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Investigating the impact of loneliness and social isolation on health

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Executive Summary

The impact of loneliness and social isolation on health has become a salient public health topic in recent years, with the WHO Commission on Social Connection and the US Surgeon General calling for loneliness to be treated as a health priority. The Office for National Statistics published data in June 2024 reporting that across Great Britain 8% of adults state they feel lonely often or always.

There is a broad body of research that examines the links between loneliness, social isolation and a range of physical and mental health and wellbeing outcomes. However, most of this evidence explores the associations between loneliness, social isolation and health, and does not tell us if loneliness and social isolation themselves cause worse health outcomes[1].

We wanted to investigate whether we could understand if loneliness and social isolation cause poor health. In collaboration with the University of Bristol, Amsterdam University Medical Centre and other academic partners, we conducted an analysis to investigate potential causal links between loneliness, social isolation, and worse health outcomes. Our aim was to determine whether being lonely or socially isolated contributed to worse health outcomes.

Key results

We conducted three types of analysis (observational, sibling control and Mendelian randomisation (MR). We say there is good evidence of causality when we find an effect across all three types of analysis and when the sensitivity analysis for Mendelian randomisation also supports the presence of a causal effect. You can find more information on our analysis in the results section of this report and the technical report.

- There is good evidence that loneliness causes worse mental health and wellbeing outcomes. The impact on mental health is potentially large. For example, people who report feeling lonely are 2.25 times more likely to have been diagnosed with depression compared to those who don't report feeling lonely.
- There is also good evidence that social isolation causes lower levels of happiness and meaning in life, two of our wellbeing outcomes. Social

isolation was associated with mental health but it was not clear if this relationship was causal.

- The evidence was mixed for whether loneliness causes worse general health outcomes. We found no evidence that social isolation causes worse general health outcomes.
- We did not find evidence that loneliness or social isolation causes worse physical health outcomes.

Recommendations

Our findings suggest that tackling loneliness and social isolation could be an effective strategy to improve the population's mental health and wellbeing. Given the current challenges facing the delivery of mental health services, it should be a priority to establish the relative cost-effectiveness of loneliness interventions to improve mental health and wellbeing, in relation to other interventions aimed at improving mental health and wellbeing.

However, we find conflicting results for the impact of loneliness and social isolation on physical and general health outcomes. More research is needed to know whether tackling loneliness and social isolation will lead to an improvement in these outcomes.

Assessing the evidence of the links between loneliness, social isolation and health

Loneliness has gained momentum as an area of policy focus in the UK and globally. In 2018 the UK became the first country to introduce a dedicated Minister for Loneliness, followed by Japan in 2021. The UK government's tackling loneliness strategy aimed to improve understanding of what causes loneliness, reduce stigma and ensure that loneliness is considered across all areas of policy making.

Loneliness and social isolation have emerged as significant public health concerns, impacting individuals across age groups and backgrounds. A substantial body of evidence presents links between loneliness and a wide range of indicators of poor health (Holt-Lunstad, 2021). However, there is a lack of understanding about how loneliness might cause poor health, which is critical for designing effective interventions (Malcolm et al., 2019).

The scale of loneliness and social isolation in the UK

How are loneliness and social isolation defined and measured?
Loneliness is a subjective feeling of distress arising from a perceived mismatch between desired and actual social relationships (Perlman and Peplau, 1981). It is typically assessed using scales such as the UCLA loneliness scale and De Jong Gierveld Loneliness Scale, as well as the measure adopted by the Office for National Statistics. These tools ask questions like how often a person feels lonely, left out, or dissatisfied with their social relationships.

Social isolation is defined in many ways but the definition used for the purposes of this report is that it is an objective measure of being alone and having few or infrequent social contacts. Social isolation questionnaires include the Lubben Social Network Scale and Berkman-Syme Social Network Index (Valtorta et al., 2016). Proxy measures, such as whether or not someone lives alone, their marital status or the groups they belong to, are also frequently used by researchers as a measure of their social connection (Holt-Lunstad and Steptoe, 2022; Mansfield et al., 2024).

