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1 **Abstract**

2 Loneliness and social isolation are recognised, conceptually-distinct threats to health  
3 and wellbeing in older age but limited evidence is available on their predictors in rural  
4 populations. This study performed logistical regression modelling to explore the  
5 predictors of loneliness, isolation from one's family and isolation from one's  
6 community in 884 British rural-living older adults (57.9% female, mean age 71.5 [SD  
7 8.1] years) within the Grey and Pleasant Land dataset. While 13 per cent of  
8 participants reported feeling lonely, 49 per cent reported isolation from their family  
9 and 9 per cent reported isolation from their community. Minimal cross-over between  
10 groups was observed. Widowhood, financial difficulties, area deprivation and self-  
11 reported impairments in physical and mental health predicted loneliness. Greater  
12 financial difficulty gave lower odds of isolation from one's family, and higher levels of  
13 community engagement gave lower odds of isolation from the community. Ageing in  
14 place (longer residency) was the only common predictor for all three dependent  
15 variables. Initiatives aimed at tackling loneliness and social isolation in rural-living  
16 older people must recognise that the two concepts are distinct, affecting different  
17 population sub-groups with mostly different risk factor profiles. Future interventions  
18 and policies should clearly identify whether their target is loneliness or social  
19 isolation and tailor their interventions appropriately.

20

21

22

# 1 Introduction

2 A lack of social connectedness is a known risk factor for mortality, comparable in  
3 magnitude to other established risk factors including smoking and obesity (Holt-  
4 Lunstad et al., 2010; 2015). A lack of social connectedness has been operationalised  
5 as a subjective feeling of loneliness, or objective concept, of being socially isolated.  
6 Loneliness has been defined as a discrepancy between the perceived quantity and  
7 quality of one's social relationships and one's desire for them (Scarf and de Jong  
8 Gierveld, 2008). Social isolation has been defined as less than weekly contact with  
9 family, friends or neighbours (Victor et al., 2003). A meta-analysis of 70 longitudinal  
10 cohort studies found that loneliness and social isolation each independently increase  
11 mortality risk by almost 30 per cent in a large and age-diverse sample, though  
12 objective social deficits were more detrimental to adults under age 65 (Holt-Lunstad  
13 et al., 2015). It is widely recognised that loneliness and social isolation are related  
14 but conceptually and empirically distinct; one can be socially isolated but not feel  
15 lonely and vice versa (Cornwell and Waite, 2009; Havens et al., 2004; Wenger and  
16 Burholt, 2004).

17

18 Social disconnectedness is seen in both younger and older adults. The UK has a  
19 higher prevalence of loneliness in younger (less than 25 years) and older adults  
20 (over 65 years), with around 9 per cent in both groups reporting feeling severely  
21 lonely, but only 5% of those aged 25 to 44 years feeling severely lonely (Victor and  
22 Yang, 2012). A recent analysis of representative UK-based data from the Opinions  
23 and Lifestyle Survey presented the same pattern in loneliness prevalence across  
24 5,159 individuals (Thomas, 2015). The prevalence of social isolation, about 5

1 percent, is similar across younger adults (Caspi et al., 2006) and middle-aged and  
2 older adults (Jivraj et al., 2012).

3  
4 While preventing or alleviating loneliness and social isolation is important across the  
5 lifespan, population ageing has led to an increased focus on identifying effective  
6 ways to achieve this in older age (e.g. Dickens et al., 2011). Evidence suggests that,  
7 in older age, loneliness might have more severe health consequences than social  
8 isolation (Holwerda et al., 2012; Tilvis et al., 2011). Longitudinal studies of older  
9 populations show that loneliness increases the risk of all-cause mortality, while social  
10 isolation does not (Holwerda et al., 2012; Tilvis et al., 2011). Loneliness increases  
11 the risk of peripheral vascular disease mortality (Patterson and Veenstra, 2010),  
12 cognitive decline (Boss et al., 2015) and results in a greater number of physician  
13 visits (Newall et al., 2015), irrespective of social isolation. These health effects may  
14 occur through the mechanism of biological stress brought on by the psychological  
15 experience of loneliness (Step toe et al., 2004). A meta-analysis of 91 prospective  
16 studies demonstrated that increased social contact frequency (the reverse of social  
17 isolation) had only a minimal effect on longevity (Shor and Roefs, 2015).

18  
19 There is some controversy within the literature however, which may stem from  
20 inconsistent definitions of social isolation. Step toe et al. (2013) found social isolation  
21 to be predictive of all-cause mortality, while loneliness was not. In this study social  
22 isolation included a measure of social participation, an active component which  
23 broadens the more common definition of social isolation as the quantity of social  
24 contact. Social participation has been analysed as a separate concept from social

1 isolation and found to have had a different longitudinal influence on mortality in an  
2 older Finnish population (Tilvis et al., 2011).

3

4 Loneliness has been conceptualised in various different ways. The cognitive  
5 perspective of loneliness conceptualises loneliness as arising from maladaptive  
6 cognitive and psychological processes, resulting in the negative interpretation of  
7 social cues, even when they are not (Cacioppo et al., 2003; Peplau and Perlman,  
8 1982). Using this perspective, several dimensions of loneliness have been formed.  
9 De Jong Gierveld et al. (2006) conceptualised loneliness as two-dimensional: a lack  
10 of social contact ('social loneliness') and a lack of emotional support ('emotional  
11 loneliness'). Cacioppo et al. (2015) argued a further differentiation: a perceived lack  
12 of social contact from the closest others (e.g. spouse; 'intimate loneliness'), friends  
13 or other family ('relational loneliness'), and one's wider social network ('collective  
14 loneliness'). Despite this theoretical complexity, a unidimensional concept of  
15 loneliness as a subjective satisfaction with one's total level of social contact had also  
16 been applied in many large studies (Fokkema et al., 2012; Sundström et al., 2009;  
17 Tilvis et al., 2011; Victor and Yang, 2012; Victor et al., 2005), and is used in the  
18 current study.

