

Appendix 1: Table to show papers included in qualitative synthesis of literature examining associations between loneliness, social isolation, cardiovascular disease and mortality

Paper	Author	Publication date
Loneliness and social isolation as risk factors for mortality: a meta-analytic review	Stephenson et al	2015
Social isolation, loneliness, and all-cause mortality in older men and women	Wardle et al	2013
A Prospective Study of Social Isolation, Loneliness, and Mortality in Finland	Anttila and Tanskanen	2016
Loneliness and mortality among older adults in China	Waite and Luo	2014
Loneliness, social isolation, their synergistic interaction, and mortality	Wagner and Beller	2018
Reported loneliness rather than social isolation is a risk factor for 10-year mortality in older men	Andrew	2012
Social isolation: a predictor of mortality comparable to traditional clinical risk factors	Adler et al	2013
Loneliness, health, and mortality in old age: a national longitudinal study	Cacioppo et al	2012
Does the mortality risk of social isolation depend upon socioeconomic factors?	Patterson	2016
Loneliness, health and mortality	Andersson et al	2019
Loneliness, social networks, and mortality: 18 years of follow-up	Stessman et al	2011
Situational versus chronic loneliness as risk factors for all-cause mortality.	Shiovitz-Ezra and Avalon	2010
Social isolation and adult mortality: the role of chronic inflammation and sex differences	Li et al	2013
Among elderly men, feelings of loneliness are associated with increased 10-year mortality risk, independent of social isolation and medical and psychiatric conditions	Obisesan	2013
Older people who report loneliness have increased risk of mortality and functional decline	Theeke	2013
Loneliness and risk of mortality: a longitudinal investigation in Alameda County, California	Patterson and Veenstra	2010
Consequences of loneliness on physical activity and mortality in older adults and the power of positive emotions	Stewart et al	2013
Effect of loneliness on mortality after retirement.	Niemi	1979
Social isolation, C-reactive protein, and coronary heart disease mortality among community-dwelling adults	Gramling et al	2013
Increased risk of mortality associated with social isolation in older men: only when feeling lonely? Results from the Amsterdam Study of the Elderly (AMSTEL)	Schoevers et al	2012
Suffering from loneliness indicates significant mortality risk of older people	Pitkälä KH. Et al	2011
Social isolation and loneliness as risk factors for myocardial infarction, stroke and mortality: UK Biobank cohort study of 479 054 men and women	Elovainio et al	2018
Emotional loneliness is associated with mortality among mentally intact nursing home residents with and without cancer: a five-year follow-up study.	Ranhoff et al	2013
Feelings of Loneliness and Living Alone as Predictors of Mortality in the Elderly: The PAQUID Study.	Dartigues et al	2016
Impact of loneliness and depression on mortality: results from the Longitudinal Ageing Study Amsterdam	Schoevers et al	2016
Relationship of depression, anxiety, and social isolation to chronic heart	Gottlieb et al	2006

