Age and Ageing 2021; **50:** 1329–1335
https://doi.org/10.1093/ageing/afab004
Published electronically 11 February 2021

RESEARCH PAPER

Mortality risk associated with combinations of loneliness and social isolation. Findings from The Irish Longitudinal Study on Ageing (TILDA)

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Abstract

Background: Social distancing and similar measures in response to the coronavirus disease 2019 pandemic have greatly increased loneliness and social isolation among older adults. Understanding the association between loneliness and mortality is therefore critically important. We examined whether combinations of loneliness and social isolation, using a metric named social asymmetry, was associated with increased mortality risk.
Methods: The sample was derived from participants in The Irish Longitudinal Study on Ageing, a nationally representative sample of community-dwelling older adults aged ≥50. Survey data were linked to official death registration records. Cox proportional hazards regressions and competing risk survival analyses were used to examine the association between social asymmetry and all-cause and cause-specific mortality.
Results: Of four social asymmetry groups, concordant low lonely (low loneliness, low isolation) included 35.5% of participants; 26.4% were concordant high lonely (high loneliness, high isolation); 19.2% were discordant robust (low loneliness, high isolation) and 18.9% discordant susceptible (high loneliness, low isolation). The concordant high lonely (hazard ratio [HR] = 1.43, 95% confidence interval [CI]: 1.09–1.87) and discordant robust (HR = 1.37, 95% CI: 1.04–1.81) groups had an increased mortality risk compared to those in the concordant low lonely group. The concordant high lonely group had an increased risk of mortality due to diseases of the circulatory system (sub-distribution hazard ratio = 1.52, 95% CI: 1.03–2.25).
Conclusion: We found that social asymmetry predicted mortality over a 7-year follow-up period. Our results confirm that a mismatch between subjective loneliness and objective social isolation, as well as the combination of loneliness and social isolation, were associated with an increased all-cause mortality risk.

Keywords: mortality, loneliness, social isolation, social asymmetry, ageing, older people

Key Points

- Social asymmetry captures the degree of overlap between subjective loneliness and objective social isolation.
- Combinations of loneliness and social isolation are associated with premature mortality.
- Loneliness and social isolation are distinct constructs that are independently associated with premature mortality.
- Policies in response to the COVID-19 pandemic have greatly increased loneliness and social isolation among older adults.

Introduction

The absence of strong social ties in the form of loneliness and social isolation have been shown to be harmful to both physical and psychological well-being [1–5]. A recent meta-analysis by Holt-Lunstad *et al.* found that the risk of mortality associated with both actual and perceived social isolation was comparable to that of established risk factors, including smoking [6]. Findings such as these have led to loneliness being of critical concern to public health practitioners. This concern has been heightened by health policy responses to the coronavirus disease 2019 (COVID-19) pandemic which have greatly curtailed opportunities for social interactions. Social distancing and similar measures in response to the COVID-19 pandemic have greatly increased loneliness and social isolation among older adults [7–9]. The negative impacts of these measures on the physical and psychological well-being of older adults are not yet understood but are likely to be dramatic and long lasting.

Loneliness is the subjective assessment of an individual's satisfaction with the quality of their social relationships and is typically considered the psychological embodiment of social isolation [10]. Social isolation on the other hand, is an objective measure or count of an individual's social contacts [11]. Studies have previously reported on the association between loneliness and social isolation and mortality risk, with mixed results. Julsing *et al.* [12] found no association between loneliness and all-cause, cardiovascular and non-cardiovascular deaths among Dutch men, whereas research from the US Health and Retirement Study [13] and elsewhere [14] found that loneliness did predict early mortality. On the other hand, research from the English Longitudinal Study of Ageing found that although both loneliness and social isolation were associated with premature mortality, social isolation was the more important factor [10].

The correlation between loneliness and social isolation tends to be weak [2,3,10,15] and the level of agreement or discordance between the two may be important, particularly as loneliness and social isolation relate differently to health outcomes, including mortality [6,10,12,14]. There may also be important discordance between loneliness and social isolation whereby individuals may report high levels of loneliness despite being objectively socially integrated and vice versa [15]. Despite this, few studies have examined the two constructs concurrently which has potentially limited our understanding of their intersection [6,16]. Furthermore, it has been suggested that the adverse effects of loneliness may be overestimated when an objective measure of social isolation is not accounted for in analyses [10,17].

