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What is the impact of multimorbidity on out-of-pocket healthcare expenditure among community-dwelling older adults in Ireland? A cross-sectional study

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ABSTRACT

Objectives Individuals with multimorbidity use more health services and take more medicines. This can lead to high out-of-pocket (OOP) healthcare expenditure. This study, therefore, aimed to assess the association between multimorbidity (two or more chronic conditions) and OOP healthcare expenditure in a nationally representative sample of adults aged 50 years or over.

Design Cross-sectional analysis of data collected in 2016 from wave 4 of The Irish Longitudinal Study on Ageing.

Setting
Ireland.

Participants
Community-dwelling adults aged 50 years and over.

Method
A generalised linear model with log-link and gamma distributed errors was fitted to assess the association between multimorbidity and OOP healthcare expenditure (including general practitioner, emergency department, outpatients, specialist consultations, hospital admissions, home care and prescription drugs).

Results Overall, 3453 (58.5%) participants had multimorbidity. Among those with any OOP healthcare expenditure, individuals with multimorbidity spent more on average per annum (€806.8 for two conditions, €885.8 for three or more conditions), than individuals with no conditions (€580.3). Pharmacy-dispensed medicine expenditure was the largest component of expenditure. People with multimorbidity on average spent more of their equivalised household income on healthcare (7.1% for two conditions, 9.7% for three or more conditions), than people with no conditions (5.0%). A strong positive association was found between number of conditions and OOP healthcare expenditure (p<0.001) and between having private health insurance and OOP healthcare expenditure (p<0.001). A strong negative association was found between eligibility for free primary/hospital care and heavily subsidised medicines and OOP healthcare expenditure (p<0.001).

Conclusions This study suggests that having multimorbidity in Ireland increases OOP healthcare expenditure, which is problematic for those with more conditions who have lower incomes. This highlights the need for this financial burden to be considered when designing healthcare/funding systems to address multimorbidity, so that access to essential healthcare can be maximised for those with greatest need.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ We conducted multivariate and quantile regressions to assess the association between multimorbidity and out-of-pocket (OOP) healthcare expenditure.
⇒ We used data from The Irish Longitudinal Study on Ageing (TILDA), which captures a nationally representative sample of community-dwelling older adults in Ireland.
⇒ TILDA only sampled those aged 50 years or over, and therefore, a significant portion of the population, who may have different patterns of multimorbidity and OOP healthcare expenditure were not included.
⇒ Household adaptations and travel costs to access healthcare were not included in this analysis meaning that OOP healthcare expenditure is likely to be underestimated.

INTRODUCTION

Multimorbidity is the co-occurrence of two or more chronic medical conditions in an individual. The prevalence of multimorbidity and its complexity has been increasing in recent decades.[1–4] Its prevalence is estimated to range from 13% to 72% depending on age group and setting.[5] Multimorbidity is a major challenge for individuals and healthcare systems across the world.[6]

Greater healthcare utilisation[7] and polypharmacy (the use of five or more regular medicines),[8] two of the major challenges associated with multimorbidity, are primarily caused by the extra healthcare needs that come with having additional conditions, but also, the additional needs that arise due to the interactions between conditions.[9] High

healthcare utilisation and polypharmacy among people with multimorbidity is also partly caused by the single condition focus of healthcare. This single condition focus manifests itself across healthcare systems, in clinical guidelines, specialty care provision, reimbursement systems and research.[10–13] High healthcare utilisation and polypharmacy lead to high levels of out-of-pocket (OOP) healthcare expenditure for people with multimorbidity.[14 15] Studies from a range of high-income countries[1 16] (HICs) and middle-income countries[17–20] (MICs) have shown a positive association between multimorbidity and OOP healthcare expenditure. Studies in HICs estimate that the expenditure associated with having two or more chronic conditions is multiples of that experienced by those without multimorbidity.[1 16] However, studies[1 16] in HICs have not accounted for healthcare entitlements in their analyses, or conducted analysis across the distribution of expenditure.[1 16] Furthermore, there is a need for up to date research in HICs as OOP healthcare expenditure may be rising due to increases in use of prescription medicines,[21] increased development of expensive drugs,[22] ageing populations[23] and the increasing prevalence of chronic disease[24] and multimorbidity.[1–4]

There are many potential consequences of high OOP healthcare expenditure.[14 15] For example, high OOP healthcare expenditure can lead to people with multimorbidity sacrificing basic necessities, which can have a negative effect on well-being.[25 26] Multimorbidity can also lead to non-adherence to medication and healthcare non-attendance,[14 26 27] which in turn can have negative health consequences.[14 26 28] High OOP healthcare expenditure has the potential to be exacerbated by the strong association between multimorbidity and socioeconomic deprivation.[29 30] Provision of subsidised or free care at the point of delivery may protect against the financial burden caused by chronic conditions.[31]