19

20 Researchers have also identified various social network types: 'friend', 'congregant',  
21 'family' and 'diverse' centred networks ('diverse' being a combination of all contact  
22 types) (Litwin and Shiovitz-Ezra, 2010). Different sources of social relationships (e.g.  
23 family or friends) have been seen to offer different levels of support for older  
24 Europeans (Wenger, 1997). Isolation from these different types of social networks  
25 may therefore also differ in their consequences on older adult health and wellbeing

1 and in their predictors. In this paper we focus on isolation from one's family and from  
2 one's friends and neighbours, to explore if they are experienced by older people with  
3 different personal and social characteristics.

4

5 Despite a growing awareness that social isolation and loneliness are conceptually  
6 distinct (Cacioppo et al., 2015), this is not yet reflected in policy and practice.  
7 National UK policy documents consistently use loneliness and social isolation  
8 interchangeably, or 'loneliness and social isolation' as one construct (House of Lords,  
9 2013). This is also true for many local policy documents in the UK (e.g. Devon  
10 County Council, 2013; Norfolk County Council, 2013; Wiltshire Council, 2013).  
11 Building on this, public interventions targeting social isolation may not benefit many  
12 individuals at risk/suffering from loneliness due to maladaptive social cognition  
13 (Cacioppo and Cacioppo, 2014). A systematic review found that only interventions  
14 addressing maladaptive social cognition were successful at lowering loneliness,  
15 whereas interventions focussing on social contact were able to widen individuals'  
16 social networks, but not lower loneliness (Masi et al., 2011). Similarly, the group  
17 interventions effective at reducing loneliness identified by Cattan et al. (2005) had an  
18 educational focus or provided targeted support activities for participants at risk, for  
19 example for widowed individuals. Thus, it may be that it was not just the bringing  
20 together of peers in a group setting which reduced loneliness, but that the  
21 interventions stimulated a cognitive shift to better handle their particular social  
22 context.

23

24 Identifying independent predictors of loneliness and social isolation may aid  
25 practitioners recognise individuals at risk and tailor interventions appropriately. In a

1 longitudinal study, worsening loneliness eight years after baseline measurements  
2 was significantly related to being no longer married, and showed a trend of relation  
3 to deterioration in social activity, increasing chronic illness, no longer cohabiting and  
4 a decrease in number of confiding relationships for UK older adults (Victor and  
5 Bowling, 2012). Cross-sectional, UK data show older age loneliness to be related  
6 with lower socio-economic status, less contact with one's children (Demakakos et al.,  
7 2006), lack of transport and living in a rural area (Drennan et al., 2008). Increasing  
8 social isolation over time was predicted by being male, less wealthy and living in  
9 rural areas in the English Longitudinal Study of Ageing (ELSA) (Jivraj et al., 2012).

10

11 Despite research findings that older adults living in rural areas are more likely to  
12 experience loneliness (Drennan et al., 2008) and social isolation (Jivraj et al., 2012)  
13 than their urban counterparts, few studies have been devoted to understanding  
14 loneliness and social isolation in a rural population (Burholt and Dobbs, 2012). Rural  
15 areas, defined as settlements with a population below 10,000 (Department for  
16 Environment, Food and Rural Affairs [DEFRA], 2013), house a higher proportion of  
17 adults over the age of 65 (25.0%) than urban areas in the UK (15.3%), a gap  
18 expected to widen further in the near future (DEFRA, 2015). Rural areas are also  
19 characterised by less accessible public transport, public facility maintenance (i.e.  
20 roads and pavements), commercial outlets, and health and social care services, as  
21 well as greater income inequality and fewer households with children living at home  
22 (Age UK, 2013; Le Mesurier, 2003; Philip and Gilbert, 2007). These factors may put  
23 rural residents at risk of declining social opportunities and possibly loneliness and/or  
24 social isolation as they age.

25

1 While a few studies compared predictors of loneliness and social isolation in older,  
2 rural populations (Burholt and Wenger, 2004; Havens et al., 2004), these relate to  
3 Welsh and Canadian older adults, respectively, and their findings are now dated. As  
4 different cultures, societies, and time-dependent political contexts influence the  
5 experience of loneliness (Yang and Victor, 2012), there is a need to re-investigate  
6 predictors of both social isolation and loneliness in recent UK-based data. This study  
7 explores the differences in predictors of loneliness and two types of social isolation  
8 (from one's family and from one's community) in an older, rural-living population  
9 living in UK.

10

## 11 **Methods**

### 12 **The Grey and Pleasant Land dataset**

13 The Grey and Pleasant Land (GaPL) study was designed to capture diversity in a  
14 representative sample of older adults living in rural areas in South West UK, where  
15 population ageing is more pronounced (Brown et al., 2005). The data was collected  
16 in 2009 and comprised quantitative survey responses from 920 adults aged 60 and  
17 over living across three rural communities in South Wales and three in South West  
18 England (Economic Social Research Council [ESRC], 2015). The survey included  
19 items on demographic, socio-economic, personal, social, environmental and  
20 transport-related factors (Shergold and Parkhurst, 2012). In each country, three  
21 areas were selected according to their fit to pre-defined types of rurality: Type A  
22 (remote and deprived), Type B (less remote and deprived) and Type C (less remote  
23 and less deprived). These rurality types were constructed by taking into account: the  
24 2005 DEFRA urban/rural definition of settlements (ONS, 2016); social, cultural,  
25 political and economic differences; lifestyle differences (e.g. retirement retreats or



1 dynamic commuter areas); the proximity to cities or large towns, nature of work (e.g.  
2 agriculture reliant), and the presence of older people using Census data (Hennessy,  
3 Means and Burholt, 2014). Type A areas adhered to DEFRA's Rural 80 classification,  
4 and both Type B and Type C areas adhered to the Rural 50 classifications (ONS,  
5 2016). For an in-depth account of the characteristics of each rural type see Burholt  
6 (2012).