Among the competing theories that aim to explain loneliness in later life, cognitive discrepancy theory states that loneliness stems from a mismatch between desired and actual frequency and quality of social interactions [1,18]. To accurately capture this concept requires that we derive a measure that takes account of both an individual's subjective feelings of loneliness and an objective measure of their social integration or isolation. To achieve this, we used a measure of 'social asymmetry'. This construct was first proposed by McHugh *et al.* (2017) who found that a mismatch between loneliness and isolation was associated with cognitive performance, and suggested that this metric may be useful to distinguish the effects of loneliness and social isolation on other health-related outcomes. Since previous studies on the mortality risk associated with loneliness and/or social isolation have not explicitly captured combinations of the two constructs, our aim was to examine whether the concordance and discordance between the two was associated with increased mortality risk.

Methodology

Data were from The Irish Longitudinal Study on Ageing (TILDA), a prospective nationally representative study of community-dwelling adults aged ≥50 years resident in the Republic of Ireland. Details of the methodology employed by TILDA are described elsewhere [19–22]. In summary, TILDA participants were selected using multi-stage stratified random sampling whereby 640 geographical areas, stratified by socioeconomic characteristics, were initially selected. Forty households were then randomly selected within each of these areas. The Irish GeoDirectory listing of all residential addresses provided the sampling frame. The first wave of data collection was conducted between 2009 and 2011, with subsequent waves collected at 2-year intervals. At Wave 1, 8,175 CAPI interviews were completed with a response rate of 62%, and 85% ($n = 6{,}915$) of these respondents returned Self-Completion Questionnaires (SCQs). Details of the sample maintenance strategies used by TILDA are also reported elsewhere [19]. A full description of all the variables used in our analyses is provided in Appendix A and summarised here.

Dependent variable

Cause of death was identified from official death registration data and linked to individual level survey data from TILDA. Linked survey-death registration data were available for 550 decedents [23].

Independent variables

Baseline loneliness was measured using a modified version of the University of California Los Angeles Loneliness scale [24]. The size of social networks was measured using the Berkman-Syme Social Network Index [11]. To capture the level of overlap and discordance between loneliness and social isolation, we constructed a measure of social asymmetry according to the method proposed by McHugh *et al.* (2017). The four groups arrived at were: Concordant high lonely (high loneliness, high isolation); Concordant low lonely (low loneliness, low isolation); Discordant susceptible (high loneliness, low isolation); and Discordant robust (low loneliness, high isolation).

Statistical approach

We used Cox proportional hazards regression models to estimate the hazard ratios for the association between social asymmetry and all-cause mortality. Respondents lost to follow-up were right-censored at the end of the follow-up-period (March 2017). We chose the concordant low lonely group (low loneliness and low social isolation) as the reference category as based on previous literature, we hypothesised that this would be the group with the lowest risk of premature mortality. To estimate the association between social asymmetry and cause-specific mortality for deaths due to neoplasms and diseases of the circulatory system, we conducted a competing risk survival analysis [25]. This approach takes account of the fact that there are competing risks to survival when examining cause-specific mortality. Participants can survive, die from the specific cause of interest, or die from another, competing cause. Interpretation of the resulting sub-distribution hazard ratios (SHR) is similar to that of the Cox hazard ratio (HR) [26]. Survey weights were applied to adjust our estimates for clustering and stratification due to the complex multi-stage sampling design. These weights also accounted for systematic differences in participation among different sub-groups to ensure that any estimates derived from the sample are representative of the wider population of community-dwelling adults aged 50+. All analyses were conducted using Stata/MP 14.2 [27].

Results

Figure 1 shows the distribution of social isolation and loneliness scores. Overall, 7.5% (95% CI: 6.8–8.2) of the sample were in the most isolated group which included those with one or fewer regular social contacts, whereas 23.1% (95% CI: 22.1–24.1) were in the most integrated group. In terms of loneliness, 34.3% (95% CI: 33.1–35.5) had the lowest loneliness score.