Recent surveys indicate that loneliness affects a substantial portion of the adult population in Great Britain, but it is not evenly distributed.

- 8% of adults in Great Britain say they feel lonely "often" or "always' '.
- Groups more likely to experience loneliness include those with long-term disabilities or health conditions, people living in deprived areas, LGBTQ+ individuals, and ethnic minorities.
- Loneliness may be most prevalent during adolescence and early adulthood, with one survey stating 10% of 16-24 year olds report frequent loneliness.

Unlike loneliness, there is currently no standardised UK measure and no routine monitoring of social isolation in the UK. Estimates tend to rely on proxy indicators like living alone or measuring the frequency of someone's social contacts (Holt-Lunstad and Steptoe, 2022). For instance, over 8 million people currently live alone, while the European Social Survey suggested in the period between 2002 and 2018, 17-23% of the UK population experienced social isolation, meaning they saw friends/family or colleagues in a social context once a month or less (d'Hombres et al., 2021).

Loneliness, social isolation and health

Numerous observational studies have concluded that both loneliness and social isolation are associated with general, physical and mental health outcomes (Holt-Lunstad, 2021; Leigh-Hunt et al., 2017; Park et al., 2020). Weak social connections are estimated to increase the likelihood of early death by 50%, which may be comparable to smoking 15 cigarettes a day and more damaging to health than obesity (Holt-Lunstad et al., 2010).

The extent of research exploring the impact of loneliness or social isolation on health outcomes varies, as does the size of the reported associated risks (see Table 2, Appendix 1). The associations of loneliness and social isolation with increased risk of mortality, depression, and cardiovascular disease are the most substantial and well-established (Leigh-Hunt et al., 2017). For example, loneliness is associated with a 2.3 times increased likelihood of depression (Mann et al., 2022) and social isolation is associated with a 1.5 times greater risk of coronary heart disease (Steptoe and Kivimäki, 2013).

The size of these associations suggests that loneliness and social isolation may be significant issues for people's health; however, the presence of an association does

not mean one factor causes the other (or vice versa). It is important, therefore, that we understand if these associations reflect a causal impact (e.g. being lonely causes depression) and whether reducing loneliness and social isolation will improve health outcomes.

Association and causation

- **Association** is a relationship between two factors in which they vary together. For example, as loneliness increases the risk for depression increases. However, it does not mean that a change in one factor caused the change in the other.
- **Causation** is a relationship between two factors where a change in one brings about change in the other.

Understanding whether loneliness and social isolation cause worse health

Establishing causation is a common problem in epidemiology and there is no easy answer; there are no statistical tests for establishing causality (Howick et al., 2019). However, some methods are better suited than others to assess whether a relationship is causal. Below we discuss what previous research may tell us about whether loneliness and social isolation cause poor health. We discuss:

- How observational studies can give us an understanding of association but are limited in their ability to tell us about causality, and
- Experimental studies that can give us an indication of whether the associations found in observational studies are causal.

Observational studies: cross-sectional and longitudinal

The majority of research on loneliness, social isolation and health, comes from observational studies[2]. From these, we know that there are often large associations of loneliness and social isolation with health outcomes, even when controlling for the effect of other factors (e.g., age and gender). However, it is difficult to establish causality with observational studies. Other factors that have not been controlled for may be influencing both loneliness and health outcomes, resulting in a misleading association. Additionally, poor health could lead to increased loneliness and social isolation rather than the other way around - something called reverse causality (Howick et al. (2019). Longitudinal studies are less prone to these issues than cross-sectional ones but do not eliminate them entirely (Rohrer and Murayama, 2023).

Experimental studies

The best way to establish causation between loneliness or social isolation and a health outcome is to conduct a randomised controlled trial where individuals are randomly allocated to an intervention group or control group where they do not receive the intervention. However, it is often not ethical to randomise people to be isolated or feel lonely, especially for extended periods. Given this, other types of experimental studies may provide the 'next-best' estimate of causality.