7

8 Using Census data, every resident aged 60 and over in the selected areas was  
9 posted information about the study and given the choice to opt out. All residents who  
10 did not opt out were visited by researchers and, if consenting, asked to complete the  
11 survey in their native language (Curry and Fisher, 2013). The estimated response  
12 rate for households containing people age 60 and over was 68% (Hennessy, Means  
13 and Burholt, 2014).

14

## 15 Study design

16 The present secondary analysis of GaPL data was exploratory in nature, given the  
17 scarcity of recent findings about predictors of loneliness and social isolation in rural  
18 settings (Burholt and Dobbs, 2012). Multivariate binary logistic regression models  
19 were constructed to explore the associations between an array of socio-  
20 demographic, socio-economic, health-related and behavioural variables and three  
21 dependent variables: loneliness, isolation from family and isolation from the  
22 community. The sample was analysed as a whole in order to test potential predictors  
23 of loneliness and social isolation in a variety of rural settings (not testing between  
24 different types) and to attain the strongest possible statistical inferences. Potential

1 clustering by rural dwelling was controlled for in the models. Data from 884  
2 respondents was used, excluding 38 cases with incomplete datasets.

3

#### 4 Dependent variables

5 Loneliness: A unidimensional variable ('lonely', 'not lonely') was created from the  
6 question "*I experience a general sense of loneliness*" with response options 'agree',  
7 'disagree' or 'don't know'. As self-rating scales for loneliness tend to underestimate  
8 loneliness due to a propensity for lonely individuals to not want to admit their  
9 loneliness consciously or unconsciously (Perlman, 2004), the 'I don't know' response  
10 was interpreted as an indication of some level of loneliness, even if unconscious.  
11 Thus, consistent with coding approach used for De Jong Gierveld's loneliness  
12 measure (De Jong Gierveld en Kamphuis, 1985), 'agree' and 'don't know' were  
13 combined. A single item loneliness measure has been used in large English (Victor  
14 and Yang, 2012; Victor et al., 2005) and European studies (Fokkema et al., 2012;  
15 Sundström et al., 2009; Tilvis et al., 2011).

16

17 Social isolation variables: Variables ('isolated', 'not isolated') were constructed using  
18 the social isolation definition: 'having less than weekly direct contact with family and  
19 friends' (Victor et al., 2003). This definition has been used in other large studies  
20 (Jivraj et al., 2012; Holwerda et al., 2012; Tilvis et al., 2012). Isolation from family  
21 was defined as 'having less than weekly direct contact with family' and constructed  
22 using the question "*How often do you see any of your children or other relatives?*"  
23 Isolation from the community was defined as 'having less than weekly direct contact  
24 with friends and neighbours' and constructed using the questions "*If you have friends*  
25 *in this community how often do you have a chat or do something with one of your*

1 *friends?” and “How often do you have a chat with or do something with your*  
2 *neighbours?”*

3

#### 4 Explanatory variables

5 Due to the exploratory nature of this analysis, a range of explanatory variables were  
6 chosen. Some variables were chosen because they have previously been found  
7 related to loneliness or social isolation in urban, mixed or rural populations, and it is  
8 important to see whether these predictors are also valid in a more contemporary  
9 rural context. Predictors of loneliness include widowhood (Demakakos et al., 2006;  
10 Golden et al., 2009; Victor, et al., 2005; 2006; Victor and Yang, 2012; Wenger and  
11 Burholt, 2004), poor physical health (Drennan et al., 2008; Victor and Bowling, 2012;  
12 Wenger and Burholt, 2004), poor psychological health (Victor, et al., 2005), low  
13 education level (Victor, et al., 2005; Victor and Yang, 2012), low wealth status  
14 (Demakakos et al., 2006); recent immigration (Wenger and Burholt, 2004), lower  
15 levels of community participation (Newall et al., 2009). Predictors of social isolation  
16 include being unmarried (Golden et al., 2009; Jivraj et al., 2012), not being widowed  
17 (Jivraj et al., 2012), low wealth/socioeconomic status (Jivraj et al., 2012; Wenger, et  
18 al., 1995) and having a physical disability (Golden et al., 2009). The access to a car  
19 (Lee et al, 2011) and public transport (Shergold and Parkhurst, 2012) explanatory  
20 variables were included because they have been shown to be specifically important  
21 for the maintenance of social functioning in rural areas.

22

23 Some explanatory variables were chosen due to hypothesized relationships between  
24 certain behaviours and either loneliness or social isolation. Contact with children,  
25 either face to face or over the phone was a significant cross-sectional predictor of

1 loneliness data from the English Longitudinal Study of Ageing (ELSA) (Demakakos et  
2 al., 2006), and the authors argued that phone contact with children was important for  
3 parents who lived far from their kin. In a rural context, it can be expected that many  
4 children have moved away to find better employment opportunities and affordable  
5 housing (Wenger, 2001). Thus, access to a mobile phone was chosen as a predictor  
6 variable.