The percentage of participants in each social asymmetry category is shown in Figure 2. The concordant low lonely group was largest and included 35.5% (95% CI: 34.2–36.9) of participants. The next largest category was concordant high lonely (26.4%, 95% CI: 25.2–27.6). These were followed by discordant robust (19.2%, 95% CI: 18.1–20.4) and discordant susceptible (18.9%, 95% CI: 17.8–20.0). The characteristics of the total sample and within each social asymmetry group are reported in Appendix B.

The results of the unadjusted Cox proportional hazards regression model for all-cause mortality and competing risk survival analyses for neoplasms and diseases of the circulatory system are presented in Table 1. Concordant low lonely (low loneliness and low social isolation) was the reference social asymmetry category. Participants in the concordant high lonely (HR = 1.55, 95% CI: 1.22–1.98), discordant susceptible (HR = 1.43, 95% CI: 1.10–1.87), and discordant robust (HR = 1.54, 95% CI: 1.18–2.00) categories, had an increased mortality risk. An increased risk of mortality from diseases of the circulatory system was observed among the concordant high lonely group (SHR = 1.75, 95% CI: 1.20–2.54) and the discordant susceptible group (SHR = 1.66, 95% CI: 1.05–2.61).

Next, we adjusted the three risk models by sociodemographic and health-related covariates. These adjusted estimates are presented in Table 2. We found that the pattern of risk among the social asymmetry categories was unchanged by the inclusion of covariates. Participants in the concordant high lonely (HR = 1.43, 95% CI: 1.09–1.87) and discordant robust (HR = 1.37, 95% CI: 1.04–1.81) categories, each had an increased mortality risk compared to those in the concordant low lonely group. Furthermore, participants in the concordant high lonely group had an increased risk of mortality due to diseases of the circulatory system (SHR = 1.52, 95% CI: 1.03–2.25).

Women were less likely than men to have died during the study follow-up period and were also less likely than men to have died due to cancers or diseases of the circulatory system. Given these differences and established gender differences in mortality, we estimated gender specific hazard models according to the same specifications as above. These results are presented in Figure 3. Women in the discordant susceptible (HR = 1.67, 95% CI: 1.09–2.56) and discordant robust group (HR = 1.66, 95% CI: 1.08–2.54) had an increased risk of all-cause mortality, whereas men in these groups did not.

Discussion

We found that social asymmetry did predict mortality over a 7-year follow-up period. Our results therefore suggest that a mismatch between subjective loneliness and objective social isolation/integration, as well as the combination of high loneliness and social isolation, were associated with an increased all-cause mortality risk. We also showed that the nature of this association was different for men and women and differed according to the specific underlying cause of death. The increased risk of mortality among the discordant groups was due to the increased risk among women. This is despite the fact that women have a lower mortality risk overall. This suggests that discordance between isolation and loneliness may be more keenly felt by women. An analysis of the association between these asymmetry groups among men and women, and other health-related outcomes would enable us to test this contention.

In comparison with the concordant low lonely category, both the concordant high lonely group and the discordant robust group had a greater risk of all-cause mortality. The concordant high lonely group had an increased risk of death from diseases of the circulatory system among men in particular, whereas women in this group had an increased risk of death due to cancers. Although many of the differences in risk estimates were small, they do suggest some potential important patterns.

