP ($P = .0001$) and MIDAS scores ($P = .0001$) but inversely associated with mood state problems ($P = .0002$)
Jao, 2018	United States	Nursing home residents (N=126)	Inclusion: diagnosis of dementia following <i>Diagnostic and Statistical Manual of Mental Disorder, Fourth Edition (DSM-IV)</i> and MMSE scores between 7 and 24	Cohort	Social interaction, using the Passivity in Dementia Scale (PDS)	Affect, using the Philadelphia Geriatric Center Apparent Affect Rating Scale; 2 positive affect states (interest and pleasure) and 3 negative affect states (anxiety, anger, and sadness) were included	Social interaction was associated with higher interest and pleasure at within- and between-person levels ($P < .001$); increased social interaction significantly predicted higher sadness ($P = .01$) and anxiety ($P < .001$) at the within-person level; social interaction was not associated with anger

Kroemeke, 2016*	Poland	Nursing home residents (N=180)	Inclusion: no cognitive disorder (no diagnosis of dementia or mild cognitive impairments)	Cross-sectional (at baseline) and longitudinal (after 1 mo)	Social support (received and provided), using the Berlin Social Support Scales (BSSS)	Positive affect, using 3 items (joy, satisfaction, and optimism) from the Positive and Negative Affect Schedule (PANAS)	In cross-sectional analysis, there was a significant positive relationship between providing and receiving support and positive affect; in longitudinal analysis, neither received support nor given support were associated with positive affect
Lee, 2017	United States	Nursing home and assisted living residents (N=110)	Inclusion: diagnosis of dementia following <i>Diagnostic and Statistical Manual of Mental Disorder, Fourth Edition (DSM-IV)</i> and MMSE score < 24	Cross-sectional	Social interaction, using observations of interaction between nursing staff and nursing home residents (verbal or nonverbal; positive, negative, or neutral)	Positive and negative emotional expressions, using observations	Verbal ($P < .01$) and verbal + nonverbal ($P < .01$) interactions were associated with positive emotional expressions; verbal + nonverbal ($P = .01$) interactions were associated with negative emotional expressions. Positive ($P < .01$) and neutral interactions ($P < .01$) were associated with positive emotional expression; neutral ($P = .00$) and negative interactions ($P = .02$) were associated with negative emotional expression
Sherer, 2001	Israel	Nursing home residents (N=43)	Exclusion: Alzheimer's disease	Cross-sectional	Social network, using 25 open-ended questions about number of friends, whether they visit them, when, frequency of visits, duration, content of visits, what was good or bad about them, satisfaction from visits, and frequency of other communications	Morale, using the Philadelphia Geriatric Center Morale Sub-Scales for agitation (anxiety and dysphoric mood), attitudes toward own aging, and lonely dissatisfaction	Number of friends had a positive association with attitudes toward aging ($P < .05$); meeting friends had a positive association with the 3 morale variables ($P < .05$); duration of visits was not related to morale levels
Anxiety (n=3 studies) Ahmed, 2014*	Egypt	Geriatric home residents (N=240)	Exclusion: cognitive impairment (MMSE score < 25)	Cross-sectional	Loneliness, using a 3-item loneliness scale	Anxiety, using the Arabic version of the Hamilton Anxiety Scale	Loneliness often (OR 4.46, 95% CI 1.36–14.68; $P = .014$) was associated with anxiety but not loneliness sometimes (OR 2.47, 95% CI 0.64–9.54; $P = .19$)

(continued on next page)

Supplementary Table 1 (continued)

First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Social Exposure	Mental Health Outcome	Study Finding
Drageset, 2013*	Norway	Nursing home residents (N=227)	Inclusion: "cognitively intact" [0.5 or less on the Clinical Dementia Rating Scale (CDR)]	Cross-sectional	Social support, using the revised Social Provision Scale (SPS): attachment, social integration, opportunity of nurturance and reassurance of worth	Anxiety, using the Hospital Anxiety and Depression Scale (HADS)	The social support subdimension of attachment was associated with less anxiety (OR 0.97, 95% CI 0.94, 0.99; $P = .019$)
Keister, 2006*	United States	New nursing home residents (N=114)	None specified	Cross-sectional	Social support, using the Modified Inventory of Socially Supportive Behaviors assessing 4 dimensions of social support (informational, tangible, emotional, and integration support)	Anxiety, using the State-Trait Anxiety Inventory	One aspect of social support was positively associated with anxiety; as informational support increased, anxiety increased ($P < .05$)
Medication use (n=3 studies) Foebel, 2015	Canada	Long-term care residents (N=47,768)	None specified	Cohort	Social engagement, using RAI	New antipsychotic medication use, using RAI measure of drugs in the 7 d prior to assessment	Reduced social engagement associated with lower risk of new antipsychotic use (OR 0.78, 95% CI 0.71-0.87; $P < .001$)
Hjaltadóttir, 2012*	Iceland	Nursing home residents (N=3694)	None specified	Not stated	Social engagement, using the RAI Index of Social Engagement (ISE)	Hypnotic drug use, using RAI data on drug use for more than 2 d in past week	Compared to residents with higher social engagement, moderate (OR 1.06, 95% CI 0.93-1.22) and low (OR 0.92, 95% CI 0.80-1.06) social engagement not associated with hypnotic drug use
Saleh, 2017	Canada	Newly admitted residents (N = 2639)	Inclusion: diagnosis of Alzheimer's disease or other dementias	Cross-sectional	Social engagement, using the RAI Index of Social Engagement (ISE)	Antipsychotic medication use, using RAI measure of drugs in the 7 d prior to assessment	Social engagement was associated with antipsychotic use when controlling for sociodemographic variables (OR 0.86, 95% CI 0.82-0.90; $P < .001$) but association disappeared when controlling for health variables (OR 0.97, 95% CI 0.97-1.00; $P = .21$)