7 Physical activity variables were included as it is argued that individuals who feel  
8 lonely due to maladaptive social cognition may withdraw themselves from the  
9 company of others, perceiving the social exchanges to be of negative nature, and  
10 that this may then lead to less accumulated physical activity (Hawkey and Cacioppo,  
11 2010). In the reverse direction, less engagement with physical activity for any reason  
12 could also decrease the opportunities for social contact, and in this manner increase  
13 both social isolation and loneliness.

14

15 The range of explanatory variables were grouped thematically in order to perform a  
16 stepped regression analysis, and to exclude collinear variables within thematic  
17 groups. The themes included a) socio-demographic and socio-economic (SDSE)  
18 variables; b) health-related variables; and c) behavioural variables.

19

20 The SDSE variables comprised: 'widowhood' and 'household car access' (both  
21 'yes'/'no'), 'years of residence in the community' ('less than 5', '6-10', '11-20', '21-30'  
22 and 'more than 30 years'), 'educational attainment' ('no qualifications', 'primary',  
23 secondary', 'college level', 'tertiary'), 'perceived financial coping' ('living comfortably',  
24 'doing all right' and 'experiencing some to many problems') and 'neighbourhood  
25 deprivation rating' (membership of national quintiles of the English 2007 Indices of

1 Multiple Deprivation [IMD] and Welsh 2008 IMD scores). The English IMD scores  
2 include Census information on: income, employment, health and disability, education  
3 skills and training, barriers to housing and services, living environment and crime  
4 (Communities and Local Government, 2007). The Welsh IMD scores include Census  
5 information on: income, housing, employment, access to services, health,  
6 environment, education and crime and fire (Statistics for Wales, 2008).

7

8 Two health-related variables were used: perceived physical and mental health over  
9 the last four weeks. 'Perceived physical health' was constructed by combining two  
10 questions: *"How much did physical problems limit your usual physical activities?"* and  
11 *"How much energy did you have?"* Five response categories were constructed by  
12 taking the minimum response for both questions: 'not at all', 'very little', 'to some  
13 extent', 'quite a lot' and 'very limited' physical health. 'Perceived mental health' was  
14 constructed using responses to: *"How much did emotional problems limit your usual  
15 physical activities?"* merged into four response categories: 'not at all', 'slightly',  
16 moderately', 'quite a lot or very much'. The physical and mental health variables were  
17 only weakly correlated (Spearman's rho= 0.229,  $p < 0.001$ ).

18

19 Eight behavioural variables were computed: 'local social participation' (sum of weekly  
20 engagement in 12 types of community-based activities, e.g. residents' association,  
21 school, voluntary and charity group: '0', '1', '2', '3', '4 or more' types); frequency of  
22 'walking in the countryside', frequency of 'gardening' (both 'never', 'at least once a  
23 month', 'at least once a week' and 'most days'); 'total outdoor active pursuits' (sum of  
24 weekly engagement in nine physically active, outdoor pursuits, e.g. gardening,  
25 collecting, walking in the countryside: '0', '1', '2', '3', '4 or more'). Other variables

1 were 'telephone use' ('never/ don't own one', 'less than once a week', 'weekly' and  
2 'daily'), 'use of public transport' ('less than once a month', 'in last month', in last  
3 week') and 'assisting others' and 'caring for pets' (both 'yes'/'no').

4

## 5 Control variables

6 Older age (Demakakos et al., 2006; Drennan et al., 2008) as well as female gender  
7 (Victor and Yang, 2012) have been associated with loneliness, and older age  
8 (Goldern et al., 2009; Jivraj et al., 2012; Wenger, et al., 1995) and being male (Jivraj  
9 et al., 2012) associated with social isolation for adults over age 60. Age categories  
10 ('60-69', '70-79', '80-89', '90-99') and gender were therefore included as control  
11 variables so as to discount any potential influence of age and gender on social  
12 network size and loneliness while looking at the modifiable explanatory variables.  
13 Country (England or Wales) was also controlled for because the area deprivation  
14 variable (IMD) was constructed using different parameters in England and Wales.

15

## 16 Statistical analysis

17 The Stata 12.0 statistics package was used for all analyses. Cases with missing  
18 responses for any of the dependent variables were excluded (n=38). To assess  
19 potential selection bias, the responses of excluded and included cases were  
20 compared using the appropriate parametric tests (T-tests for continuous and binary  
21 variables and one-way ANOVA for ordinal variables with three or more levels). The  
22 proportion of respondents in each category of SDSE and rurality variables are  
23 presented for the whole sample and stratified by gender. The overlap between the  
24 three dependent variables was explored descriptively by cross-tabulation.

25

1 Binary regression modelling, adjusted for clustering for the six geographical areas to  
2 obtain robust standard errors (Rabe-Hesketh and Skondral, p.591, 2012), was used  
3 in all analysis. The resultant odds ratios (OR) and associated 95 per cent confidence  
4 intervals are reported, with statistical significance set at  $p < 0.05$ . Separate regression  
5 models were constructed for each dependent variable to test their associations with  
6 explanatory variables. Collinearity, defined as Spearman's Rho greater than or equal  
7 to 0.3, between all explanatory variables was tested prior to modelling.