Below we highlight evidence from a range of experimental studies that either focus on short-term effects or do not directly manipulate social isolation or loneliness. However, they do help provide evidence on whether there are causal effects of loneliness and social isolation on health. These studies are arguably less prone to the pitfalls of establishing causality in observational studies that we have discussed.

- **Non-randomised trials of social isolation,** ie, trials without a control group, have found that socially isolating individuals between eight and ten hours increased fatigue (Stijovic et al., 2023) and reduced happiness (Tomova et al., 2020).
- **Cyberball randomised trials,** where participants play a virtual game designed to manipulate social inclusion or ostracism, show that being ostracised reduces positive affect and increases anxiety (Hartgerink et al., 2015).
- **Social interaction randomised trials,** where participants are instructed to have short interactions with strangers, found increased mental wellbeing (Gunaydin et al., 2021; Kardas et al., 2022; Sandstrom and Dunn, 2014).
- **Loneliness reduction interventions,** where participants engage with interventions designed to reduce loneliness (e.g. therapy and social skills development). Many studies that report reductions in loneliness also report positive changes in health-related indicators, including depressive symptoms, sleep, blood pressure, inflammation, health-related quality of life, and primary care attendance (Creswell et al., 2012; Kahlon et al., 2021; Käll et al., 2021; McDaid and Park, 2021; Pitkala et al., 2009; Theeke et al., 2016).
- **Animal experiments,** where isolation is experimentally manipulated in animals, have found that rodents exhibit depressive, anxious, hyperactive, and addiction-like behaviours, some of which persist even after re-socialization (Orben et al., 2020).

The experiments presented above provide some evidence that loneliness and social isolation have a negative causal impact on health outcomes and that it is not just an association. However, each of these methods has its limitations. Non-randomised trials don't have a control group (e.g., non-isolated participants to compare outcomes against) and as such, are considered to be at higher risk of bias. Cyberball and social interaction experiments are only tangentially related to loneliness and social isolation. For the loneliness interventions, we can't be sure that the impact on health is a result of reductions in loneliness or as a result of some other impact of the programme (eg, self-efficacy, greater physical activity, etc).

In situations like this, where experimental studies can get you only so far towards establishing causation, more novel approaches to experimental design may be explored. One such approach is **Mendelian randomisation**[3]. Mendelian randomisation is a method that takes advantage of the fact that our genes are randomly assigned at conception to create a type of natural experiment[4]. Studies using this method have found mixed impacts of loneliness on cardiovascular outcomes (Abdellaoui et al., 2019; Cai et al., 2024), and consistent evidence that loneliness increases the risk of depression (Gu et al., 2023; Sbarra et al., 2023; Zhu et al., 2024) but no effect of social isolation on depression (Socrates et al., 2023).

In summary, there is a large association between loneliness and social isolation with various health outcomes. Experimental studies suggest that this relationship is causal, ie, loneliness and social isolation cause worse health outcomes, but further research is needed to validate this.

In Chapter 2 we present the results of a study conducted in collaboration with the University of Bristol, Amsterdam UMC and other academic partners, which contributes to the understanding of whether loneliness and social isolation cause worse health outcomes. This study is the most comprehensive application of Mendelian randomisation to date in examining the health effects of loneliness and social isolation. It is, to our knowledge, the first to employ sibling control analysis in this area of research. It is also the first to triangulate results across observational analysis, sibling control analysis, and Mendelian randomisation.

Our results: Investigating causal relationships between loneliness, social isolation and health

To address the need for more robust research on the potential causal relationship between loneliness, social isolation, and health outcomes, we conducted a study in collaboration with the University of Bristol, Amsterdam UMC and other academic partners.