Cognitive decline (n=2 studies)							
Freeman, 2017	Canada	Nursing home residents (N=111,052)	Included, results stratified by diagnosis of dementia	Cohort	Social engagement, using the RAI Index of Social Engagement (ISE)	Cognitive performance, using the RAI Cognitive Performance Scale (CPS)	Social engagement was protective against cognitive decline ($P < .001$), and more pronounced for residents without a diagnosis of dementia
Yukari, 2016	Czech Republic, England, Finland, France, Germany, Israel, Italy, and the Netherlands	Nursing home residents (N=1989)	None specified	Cohort	Social engagement, using 7 items, similar to the RAI Index of Social Engagement (ISE)	Cognitive performance, using the RAI-MDS Cognitive Performance Scale (CPS)	Lower social engagement associated with a greater cognitive decline; the greatest cognitive decline observed among socially disengaged residents with dual sensory impairment (1.87; 1.24:2.51).
Death anxiety (n=2 studies)							
Azaiza, 2010	Israel	Nursing home residents (N=65)	None specified	Cross-sectional	Social support, using the Social Support Scale	Death and dying anxiety, using 2 scales based on Carmel and Mutran (1997)	Higher social support was associated with lower death anxiety ($P < .05$)
Mullins, 1982	United States	Nursing home residents (N=228)	None specified	Cross-sectional	Social support, using subjective assessment of the extent of the social support the resident received from others	Death anxiety, using the Death Anxiety Scale	Among younger residents (age < 75 y), lack of social support associated with higher death anxiety
Boredom (n=2 studies)							
Ejaz, 1997	United States	Nursing home residents (N=175)	Inclusion: cognitively alert	Cross-sectional	Social engagement (inside the nursing home), using RAI-MDS variable for group activities that involve social interaction and time spent alone Social network (inside the nursing home), using the total number of people (residents and staff) to whom the resident felt close and friendship with other residents Social interaction (inside the nursing home), using positive interactions and negative interactions Social engagement (outside the nursing home), using variables for each of the number of visits from family and friends in past month	Boredom, using interview item that asked subjects to rate how often they were bored in the nursing home	Negative social relationships associated with boredom ($P < .01$)

(continued on next page)

Supplementary Table 1 (continued)

First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Social Exposure	Mental Health Outcome	Study Finding
Slama, 2000	United States	Veterans Home residents (N=35)	Inclusion: cognitively intact per Section B (Cognitive Patterns) of the Minimum Data Set (MDS)	Cross-sectional	Loneliness, using the UCLA Loneliness Scale	Boredom, using question from Geriatric Depression Scale (GDS)	Loneliness was correlated with boredom ($P = .009$)
Suicidal thoughts (n=2 studies) Zhang, 2018	China	Nursing home residents (N=205)	Exclusion: a diagnosis of "dementia" or moderate to severe cognitive deficit (MMSE score < 16 for participants with no formal education and a MMSE score <20 for primary school graduates or above)	Cross-sectional	Social support, using the Multidimensional Scale of Perceived Social Support (MSPSS)	Suicidal thoughts, using item 9 of the Beck Depression Inventory (BDI)	In univariate analysis, those with suicide thoughts reported lower social support from family ($P < .001$), friends ($P < .001$), and significant others ($P < .001$); perceived social support from family, friends, and significant others moderated the relationship between physical health and suicidal thoughts
Zhang, 2017	China	Nursing home residents (N=205)	Exclusion: a diagnosis of "dementia" or moderate to severe cognitive impairment (MMSE score < 16 for participants with no formal education and an MMSE score <20 for primary school graduates or above)	Cross-sectional	Loneliness, using the UCLA Loneliness Scale Social engagement, using the frequency of visits with their children, and the numbers of different types of social activities in which they engaged	Suicidal ideation, using item 9 of the Beck Depression Inventory (BDI)	In univariate analysis, those who had higher loneliness, fewer visits from their children, and participated in fewer social activities all had higher suicidal ideation scores ($P < .05$); in path analysis, results suggest loneliness can impact suicidal ideation, mediated by depression and hopelessness; frequency of visits and engagement in social activities can also affect suicidal ideation (mediated by loneliness or self-esteem, respectively)

Psychiatric morbidity (n=1 study) Andrew, 2005	England	Care home residents (N = 2493)	None specified (but use of proxy respondents based on the results of a cognitive function screen)	Cross-sectional	Social engagement, using group participation Social support, using the Social Support Index (SSI)	Psychiatric morbidity, using the General Health Questionnaire (GHQ), where scores ≥ 4 were taken to define a "case" of psychiatric morbidity, and scores < 4 a "non-case"	Severe lack of social support associated with increased odds of psychiatric morbidity (OR 1.62, 95% CI 1.05-2.52) but not moderate lack of social support (OR 0.87, 95% CI 0.53-1.41); no association between group participation and psychiatric morbidity (OR 0.95, 95% CI 0.88-1.03)
Daily crying (n=1 study) Palese, 2018	Italy	Nursing home residents (N=8875)	None specified	Cross-sectional	Social engagement, using involvement in socially based activities	Daily crying, defined as the occurrence of at least 1 episode of crying daily over the last month	Residents involved in socially based activities were less likely to cry on a daily basis (OR 0.882, 95% CI 0.811-0.960)

*Study reports more than 1 mental health outcome.

Supplementary Table 2

Summary of Studies Used to Address Question 2, Presented According to Strategy and Study Type (Observational or Intervention)