8

9 Each dependent variable underwent five modelling steps (Models a-e) and all  
10 models were adjusted for age, gender and country. Model A: The dependent variable  
11 was entered with each explanatory variable into different univariate models. Model B:  
12 The explanatory variables in each sub-category (e.g. SDSE variables) with  
13 significant associations to the dependent variable in Model A were force entered as a  
14 group into an adjusted multivariate model. Model C: Explanatory variables with  
15 persisting significant individual associations in Model B of each sub-category (Wald  
16 test p-value) were force entered simultaneously in a multivariate model. Model D:  
17 Where collinear explanatory variables were both brought forward, a different model  
18 was constructed with each and the collinear variable with the highest statistically  
19 significant effect size retained in subsequent models. Model E: Explanatory variables  
20 with persisting significant associations in Models C and D, were force-entered into a  
21 fully-adjusted model with either global social isolation (isolation from both family and  
22 the community) added to the loneliness model, or loneliness added to the isolation  
23 sub-type models as another confounding variable. This was done to assure  
24 independent influences by the predictors, distinct from any potential overlap between  
25 loneliness and social isolation.

1

2 Missing responses of explanatory variables were coded as 999 ('missing') and  
3 retained in the logistic models to maximise the sample size. In each step,  
4 explanatory variables with ordered categories were entered as ordinal variables (to  
5 derive measures of effect size for each level). The missing values categories were  
6 tested against the reference category, but not included in the tables. Next, the logistic  
7 regression tests were repeated with the missing cases excluded, entering the  
8 explanatory variable as a continuous variable to test the overall trend of increasing  
9 category membership of these variables.

10

## 11 **Results**

### 12 **Participant characteristics**

13 Table 1 summarises the participant characteristics. The gender distribution was  
14 relatively equal (57.9% women), though younger respondents were over-  
15 represented. The average age was 71.5 (SD 8.2, range 60-97) and respondents  
16 were evenly distributed between the three pre-defined rural area types.

17

18 [TABLE 1]

19

20 The excluded cases were more likely to live alone (included 30% vs. excluded 47%,  
21  $p=0.047$ ) and in more deprived communities ( $p=0.011$ ), and had better levels of  
22 perceived mental health ( $p=0.013$ ) compared with included cases. All other variables  
23 did not differ significantly between included and excluded cases.

24

### 25 **Prevalence of loneliness and isolation variables**



1 Figure 1 shows the prevalence of the loneliness and isolation: 13 per cent (111/884)  
2 were classified as lonely. Eight per cent of the respondents (70/884) responded  
3 positively and five per cent (41/884) showed uncertainty ('don't know') to the direct  
4 loneliness question; 49 per cent (437/884) were isolated from their family; 9 per cent  
5 (80/884) were isolated from their community; and 5 per cent (45/884) were isolated  
6 from both family and community. While significantly more men were isolated from  
7 their family than women (54.1% vs. 46.3%,  $p=0.024$ ), no gender differences were  
8 observed for loneliness or isolation from the community (Figure 1). Significantly  
9 higher proportions of older respondents reported loneliness ( $p=0.018$ ), and to a  
10 lesser extent isolation from family ( $p=0.040$ ), although no differences were observed  
11 in isolation from the community (Figure 1).

12

13 [FIGURE 1]

14

15 Only 1.4 per cent (12/884) of respondents were lonely and isolated from both family  
16 and the community. Around a third of people who reported feeling lonely (36.0%,  
17 40/111) were not isolated in any way. A large proportion of those isolated from their  
18 family (85.6%, 374/437) or isolated from the community (75.0%, 60/80) were not  
19 lonely. Few of those isolated from their family were also isolated from the community  
20 (13.2%, 45/341); while around half of those isolated from the community were also  
21 isolated from their family (56.3%, 45/80).

22

23 [TABLE 2]

24

25 Factors associated with loneliness

1 In preliminary univariate models all six SDSE variables, both physical and mental  
2 health variables, and two behavioural variables (community engagement, telephone  
3 use) were significantly associated with reports of being lonely (Table 2). However, in  
4 the final, fully adjusted Model (Table 3), car access was dropped due to collinearity  
5 with widowhood and community engagement was dropped as it suppressed the effect  
6 of perceived financial difficulties. In both cases the retained variable showed the  
7 strongest effect. Factors which independently increased the odds of loneliness were:  
8 being widowed (OR=2.03, 95% CI: 1.56 to 2.64), perceived financial difficulties  
9 (OR=0.36, 95% CI: 0.17 to 0.79 for highest category vs. lowest), living in the 4<sup>th</sup>  
10 highest deprivation quintile vs. lowest (OR=1.81, 95% CI: 1.09 to 2.99), and feeling  
11 more limited by physical health (OR=1.12, 95% CI: 1.04 to 1.50) or mental health  
12 (OR=2.33, 95% CI: 1.23 to 4.38 for highest category vs. lowest). The only factor that  
13 reduced the odds of loneliness was a longer residence in the community (OR=0.80,  
14 95% CI: 0.68 to 0.94 for each 10 year increase, and OR=0.36, 95% CI: 0.17 to 0.79  
15 for being resident 30 years or over, vs. <5 years). When social isolation was added  
16 to the fully adjusted model, it significantly increased odds of loneliness (OR=2.59,  
17 95% CI: 1.09 to 6.14), and seemed to exert a very small moderating effect  
18 (increasing the strength of associations) between widowhood and loneliness, and  
19 between poorer mental health and loneliness. Further, it demonstrated a very small  
20 mediating effect (decreasing the strength of associations) between older age and  
21 loneliness. For the control variables in the fully adjusted model, each 10-year  
22 increase in age raised the odds of loneliness (OR=1.23, 95% CI: 1.03 to 1.47), but  
23 gender and country were not associated with loneliness.

