



Physical multimorbidity and wish to die among adults aged ≥ 65 years: A cross-sectional analysis of the Irish Longitudinal Study on Ageing

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ABSTRACT

Background: Physical multimorbidity (i.e., ≥ 2 chronic conditions) may induce feelings of wish to die (WTD), but there is limited literature on this topic, while the mediators in this association are largely unknown. Thus, the aim of the present study was to investigate this association and its mediators among older Irish adults.

Methods: Cross-sectional, nationally representative data from Wave 1 of the Irish Longitudinal Study on Ageing 2009–2011 were analyzed. Information on self-reported lifetime diagnosis of 14 chronic physical conditions were obtained. WTD was defined as answering affirmatively to the question “In the last month, have you felt that you would rather be dead?” Multivariable logistic regression and mediation analyses were conducted.

Results: Data on 2941 adults aged ≥ 65 years [mean (SD) age 73.2 (5.2) years; 45.0 % males] were analyzed. Physical multimorbidity was associated with 3.39 (95%CI 1.58, 7.28) times higher odds for WTD. This association was largely explained by pain (% mediated 28.1 %), followed by depression (19.4 %), sleep problems (18.4 %), perceived stress (13.0 %), loneliness (10.4 %), anxiety (8.1 %), and disability (7.2 %).

Conclusions: Multimorbidity was associated with increased odds for WTD among Irish older adults. Addressing the identified mediators may contribute to reducing feelings of WTD among older adults with multimorbidity.

1. Introduction

Wish to die (WTD), also known as passive death ideation or a death wish, involves thoughts of one's own death, that one would be better off dead, or wishing for one's death (Silverman et al., 2007). It is important to highlight that WTD is a distinct construct from suicidal ideation as it does not necessarily involve thoughts or plans of taking one's own life (Szanto et al., 1996). WTD is a relatively new phenomenon under study and limited data exists on the concept in comparison to suicidal ideation. However, research suggests that the prevalence of WTD in the European older adult population is high. For example, in a European cohort of 6791 community-dwelling older adults (mean age 80 years) from 12

countries, the prevalence of WTD was over 12 % (Stolz et al., 2016). Moreover, other research has identified that rates of WTD are higher in selected groups, such as those who utilize ageing services (O'Riley et al., 2014).

The high prevalence of WTD in old age is of concern as it has been associated with multiple negative health outcomes. For example, in one study of 1202 older adult participants from 20 US primary care practices, WTD was associated with an increased risk of 5-year mortality regardless of depressive status (adjusted hazard ratios ranging from 1.62 to 1.71) (Raue et al., 2010). Moreover, another study of older Irish adults observed that those who reported a WTD had double the risk of death from cardiovascular disease in the following 9 years (Ragab et al.,

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2021). In addition, in a sample of 232 patients from an acute care internal medicine ward in a Swiss university hospital, quality of life was negatively associated with the likelihood of WTD (OR: 0.54, 95 % CI 0.39–0.75, $P < 0.001$) (Borner et al., 2020). Associations between WTD and negative outcomes may be explained by the influence of WTD on psychological factors and health behaviors (e.g., limited help-seeking, self-neglect, poor treatment adherence, reduction in self-efficacy, sense of control over self-care activities, and environmental safety) that contribute to heightened risk of medical illnesses (Raue et al., 2010). Owing to the high prevalence of WTD and the consequent negative outcomes, it is of upmost importance to identify correlates of WTD to inform targeted interventions. One potentially important but understudied correlate is that of physical multimorbidity.

Physical multimorbidity may be defined as the presence of two or more long-term physical health conditions (NICE | The National Institute for Health and Care Excellence, 2018). Physical multimorbidity can feasibly be associated with WTD through several mechanisms. For example, via physical symptoms, psychological distress (including anxiety and depression), existential suffering and pain, social deprivation, or sleep problems (Balaguer et al., 2016; Lapierre et al., 2012; Sindi et al., 2020). However, there is limited literature on the relationship between multimorbidity and WTD. In one study including a representative sample of community living Canadian adults aged 65 years and over ($N = 2777$), an increase in one chronic condition was associated with 1.14 (95%CI 1.04, 1.25) times higher odds for WTD (Lapierre et al., 2012). However, the focus of this Canadian study was not specifically on multimorbidity (i.e., ≥ 2 chronic conditions). To the best of our knowledge, there are no other studies on chronic disease counts or multimorbidity and WTD. Clearly, more research is required to identify associations between physical multimorbidity with WTD. Moreover, to date, no study has investigated potential mediators (i.e., factors that can be the result of multimorbidity, and also be the cause of WTD). It is important to identify such variables as they can be targeted in interventions to prevent or address WTD.