failure outpatient mortality		
Extreme social isolation, use of community-based senior support services, and mortality among African American elderly women.	Nickerson et al	1997
Loneliness and All-Cause, Cardiovascular, and Noncardiovascular Mortality in Older Men: The Zutphen Elderly Study	Giltay et al	2016
The feeling of loneliness prior to coronary artery bypass grafting might be a predictor of short-and long-term postoperative mortality	Karlsson et al	1998
Combined effects of job strain and social isolation on cardiovascular disease morbidity and mortality in a random sample of the Swedish male working population	Theorell et al	1989
Social isolation and mortality in ischemic heart disease. A 10-year follow-up study of 150 middle-aged men	Edwards et al	1988
Effects of psychosocial group rehabilitation on health, use of health care services, and mortality of older persons suffering from loneliness: a randomized, controlled trial	Tilvis et al	2009
All-cause mortality and multimorbidity in older adults: The role of social support and loneliness	Haro et al	2017
Social isolation, health literacy, and mortality risk: Findings from the English Longitudinal Study of Ageing	Steptoe et al	2018
Social isolation and all-cause mortality: a population-based cohort study in Denmark	Ehrenstein et al	2018
Heartbeat: Social isolation is associated with increased mortality after acute myocardial infarction or stroke	Otto	2018
Association of loneliness with all-cause mortality: A meta-analysis.	Miret et al	2018
The Pathophysiology of Perceived Social Isolation: Effects on Health and Mortality.	Bhatti and Hag	2017
Relationships between social isolation, neighbourhood poverty, and cancer mortality in a population-based study of US adults	Llanos et al	2017
Co-existence of social isolation and homebound status increase the risk of all-cause mortality	Fujiwara et al	2019
Social Isolation and Mortality in US Black and White Men and Women.	Gapstur et al	2019
Loneliness, social isolation and risk of cardiovascular disease in the English Longitudinal Study of Ageing	Hanratty et al	2018
Social isolation and cardiovascular disease: an atherosclerotic pathway?	Knox and Uvnäs-Moberg K.	1998
Loneliness and cardiovascular disease and the role of late-life depression	Van der Mast et al	2018
Loneliness and all-cause mortality in community-dwelling elderly Singaporeans	Chan et al	2015
Social isolation, cognitive decline, and cardiovascular disease risk	White et al	2015
Depression, isolation, social support, and cardiovascular disease in older adults	Arthur et al	2006
Does social isolation predict hospitalization and mortality among HIV+ and uninfected older veterans?	Justice et al	2013
The personal and community impact of a Scottish Men's Shed	Leslie et al	2018
Loneliness in older adults is associated with diminished cortisol output	Comijs et al	2017
Sleep disturbance and longitudinal risk of inflammation: Moderating influences of social integration and social isolation in the Coronary Artery Risk Development in Young Adults (CARDIA) study	Irwin et al	2015
Longitudinal study of suicide after traumatic injury	Dischinger et al	2006
Social isolation and health, with an emphasis on underlying mechanisms	Cacioppo and Hawkey	2003
Type A behaviour, social support, and coronary risk: interaction and	Orth-Gomer and	1990

significance for mortality in cardiac patients	Uden	
Older Adults' Social Relationships and Health Care Utilization: A Systematic Review	Hanratty et al	2018
Frequency of Leaving the House and Mortality from Age 70 to 95	Stessman et al	2018
Whites but Not Blacks Gain Life Expectancy from Social Contacts	Assari	2017
Does current smoking predict future frailty? The English longitudinal study of ageing	Walters et al	2018
An overview of systematic reviews on the public health consequences of social isolation and loneliness	Caan et al	2017
The association between social support and physical activity in older adults: a systematic review	Van Uffelen et al	2017
Prevalence of orthostatic hypertension in the very elderly and its relationship to all-cause mortality	Stessman et al	2016
Gender-specific secondary prevention? Differential psychosocial risk factors for major cardiovascular events	Stewart et al	2016
Psychosocial interventions for patients with coronary heart disease and depression: A systematic review and meta-analysis	Thompson et al	2016
Gender differences in the roles for social support in ensuring adequate fruit and vegetable consumption among older adult Canadians	Rugel and Carpiano	2015
unobtrusive in-home detection of time spent out-of-home with applications to loneliness and physical activity	Austin et al	2014
Role of social factors on cell death, cerebral plasticity and recovery after stroke	Venna and McCullough	2015
Nutritional risk and body mass index predict hospitalization, nursing home admissions, and mortality in community-dwelling older adults: results from the UAB Study of Aging with 8.5 years of follow-up	Locher et al	2014
Using multi-level data to estimate the effect of social capital on hazardous alcohol consumption in the former Soviet Union	McKee et al	2014
Social networks, social support, and burden in relationships, and mortality after breast cancer diagnosis in the Life After Breast Cancer Epidemiology (LACE) study	Caan et al	2013
Socioeconomic status, structural and functional measures of social support, and mortality: The British Whitehall II Cohort Study, 1985-2009	Singh-Manoux et al	2012
Living alone and alcohol-related mortality: a population-based cohort study from Finland	Kivimaki et al	2011
Positive life orientation predicts good survival prognosis in old age	Pitkala et al	2012
Long-term effect of social relationships on mortality in patients with congestive heart failure	Murberg	2004
Is depression in old age fatal only when people feel lonely?	Westendorp et al	2005
Predictors of cognitive decline and mortality of aged people over a 10-year period	Strandberg et al	2004
Towards a suicide free society: identify suicide prevention as public health policy	Singh and Singh	2004
Eating habits and appetite control in the elderly: the anorexia of aging.	Cannella et al	2003
Effects of depression and social integration on the relationship between alcohol consumption and all-cause mortality	Rogers et al	2002
Longitudinal study of psychiatric symptoms, disability, mortality, and emigration among Bosnian refugees	Massagli et al	2001
Characteristics of socially isolated patients with coronary artery disease who are at elevated risk for mortality	Mark et al	2001
Self-reported life satisfaction and 20-year mortality in healthy Finnish adults	Koskenvuo et al	2000
Why do men get more heart disease than women? An international	Weidner	2000