The headline findings of this study are as follows:

- There is good evidence that loneliness causes worse mental health and wellbeing outcomes.
    - The impact on mental health is potentially large. For example, people who report feeling lonely are 2.25 times more likely to have been diagnosed with depression compared to those who don't report feeling lonely. This is comparable to negative life events such as bereavement and unemployment.
- There is also good evidence that social isolation causes lower levels of happiness and meaning in life, two of our wellbeing outcomes. Social isolation was associated with mental health but it was not clear if this relationship was causal.
- The evidence for the effect of loneliness on general health outcomes was mixed. We found good evidence that loneliness causes an increased risk of multimorbidity and a decrease in quality-adjusted life years (QALYs) and that loneliness may cause an increased risk of early death. However, loneliness did not seem to cause an increase in the number of times someone is admitted to hospital.
- We did not find evidence that loneliness causes worse physical health outcomes. Possible reasons for the contradiction between this result and the results for general health are discussed in the results section.
- We did not find evidence that social isolation causes worse physical health outcomes.

Analytical Methods, Data and Measures

Analytical methods

We used three analytical methods aimed at identifying a causal relationship between loneliness and social isolation and health outcomes: observational analysis, sibling control analysis, and Mendelian randomisation. By triangulating the results from these approaches, we aimed to make a unique contribution to the existing evidence base and better understand how loneliness and social isolation impact health. An extended description of these methods is available in Appendix 2 and the technical report.

Observational analysis[5] is a common method used in this research area, relying on comparing health outcomes of individuals reporting and not reporting loneliness. This method gives us the association between loneliness and health outcomes whilst controlling for the effect of demographic and socio-economic factors, e.g. age, sex, education, disability and adverse childhood experiences.

Sibling control analysis builds on our observational analysis. In this analysis, we control for the effect of the same factors as we do in our observational analysis. In addition, sibling control analysis then takes advantage of the fact that siblings share some genetic and environmental factors and controls for these as well. By controlling for more factors than observational analysis, sibling control analysis can get us closer to an estimate of a causal effect.

Mendelian randomisation[6] is a method that takes advantage of our genes being randomly assigned at conception to create something similar to a randomised controlled trial. The likelihood of any individual experiencing something like loneliness or high blood pressure is affected by our genes (nature) and environment (nurture). As such, the likelihood that an individual experiences loneliness or social isolation is partially determined by whether they randomly received a particular combination of genes at birth. Mendelian randomisation exploits this random genetic propensity to loneliness and social isolation. In our case, it allows us to determine whether people randomly genetically predisposed to loneliness or social isolation are also more likely to have adverse health outcomes. A critical assumption for the robustness of Mendelian Randomisation is that the genetic variants related to loneliness or social isolation must only affect the health outcome (e.g., blood pressure) via its effects on loneliness or social isolation. We conducted

sensitivity analyses to determine whether this was the case (further details are in our technical report).

Triangulation[7] is how we bring these results together. In this process, we first use our observational analysis to establish whether there is an association between loneliness or social isolation and a given health outcome. We then use the results from our sibling control analysis and our Mendelian randomisation analysis to provide evidence of whether an association reflects a causal impact of loneliness or social isolation on the health outcome. If we find consistent effects across our three analyses this provides confidence that there is a causal effect. We say there is good evidence of causality when we find an effect across our three types of analysis (observational, sibling control and Mendelian randomisation) and when the sensitivity analysis for Mendelian randomisation also supports the presence of a causal effect.

Magnitude of effects

When discussing the magnitude of an effect in the results we rely on the sibling control analysis. This is because (a) this method gives a more robust estimate of the size of the effect than observational analysis and (b) the magnitude of effects in a Mendelian randomisation analysis are not as interpretable.

Data

The main data source for the analysis is UK Biobank, a large UK-based population study. This dataset includes information on the genetic makeup of around 500,000 people living in the UK, their self-reported loneliness, social isolation, and health outcomes, with data from between 2006 and 2021. Where required, we complement this data with genetic information from other datasets. Further details on the datasets used can be found in our technical report.

Measures

Loneliness and social isolation

In the observational and sibling control analysis and some of our Mendelian randomisation analysis, our measure of loneliness is a binary (yes/no) measure of loneliness in response to the survey question "Do you often feel lonely?". We use slightly different measures for loneliness and outcomes in some of our Mendelian

randomisation analysis due to the specifics of the method. Further details can be found in the technical report.