24

25 Factors associated with *isolation from one's family*

1 In preliminary univariate models (Table 2) two SDSE variables (length of residence,  
2 perceived financial coping), and three behavioural variables (total weekly active  
3 pursuits, walking in the countryside, telephone use) were significantly associated  
4 with being isolated from one's family. However, in the fully adjusted Model (Table 3),  
5 only the two SDSE variables remained significant. A longer residence in the  
6 community decreased the risk of being isolated from one's family (OR=0.71, 95% CI:  
7 0.63 to 0.80 for each 10 year increase, and OR=0.27, 95% CI: 0.15 to 0.49 for being  
8 resident 30 years or over, vs <5 years). Counter-intuitively, perceiving financial  
9 difficulty also reduced the likelihood of being isolated from one's family (OR=0.67,  
10 95% CI: 0.53 to 0.84 for the highest vs. lowest category). When adding loneliness to  
11 the final model, it did not predict isolation from family, and did not change any of the  
12 associations between the predictors and isolation from family. For the control  
13 variables in the fully adjusted model, being male increased odds of family isolation  
14 (OR=0.25, 95% CI: 1.02 to 1.52) but age and country were not associated with  
15 isolation from family.

16

### 17 Factors associated with isolation from the community

18 In preliminary univariate models (Table 2) only one SDSE variable (length of  
19 residence), and two of the behavioural variables (community engagement, assisting  
20 others) were significantly associated with being isolated from the community. In the  
21 fully adjusted Model (Table 3) only length of residence and community engagement  
22 remained significant. A longer residence in the community decreased the risk of  
23 being isolated from the community (OR=0.85, 95% CI: 0.75 to 0.96 for each 10 year  
24 increase, and OR=0.48, 95% CI: 0.25 to 0.95 49 for being resident 30 years or over,  
25 vs <5 years). Each extra community engagement activity engaged in decreased the

1 odds of community isolation (OR=0.56, 95% CI: 0.41 to 0.77), with three or more  
2 community engagement activities decreasing the odds by over 80 per cent  
3 (OR=0.16, 95% CI: 0.03 to 0.73). When loneliness was added to the final model, it  
4 did not significantly predict community isolation, but showed a very small mediating  
5 effect (reducing the associations) between community engagement and community  
6 isolation, and a strong mediating effect between older age and community isolation.  
7 For the control variables in the fully adjusted model, being male increased odds of  
8 community isolation (OR=1.46, 95% CI: 1.07 to 1.99) but age and country were  
9 unrelated to community isolation loneliness were not significant.

10

11 [TABLE 3]

12

## 13 **Discussion**

14 This study explored the differences in predictors of loneliness and two types of social  
15 isolation (from one's family and from one's community) in adults aged 60 and older  
16 living in rural areas of south west UK. This is the first UK study to explore co-factors  
17 of these social variables in a large, diverse rural sample since the late 1980s (Burholt  
18 and Dobbs, 2012; Stockdale, 2011). As hypothesised, loneliness and the two  
19 isolation types had different, independent cross-sectional predictors, as supported by  
20 previous research (Havens et al., 2004; Wenger and Burholt, 2004). Being a  
21 newcomer in the community was the only predictor common to all three social deficit  
22 variables. Widowhood, older age and poor mental or physical health were only  
23 related to loneliness.

24

1 In our rural sample eight per cent agreed to being lonely and five per cent showed  
2 uncertainty ('don't know') to the loneliness question, which was interpreted as an  
3 underlying loneliness not expressed due to the taboo associated with loneliness  
4 (Perlman, 2004). The proportion of definite cases of loneliness seems similar to the 9  
5 per cent who were 'severely' lonely in a nationally-representative sample of UK older  
6 adults, which included more urban than rural-living participants (Victor and Bowling,  
7 2012). However, it is not possible to compare these questions due to their difference  
8 in wording and response categories. The level of social isolation (from both family  
9 and the community) was comparable to UK nationally-representative data at around  
10 5 per cent (Jivraj et al., 2012), though again, the constructs used to measure these  
11 were also worded differently, precluding accurate comparison. We found that gender  
12 was not associated with loneliness, supporting previous findings in UK older adults  
13 (Victor et al., 2006). Men were, however, more likely to experience both types of  
14 social isolation, supporting previous findings that older men in England were almost  
15 twice as likely as women to become socially isolated over time (Jivraj et al., 2012).  
16 The trend of higher odds of loneliness with increasing age also confirms previous  
17 evidence from longitudinal English (Jivraj et al., 2012; Shankar et al., 2013) and  
18 cross-sectional Irish data (Drennan et al., 2008). Given the over representation of  
19 adults aged 60 to 69, it may be that a large percentage of younger respondents were  
20 still working (Emmerson and Tetlow, 2006). This could play part in the age difference  
21 in feelings of loneliness, as retirement correlated positively with loneliness in several  
22 American datasets, despite this association not necessarily being of a cause and  
23 effect nature (Kerwin, 2004).

24

1 Widowedness is one of the most empirically supported predictors of loneliness in  
2 studies of older populations (Demakakos et al., 2006; Dykstra et al., 2005; Victor et  
3 al., 2005). The current findings and previous reports show that rural-living individuals  
4 are not different in this regard (Wenger and Burholt, 2004; Wenger et al., 1996). The  
5 relation of widowedness only to loneliness, not types of social isolation, supports the  
6 Cacioppo et al.'s (2015) differentiation between loneliness arising from loss of an  
7 intimate relationship, from that arising from a lack of wider relations or the collective  
8 community. A review of 39 qualitative studies of bereavement concluded that the  
9 relationships widoweders have with close others cannot replace that which is lost (the  
10 spouse) (Naef et al., 2013). Thus, adaptation to widowedness might not be as easy as  
11 gaining other close social contacts.