Given this background, the aim of the present study was to investigate the association of individual chronic conditions and physical multimorbidity with WTD, in a large representative sample of Irish adults aged ≥ 65 years. A further aim was to explore to what extent sleep problems, pain, depression, anxiety, loneliness, perceived stress, and disability mediate the association.

2. Methods

2.1. The survey

We analyzed data from the first wave of the Irish Longitudinal Study on Ageing (TILDA) survey. We used data from wave 1 as it included all the variables of interest, while it is also the wave which is least biased in terms of representativeness as there is no loss to follow-up. Full details of the survey, including its sampling methods, have been described in detail elsewhere (Barrett et al., 2011; Kenny et al., 2010; Nolan et al., 2014). Briefly, this was a community-based survey of older adults residing in Ireland conducted by Trinity College Dublin. The survey was conducted between October 2009 and February 2011. The target sample consisted of all individuals living in private households aged 50 and over in Ireland. Clustered random sampling was used to obtain nationally representative samples. Specifically, the TILDA sampling frame was based on a comprehensive record of all residential addresses in Ireland. The initial sampling frame was made up of 3155 clusters (500–1180 addresses per cluster). A total of 640 clusters were randomly selected using proportionate stratification by socio-economic group (three categories) and geography. The second stage consisted of a random selection of a sample of 40 addresses from each of the 640 clusters, resulting in a total of 25,600 addresses. The survey excluded institutionalized individuals, anyone with known dementia or anyone unable to personally provide written informed consent to participate due to severe cognitive

impairment. Trained personnel conducted interviews with the use of Computer Assisted Personal Interviewing (CAPI). For sensitive questions, participants were asked to fill in a self-completion questionnaire (SCQ), which was returned after the interview. The response rate was 62 %, and of those who participated, 84 % returned the SCQ. Sampling weights were generated with respect to age, sex and educational attainment to the Quarterly National Household Survey 2010. Ethical approval for TILDA was obtained by the Faculty of Health Sciences Ethics Committee of Trinity College Dublin. Written informed consent was obtained from all participants.

2.2. Wish to die (WTD)

As in previous publications using the same dataset (Briggs et al., 2021; Ragab et al., 2021), WTD was defined as answering affirmatively to the question “In the last month, have you felt that you would rather be dead?”

2.3. Chronic physical conditions and physical multimorbidity

Chronic physical conditions were assessed by the question “Has a doctor ever told you that you have any of the conditions on this card?” The total number of the following 14 conditions were summed: asthma, arthritis, cancer, chronic lung disease (chronic bronchitis or emphysema), cirrhosis, diabetes, eye disease (cataracts, glaucoma, age-related macular degeneration, or other eye disease), heart disease (angina, heart attack, congestive heart failure, heart murmur, abnormal heart rhythm, or other heart disease), high cholesterol, hypertension, osteoporosis, stomach ulcer, stroke, and varicose ulcer. Physical multimorbidity was defined as having at least two chronic conditions, in line with previously used definitions (Jacob et al., 2019).