Our measure of social isolation is a combination of responses to two questions: 1) frequency of friend/family visits and 2) number of people in their household. The combined social isolation measure ranges from 0 to 2 with a higher score reflecting greater social isolation.

Health outcomes

In this study we examine three categories of health outcomes: 1. general health (reflecting the overall health status of an individual), 2. physical health and 3. mental health and wellbeing. The health outcomes in this study are listed in Table 1 below. Further details about the measures used in this report can be found in Appendix 3.

Table 1: Health outcomes

General health	Physical health	Mental health*	Wellbeing*
Quality-adjusted life years (QALYs)	Coronary Artery Disease (CAD)	Self-harm	Wellbeing spectrum
Death	Systolic blood pressure	Suicide attempts	Positive affect/ happiness
Hospital admissions	Heart failure	Depression diagnosis**	Life satisfaction
Multimorbidity (having two or more health conditions)	Stoke	Depression trait**	Meaning in life
	Type 2 Diabetes	Anxiety diagnosis**	
		Anxiety trait**	

*Mental health and wellbeing outcomes are separated here but considered together in our results section.

***Diagnosis outcomes are whether or not an individual has a clinical diagnosis of depression and anxiety. Trait outcomes are individuals' scores on questionnaires designed to assess the degree of depression and anxiety.*

Results

In this section, we present and discuss the results of our analyses. Results tables and figures are available in Appendix 4.

Loneliness results

Loneliness and general health

Overall, we found mixed evidence that loneliness causes worse general health. Our results found that being lonely:

- Causes a decrease of one percentage point in quality-adjusted life years (QALYs);
- Causally increases the likelihood of experiencing multimorbidity (having two or more health conditions) by 1.73 times;
- Is associated with a higher risk of death at a given time by 25%, though the causal impact is more uncertain;
- However, being lonely did not seem to impact the number of times that someone is admitted to hospital.
- See results in Table 4 and Figure 1 in Appendix 4.

In our observational analysis, we find that loneliness is associated with worse health for all four of our general health outcomes: death, multimorbidity, hospital admissions, and QALYs.

The sibling control and Mendelian randomisation analysis provide evidence of a causal impact of loneliness on multimorbidity and QALYs. Those who report being lonely have an increased likelihood of multimorbidity of 1.73 and experience a one percentage point decrease in QALYs.

For risk of death, we found an effect in our sibling control analysis suggesting a causal effect but our Mendelian randomisation result was too imprecise to verify this. The effect of loneliness on death is possibly quite large with our sibling control estimate suggesting that those who report being lonely are at a 25% increased risk of dying at a given time.

We did not find causal evidence that loneliness increases the number of times someone is admitted to hospital in our sibling control analysis. However, the sibling control result was not precise enough to rule out small effects. Our Mendelian randomisation result was too imprecise to provide evidence for or against causality.

In summary, our results provide evidence that loneliness causes an increased risk of multimorbidity and a decrease in QALYs and that loneliness may cause an increased risk of early death. We did not find evidence that loneliness increases the number of times someone is admitted to hospital.

Loneliness and physical health

Overall, we did not find clear evidence that loneliness causes worse physical health outcomes for those we examined. We found that loneliness:

- Was associated with coronary artery disease (CAD) and heart failure but it is not clear if these relationships are causal;
- Was not associated with stroke and Type 2 Diabetes;
- Surprisingly, seems to be linked to lower blood pressure, but again this relationship may not be causal.
- See results in Table 5 and Figure 2 in Appendix 4.

We found that loneliness was negatively related to CAD and heart failure in our observational analyses. However, results from sibling control analysis did not provide support that this relationship was causal. The sibling control results are precise enough to rule out the possibility of very large causal effects of loneliness on CAD and heart failure. The Mendelian randomisation results for stroke and heart failure were consistent with the sibling control results. They show no effect, providing evidence that the associations for these outcomes are not causal. These results suggest that if there is an effect, it is likely small to medium. In sum, these results support there not being a causal effect of loneliness on CAD and heart failure but, if there is one, it is unlikely that it is a very large effect.