perspective		
Depressive symptoms and lack of social integration in relation to prognosis of CHD in middle-aged women. The Stockholm Female Coronary Risk Study	Oth-Gomer et al	2000
Pet ownership protects against the risks and consequences of coronary heart disease	Patronek and Glickman	1993
Social Networks and Health Outcomes: Importance for Racial and Socioeconomic Disparities in Cardiovascular Outcomes	Child and Albert	2018
A conceptual model of social networks and mechanisms of cancer mortality, and potential strategies to improve survival	Molina et al	2018
The role of social relationships in the link between olfactory dysfunction and mortality	Leschak	2018
Loneliness, Social Isolation, and Cardiovascular Health	Xia and Li	2018
Loneliness and Health in Older Adults: A Mini-Review and Synthesis	Ong et al	2016
Breast cancer and social environment: getting by with a little help from our friends.	De Vries et al	2016
One is the deadliest number: the detrimental effects of social isolation on cerebrovascular diseases and cognition.	McCullough et al	2015
Personal Networks and Mortality Risk in Older Adults: A Twenty-Year Longitudinal Study	Steverink et al	2015
The neuroendocrinology of social isolation	Cacioppo	2015
Toward a neurology of loneliness	Cacioppo	2014
Social network ties and inflammation in U.S. Adults with cancer	Frenk et al	2014
Social relationships and health: The toxic effects of perceived social isolation	Cacioppo and Cacioppo	2014
An exploration of the value and mechanisms of befriending for older adults in England	Lester et al	2012
Suicide and suicidal behavior	Nock et al	2008
Vitamin D and the social aspects of disease	Grimes et al	2011
Social Isolation	Cacioppo	2011
Loneliness matters: A theoretical and empirical review of consequences and mechanisms	Hawkley and Cacioppo	2010
Neural pathways link social support to attenuated neuroendocrine stress responses	Lieberman et al	2007
Peritoneal dialysis-related peritonitis: Can we predict it?	Chow and Li	2007
Social integration is associated with fibrinogen concentration in elderly men	Seeman et al	2005
The anatomy of loneliness	Berntson et al	2003
Loneliness and pathways to disease	Hawkley and Cacioppo	2003
Psychosocial influences on the development and course of coronary heart disease: Current status and implications for research and practice	Smith and Ruiz	2002
Social relationships and mortality in patients with congestive heart failure	Murberg and Bru	2001
Segregation and mortality: The deadly effects of racism?	Collins et al	1999
The role of social relations in health promotion	Berkman	1995
Social relationships and health	House et al	1988
Contribution of risk factors to excess mortality in isolated and lonely individuals: an analysis of data from the UK Biobank cohort study.	Kivimaki et al	2017
Exploring interactive surface designs for eliciting social activity from elderly adults	Binda et al	2016
Myocardial infarction and coronary death among women: psychosocial predictors from a 20-year follow-up of women in the Framingham Study.	Castelli et al	1992