2.4. Mediators

The potential mediators in the association between multimorbidity and WTD were selected based on previous literature that suggest that they can be the result of multimorbidity, while they can also potentially be the cause of WTD. Specifically, potential mediators included sleep problems, pain, depression, anxiety, loneliness, perceived stress, and disability (Briggs et al., 2021; Lapierre et al., 2012). A composite sleep score (range 0–7 with higher scores representing more sleep problems) was created based on three questions on the likelihood of dozing off or falling asleep during the day, frequency of trouble falling asleep, and trouble with waking up too early and not being able to fall asleep again (Scarlett et al., 2021). Those who answered affirmatively to the question “Are you often troubled with pain?” were considered to have pain. The scale used for depressive symptoms was the 20-item Center for Epidemiologic Studies Depression (CES–D) (Radloff, 1977), which assesses symptoms experienced in the seven days preceding the survey (Cronbach's alpha 0.88). A positive screen for depression was defined as a cutoff score ≥ 16 . This cut-off point has been associated with 100 % sensitivity and 88 % specificity for major depression in community-dwelling older adults (Beekman et al., 1997). Anxiety was assessed with the anxiety subscale of the Hospital Anxiety and Depression Scale (HADS-A) (Zigmond and Snaith, 1983) (Cronbach's alpha 0.84). A positive screen for generalized anxiety disorder was defined as a score of ≥ 8 . This cut-off point has been associated with 89 % sensitivity and 75 % specificity for the screening of generalized anxiety disorder (Bjelland et al., 2002; Olsson et al., 2005). The short form of the University of California, Los Angeles (UCLA) Loneliness Scale (Russell et al., 1980) was used to assess feelings of loneliness, and this was a scale ranging from 3 to 9 with higher scores representing higher levels of loneliness (Cronbach's alpha 0.82). The 4-item version of the Perceived Stress Scale was used to assess the level of stress over the past month (Cohen et al., 1983). This scale ranged from 0 to 16 with higher scores indicating greater levels of perceived stress. Difficulties with six types of activities

of daily living (ADL) (dressing, walking, bathing, eating, getting in or out of bed, and using the toilet) were assessed by asking participants to indicate whether they had any difficulty performing these activities (Santini et al., 2017). ADL disability was defined as having difficulty with at least one of these ADLs.

2.5. Control variables

The selection of control variables was based on past literature (Huh et al., 2019), and included age, sex, education, alcohol consumption (non-drinkers, light/moderate drinkers, heavy drinkers) (Cousins et al., 2014), and smoking (never, past, current). Education was classified as: primary (some primary/not complete, primary or equivalent); secondary (intermediate/ junior/group certificate or equivalent, leaving certificate or equivalent); and tertiary (diploma/certificate, primary degree, postgraduate/higher degree).

2.6. Statistical analysis

The analysis was done with Stata version 14.2 (Stata Corp LP, College Station, Texas). A total of 3499 people aged ≥ 65 years participated in the survey. Of these individuals, 2941 returned the SCQ. We restricted our analysis to those who returned the SCQ as some information used in the current analysis was obtained via this mode (e.g., anxiety, alcohol consumption). Differences in baseline characteristics were tested by Chi-squared tests and Student's *t*-tests for categorical and continuous variables, respectively. Multivariable logistic regression analysis was done to assess the association of individual chronic physical conditions and physical multimorbidity (exposures) with WTD (outcome). Finally, in order to assess the degree to which the association between physical multimorbidity and WTD can be explained by sleep problems, pain, depression, anxiety, loneliness, perceived stress, and disability, we conducted mediation analysis using the *khb* (Karlson Holm Breen) command in Stata (Breen et al., 2013). This method can be applied in logistic regression models and decomposes the total effect (i.e., unadjusted for the mediator) of a variable into direct (i.e., the effect of multimorbidity on WTD adjusted for the mediator) and indirect effects (i.e., the mediational effect). Confidence intervals were calculated with the delta method (Sobel, 1982). Using this method, the percentage of the main association explained by the mediator can also be calculated (mediated percentage). The mediated percentage is the percent attenuation in the log odds of physical multimorbidity after the inclusion of the potential mediator in the model, compared to the model without the mediator. Details on the circumstances under which the indirect effect becomes significant are provided in the article by Kohler et al. (2011). The mediators were included individually in the models as it is possible for the mediators to be intertwined in the potential causal pathway between physical multimorbidity and WTD. For example, it is possible for physical multimorbidity to induce pain, which can cause sleep problems or perceived stress, and these factors in turn can lead to WTD. Thus, we did not adjust for other mediators in the mediation analysis to avoid overadjustment. All regression analyses including the mediation analysis were adjusted for age, sex, education, alcohol consumption, and smoking. All variables were included in the analysis as categorical variables, except for age, sleep problems, loneliness, and perceived stress. The sample weighting and the complex study design including clustering within households were taken into account to obtain nationally representative estimates using the Stata *svy* command. Results are expressed as odds ratios (ORs) and their 95 % confidence intervals (95% CIs). A *P*-value < 0.05 was considered to be statistically significant.