We did not find an association between loneliness, stroke and Type 2 diabetes in any of our analyses. We found that loneliness may lower systolic blood pressure which was the opposite direction to the one we expected. It wasn't clear from our sibling control and Mendelian randomisation analyses whether this relationship was causal.

The results for the effect of loneliness on physical health seem to contradict the potentially large effects found for loneliness on the general health outcomes of multimorbidity and death. Three possible explanations for this inconsistency are:

1. The effect of loneliness on each individual physical health outcome may be too small to detect in our analysis but the cumulative effect of these small effects can be observed in the general health outcomes;
2. The physical health outcomes that explain the connection between loneliness and general health were not included in this study;
3. For multimorbidity and QALYs specifically, the result may be primarily driven by mental health (see our mental health results below).

In summary, despite the results we found for general health, we do not find strong evidence that loneliness causes the specific physical health outcomes studied here.

Loneliness, mental health and wellbeing

Overall, we found good evidence that loneliness causes worse mental health and wellbeing outcomes. We found that loneliness:

- Increases the likelihood of experiencing mental health problems and lowers wellbeing;
- These effects are potentially large. For example, we find that those who are lonely are 1.69 times more likely to self-harm than not, 1.85 times more likely to have attempted suicide and 2.25 times more likely to have been diagnosed with depression, compared to individuals who are not lonely.
    - For comparison, adults who lost a parent in childhood are 2.16 times more likely to be diagnosed with depression (Simbi et al., 2020), and those who are unemployed are 1.88 times more likely to be diagnosed with depression (Amiri, 2022).
- See results in Table 6 and Figure 3 in Appendix 4.

Loneliness is negatively associated with all our mental health and wellbeing outcomes in the study. We also find an effect in all our sibling control and Mendelian randomisation results providing evidence that the relationship is causal. The only exception is the Mendelian randomisation result for anxiety diagnosis (a clinical diagnosis of anxiety), though we do find an effect on anxiety trait (a measure of anxiety from individuals' response to an anxiety questionnaire). The overall pattern of results provides strong evidence of a causal impact of loneliness on mental health and wellbeing.

The results from our sensitivity analyses for Mendelian randomisation broadly support our conclusion that loneliness causes worse mental health and wellbeing. See the technical report for details of these analyses.

In summary, these results suggest good evidence that loneliness causes worse mental health and wellbeing outcomes.

Social isolation results

Social isolation and general health

Overall, we did not find evidence that social isolation causes worse general health outcomes. There was evidence of associations in our observational analysis but these mostly disappeared when conducting sibling control analyses and Mendelian randomisation analysis. However, in most cases, it is not possible to tell if this was a result of these analyses being more imprecise than observational analyses or because there is no causal impact. See results in Table 7 and Figure 4 in Appendix 4.

Social isolation and physical health

Overall, we did not find evidence that social isolation causes worse physical health outcomes. We found an association in our observational analysis between social isolation and three of our five physical health outcomes: decreased risk of CAD, increased risk of type 2 diabetes and increased systolic blood pressure. However, when conducting sibling control and Mendelian randomisation analysis, these effects disappeared and we did not find evidence to suggest causal relationships with any of the physical health outcomes. The results for these outcomes across analyses are inconsistent, which suggests a causal effect is unlikely. However, we note that some of the Mendelian randomisation analyses are again very imprecise. See results in Table 8 and Figure 5 in Appendix 4.

Social isolation, mental health, and wellbeing

Overall, we found good evidence that social isolation causes worse wellbeing for some wellbeing outcomes. It was not clear whether social isolation caused worse mental health outcomes. We found that social isolation:

- Causes lower levels of happiness and meaning in life, two of our wellbeing outcomes.

- Social isolation is associated with worse mental health outcomes, but it was not clear whether this is a causal relationship.
- See results in Table 9 and Figure 6 in Appendix 4.

We found an association between social isolation and all of the mental health and wellbeing outcomes examined in our observational analyses, except for the anxiety trait.