Disability, psychosocial factors and mortality among the elderly in a rural French population	Albarede et al	1990
Social ties and survival among the elderly in Tampere, Finland. International Journal of Epidemiology	Jylha and Aro	1989
Relationship between respiratory mortality and self-perceptions of aging	Levy and Myers	2005
Psychological predictors of mortality in old age	Maier and Smith	1999
Social networks and longevity. A 14 year follow-up study among elderly in Denmark.	Waldstrom et al	1991
Effects of social support and personal coping resources on mortality in older age: the Longitudinal Aging Study Amsterdam	Van Eijk et al	1997
Positive life orientation as a predictor of 10-year outcome in an aged population. Journal of clinical epidemiology	Tilvis et al	2004
Loneliness in older persons: a predictor of functional decline and death.	Covinsky et al	2012
Loneliness, health, and longevity	Jacobs et al	2014
Social isolation, social activity and loneliness as survival indicators in old age; a nationwide survey with a 7-year follow-up	Pitkala et al	2012
Mortality and depressive symptoms in inhabitants of residential homes.	Cuijpers	2001
Psychosocial factors and breast cancer: a 6-year Italian follow-up study. Psychotherapy and psychosomatics	Grassi et al	1997
Health and social networks as predictors of survival in old age.	Ljungquist and Sundstrom	1996
A longitudinal analysis of factors related to survival in old age	Wenger	1992
Social networks, social support, and mortality among older people in Japan	Liu et al	1994

Appendix 2: Thematic grouping of papers included in synthesis of literature examining associations between loneliness, social isolation, cardiovascular disease and mortality

Theme	Supporting papers
<p>Original research and reviews exploring the link between loneliness/social isolation and mortality</p>	<p>Loneliness and social isolation as risk factors for mortality: a meta-analytic review Social isolation, loneliness, and all-cause mortality in older men and women A Prospective Study of Social Isolation, Loneliness, and Mortality in Finland Loneliness, social isolation, their synergistic interaction, and mortality Reported loneliness rather than social isolation is a risk factor for 10-year mortality in older men Social isolation: a predictor of mortality comparable to traditional clinical risk factors Loneliness, health, and mortality in old age: a national longitudinal study Does the mortality risk of social isolation depend upon socioeconomic factors? Loneliness, health and mortality Loneliness, social networks, and mortality: 18 years of follow-up Situational versus chronic loneliness as risk factors for all-cause mortality. Among elderly men, feelings of loneliness are associated with increased 10-year mortality risk, independent of social isolation and medical and psychiatric conditions Older people who report loneliness have increased risk of mortality and functional decline Effect of loneliness on mortality after retirement. Increased risk of mortality associated with social isolation in older men: only when feeling lonely? Results from the Amsterdam Study of the Elderly (AMSTEL) Suffering from loneliness indicates significant mortality risk of older people Social isolation and loneliness as risk factors for myocardial infarction, stroke and mortality: UK Biobank cohort study of 479 054 men and women Emotional loneliness is associated with mortality among mentally intact nursing home residents with and without cancer: a five-year follow-up study. Feelings of Loneliness and Living Alone as Predictors of Mortality in the Elderly: The PAQUID Study. Impact of loneliness and depression on mortality: results from the Longitudinal Ageing Study Amsterdam Relationship of depression, anxiety, and social isolation to chronic heart failure outpatient mortality Extreme social isolation, use of community-based senior support services, and mortality among African American elderly women. Loneliness and All-Cause, Cardiovascular, and Noncardiovascular Mortality in Older Men: The Zutphen Elderly Study The feeling of loneliness prior to coronary artery bypass grafting might be a predictor of short- and long-term postoperative mortality Combined effects of job strain and social isolation on cardiovascular disease morbidity and mortality in a random sample of the Swedish male working population Social isolation and mortality in ischemic heart disease. A 10-year follow-up study of 150 middle-aged men All-cause mortality and multimorbidity in older adults: The role of social support and loneliness Social isolation, health literacy, and mortality risk: Findings from the English Longitudinal Study of Ageing Social isolation and all-cause mortality: a population-based cohort study in Denmark Heartbeat: Social isolation is associated with increased mortality after acute myocardial infarction or stroke Association of loneliness with all-cause mortality: A meta-analysis. The Pathophysiology of Perceived Social Isolation: Effects on Health and Mortality. Co-existence of social isolation and homebound status increase the risk of all-cause mortality Social Isolation and Mortality in US Black and White Men and Women. Loneliness, social isolation and risk of cardiovascular disease in the English Longitudinal Study of Ageing Loneliness and all-cause mortality in community-dwelling elderly Singaporeans Social isolation, cognitive decline, and cardiovascular disease risk Depression, isolation, social support, and cardiovascular disease in older adults Does social isolation predict hospitalization and mortality among HIV+ and uninfected older veterans? Type A behaviour, social support, and coronary risk: interaction and significance for mortality in</p>