3. Results

The analytical sample consisted of 2941 adults aged ≥ 65 years [mean (SD) age 73.2 (5.2) years; 45.0 % males]. The prevalence of WTD and physical multimorbidity were 3.3 % and 69.4 %, respectively. The

percentage of those with 2, 3, and ≥ 4 chronic conditions were 24.2 %, 19.1 %, and 26.1 %, respectively. The sample characteristics are provided in Table 1. The prevalence of pain, depression, anxiety, and disability were higher, and sleep problems, loneliness, and perceived stress worse in those with WTD and also among those with physical multimorbidity. People with both WTD and physical multimorbidity (vs. people with do not have both WTD and physical multimorbidity) were significantly more likely to be females, have lower levels of education, and to have smoked, with higher prevalence of pain, depression, anxiety, and depression, while they also scored worse for sleep problems, loneliness, and perceived stress (Appendix Table S1). Arthritis (39.4 %), high cholesterol (39.6 %), and hypertension (49.2 %) were the most common individual chronic conditions, while high cholesterol with hypertension (24.5 %), and arthritis with hypertension (21.8 %) were the most common pairs of chronic conditions (Table 2). In terms of individual chronic conditions, after adjustment for potential confounders, arthritis, chronic lung disease, eye disease, heart disease, hypertension, osteoporosis, stroke, and varicose ulcer were all significantly associated with increased odds for WTD (OR = 2.00–4.10) (Fig. 1). Physical multimorbidity was associated with 3.39 (95%CI 1.58, 7.28) times higher odds for WTD. Pain (%mediated 28.1 %) was the factor that explained the largest proportion of the association between physical multimorbidity and WTD, followed by depression (19.4 %), sleep problems (18.4 %), perceived stress (13.0 %), loneliness (10.4 %), anxiety (8.1 %), and disability (7.2 %) (Table 3). For example, after the inclusion of pain in the model, the OR was attenuated from OR = 3.33 (95%CI = 1.55–7.15) (total effect) to OR = 2.38 (95%CI = 1.07–5.26) (direct effect). The remaining portion of the total effect (i.e., the indirect effect) was OR = 1.40 (95%CI = 1.22–1.61), and the mediated percentage, which is derived from log odds, was 28.1 %.

4. Discussion

4.1. Main findings

In this large representative sample of Irish adults aged ≥ 65 years, arthritis, chronic lung disease, eye disease, heart disease, hypertension, osteoporosis, stroke, and varicose ulcer were all significantly associated with increased odds for WTD. Arthritis, high cholesterol, and hypertension were the most common individual chronic conditions in our study. Reflecting the high prevalence of these conditions, the most common combinations of chronic conditions also often included these three conditions. Physical multimorbidity (i.e., ≥ 2 chronic conditions) was associated with 3.39 times higher odds for WTD. Of the investigated mediating variables, pain explained the largest proportion of the association between multimorbidity and WTD (%mediated 28.1 %), followed by depression (19.4 %), sleep problems (18.4 %), perceived stress (13.0 %), loneliness (10.4 %), anxiety (8.1 %), and disability (7.2 %). To the best of our knowledge, this is the first study specifically on multimorbidity and WTD, while the identification of the mediators in this association is a particular novelty of this study.

4.2. Interpretation of the findings

The association between multimorbidity and WTD may be explained by the cumulative effects of individual chronic conditions on WTD. Indeed, many of the individual conditions which were associated with WTD in our study are directly associated with symptoms (e.g., functional limitation, disability), which can all lead to perceived burden, loss of meaning and purpose, hopelessness, loss of control, low self-worth (Robinson et al., 2017) and other factors that can increase risk for WTD.

In our study, pain explained nearly 30 % of the association between multimorbidity and WTD, followed by depression, and sleep problems, which explained nearly 20 % of the association each. Pain can lead to an increased risk for WTD, as patients with this condition may perceive death as the only solution to this problem (Hooley et al., 2014). For