For positive affect/happiness and meaning in life, we found evidence that these associations are causal. The effects in our sibling control and Mendelian randomisation analyses were consistent with observational results, providing evidence that social isolation causes a decrease in positive affect/happiness and meaning in life outcomes. Results from our sensitivity analyses for Mendelian randomisation broadly supported these conclusions (see the technical report for more details).

It was not clear whether social isolation caused worse wellbeing as measured by the wellbeing spectrum and life satisfaction outcomes. We were only able to examine these outcomes using Mendelian randomisation. Whilst we don't find an effect at commonly used significance levels, the direction of effect is consistent with the other wellbeing results. Without our other methods to triangulate these findings with, we do not come to a strong conclusion on these outcomes.

It was also not clear whether there was a causal impact of social isolation on our mental health outcomes (self-harm, suicide attempt, depression diagnosis, depression trait, anxiety diagnosis, anxiety trait). We did not find effects in our sibling control analysis. However, it was inconclusive whether this was because there was no effect or whether the sibling control analysis was not precise enough to detect the effect. Our Mendelian randomisation results were too imprecise to provide evidence for or against causal effects. As a result, we cannot rule out causal effects on our mental health outcomes.

In summary, we found evidence that social isolation causes worse wellbeing for some wellbeing outcomes. We found that it is associated with worse mental health but it wasn't clear whether this relationship was causal.

How our results fit with previous research

Our results for mental health and wellbeing are consistent with previous research. We found that almost all our mental health and wellbeing outcomes are associated with loneliness and social isolation. Our results support the idea that loneliness and social isolation have a negative impact on many of these outcomes, particularly for loneliness.

We found evidence that loneliness and social isolation are associated with worse general health outcomes, which is in line with previous research. However, we found mixed evidence for whether this association was causal. We found evidence for a causal effect of loneliness on multimorbidity and QALYs and possibly for early death. On the other hand, we did not find evidence that the association between social isolation and general health outcomes was causal.

The most significant discrepancy between our study and previous research was for physical health outcomes. We found inconsistent associations in our observational analysis between loneliness, social isolation, and physical health outcomes, especially for social isolation. These differences may be because we control for different factors in our analysis to those controlled for in other studies (see results tables in Appendix 2 to see the different levels of adjustment we used and Appendix 5 to see how different levels of adjustment affect results).

For social isolation specifically, our contrasting results might be because our measure differs from those used in other studies. For example, we did not include group activities or social support in our measure of social isolation, whereas other studies do. We decided not to include group activities as we felt there was too great a risk that these activities impact health through means other than isolation (e.g., sports club/gym attendance may affect health through physical activity rather than reduction in social isolation). We didn't include social support as we felt this is better treated as a separate construct from social isolation.

Strengths and limitations of our analyses

Strengths

- We used multiple methods, all of which have their own strengths and weaknesses. By interpreting the results of these together we have greater confidence in our findings as they're less likely to be impacted by a specific weakness of a single method.

- Our analyses included a range of outcomes. We also included, for some of the outcomes, both binary and continuous measures of the same concept e.g., for depression and anxiety. This approach allowed for a comprehensive assessment of the relationship between loneliness, social isolation and health.

Limitations

- Our Mendelian randomisation analysis, and in some cases our sibling control analysis, lacked enough precision to provide evidence for or against there being a causal effect of the size found in our observational analysis.
- Our loneliness measure had limitations. The measure was a binary response to a single survey question asking whether the respondent was lonely. A composite measure may have provided more informative results.
- Our measure of social isolation also had limitations. Social isolation is an objective measure of being alone and having few or infrequent contact. Our measure only included the number of people in the household and the number of visits with family/friends. This is not a precise measure of how much time someone spends alone and the frequency of their social contacts.

Our recommendations

Policy implications

Our findings suggest that addressing loneliness could be an effective strategy for policy makers aiming to improve the population's mental health and wellbeing. We found strong evidence that loneliness causes depression which is comparable to the effects of bereavement and unemployment. However, it is not clear whether targeting loneliness and social isolation will improve physical health outcomes.