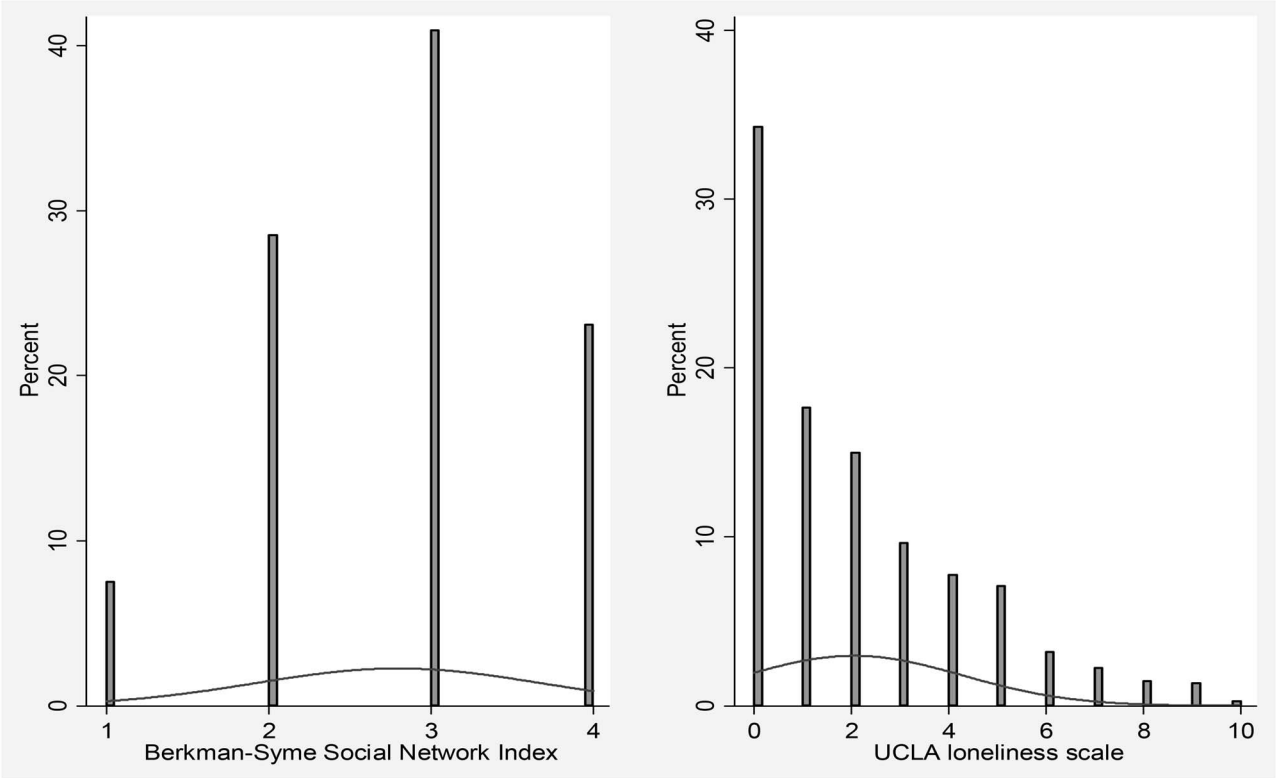

Figure 1. Distribution of social isolation and loneliness scores.

Table 1. Unadjusted association between social asymmetry and all-cause and cause-specific mortality. The reference category is concordant low lonely

	Concordant high lonely			Discordant susceptible			Discordant robust		
	(S)HR	95% CI	*P* value	(S)HR	95% CI	*P* value	(S)HR	95% CI	*P* value
All-cause[a] (*n* = 550)	1.55	1.22–1.98	<0.001	1.43	1.10–1.87	0.008	1.54	1.18–2.00	<0.001
Neoplasms (*n* = 215)	1.19	0.86–1.67	0.297	0.96	0.65–1.43	0.845	1.07	0.72–1.58	0.749
Circulatory system (*n* = 183)	1.75	1.20–2.54	0.003	1.66	1.05–2.61	0.029	1.45	0.93–2.24	0.101

[a]Coefficients for all-cause mortality are reported as hazard ratios estimated using standard Cox proportional hazards regression. Coefficients for cause-specific mortality are sub-distribution hazard ratios [25]. Median follow-up time = 3.8 years.