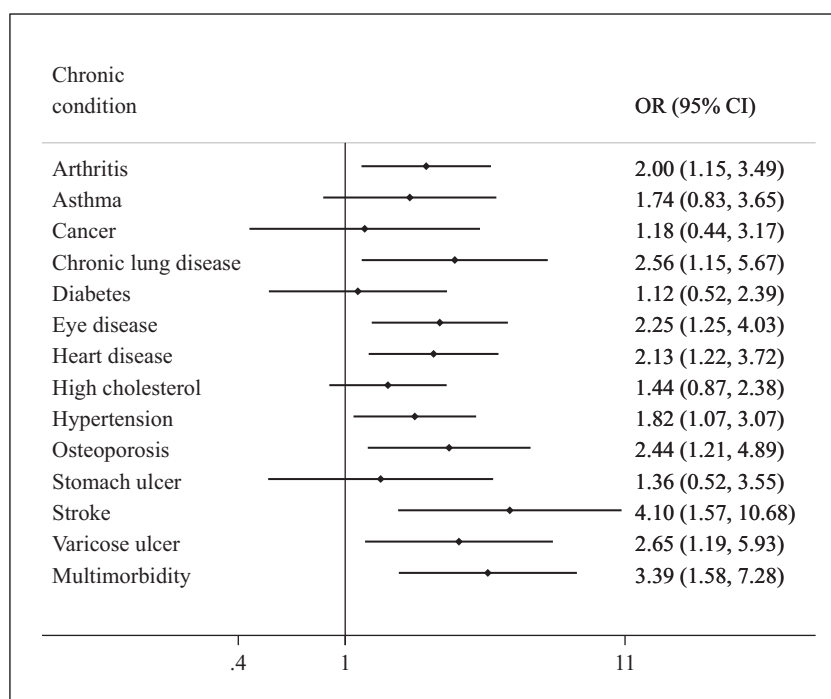


Fig. 1. Association of individual chronic physical conditions and physical multimorbidity with wish to die (outcome) estimated by multivariable logistic regression

Abbreviation: OR Odds ratio; CI Confidence interval

Models are adjusted for age, sex, education, alcohol consumption, and smoking.

Estimates for cirrhosis could not be obtained due to the small number.

Table 1
Sample characteristics (overall and by presence of wish to die or physical multimorbidity).

Characteristic		Overall	Wish to die			Physical multimorbidity		
			No (N = 3381)	Yes (N = 106)	P-value ^a	No (N = 1126)	Yes (N = 2373)	P-value ^a
Age (years)	Mean (SD)	73.2 (5.2)	73.2 (5.2)	73.1 (5.1)	0.945	72.4 (5.3)	73.5 (5.1)	<0.001
Sex	Female	55.0	54.7	64.0	0.095	47.1	58.5	<0.001
	Male	45.0	45.3	36.0		52.9	41.5	
Education	Primary	56.9	56.3	72.9	0.003	55.1	57.6	0.371
	Secondary	30.9	31.3	18.4		32.5	30.3	
	Tertiary	12.2	12.3	8.6		12.4	12.1	
Alcohol consumption	Non-drinker	46.3	45.9	56.5	0.109	44.9	46.9	0.488
	Light/moderate drinker	37.8	38.2	25.8		38.0	37.7	
	Heavy drinker	16.0	15.9	17.7		17.1	15.4	
Smoking	Never	44.6	44.9	37.3	0.152	47.5	43.4	0.005
	Quit	41.6	41.6	41.5		36.9	43.6	
	Current	13.8	13.5	21.1		15.7	13.0	
Sleep problems	Mean (SD)	2.4 (1.7)	2.4 (1.6)	4.0 (1.8)	<0.001	2.1 (1.6)	2.6 (1.7)	<0.001
Pain	No	62.6	63.9	26.4	<0.001	80.1	54.9	<0.001
	Yes	37.4	36.1	73.6		19.9	45.1	
Depression	No	91.5	93.2	42.1	<0.001	96.6	89.2	<0.001
	Yes	8.5	6.8	57.9		3.4	10.8	
Anxiety	No	80.7	81.8	44.6	<0.001	85.1	78.7	<0.001
	Yes	19.3	18.2	55.4		14.9	21.3	
Loneliness	Mean (SD)	4.2 (1.5)	4.1 (1.5)	5.8 (1.9)	<0.001	4.0 (1.5)	4.3 (1.5)	<0.001
Perceived stress	Mean (SD)	4.2 (3.0)	4.2 (3.0)	7.3 (3.2)	<0.001	3.9 (2.9)	4.4 (3.1)	<0.001
Disability	No	86.0	86.6	68.0	<0.001	94.1	82.4	<0.001
	Yes	14.0	13.4	32.0		5.9	17.6	

Abbreviation: SD Standard deviation.

Data are % unless otherwise stated.

Ns are unweighted figures.