1. Manage Pain							
Observational studies							
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Exposure	Social Outcome	Study Finding
Almenkerk, 2015	The Netherlands	Nursing home residents with chronic stroke (N=274)	None specified	Cross-sectional	Pain, using Resident Assessment Instrument-Minimum Data (RAI-MDS)	Social engagement, using RAI-MDS Revised Index for Social Engagement (RISE)	Substantial pain was associated with low social engagement (OR 4.25, 95% CI 1.72-10.53; $P < .05$), but only in residents with no/mild or severe cognitive impairment; this relation disappeared adjusted for Neuropsychiatric Inventory Questionnaire score (OR 1.95, 95% CI 0.71-5.39)
Klapwijk, 2016	The Netherlands	Nursing home residents with dementia (N=288)	Inclusion: moderate to very severe dementia, using the Reisberg Global Deterioration Scale (Reisberg GDS) 5-7	Cross-sectional	Pain, using the Pain Assessment Checklist for Seniors with Limited Ability to Communicate (PACSLAC-D)	Social relations, using the QUALIDEM Social isolation, using the QUALIDEM	In unadjusted analysis, pain was associated with social relations (OR 0.88, 95% CI 0.83-0.94; $P < .01$) and social isolation (OR 0.88, 95% CI 0.82-0.94; $P < .01$). Associations were no longer statistically significant in multivariable analysis.
Lai, 2015*	Hong Kong	Nursing home residents (N=125)	None specified	Cross-sectional	Pain	Social relationships, using the WHOQOL-BREF	Pain associated with lower social relationships score ($P < .001$)
Lood, 2017	Sweden	Nursing home residents (N=4451)	None specified	Cross-sectional	Pain, using the Pain Assessment in Advanced Dementia Scale	Social engagement, using a list of study-specific items on participation (eg, going on an outing/excursion, having everyday conversations with staff not related to care)	Pain was correlated with less participation in social occupations ($P < .01$); however, it was no longer statistically significant in the adjusted model
Tse, 2013	Hong Kong	Nursing home residents (N=535)	Exclusion: mental disorder or cognitive impairment	Cross-sectional	Pain, using an 11-point numeric rating scale (NRS)	Loneliness, using the UCLA Loneliness Scale	In unadjusted analysis, pain was not associated with loneliness ($P = .557$).
Tse, 2012	Hong Kong	Nursing home residents (N=302)	None specified	Cross-sectional	Pain, using the Geriatric Pain Assessment	Loneliness, using the UCLA Loneliness Scale	In unadjusted analysis, pain associated with higher loneliness ($P = .05$).
Van Kooten, 2017	The Netherlands	Nursing home residents (N=199)	Inclusion: diagnosis of dementia Exclusion: Parkinson disease dementia, alcohol-related dementia, cognitive deficits due to psychiatric disorders	Cross-sectional	Pain, using the Mobilization Observation Behavior Intensity Dementia (MOBID-2) Pain Scale	Social relations, using the QUALIDEM	The association between pain and social relations was not statistically significant for mild ($P = .25$) or moderate-severe pain ($P = .25$)
Won, 2006	United States	Nursing home residents with persistent pain (N=10,372)	Exclusion: moderate to severe cognitive impairment based on a Cognitive Performance Scale (CPS) score of >2 (equivalent of <19 in MMSE)	Cohort	Analgesic use, standing long-acting opioids (vs standing-acting opioids; standing nonopioids; and no analgesics)	Social engagement, using RAI-MDS Index of Social Engagement	Standing long-acting opioids (vs standing nonopioids) were associated with improvements in social engagement (propensity adjusted rate ratio 1.60; 95% CI, 1.02-2.48)

Intervention studies								
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding
Chibnall, 2005	United States	Nursing home residents with moderate-to-severe dementia (N=25)	Inclusion: moderate-to-severe dementia indicated by a stage 5 or 6 on the Functional Assessment Staging (FAST)	Yes	Randomized controlled trial, crossover	Analgesic medication, 4 weeks of acetaminophen (3000 mg/d) (vs placebo)	Social interaction (direct and passive social involvement), using Dementia Care Mapping (DCM) Social withdrawal, using DCM	Acetaminophen intervention group exhibited significant increases in direct social interaction ($P = .05$) and passive social involvement ($P = .006$)
Husebo, 2019	Norway	Nursing home residents (N=723)	None	Nursing homes randomized	Cluster-randomized controlled trial	Staff education and training on communication, systematic pain management, medication review, and activities (vs usual care)	Social relations, using the QUALIDEM Social isolation, using the QUALIDEM	During the follow-up (month 4-9), there was an intervention effect for social relations ($P < .05$)
Tse, 2012	China	Nursing home staff (N=147) and residents (N=535)	Exclusion: cognitive impairment and history of mental disorders	Nursing homes randomized	Cluster-randomized controlled trial	Integrated pain management program including a physical exercise program and multisensory stimulation art and craft therapy, 1 h/wk for 8 wk (vs usual care)	Loneliness, using the Chinese version of Revised UCLA Loneliness Scale	Intervention group showed significantly lower loneliness after the program ($P < .001$). There was no change in the control group.
Tse, 2013	China	Nursing home staff (n=60) and residents (n=90)	Inclusion: oriented to time and place	Nursing homes randomized	Pretest-posttest (2 groups)	Integrated pain management program that included garden therapy and physiotherapy exercise for the residents, 1 h/wk for 8 wk (vs usual care)	Loneliness, using the Chinese version of Revised UCLA Loneliness Scale	Intervention group showed significant improvement in loneliness after the program ($P < .05$) but not in the control group
Tse, 2016	China	Nursing home residents (N=50)	Inclusion: score ≥ 6 in the Abbreviated Mental Test. Exclusion: cognitive impairment or mental disorders	Nursing homes randomized	Pretest-posttest (2 groups)	Group-based pain management program that included physical exercise, interactive teaching and sharing of pain management education, 1 h twice per wk for 8 wk (vs usual care)	Loneliness, using the Chinese version of Loneliness Scale	Loneliness decreased in both intervention and control groups; no significant difference in loneliness between the 2 groups at baseline or week 12

2. Address Vision and Hearing Impairments

Observational studies								
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Exposure	Social Outcome	Study Finding	
Achterberg, 2003	The Netherlands	Newly admitted nursing home residents (N=562)	None specified	Cross-sectional	Vision impairment, using the Resident Assessment Instrument—Minimum Data Set 2.0 (RAI-MDS) Hearing impairment, using RAI-MDS	Social engagement, using RAI-MDS Index of Social Engagement	Vision impairment associated with low social engagement (OR 1.7, 95% CI 1.1–2.5; $P = .011$) but not hearing impairment (OR 1.0, 95% CI 0.7–1.6; $P = .85$)	
Bliss, 2017*	United States	New nursing home residents followed to 1 y (N=15,927)	None specified	Cohort	Vision impairment, using RAI-MDS	Social engagement, using RAI-MDS Index of Social Engagement 1 y after admission	Vision impairment associated with lower social engagement at 1-y follow-up ($P < .001$)	
Branco, 2007*	United States	African American and white nursing home residents (N = 1667)	None specified	Cross-sectional	Vision impairment, using RAI-MDS Hearing impairment, using RAI-MDS	Social engagement, using RAI-MDS Index of Social Engagement	Stratified by racial/ethnic group: impaired vision was associated with lower social engagement among whites ($P < .001$) but not African Americans; the associations with hearing impairment were not statistically significant	