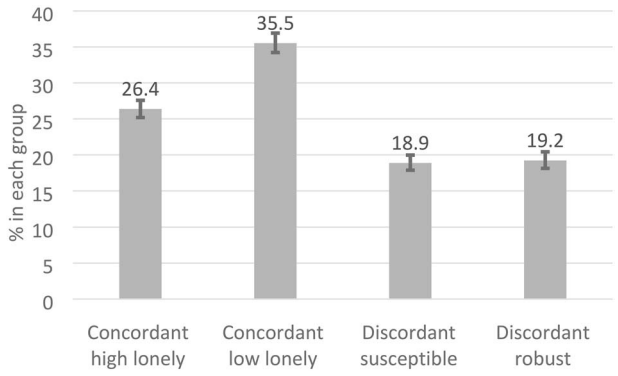

Figure 2. Percentage (and 95% error bars) of participants in each of the four social asymmetry categories.

Some previous studies have compared the effect of both loneliness and social isolation on health outcomes, including frailty [4,5], and mortality [10], and the authors of the social asymmetry metric found that the combination of low loneliness and high social isolation was predictive of cognitive performance cross-sectionally [15]. Our analysis is the first to demonstrate that while the combination of high loneliness and social isolation is the most damaging, a discrepancy between the two is also associated with premature all-cause mortality. Importantly, by combining the two constructs we have also avoided the risk of over estimating the association between loneliness and death noted previously [10,17].

Although loneliness is associated with depressive symptomology, the inclusion of depression in our adjusted survival analyses did not explain the association between social asymmetry and all-cause or cause-specific mortality. Therefore, there are other potential pathways that might explain these associations, such as health-related behaviours, healthcare access and utilisation, and physiological mechanisms. Although the difference in the estimated risk was small (1.37

Table 2. Association between social asymmetry and all-cause and cause-specific mortality, adjusted for covariates. Estimates of the risk associated with each covariate are also shown

	All-cause[a] (550 deaths)			Neoplasms (215 deaths)			Circulatory system (183 deaths)		
	HR	95% CI	*P* value	SHR	95% CI	*P* value	SHR	95% CI	*P* value
Concordant low lonely	Reference category			Reference category			Reference category		
Concordant high lonely	1.43	1.09–1.87	0.009	1.18	0.82–1.69	0.375	1.52	1.03–2.25	0.036
Discordant susceptible	1.26	0.94–1.68	0.118	1.02	0.68–1.53	0.923	1.28	0.77–2.12	0.345
Discordant robust	1.37	1.04–1.81	0.027	0.99	0.65–1.49	0.946	1.19	0.75–1.88	0.469
Female (versus male)	0.58	0.48–0.71	<0.001	0.73	0.55–0.97	0.030	0.57	0.41–0.78	<0.001
Urban (versus rural)	0.94	0.77–1.16	0.576	1.06	0.80–1.40	0.711	1.04	0.77–1.41	0.793
Primary education	Reference category			Reference category			Reference category		
Secondary	0.90	0.72–1.12	0.350	1.15	0.84–1.58	0.394	0.74	0.52–1.05	0.090
Third/higher	0.93	0.71–1.21	0.562	1.13	0.79–1.62	0.504	0.56	0.35–0.88	0.012
Never smoked	Reference category			Reference category			Reference category		
Past	1.05	0.84–1.30	0.680	0.98	0.70–1.36	0.883	1.15	0.80–1.64	0.445
Current	2.12	1.62–2.78	<0.001	2.06	1.38–3.09	<0.001	2.00	1.30–3.06	0.002
Walk minutes	1.00	1.00–1.00	0.167	1.00	1.00–1.00	0.527	1.00	1.00–1.00	0.235
Problem alcohol	1.03	0.71–1.50	0.864	1.29	0.81–2.04	0.283	1.18	0.68–2.06	0.564
Obese	1.03	0.82–1.30	0.776	0.91	0.66–1.27	0.589	0.99	0.69–1.41	0.940
Any CVD	0.83	0.66–1.05	0.128	0.80	0.58–1.09	0.153	1.16	0.78–1.72	0.458
Any chronic condition	1.25	0.90–1.75	0.183	1.61	0.99–2.60	0.054	0.98	0.58–1.64	0.923
Depressive symptoms	1.02	1.00–1.04	0.044	1.01	0.99–1.04	0.307	1.01	0.99–1.04	0.254
Polypharmacy	1.25	1.01–1.55	0.044	0.89	0.64–1.24	0.476	1.24	0.89–1.73	0.202

[a]Coefficients for all-cause mortality are reported as hazard ratios estimated using standard Cox proportional hazards regression. Coefficients for cause-specific mortality are sub-distribution hazard ratios [25]. Median follow-up time = 3.8 years.