^a P-values were obtained by Chi-squared tests and Student's *t*-tests for categorical and continuous variables, respectively.

example, it has been observed that chronic pain can engender hopelessness, facilitate a desire for escape through death, and erode the natural fear of dying (Hooley et al., 2014). Depression is common in people with multimorbidity (Read et al., 2017), and multimorbidity may lead to depression through factors such as increasing symptom burden, disability, decreasing quality of life, pain, beliefs about disease, and coping style (Read et al., 2017). Depression is likely associated with WTD owing to anhedonia (i.e., lack of joy and pleasure), cognitive

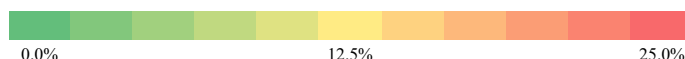
impairment (e.g., ability to concentrate), and hopelessness (e.g., unpleasant future expectations), as well as feelings of worthlessness and guilt (Pompili, 2019).

Previous studies have shown that sleep problems are common in people with multimorbidity due to factors such as anxiety, stress, depression, or the symptoms per se (e.g., pain, nocturia in diabetes, and breathing problems in chronic lung disease) (Charles et al., 2011; Cheatle et al., 2016; Ferguson et al., 2020; Nutt et al., 2008; Ronaldson

Table 2

Prevalence of chronic physical diseases and each pair of chronic physical diseases.

	Prevalence (%)	Arthritis	Asthma	Cancer	Chronic lung disease	Cirrhosis	Diabetes	Eye disease	Heart disease	High cholesterol	Hypertension	Osteoporosis	Stomach ulcer	Stroke
Arthritis	39.35													
Asthma	9.68	4.76												
Cancer	8.19	3.32	0.85											
Chronic lung disease	5.34	2.51	1.59	0.64										
Cirrhosis	0.46	0.29	0.04	0.03	0.05									
Diabetes	10.85	4.22	1.33	0.87	0.43	0.07								
Eye disease	29.19	13.85	3.51	2.95	2.12	0.14	3.88							
Heart disease	27.89	13.37	3.43	2.30	2.04	0.12	4.00	10.34						
High cholesterol	39.56	18.39	3.98	3.92	2.56	0.29	5.27	12.56	13.76					
Hypertension	49.24	21.84	5.25	4.56	2.76	0.21	7.08	15.91	15.55	24.48				
Osteoporosis	13.10	6.78	2.25	1.20	1.32	0.12	0.72	5.20	3.16	6.43	5.82			
Stomach ulcer	6.97	3.41	1.01	0.79	0.50	0.07	0.74	1.95	2.71	3.18	3.78	1.26		
Stroke	2.61	0.93	0.24	0.21	0.31	0.03	0.44	0.71	1.23	1.23	1.78	0.24	0.08	
Varicose ulcer	5.43	2.97	0.85	0.66	0.38	0.08	0.56	2.47	1.80	2.08	3.04	1.09	0.45	0.13

**Table 3**

Mediators in the association between physical multimorbidity and wish to die.

Mediator	Effect	OR [95%CI]	P-value	%Mediated
Sleep problems	Total	3.29 [1.50,7.19]	0.003	18.4
	Direct	2.64 [1.22,5.70]	0.013	
	Indirect	1.25 [1.12,1.38]	<0.001	
Pain	Total	3.33 [1.55,7.15]	0.002	28.1
	Direct	2.38 [1.07,5.26]	0.033	
	Indirect	1.40 [1.22,1.61]	<0.001	
Depression	Total	2.91 [1.25,6.75]	0.013	19.4
	Direct	2.36 [1.02,5.47]	0.044	
	Indirect	1.23 [1.15,1.32]	<0.001	
Anxiety	Total	2.96 [1.37,6.41]	0.006	8.1
	Direct	2.71 [1.25,5.87]	0.011	
	Indirect	1.09 [1.03,1.16]	0.004	
Loneliness	Total	3.32 [1.48,7.42]	0.004	10.4
	Direct	2.93 [1.32,6.50]	0.008	
	Indirect	1.13 [1.05,1.22]	0.001	
Perceived stress	Total	2.96 [1.33,6.59]	0.008	13.0
	Direct	2.57 [1.17,5.61]	0.018	
	Indirect	1.15 [1.06,1.26]	0.001	
Disability	Total	3.34 [1.55,7.19]	0.002	7.2
	Direct	3.06 [1.40,6.70]	0.005	
	Indirect	1.09 [1.02,1.17]	0.013	

Abbreviation: OR Odds ratio; CI Confidence interval.