(continued on next page)

Supplementary Table 2 (continued)

2. Address Vision and Hearing Impairments								
Observational studies								
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Exposure	Social Outcome	Study Finding	
Guthrie, 2018	Canada	Long-term care (LTC) residents (N= 110,578)	None specified	Cross-sectional	Vision impairment, using RAI-MDS Hearing impairment, using RAI-MDS Dual sensory impairment, using RAI-MDS Deafblind Severity Index (DbSI)	Social engagement, using RAI-MDS Index of Social Engagement	Residents with cognitive impairment and dual sensory impairment (DSI) experienced the lowest rates, based on the raw proportions, on 5 of 6 Index of Social Engagement items	
Kang, 2012	United States	Nursing home residents with dementia (N=153)	Inclusion: diagnosis of Alzheimer's disease or other dementia, as recorded in their medical charts	Cross-sectional	Vision impairment, using RAI-MDS Hearing impairment, using RAI-MDS	Social engagement, using the MDS-NH section F1e Sense of Involvement/Initiative	Vision impairment inversely associated with social engagement ($P = .039$); the association with hearing impairment was not statistically significant.	
Li, 2014*	United States	Nursing home residents (N = 868,011)	None specified	Cross-sectional	Vision impairment, using RAI-MDS Hearing impairment, using RAI-MDS	Social engagement, using RAI-MDS Index of Social Engagement	Results suggest, when stratified by racial/ethnic group, highly or severely impaired vision and more than minimal difficulty hearing had lower social engagement for all groups	
Owsley, 2007	United States	Nursing home residents with cataracts (N=45)	Exclusion: moderate or severe cognitive impairment (MMSE score < 14)	Cohort	Cataract surgery	Social interaction, using the Nursing Home Vision-Targeted Health-Related Quality of Life Questionnaire (NHVQoL)	Cataract surgery group exhibited significant score improvements in social interaction ($P = .033$)	
Resnick, 1997*	United States	Nursing home residents (N=18,873)	None specified	Cross-sectional	Vision impairment, using RAI-MDS Hearing impairment, using RAI-MDS	Social engagement, using RAI-MDS Index of Social Engagement	Vision: minimal (OR 1.19, 95% CI 1.10-1.29), moderate (OR 1.40, 95% CI 1.19-1.63), and severe vision impairment (OR 1.51, 95% CI 1.23-1.86) were all associated with low social engagement. Hearing: Only severe hearing impairment (OR 1.42, 95% CI 1.10-1.83) was associated with low social engagement.	
Intervention studies								
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding
Owsley, 2007	United States	Nursing home residents (>55 y old) with uncorrected refractive error (N=142)	Exclusion: moderate or severe cognitive impairment (MMSE score < 14)	Yes	Randomized controlled trial	Immediate refractive error correction (vs delayed correction)	Social interaction, using the Nursing Home Vision-Targeted Health-Related Quality of Life Questionnaire (NHVQoL)	At follow-up, refractive error group exhibited higher social interaction ($P = .03$)

3. Sleep at Night, Not During the Day								
Observational studies								
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Exposure	Social Outcome	Study Finding	
Garms-Homolová, 2010	Germany	Nursing home residents (N=2577)	None specified	Cross-sectional	Sleep disturbances, "sleepless, has difficulty falling asleep or staying asleep" (insomnia) and "non-restful sleep/tired in the morning" (NRS), using RAI-MDS	Social engagement, using RAI-MDS Index of Social Engagement (ISE)	Compared to those with no sleep disturbances, those with pronounced sleep disturbances had lower social engagement ($P < .01$)	
Lai, 2015*	Hong Kong	Nursing home residents (N=125)	None specified	Cross-sectional	Sleep difficulty	Social relationships, using the WHOQOL-BREF	Sleep difficulty was not associated with social relationships score	
Intervention Studies								
First Author, year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding
Alessi, 2005	United States	Nursing home residents with daytime sleepiness and nighttime sleep disruptions (N=118)	None specified	Yes	Randomized controlled trial	Multiple nonpharmacologic efforts to improve sleep, ie, decreased daytime in-bed time, 30 min of outdoor sunlight exposure, increased physical activity, and structured bedtime routine (vs usual care)	Social engagement, using observations of participation in social activities and calculated as percentage of observations per day	Intervention group exhibited significant increases in social engagement ($P < .001$)
4. Find Opportunities for Creative Expression, Like Art, Music, and Storytelling								
Intervention Studies								
First Author, year	Country	Population (N=)	Inclusion/Exclusion Related To Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding
Boersma, 2018	Netherlands	Residents with dementia (n=141) and their professional caregivers (n=136)	Inclusion: cognitive problems due to dementia	No	Pretest-posttest (2 groups)	Veder contact method, a person-centered method using theatrical, poetic, and musical communication for application in 24-h care that encourages social interaction (vs usual care)	Social relations, using the QUALIDEM Social isolation, using the QUALIDEM	Implementation of VCM led to significant positive improvements in the residents' social relations ($P = .002$). The association with social isolation was not statistically significant
Fritsch, 2009	United States	Nursing home residents with dementia and staff (2088 ten-minute observation periods that were conducted in 20 nursing homes)	Inclusion: dementia	Nursing homes randomized	Post only (2 groups)	TimeSlips program, a group storytelling program that encourages creative expression among persons with dementia, 1 h/wk for 10 wk (vs usual care)	Social engagement, using 10-min, coded observations	There were higher levels of social engagement among residents in TimeSlips homes ($P = .003$)
Roswiyani, 2019*	Indonesia	Older adult nursing home residents (N=267)	Exclusion: moderate or severe cognitive impairment (MMSE score < 18)	Yes	Randomized controlled trial (4 groups)	Art activities + qigong exercise (intervention integration); art activities only; qigong only, 90 min twice per week for 8 wk (vs control)	Social relationships, using the WHOQOL-BREF	There was an increase in social relationships in the intervention integration and art groups (but the increase was larger in the art group); the comparison of the art group to the control group was statistically significant ($P = .019$)