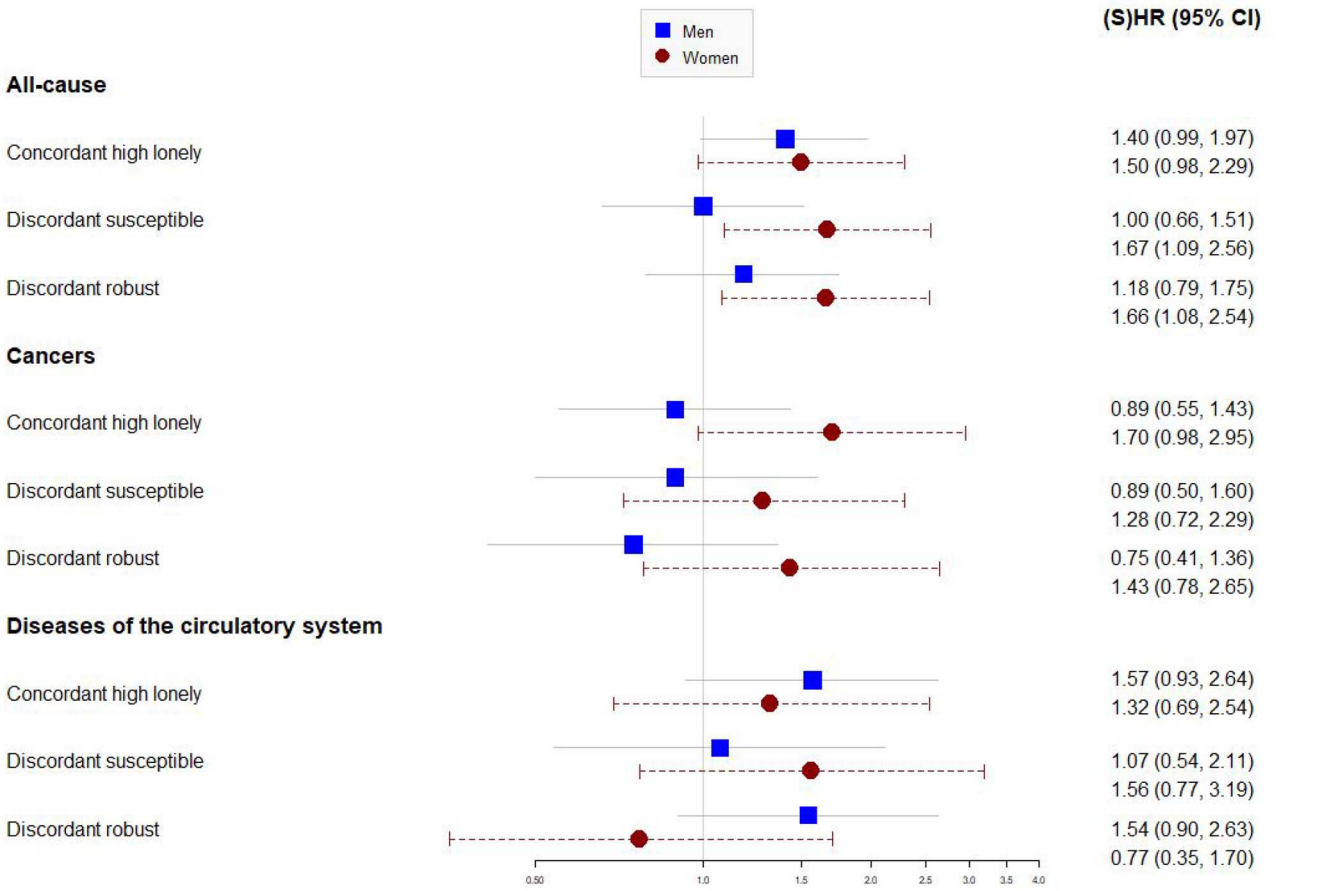

Figure 3. Association between social asymmetry and all-cause and cause-specific mortality, adjusted for covariates and stratified by gender.