cardiac patients
Older Adults' Social Relationships and Health Care Utilization: A Systematic Review
Whites but Not Blacks Gain Life Expectancy from Social Contacts
An overview of systematic reviews on the public health consequences of social isolation and loneliness
Gender-specific secondary prevention? Differential psychosocial risk factors for major cardiovascular events
Role of social factors on cell death, cerebral plasticity and recovery after stroke
Social networks, social support, and burden in relationships, and mortality after breast cancer diagnosis in the Life After Breast Cancer Epidemiology (LACE) study
Socioeconomic status, structural and functional measures of social support, and mortality: The British Whitehall II Cohort Study, 1985-2009
Positive life orientation predicts good survival prognosis in old age
Long-term effect of social relationships on mortality in patients with congestive heart failure
Predictors of cognitive decline and mortality of aged people over a 10-year period
Towards a suicide free society: identify suicide prevention as public health policy
Longitudinal study of psychiatric symptoms, disability, mortality, and emigration among Bosnian refugees
Characteristics of socially isolated patients with coronary artery disease who are at elevated risk for mortality
Self-reported life satisfaction and 20-year mortality in healthy Finnish adults
Why do men get more heart disease than women? An international perspective
Depressive symptoms and lack of social integration in relation to prognosis of CHD in middle-aged women. The Stockholm Female Coronary Risk Study
[Social Networks and Health Outcomes: Importance for Racial and Socioeconomic Disparities in Cardiovascular Outcomes](#)
[A conceptual model of social networks and mechanisms of cancer mortality, and potential strategies to improve survival](#)
[The role of social relationships in the link between olfactory dysfunction and mortality](#)
[Loneliness, Social Isolation, and Cardiovascular Health](#)
[Loneliness and Health in Older Adults: A Mini-Review and Synthesis](#)
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Personal Networks and Mortality Risk in Older Adults: A Twenty-Year Longitudinal Study
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Mortality and depressive symptoms in inhabitants of residential homes.
Psychosocial factors and breast cancer: a 6-year Italian follow-up study. Psychotherapy and psychosomatics
Health and social networks as predictors of survival in old age.
A longitudinal analysis of factors related to survival in old age