(continued on next page)

Supplementary Table 2 (continued)

4. Find Opportunities for Creative Expression, Like Art, Music, and Storytelling								
Intervention Studies								
First Author, year	Country	Population (N=)	Inclusion/Exclusion Related To Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding
Van Dijk, 2012	Netherlands	Nursing home residents (N=169)	Inclusion: diagnosed dementia	No	Pretest-posttest (3 groups)	Veder Method for group theater living-room activities with trained professional caregivers (group 1) or professional actors (group 2) [vs regular reminiscence group activity (group 3)]	Social relations, using the QUALIDEM Social isolation, using the QUALIDEM	At post-test, group 2 showed less socially isolated behavior ($P = .04$); no difference was observed in social relations
Weiss, 1989	United States	Nursing home residents (N=49)	None specified	No	Pretest-posttest (2 groups)	Textile art classes, 1 h 3 times per week for 8 wk (vs control)	Social network, using number of other residents in the nursing home a subject reported knowing by name Social interaction	Quality of social interaction was significantly higher in posttest ($P = .01$) No difference was observed in social network ($P = .14$)
5. Exercise								
Observational Studies								
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Exposure	Social Outcome	Study Finding	
Vitorino, 2012	Brazil	Long-stay care facility residents (N=77)	None specified	Cross-sectional	Physical activity, yes or no	Social relationships, using the WHOQOL-BREF Social participation, using the WHOQOL-OLD	Physical activity was not associated with social relationships ($P = .561$)	
Wójcik, 2017	Poland	Nursing home residents (N=58)	None specified	Cross-sectional	Participation in rehabilitation and satisfaction with its progress, via questionnaire	Social relationships, using the WHOQOL-BREF	The association between participation in rehabilitation and quality of life was not statistically significant	
Intervention Studies								
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding
Barthalos, 2016	Hungary	Nursing home residents (N=45)	Exclusion: moderate or severe cognitive impairment (MMSE score < 15)	No	Pretest-posttest (3 groups)	Physical activity, resistance training 45 min twice per week vs physical + mental activity (weekly lectures and discussions on aging and quality of life) vs control (no physical or mental training)	Social participation, using the WHOQOL-OLD	Both physical activity ($P = .004$) and physical + mental activity ($P = .004$) groups improved in social participation
Castilho-Weinert, 2014	Brazil	Nursing home residents (N=43)	None specified	No	Pretest, posttest (1 group)	Physical therapy program, recreational dynamic activities and psychomotor circuits, 30 min/wk for 16 wk	Social relationships, using the WHOQOL-BREF	There was no change in social relations ($P = .384$)
Hsu, 2016	Taiwan	Long-term care residents (N=60)	Exclusion: cognitive impairment (MMSE score < 25)	Yes	Randomized controlled trial	Seated tai chi exercise, 40 min 3 times per week for 26 wk (vs usual activity control group)	Social relationships, using the WHOQOL-BREF	Seated tai chi intervention improved social relations ($P < .005$)
Lee, 2010	China	Nursing home residents (N=139)	Inclusion: intact cognitive function (abbreviated mental test score > 6)	No	Pretest-posttest (2 groups)	Tai chi exercise, 1 h 3 times per week for 26 wk (vs control group)	Social support (network and satisfaction), using the Chinese version of the Social Support Questionnaire–Short Form (SSQ6)	No significant changes were detected regarding the effect of the tai chi program on social support

Roswiyani, 2019*	Indonesia	Nursing home residents (N=267)	Exclusion: moderate or severe cognitive impairment (MMSE score < 18)	Yes	Randomized controlled trial (4 groups)	Art activities + qigong exercise (intervention integration); art activities only; qigong only, 90 min twice per week for 8 wk (vs control)	Social relationships, using the WHOQOL-BREF	There was an increase in social relationships in the intervention integration and art groups (but the increase was larger in the art group); the comparison of the art group to the control group was statistically significant ($P = .019$)
Tse, 2014	China	Nursing home residents with chronic pain (N=396)	Exclusion: cognitive impairment	Nursing homes randomized	Pretest-posttest (2 groups)	Physical exercise program, consisting of muscle strengthening, stretching, and massages, 1-h/wk for 8 wk (vs no treatment control)	Loneliness, using the Chinese version of UCLA Loneliness Scale	The intervention group showed significant decrease in loneliness ($P < .05$) and the control group did not show any significant improvement

6. Maintain Religious Observations

Observational Studies

First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Exposure	Social Outcome	Study Finding
Bliss, 2017*	United States	New nursing home residents followed to 1 y (N=15,927)	None specified	Cohort	Spirituality, using RAI-MDS	Social engagement, using RAI-MDS Index of Social Engagement 1 y after admission	Spirituality not associated with social engagement at 1-y follow-up ($P = .06$)
Branco, 2007*	United States	African American (n = 172) and white (n = 1595) nursing home residents	None specified	Cross-sectional	Religious activities, using RAI-MDS Strength from faith, using RAI-MDS	Social engagement, using RAI-MDS Index of Social Engagement (ISE)	Among both African American and white residents, strength from faith ($P < .01$) and religious activity preference ($P < .001$) were positively associated with social engagement
Koenig, 1997	United States	Nursing home residents (N=115)	None specified	Cross-sectional	Religious coping, using the Religious Coping Index (RCI)	Social support, using frequency of visitors, frequency of other contacts, intimacy with staff, and intimacy with visitors	Religious coping was positively associated with social support ($P = .01$)