12

13 Physical and mental health has frequently been linked to the prevalence of  
14 loneliness across British, other European and American samples (Hawkley and  
15 Cacioppo, 2010). While the current study's cross-sectional association between  
16 perceived physical and mental health and loneliness cannot infer causality,  
17 longitudinal studies have found that loneliness is associated with the risk of being  
18 diagnosed with depression (Cacioppo et al., 2010) and Alzheimer Disease (Boss et  
19 al. 2015) and lower self-rated health (Hawkley et al., 2009). In a 20-year follow-up of  
20 older adults in rural Wales, deteriorating health was related to the onset of  
21 loneliness, but not social isolation (Burholt and Wenger, 2004). Longitudinal analysis  
22 of Dutch, American and English samples have also reported that improvements in  
23 physical health and function were associated with a reduced risk of being lonely  
24 (Dykstra et al., 2005; Luo et al., 2012; Victor and Bowling, 2012). Poor physical  
25 function and physical or mental health may be a way for health professionals to

1 identify individuals at risk of loneliness. The promotion of healthy lifestyles and  
2 physical activity could also have a role in preventing the onset of loneliness through  
3 preserving better physical health and function.

4

5 This study's finding that perceived financial difficulties increased odds of loneliness  
6 confirm other cross-sectional observations of English (Demakakos et al., 2006) and  
7 other European older samples (Drennan et al., 2008; Fokkema et al., 2012; Losada  
8 et al., 2012). The lack of association between financial difficulties and isolation from  
9 the community is similar to findings that wealth was not related to overall social  
10 isolation across 5 waves in the ELSA (Jivraj et al., 2012) and in a cross-sectional  
11 analysis of older adults in rural Canada (Havens et al., 2004). The association  
12 between greater perceived financial difficulties and more contact with one's family  
13 has not been previously reported. It could be that rural-dwelling individuals with  
14 financial issues tend to get instrumental help from their family but that this type of  
15 support is not emotionally beneficial, as odds of loneliness are worse. Similar  
16 differences between types of social support were seen in a 6-year study of 2,255  
17 Dutch middle aged and older participants, for whom emotional support, but not  
18 instrumental support, offered protective cognitive effects and loneliness relief  
19 (Ellwardt et al., 2013).

20

21 Engagement with more community activities was found to be associated with a lower  
22 risk for isolation from one's community. Community participation and altruistic  
23 behaviours, such as volunteering, inextricably involve social contact and have been  
24 related to increased psychological well-being and reduced all-cause mortality (Barron  
25 et al., 2009; Cattan et al., 2011). The lack of association with loneliness was

1 therefore a little surprising, given Canadian findings that greater weekly social  
2 participation was associated with less loneliness in both a cross-sectional analysis of  
3 1,243 older adults, and five year longitudinal analysis of 688 older adults (Newall et  
4 al. 2009). A possible explanation might be related to the classification of loneliness  
5 by Cacioppo et al. (2015) in three dimensions: intimate, relational and collective. It  
6 may be that community engagement activities can decrease the collective  
7 loneliness, which refers to “a person’s valued social identities or ‘active network’  
8 wherein an individual can connect to similar others at a distance in the collective  
9 space” (Cacioppo et al., 2015, p. 241). Intimate loneliness, which relates to the  
10 perceived absence of a significant close other, and relational loneliness, which  
11 relates to the perceived absence of quality friendships or family connections, are  
12 more likely to be related to widowhood and distance from kin. In this study, loneliness  
13 was measured as a unidimensional concept. Further investigation of dimensions of  
14 loneliness is needed to further differentiate its predictors in a rural setting.

15  
16 Similar to the findings of this study, Burholt and Wenger (2004) found that for the 30  
17 survivors of a 20-year study in rural Wales, the indigenous to the area were least  
18 likely to be lonely or socially isolated over time. Individuals who have lived longest in  
19 an area might have developed more meaningful friendships over time than  
20 newcomers. An earlier study of 240 older adults in rural North Wales found that long-  
21 term residents’ social networks were made up of family and friends living locally,  
22 while newcomers’ social networks comprised social contacts living further afield or  
23 contained very few contacts (Wenger, 1995). Newcomers in rural communities may  
24 be at risk of both social isolation and feelings of loneliness as the social networks  
25 between longstanding villagers may be strong and closed to new members. Length



1 of residence in a rural community may be an important index for practitioners to use  
2 to identify individuals who may benefit from some form of social intervention or  
3 assistance in relation to both loneliness and social isolation.

4

5 This study clearly reiterated the conceptual independence of loneliness and social  
6 isolation also reported in other studies (Cornwell and Waite, 2009; Havens et al.,  
7 2004). However, overall social isolation did independently predict loneliness and  
8 exert a small moderating influence on the effects of widowhood and poor mental  
9 health on loneliness. This supports Wenger and Burholt's (2004) conclusion from  
10 their 20 year rural follow up study that, despite the conceptual independence of  
11 loneliness and social isolation, certain situations (widowhood and deteriorating  
12 health) predispose older individuals to both loneliness and social isolation, and that  
13 at these points in life individuals need increased support.

14

## 15 Practical implications

16 Our findings strongly support the need to stop using the terms loneliness and social  
17 isolation interchangeably. They are conceptually distinct, occur in different population  
18 sub-groups and are associated with different health and social outcomes. Together  
19 with longitudinal findings from large European studies (Holwerda et al., 2012; Jivraj  
20 et al., 2012; Tilvis et al., 2011), our data supports the need for a shift in policy focus  
21 to include loneliness as well as social isolation, but to measure these independently.