	Social networks, social support, and mortality among older people in Japan
Research exploring biological links between loneliness/social isolation and mortality	<p>Social isolation and adult mortality: the role of chronic inflammation and sex differences</p> <p>Social isolation, C-reactive protein, and coronary heart disease mortality among community-dwelling adults</p> <p>Social isolation and cardiovascular disease: an atherosclerotic pathway?</p> <p>Loneliness in older adults is associated with diminished cortisol output</p> <p>Sleep disturbance and longitudinal risk of inflammation: Moderating influences of social integration and social isolation in the Coronary Artery Risk Development in Young Adults (CARDIA) study</p> <p>Social isolation and health, with an emphasis on underlying mechanisms</p> <p>Frequency of Leaving the House and Mortality from Age 70 to 95</p> <p>Prevalence of orthostatic hypertension in the very elderly and its relationship to all-cause mortality</p> <p>One is the deadliest number: the detrimental effects of social isolation on cerebrovascular diseases and cognition.</p> <p>The neuroendocrinology of social isolation</p> <p>Toward a neurology of loneliness</p> <p>Social network ties and inflammation in U.S. Adults with cancer</p> <p>Loneliness matters: A theoretical and empirical review of consequences and mechanisms</p> <p>Neural pathways link social support to attenuated neuroendocrine stress responses</p> <p>Peritoneal dialysis-related peritonitis: Can we predict it?</p> <p>Social integration is associated with fibrinogen concentration in elderly men</p>
Research exploring behavioural links between loneliness/social isolation and mortality	<p>Loneliness and mortality among older adults in China</p> <p>Loneliness and risk of mortality: a longitudinal investigation in Alameda County, California</p> <p>Consequences of loneliness on physical activity and mortality in older adults and the power of positive emotions</p> <p>The Pathophysiology of Perceived Social Isolation: Effects on Health and Mortality.</p> <p>Sleep disturbance and longitudinal risk of inflammation: Moderating influences of social integration and social isolation in the Coronary Artery Risk Development in Young Adults (CARDIA) study</p> <p>Social isolation and health, with an emphasis on underlying mechanisms</p> <p>Does current smoking predict future frailty? The English longitudinal study of ageing</p> <p>The association between social support and physical activity in older adults: a systematic review</p> <p>Gender differences in the roles for social support in ensuring adequate fruit and vegetable consumption among older adult Canadians</p> <p>Unobtrusive in-home detection of time spent out-of-home with applications to loneliness and physical activity</p> <p>Nutritional risk and body mass index predict hospitalization, nursing home admissions, and mortality in community-dwelling older adults: results from the UAB Study of Aging with 8.5 years of follow-up</p> <p>Using multi-level data to estimate the effect of social capital on hazardous alcohol consumption in the former Soviet Union</p> <p>Living alone and alcohol-related mortality: a population-based cohort study from Finland</p> <p>Eating habits and appetite control in the elderly: the anorexia of aging.</p> <p>Effects of depression and social integration on the relationship between alcohol consumption and all-cause mortality</p> <p>The anatomy of loneliness</p> <p>Contribution of risk factors to excess mortality in isolated and lonely individuals: an analysis of data from the UK Biobank cohort study.</p>
Research exploring psychological links between loneliness/social isolation and mortality	<p>Loneliness and risk of mortality: a longitudinal investigation in Alameda County, California</p> <p>The Pathophysiology of Perceived Social Isolation: Effects on Health and Mortality.</p> <p>Loneliness and cardiovascular disease and the role of late-life depression</p> <p>Longitudinal study of suicide after traumatic injury</p> <p>Is depression in old age fatal only when people feel lonely?</p> <p>Suicide and suicidal behavior</p> <p>Psychosocial influences on the development and course of coronary heart disease: Current status and implications for research and practice</p>
Papers exploring potential interventions	Effects of psychosocial group rehabilitation on health, use of health care services, and mortality of older persons suffering from loneliness: a randomized, controlled trial

**to decrease loneliness
and social isolation**

The personal and community impact of a Scottish Men's Shed
Psychosocial interventions for patients with coronary heart disease and depression: A systematic review and meta-analysis
Pet ownership protects against the risks and consequences of coronary heart disease
[An exploration of the value and mechanisms of befriending for older adults in England](#)
[The role of social relations in health promotion](#)
[Exploring interactive surface designs for eliciting social activity from elderly adults](#)