7. Garden, Either Indoors or Outside

Intervention studies

First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding
Brown, 2004	United States	Nursing home residents (N=66)	Inclusion: could cognitively comprehend and answer questions	No	Pretest-posttest (2 groups)	Indoor gardening program once per week for 5 weeks (vs twice a week for 2 wk)	Loneliness, using the UCLA Loneliness Scale Social support, using the revised Social Provisions Scale	There were no significant differences in social support or loneliness between participant groups
Chen, 2015	Taiwan	Nursing home residents (N=10)	Exclusion: diagnosed cognitive impairment	No	Pretest-posttest (1 group)	Indoor horticultural program once per week for 10 wk	Loneliness, using the UCLA Loneliness Scale, Version 3	Loneliness decreased from baseline to follow-up at weeks 5 and 10 ($P < .001$)
Chu, 2019	Taiwan	Nursing home residents (N=150)	Exclusion: cognitive impairment (MMSE score < 25)	Yes	Randomized controlled trial	Horticultural program for 8 wk (vs usual care)	Loneliness, using the 20-item UCLA Loneliness Scale, Version 3	Loneliness decreased over time in the experimental group ($P < .001$), but increased in the control group ($P < .001$)
Lai, 2018	Hong Kong	Frail and prefrail nursing home residents (N=111)	Inclusion: normal cognition (Chinese Abbreviated Mental Test score >5) or mild cognitive impairment (questionable or mild dementia according to the Clinical Dementia Rating scale)	Yes	Randomized controlled trial	Horticulture program for 1 h/wk for 8 wk (vs social activities)	Social engagement, using the Index of Social Engagement Social network, using the Lubben Social Network Scale	There was no statistically significant difference over time, in social outcomes, between the groups

(continued on next page)

Supplementary Table 2 (continued)

7. Garden, Either Indoors or Outside									
Intervention studies									
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding	
Tse, 2010	Hong Kong	Nursing home residents (N=53)	Inclusion: cognitively intact	Nursing homes randomized	Pretest-posttest (2 groups)	Indoor gardening program for 8 wk (vs usual care)	Loneliness, using the Revised UCLA Loneliness Scale Social network, using the Lubben Social Network Scale	There were significant increases in social networks ($P < .01$) and reductions in loneliness ($P < .01$) for the experimental groups but not the control groups ($P > .05$)	
8. Visit With Pets									
Observational Studies									
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition		Study Design	Exposure	Social Outcome	Study Finding	
Calvert, 1989	United States	Nursing home residents (N=65)	Inclusion: pass mental screening (correctly answering 3 items from the Pfeiffer's Short Portable Mental Status Questionnaire)		Cross-sectional	Pet interaction (in pet programs), categorized into high vs low pet interaction groups	Loneliness, using the UCLA Loneliness Scale	Those in the high pet interaction group were statistically and significantly less lonely than those in the low pet interaction group ($P = .03$)	
Intervention Studies									
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding	
Banks, 2002	United States	Long-term care residents (N=45)	Exclusion: cognitive impairment, diagnosed or MMSE score < 24	Yes	Randomized controlled trial	Animal assisted (AAT) once per week vs AAT 3 times per week vs no AAT	Loneliness, using the UCLA Loneliness Scale	Both AAT intervention groups showed lower loneliness than control group ($P < .05$) both the 2 AAT groups did not differ from each other	
Banks, 2005	United States	Long-term care residents (N=37)	Exclusion: cognitive impairment (MMSE score < 24)	Yes	Randomized controlled trial	Animal-assisted therapy (AAT) group vs AAT individual, all 30-min sessions once per week	Loneliness, using the UCLA Loneliness Scale	Loneliness decreased for AAT individual ($P < .05$) but the difference was not statistically significant for AAT group. Posttest scores did not differ between groups	
Bernstein, 2000	United States	Long-term care residents (N=33)	None specified	No		Animal-assisted therapy (AAT) vs arts and crafts and AAT vs snack bingo	Social interaction, using observation (brief conversation, long conversation, touch)	Cognitively alert patients in AAT groups showed more brief conversation ($P < .01$) and long conversation ($P < .01$) but less touch. They also initiated brief conversation more frequently ($P = .009$) Semialert/nonalert patients in AAT showed less brief conversation, but more long conversation	
Martindale, 2008	United States	Nursing home residents (N=20)	Included.	No	Pretest-posttest (2 groups)	Animal-assisted therapy, five 1-h sessions over 6 wk (vs traditional recreation therapy activities)	Social interaction, using observation of interacting with people and the Passivity in Dementia Scale	Interacting with people was significantly greater for the AAT group ($P = .032$)	
Phelps, 2008	United States	Nursing home resident (N=5)	Exclusion: diagnosed dementia; cognitive impairment (MMSE score < 24)	No	Multiple baseline design	Dog visits, 5-10 min once per week for 6 wk	Social interaction, using observational frequency of verbal and nonverbal interaction with other residents and with the dog	Dog visits had no significant effect on social interaction	