22 It is likely that practitioners and policy makers have focussed on social isolation in  
23 the past because it is more easily represented by routinely recorded data, such as  
24 the number of people living in a household.

25

1 The current study's predictors of loneliness suggest factors which may be used to  
2 identify those at risk of loneliness in a rural older population. Nevertheless, this  
3 should not replace health practitioners directly discussing loneliness issues with their  
4 patients. Identifying and addressing loneliness is an important aspect of the  
5 emerging 'social prescribing' movement in which primary care services refer patients  
6 with social, emotional or practical needs to a range of local, non-clinical services,  
7 often provided by the voluntary or community sector (Jopling, 2016). Primary care  
8 practitioners are in a prime position to identify those at risk of loneliness, as they are  
9 often the first to know about an older adult's declining physical or mental health or  
10 bereavements which are important predictors of loneliness.

11

12 The findings of this study also highlight the importance of ageing in place with  
13 regards to social connections. Our data and previous reports show that migrating to  
14 a new area at an older age may put both rural (Wenger et al., 1996; Wenger and  
15 Burholt, 2004) and urban-dwelling (Jivraj et al., 2012) individuals at risk of loneliness  
16 and/or social isolation. In a qualitative case study comparison between urban and  
17 rural-living older English adults we found that the presence of supportive local social  
18 contacts was beneficial to staying actively engaged in their communities, regardless  
19 of setting (de Koning et al., 2015). However, rural-living older adults may be  
20 particularly prone to relocating at an older age and so losing touch with their  
21 neighbourhood community, given longitudinal Welsh findings that rural-living older  
22 adults are over 30 per cent more likely to move (either to a rural or urban place) than  
23 those living in Major Conurbations (Wu et al., 2015). Ageing in place is already a  
24 central focus of UK policy as stated in the "Ready for ageing?" report by Age UK and  
25 the International Longevity Centre (ILC) (Sinclair and Watson, 2013). However

1 increased effort is necessary to facilitate rural-living older adults to remain in their  
2 community may help preserve their social network, prevent loneliness, and optimise  
3 long-term wellbeing and ultimately health. Practically, such facilitation may take the  
4 form of greater provisions of public transport suitable for older adults, so that adults  
5 who have lost access to a car may remain independent (Shergold and Parkhurst,  
6 2012), and the provision of assisted-living arrangements for those in need.  
7 Furthermore, public health interventions could also focus on ways of assisting  
8 newcomers to rural areas to forge strong and long-lasting connections with existing  
9 residents. Such ideas need to be tried and tested with community intervention  
10 studies.

11

## 12 Strengths, limitations and recommendations

13 The GaPL dataset represents a large, diverse sample of people aged 60 and over  
14 living across six geographically and demographically different rural sites across one  
15 of the UK's most rapidly ageing regions, the South West (Office for National  
16 Statistics, 2012). Nevertheless, by design the six case studies approach, though well  
17 motivated, does not provide a probability sample and therefore strong  
18 generalisations for ageing in rural areas cannot be made. The over-representation of  
19 adults aged 60 to 69 years likely means many respondents were still employed, and  
20 that the findings apply mostly to the retirement transition period, rather than to later  
21 adulthood. Furthermore, the cross-sectional nature of the data precludes any  
22 inference of causality. Our findings add important value to an under-researched field  
23 of ageing research, however the hypotheses generated here should be tested with  
24 newly collected large, representative and ideally longitudinal data of rural-living older  
25 adults in the UK.

1

2 As with any secondary analysis, we were constrained by the existing measures  
3 available. For example, the wording for the social isolation questions regarding  
4 contact with family (specifying face-to-face contact) was different from questions  
5 reporting contact with neighbours and friends in the community (not specifying face  
6 to face contact). This may have exaggerated the difference between isolation from  
7 one's family and one's community members. Another limitation was the 'outdoor  
8 active pursuits' variable, which was a proxy for physical activity, and the 'community  
9 engagement' variable which was constructed from nine pre-defined activities. Thus  
10 these behavioural independent variables may not have been valid or sensitive  
11 enough to detect associations that have been identified in previous research (Newall  
12 et al., 2009; 2013). Future investigations using physical activity levels as predictor of  
13 loneliness or social isolation should use objective physical activity measurements, as  
14 self-reported physical activity is limited by recall accuracy (Colbert et al., 2012) and  
15 measure social activity through activity diaries. The findings of our study support the  
16 need to investigate the predictors of different dimensions of loneliness in rural  
17 populations as these are presented by Cacioppo and colleagues (2015), and  
18 different dimensions of social isolation (i.e. from family or from the community).As  
19 IMD is calculated differently across England and Wales, the findings of this study in  
20 relation to how area deprivation (IMD) co-varies with loneliness or social isolation  
21 need to be treated with caution.

22

## 23 Conclusions

24 The findings of this study strongly support the conceptual difference between  
25 loneliness and social isolation, whether from one's community or family, and highlight

1 a range of important predictors of loneliness and social isolation in rural living older  
2 adults. Researchers and practitioners are urged to use the appropriate measure of  
3 social isolation or loneliness depending on the focus of their programme.  
4 Widowhood, declining mental or physical health and financial difficulties were related  
5 independently to loneliness, regardless of social isolation, and so may be used to  
6 identify older people at-risk of loneliness in rural communities. A longer duration of  
7 residence seems an important aspect that strongly and independently lowered odds  
8 of loneliness and both types of isolation, warranting focussed public strategies to  
9 facilitate ageing in place and successful social integration of newcomers in rural  
10 areas.

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