versus 1.26) the fact that the discordant robust group had a higher risk than the discordant susceptible group suggests that social isolation may be more strongly associated with premature mortality than loneliness. Although this contention is in line with previous findings reported by others, including Steptoe *et al.* [10], our ability to establish more firmly if this is the case is limited by a lack of precision due to the small number of deaths our estimates are based on. As such, our findings generally support the contention that although loneliness is often seen as the psychological expression of objective social isolation, it does not in fact explain the association between social isolation and mortality.

Research on loneliness and social isolation is characterised by a multitude of definitions of both concepts and disagreement over how they relate to each other. For example, loneliness is sometimes considered akin to a personality trait [28], whereas elsewhere it is understood to be a psychological process [1,29]. In practice, this has resulted in a situation whereby loneliness and social isolation are typically examined separately [6,16], or treated as independent constructs in analyses [10].

An important strength of this research is our use of data from a nationally representative cohort of older adults, and importantly, our inclusion of linked official death registration data. These data allowed us to examine cause specific as well as all-cause mortality and our results highlight the important differences that can only be elucidated using this more finely grained death certificate information.

As our findings are based on an observational study, we cannot wholly discount the possibility that loneliness and social isolation are simply a feature of the end-of-life phase and therefore the observed association between loneliness and mortality is an artefact of multimorbidity. However, we controlled for many health conditions, including multimorbidity, in our analyses and in sensitivity analysis (Appendix C) we re-estimated our models excluding deaths that occurred within 1 year of baseline interview. As these results were similar to those when all deaths were included, it is unlikely that loneliness or social isolation are simply an inevitable feature of older age.

Finally, our findings demonstrate the importance of stratifying analyses of mortality by gender as failing to do so may mask important differences. Furthermore, where data are available to do so, it is important that researchers examine cause-specific mortality as limiting analyses to heterogeneous all-cause mortality data may mask important difference in the association between hypothesised risk factors and death. This in turn may mask insights into potential mechanisms to account for, in this case, the association between loneliness and social isolation and mortality.

Conclusion

Our findings show an association between loneliness, social isolation and premature mortality among older adults. Our results suggest that social isolation in particular may be an important risk factor, independent of other health-related variables, including comorbidities. As such, loneliness and social isolation may be complicit in some of the excess mortality associated with the COVID-19 pandemic. It is important that we consider this in our response to the residual effects of the COVID-19 pandemic.

We have also demonstrated the potential utility of a method by which both loneliness and social isolation can be considered in conjunction with each other so that we can account for both overlap and discrepancies between the two concepts. These combinations may be important as they suggest that a one-size-fits-all approach to local or national policy interventions may not work. As others have noted previously [2,6], we believe that efforts to address this growing public health concern must consider both loneliness and social isolation, as improving either one is unlikely to necessarily enhance the other. These findings take on an increased importance in the wake of responses to the COVID-19 pandemic including social distancing and cocooning. Loneliness and social isolation will have been impacted dramatically during the pandemic and this will have negative consequences for the physical and mental health of older adults. It is therefore critical that we understand the interplay between loneliness and social isolation so that impactful responses can be developed [7,9]. As part of this, our findings support the need for healthcare professionals to consider loneliness during clinical assessments of their patients. These interventions may benefit from the application of social prescribing, whereby clinical staff refers their patients to non-clinical community groups and services. This provides a practical example of how the social, as well as physical, needs of older adults may be met.

Declaration of Sources of Funding: This work was supported by the Health Research Board Investigator led projects scheme (ILP-PHR-2017-022). TILDA is co-funded by the Government of Ireland through the Department of Health, by Atlantic Philanthropies, and by Irish Life PLC.

The funders played no role in designing or conducting the study or in the collection, management, analysis or interpretation of the data, nor did they have any input into preparation, review or approval of this manuscript.

Declaration of Conflicts of Interest: None.

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Received 29 July 2020; editorial decision 18 December 2020