Richeson, 2003	United States	Nursing home residents with dementia (N=15)	Inclusion: diagnosed dementia; moderate or severe cognitive impairment (MMSE score < 16)	No	Pretest-posttest (1 group)	Animal-assisted therapy, 1 h 5 d per week for 3 wk	Social interaction, using a data collection tool to determine if social interactions increase after interactions with therapy dogs and their handlers	Social interaction increased pretest to posttest ($P < .05$)
Sollami, 2017	Italy	Nursing home residents (N=28)	Inclusion: mild or absent cognitive impairment (as assessed by MMSE)	Yes	Pretest-posttest (2 groups)	Animal-assisted intervention, 1 h 2 times per week for 16 sessions (vs control, usual care)	Loneliness, using the UCLA Loneliness Scale Social interaction, using the Quality of Life Scale in Late-Stage Dementia (QUALID)	Intervention group showed significantly decreased loneliness ($P = .001$) and improved positive social interactions ($P = .001$)
Vrbanac, 2013	Croatia	Nursing home residents (N=21)	None specified	No	Pretest-posttest (1 group)	Animal-assisted therapy, 90 min 3 times per week for 6 mo	Loneliness, using the UCLA Loneliness Scale	Loneliness decreased after animal-assisted therapy ($P = .003$)
Wallace, 1987	United States	Nursing home residents (N=8)	None specified	No		Pet visitation program, 15 min, 3 times per week for 8 wk (vs visits without dogs)	Social interaction, using a behavioral activity questionnaire	Only a significant effect of visitations ($P < .01$), indicating that visits, either with or without pets, increased social interaction
Wesenberg, 2019	Germany	Nursing home residents with mild to moderate dementia (N=19)	Inclusion: diagnosed Alzheimer's disease or vascular dementia	No	Pretest-posttest (2 groups)	Animal-assisted intervention with a dog, once per week for 6 mo (vs control intervention without dogs)	Social interaction, using observational frequency; divided into verbal interaction, touch, nonverbal interaction and body posture	During the animal-assisted intervention, significantly longer and more frequent periods of social interaction were observed than during the control intervention
Winkler, 1989	Australia	Nursing home residents (N=21)	None specified	No	Pretest-posttest (1 group)	Resident dog	Social interaction, using observation Sanson-Fisher behavioral observation instrument, including group behaviors	Six weeks after the dog's arrival, a significant increase in frequency of interactive behaviors was seen; by 22 wk, behaviors had reverted to baseline levels

Robotic Animals

First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding
Banks, 2008	United States	Nursing home residents (N=38)	Exclusion: cognitive impairment (MMSE score < 24) or Alzheimer's disease	Yes	Randomized controlled trial (3 groups)	Weekly animal-assisted therapy (AAT) with a living dog or AAT with a robotic dog, 30 min/wk for 8 wk (vs control)	Loneliness, using the UCLA Loneliness Scale	AAT with either AIBO or a living dog resulted in similar improvements in loneliness when compared with control group ($P < .05$)
Robinson, 2013	New Zealand	Retirement home, hospital and rest home residents (N=40)	None specified	Yes	Randomized controlled trial (2 groups)	Activity sessions with robotic seal (PAIRO), 1 h, twice per week for 12 wk (vs control)	Loneliness, using the UCLA Loneliness Scale	Those in the intervention group decreased in loneliness over time, whereas those in the control group increased in loneliness; there was a significant difference between groups in loneliness change over time ($P = .033$)

9. Use Technology to Communicate

Intervention Studies

First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding
Neves, 2018	Canada	Long-term care home residents (N=5)	Exclusion: dementia	No	Pretest-posttest (1 group), feasibility study	Accessible communication app	Social support, using the Abbreviated Duke Social Support Index Social interaction, using the Abbreviated Duke Social Support Index Loneliness, using the short revised UCLA Loneliness Scale	Increases in social support ($P = .105$) and social interaction ($P = .097$) were not statistically significant The association with loneliness was not statistically significant.

(continued on next page)

Supplementary Table 2 (continued)

9. Use Technology to Communicate									
Intervention Studies									
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding	
Siniscarco, 2017	United States	Long-term care facility residents (N=8)	Exclusion: cognitive impairment (MMSE score < 24)	No	Pretest-posttest (1 group)	Videoconferencing (1 or more times per week for 2 mo)	Loneliness (emotional), using DeJong Gierveld Loneliness Scale Social isolation, using PROMIS instruments Social support (emotional and informational), using PROMIS instruments	Emotional loneliness and social isolation decreased slightly, but not significantly Emotional support and informational support increased slightly, but not significantly.	
Tsai, 2010	Taiwan	Nursing home residents (N=57)	Exclusion: moderate or severe cognitive impairment (MMSE score < 16 for those with no formal education or MMSE score < 20 for those with at least a primary school education)	Nursing homes randomized	Pretest-posttest (2 groups)	Videoconferencing (at least 5 min/wk for 3 mo) vs regular care only	Social support, using the Social Supportive Behavior Scale Loneliness, using the UCLA Loneliness Scale	Subjects in the experimental group had significantly higher mean emotional and appraisal social support scores at 1 wk and 3 mo after baseline (compared to control group). Subjects in the experimental group also had lower mean loneliness scores at 1 wk and 3 mo after baseline.	
Tsai, 2011	Taiwan	Nursing home residents (N=90)	Exclusion: moderate or severe cognitive impairment (MMSE score < 16 for those with no formal education or MMSE score < 20 for those with at least a primary school education)	Nursing homes randomized	Pretest-posttest (2 groups)	Videoconferencing (at least 5 min/wk for 3 mo) vs regular care only	Social support, using the Social Supportive Behavior Scale and including emotional, informational, instrumental, and appraisal support Loneliness, using the UCLA Loneliness Scale	Videoconference program had a long-term effect in alleviating loneliness and improved long-term emotional social support and short-term appraisal support, but decreased residents' instrumental social support. There was no effect on informational social support.	
10. Laugh Together									
Intervention Studies									
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding	
Kuru-Alici, 2018	Turkey	Nursing home residents (N=50)	Exclusion: Alzheimer's disease or other dementia	No	Pretest-posttest (2 group)	Laughter therapy, 35-40 min twice per week for 5 wk (vs control, no intervention)	Loneliness (emotional and social), using the De Jong Gierveld Loneliness Scale	Intervention associated with decreased emotional and social loneliness with statistically significant difference from control group ($P < .001$)	
Low, 2013	Australia	Nursing home residents (N=398)	None specified	Yes	Cluster randomized controlled trial	Humor therapy from professional performers (ElderClowns + Laughterbosses), for 2 h once per week for 9-12 wk (vs usual care)	Social disengagement, using the Multidimensional Observation Scale for Elderly Subjects (MOSES)	Groups did not differ significantly over time on social disengagement ($P > .05$)	
Tse, 2010	China	Nursing home residents with chronic pain (N=70)	Inclusion: cognitively intact (indicated by a score ≤ 8 on the abbreviated mental test)	No	Pretest-posttest (2 group)	Humor therapy program, 1 h/wk for 8 wk (vs control)	Loneliness, using the revised UCLA Loneliness Scale	Intervention group showed significant decreases in loneliness ($P < .001$) but not for the control group; however, difference between groups was not statistically significant	