There is evidence of effective ways to tackle loneliness. A review commissioned by the Department for Media, Culture, and Sport identified effective approaches including Cognitive Behavioural Therapy (CBT), social support interventions, and interventions involving art and dance activities.

Whilst we have evidence these interventions work, it is less clear whether they are cost-effective compared to other methods of improving mental health and wellbeing outcomes. We recommend further research to investigate the relative cost-effectiveness of loneliness and social isolation interventions to support future policy decisions. It is important to note that there are many reasons beyond the scope of this report for why tackling loneliness and social isolation could be important. Loneliness is a feeling that one's social connections are not what one wants them to be and can be viewed as important in and of itself. Loneliness and social isolation may also impact other non-health-related outcomes, such as community cohesion.

Research recommendations

We recommend two ways that researchers studying interventions to reduce social isolation and loneliness can design their research in order to have the greatest impact on policy.

1. **An assessment of the cost-effectiveness of different interventions to tackle loneliness as a method of improving mental health**

As our study found that loneliness has an impact on mental health, it is worthwhile to explore the cost-effectiveness of different types of interventions to reduce

loneliness and their impacts on mental health. Future research should report the cost of interventions and the impacts on mental health outcomes.

There is a possibility that tackling loneliness could also be a cost-effective route to improve mental health for policy makers. To understand if reducing loneliness as a means to tackling poor mental health could contribute to providing solutions to the challenges and waiting lists experienced in accessing mental health support, it is important to understand more about the cost-effectiveness of different loneliness interventions in comparison to other interventions aimed at improving mental health and wellbeing.

Studies of the broader cost-effectiveness of interventions would also be of use. This would involve capturing a wider range of health outcomes, beyond just mental health, and measuring the impacts on healthcare utilisation (see McDaid et al. (2021) for an example of a cost-effectiveness evaluation of a loneliness intervention).

2. **Including health outcomes in loneliness and social isolation intervention trials**

Researchers studying the impact of loneliness and social isolation interventions should include health outcomes in their study. Many studies have done this previously, as discussed earlier in the report. The benefits of this are two-fold. One is discussed above - measuring these outcomes can give us a better estimate of the cost-effectiveness of interventions. The second is that it will help build the evidence on the causal impacts of loneliness and social isolation on health. However, there are a couple of challenges in using results from intervention studies to evidence the causal effects of loneliness and social isolation

The first is that many effects on health due to reductions in loneliness or social isolation are likely to take a longer period of time to manifest than is feasible to measure in a typical randomised control trial. Despite this, it would still be of use to see what the shorter-term impacts of loneliness and social isolation are on health, if any. If it can be established that there are short-term impacts through robust trials, this can help to improve the current evidence base. The second is that it will be difficult to know whether the intervention is improving health outcomes due to reductions in loneliness or social isolation or whether it is due to other factors.

Despite these challenges, loneliness/social isolation intervention trials reporting impacts on health can contribute to the evidence base answering the question, do

loneliness and social isolation have a causal impact on health? Also, Including these health outcomes also has the added benefit of enabling more comprehensive cost-effectiveness analyses to be carried out.

Endnotes

1. **Association** is a relationship between two factors in which they vary together. For example, as loneliness increases the risk for depression increases. However, it does not mean that change in one factor caused the change in the other. **Causation** is a relationship between two factors where a change in one brings about change in the other.

2. An observational study is where researchers examine the relationship between a factor (eg, loneliness) and an outcome (eg, depression), whilst controlling for the effect of other factors (eg, age and gender). A cross-sectional observational study is one where the factor and the outcome are measured at the same point in time and a longitudinal observational study is where the outcome is measured at a later point in time than the factor.

3. We use Mendelian randomisation in our study reported in Chapter 2. To find out more about the method see the Analytical Methods section in Chapter 2 or or Appendix 2.

4. A natural experiment is where people are exposed to different conditions in real life but these conditions are not created by a researcher.

5. The type of observational analysis used in this study is multivariate regression analysis.

6. A video primer on Mendelian randomisation is available here.

7. A video explainer on triangulation is available here.

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