Models are adjusted for age, sex, education, alcohol consumption, and smoking.

et al., 2021; Sleep Foundation, 2020; Stubbs et al., 2018). In turn, sleep problems can increase risk for WTD, for example, through emotional dysregulation enhancing sleep difficulties, which can further enhance emotional problems, or genetic vulnerability: the same genes are involved in the regulation of circadian rhythm and in affective disorders (Koyanagi and Stickley, 2015; Mirsu-Paun et al., 2017). Moreover, reduced sleep time has been associated with impaired decision making (McCall and Black, 2013). In particular, insomnia is associated with deficient problem-solving capacity, especially when involving complex tasks.

Other potential mediators identified in our study but which had less influence in the multimorbidity-WTD association include perceived stress, loneliness, anxiety, and disability.

Loneliness in people with multimorbidity may be common. Indeed, a previous study found that levels of social participation in people with multimorbidity is low, possibly due to factors such as limitations in physical function, pain, and discomfort (Ma et al., 2021), and this may result in feeling of loneliness. Furthermore, increased stress and anxiety

may arise not only from the distressing symptoms of chronic conditions but also by other factors such as increased costs and complexity of care to treat multiple conditions. In turn, anxiety and stress may result in higher odds of WTD owing to mechanisms such as central neurotransmitter system dysfunction including dopamine, norepinephrine and serotonin (Grippe and Johnson, 2009).

4.3. Implications of the study findings

Findings from the present study indicate that people with multimorbidity are much more likely to have WTD compared to those without multimorbidity. Health care workers should be aware of this, and screening for WTD and addressing the potential mediators assessed in our study may be important in reducing WTD among people with multimorbidity. In our study, pain, sleep problems, and depression were identified as the most important mediators.

Non-pharmacological interventions for these conditions may be ideal for people with multimorbidity as polypharmacy is already common. For example, physical activity interventions have been shown to be efficacious in pain management (Geneen et al., 2017), and these may also reduce feelings of loneliness as well as stress, sleep problems, anxiety and depression, which were also identified as significant mediators in the physical multimorbidity/WTD relationship (Smith and Merwin, 2021). Moreover, evidence suggests that mind-body exercises may be most efficacious and have been shown to be feasible among those with chronic conditions (Salmoirago-Blotcher et al., 2017). Furthermore, cognitive behavioral therapy, mindfulness training, and relaxation have been shown to be beneficial in the management of mental health complications (Gautam et al., 2020) and addressing sleep problems (McCurry et al., 2015), and thus may form a beneficial component for an intervention to prevent or manage WTD among those with physical multimorbidity.

4.4. Strengths and limitations

The large representative sample of older Irish adults and the identification of mediating variables in the physical multimorbidity/WTD relationship are key strengths of the present study. However, findings must be interpreted considering the study limitations. First, the study was cross-sectional in nature, and thus the direction of the association cannot be determined. Future research of a longitudinal nature is required to confirm the direction of the association. Second, most variables were self-reported, and thus, reporting bias (e.g., social

desirability, recall bias) may have been introduced. Third, we were unable to assess the mediating effect of social deprivation due to lack of data, despite the fact that this can theoretically be a potential mediator. This is an area for future research. Next, it is possible for the mediating effect to be an overestimation given the various ways in which multimorbidity, WTD, and the mediators can be linked. Finally, the list of chronic conditions included conditions that are common in old age, but the results of the study could have differed with the use of a different set of chronic conditions.

5. Conclusions

Physical multimorbidity was associated with a more than three-fold increased risk for WTD among older Irish adults, and this association was mediated by factors such as pain, sleep problems, and depression. Future longitudinal and intervention studies are warranted to clarify temporal associations and the impact of addressing the identified mediators on WTD among people with physical multimorbidity.

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Contributors

All authors have made a substantial, direct and intellectual contribution to the work. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

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Ethics

Ethical approval for TILDA was obtained by the Faculty of Health Sciences Ethics Committee of Trinity College Dublin. Written informed consent was obtained from all participants.

Conflict of Interest

The authors wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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Researchers interested in using TILDA data may access the data for free from the following sites: Irish Social Science Data Archive (ISSDA) at University College Dublin <http://www.ucd.ie/issda/data/tilda/>; Interuniversity Consortium for Political and Social Research (ICPSR) at the University of Michigan (Kenny, 2014).

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