11. Reminisce About Events, People, and Places								
Intervention Studies								
First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Randomized (Yes/No)	Study Design	Intervention	Social Outcome	Study Finding
Chiang, 2010	Taiwan	Institutionalized residents (N=92)	Exclusion: moderate or severe cognitive impairment (MMSE score < 19)	Yes	Randomized controlled trial	Reminiscence therapy 90 min/wk for 8 wk (vs wait list control)	Loneliness, using the Revised UCLA Loneliness Scale	Intervention group showed a decrease in loneliness, with significant difference between groups ($P < .001$)
Lai, 2004	China	Nursing home residents with dementia (N=101)	Inclusion: dementia diagnosis	Yes	Randomized controlled trial	Individual life story book to encourage reminiscence once per week for 6 wk vs comparison (social contacts) vs control (no program)	Social engagement, using the Social Engagement Scale	There were no statistically significant differences in social engagement between the groups
Schafer, 1985	United States	Nursing home residents (N=185)	None specified	No	Pretest-posttest (4 groups)	Three intervention groups (1 h/wk for 12 wk): (1) audio tapes + structured group intervention; (2) structured group intervention, and (3) audio tapes + individual activity vs control (no treatment)	Social network, using the ratio of the number of other participants a subject knew divided by the total number of people Social engagement, using the spontaneous initiation of activities with other residents Social support, using whether resident reports there was someone in whom they could confide	There were statistically significant differences between the groups for social network ($P = .02$) and social engagement ($P = .02$) Group 2 associated with increased social network and the highest social engagement. The association with social support was not statistically significant.
Serrani-Azcurra, 2012	Argentina	Nursing home residents with dementia (N=135)	Inclusion: diagnosed with Alzheimer's disease and Folstein Mini Mental Exam Score above 10	Yes	Randomized controlled trial	Life-approach reminiscence therapy, 1 h biweekly for 12 wk vs active control (counseling and informal social contacts) vs passive control	Social engagement, using the Social Engagement Scale	Social engagement increased in the intervention group, with significant difference between groups ($P < .01$)
Siverova, 2014	Czech Republic	Hospitalized long-term care elderly patients (N=41)	Inclusion: mild or moderate cognitive impairment ($9 < \text{MMSE score} < 24$)	No	Pretest-posttest (1 group)	Narrative group reminiscence therapy, 40-60 min once per week for 6-8 wk	Social relationships, using the WHOQOL-BREF Social participation, using the WHOQOL-OLD	Intervention was not associated with change in social relationships ($P = .63$) but there was an increase in social participation ($P = .002$)
Siverova, 2018	Czech Republic	Older adults in institutional care (N=116)	Inclusion: mild or moderate cognitive impairment ($10 < \text{MMSE score} < 24$)	No	Pretest-posttest (2 groups)	Group narrative reminiscence therapy, 40-60 min/wk for 8 wk (vs standard care)	Social relationships, using the WHOQOL-BREF Social participation, using the WHOQOL-OLD	There were no statistically significant differences in social relationships. The intervention group showed an increase in social participation, with a significant difference with control group ($P = .041$).
Tabourne, 1995	United States	Nursing home residents (N=40)	Inclusion: diagnosis of Alzheimer's disease or other cognitive disorder	No	Pretest-posttest (2 groups)	Life review program, 2 sessions per week for 12 wk (vs control)	Social interaction, using observer ratings	There was a significant increase in social interaction for the experimental group ($P < .001$) but not for the control group; the pre-posttest differences between groups was statistically significant ($P < .001$)

12. Address Communication Impairments and Communicate Nonverbally

Observational Studies

First Author, Year	Country	Population (N=)	Inclusion/Exclusion Related to Cognition	Study Design	Exposure	Social Outcome	Study Finding
Ballard, 2001	England	Care facility (residential and nursing homes) residents (N=112)	Inclusion: dementia, using AGE-CAT ("organic disorder") and the Clinical Dementia Rating Scale (CDR) category of 0.5 or greater	Cross-sectional	Language function, using Sheffield Screening Test for Acquired Language Disorders	Social withdrawal, using Dementia Care Mapping (DCM)	Greater impairment of receptive language was associated with increased social withdrawal ($P = .03$).
Bliss, 2017*	United States	New nursing home residents followed to 1 y (N=15,927)	None specified	Cohort	Communication difficulty, using RAI-MDS	Social engagement, using RAI-MDS Index of Social Engagement 1 year after admission	Communication difficulty associated with low social engagement at 1-y follow-up ($P < .001$)
Li, 2014*	United States	Nursing home residents (N= 868,011)	None specified	Cross-sectional	Communication difficulty, using RAI-MDS (assessing whether primary mode of expression was speech and the resident was able to make themselves understood by others)	Social engagement, using individual items from RAI-MDS Index of Social Engagement (ISE)	Communication difficulty associated with lower social engagement
Potkins, 2003	England	Nursing home and social care facility residents (N=315)	Inclusion: dementia, using AGE-CAT ("organic disorder") and the Clinical Dementia Rating Scale (CDR) category of 0.5 or greater	Cross-sectional	Expressive and receptive language function, using the Sheffield Screening Test for Acquired Language Disorders	Social withdrawal, using Dementia Care Mapping (DCM) Social engagement, using participation in social activities and Dementia Care Mapping (DCM)	Both expressive ($P = .04$) and receptive aspects of language ($P < .01$) were correlated with decreased participation in social activities. Social withdrawal was only correlated with receptive language difficulties ($P = .01$).
Resnick, 1997*	United States	Nursing home residents (N=18,873)	None specified	Cross-sectional	Communication difficulty, using RAI-MDS (assessing whether resident's primary mode of communication is defined and resident is able to be understood by others)	Social engagement, using individual items from RAI-MDS Index of Social Engagement (ISE)	Communication difficulty associated with low social engagement (OR 1.72, 95% CI 1.51-1.95)

*Study listed under more than one strategy.