Health coverage in Ireland

Health entitlements in Ireland are 'extremely complex'.[32] Households with incomes below a certain threshold (which varies based on age), or in a small percentage of cases, those with high medical expenses relative to their income, are eligible for a 'medical card'.[33] For example, a single person aged under 66 years earning €184 a week after taxes and allowable expenses, is entitled to a medical card.[34] There is no clarity around the calculations for discretionary medical cards,[35] which are held by less than 1% of the population.[36] A medical card entitles holders to free primary, community and hospital care, and heavily subsidised prescription medicines.[33] At the time of data collection, medical cardholders paid a prescription charge of €2.50 per item, capped at €25 per month . Households without a medical card, paid the first €144 per month on community-dispensed prescription medicines, up to €750 per annum on inpatient care, €100 per emergency department attendance[37] and an average fee of €50 per general practitioner (GP) consultation.[38] This €50 fee represents one of the highest payments in Europe for primary care.[39] In 2005, an additional layer of eligibility was introduced and adults with income approximately 50% higher than the medical card threshold were entitled to free GP care through a 'GP visit card'.[40] Adults aged over 70 are entitled to GP visit cards regardless of income.[40] Other government schemes include the long-term illness scheme which entitles people with certain long-term illnesses or disabilities to obtain medicines associated with that illness free of charge (patients with diabetes represent a majority within the scheme).[41] Further complicating health coverage in Ireland is the high proportion (46%)[42] of people with private health insurance (PHI). In Ireland, the level of voluntary PHI expenditure as a percentage of overall healthcare funding is the second highest in Europe.[43] PHI plans in Ireland are voluntary. Most insurance plans are hospital plans, providing access to private hospitals and/or private rooms in public hospitals.[44] Though these plans often provide limited cover for non-hospital services.[44] Those with PHI are more likely to be older and of higher socioeconomic status.[45]

There is little information on the degree of OOP healthcare expenditure for people with multimorbidity, or how factors such as eligibility for heavily subsidised/free healthcare and PHI may affect financial pressures for people with multimorbidity. These entitlement factors as well as an analysis of the effect of multimorbidity across the distribution of expenditure are not included in other similar studies in HICs.[1 16] Furthermore, OOP healthcare expenditure is likely increasing over time. Therefore, we aimed to explore the association between multimorbidity and OOP healthcare expenditure using multivariate regression and quantile regression analyses which accounted for entitlements (the medical card and PHI) along with demographic and socioeconomic variables.

METHODS

We used a cross-sectional study design and reported the study according to theStrengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[46] Multivariate regression analyses were used to investigate the association between multimorbidity and OOP healthcare expenditure. Data from The Irish Longitudinal Study on Ageing (TILDA) wave 4[47] were used. TILDA is a nationally representative study of community-dwelling adults aged 50 years and over in Ireland.[48] The sampling frame was all residential addresses in the Irish Geodirectory.[49] In wave 4, there were 5977 respondents.[49] Residents from residential care facilities (N=78) were excluded from analysis because their pattern of healthcare utilisation differs from community-dwelling adults. Data collection took place between January and December 2016. Data were collected using computer-aided personal interviewing.

TILDA respondents were provided with a list of 36 conditions and asked if a doctor had diagnosed them with any of them (online supplemental appendix A).

For this study, we developed a multimorbidity count by combining some of the 36 conditions to give 21 broader conditions (online supplemental appendix B) based on data availability and a previous TILDA study.[50] For this analysis, multimorbidity was defined as the presence of two or more of these conditions (online supplemental appendix B).

The primary outcome variable was self-reported OOP healthcare expenditure (details of questions in online supplemental appendix C). OOP healthcare expenditure is expenditure 'borne directly by a patient where insurance does not cover the full cost of the health good or service'.[51] Services and products were considered healthcare if they were in the Health Section of the United Nations Classification of Individual Consumption According to Purpose.[52] We also included social care services that are likely to be required as a result of having a chronic condition, namely home care services (services to support people to remain living on their own). OOP healthcare expenditure was estimated for the following services: GP, emergency department, outpatients, specialist medical consultations, in-patient hospital admissions, home care, prescription drugs and 'other' health expenses. Respondents were asked to exclude payments that were reimbursed by the state or health insurance companies where applicable.

For home care services, participants were asked to recall their expenditure in the previous month, and for prescription drugs it was 'on average' 'per month'. To calculate 12-month expenditure for these two areas, the amounts were multiplied by 12 (further details in online supplemental appendix D). The limitation of this is that it is less likely to accurately capture 12-month expenditure (eg, if someone had no expenses in the last month but a large one off expense 6 months ago, then their expenditure would be underestimated).

PHI premia expenditure represents a significant proportion of household spending in Ireland (approximately 3% on average).[32] In countries where expenditure on PHI is high, it is often included in analysis of OOP healthcare expenditure.[33 53 54] Therefore, PHI premia expenditure was included as a secondary outcome variable . However, PHI premia are not considered an OOP healthcare expenditure by the WHO definition. Therefore, PHI premia expenditure was not included in the regression analyses.

The financial burden of healthcare expenditure was calculated as the percentage of equivalised annual household income spent on healthcare.[16] This measure, and the 20% threshold for high financial burden, were used to allow for comparisons with a similar Australian study.[16] Equivalised household income is an adjusted household income measure based on the OECD-modified equivalence scale for household size[55]; household income is divided by number of people in the household, with a weight of one for the first adult, 0.5 for each additional adult and 0.3 for each child.

Details of how we managed outlying values which were considered likely to be incorrect are in online supplemental appendix E.

Data analysis

This study used a hurdle model to analyse OOP healthcare expenditure.[56] A hurdle model allowed us to examine the decisions to consume healthcare using OOP healthcare expenditure, as well as the intensity of healthcare expenditure for those who have OOP healthcare expenditure. A probit regression was used to model the binary outcome of any OOP healthcare expenditure or not. A participant was considered to have any OOP healthcare expenditure if they had OOP healthcare expenditure in any of the following areas: GP, medicines, emergency department, outpatients, specialist medical consultations, overnight hospital stay, home care or 'other' healthcare expenditure. Expenditure on PHI premia was excluded from adjusted analysis, but copayments and deductibles were included in all analyses. A generalised linear model (GLM) with log-link and gamma distributed errors was used to model intensity of OOP healthcare expenditure among those with any OOP healthcare expenditure. This model is commonly used for healthcare expenditure data[57 58] and allows us to better fit the long tail of the expenditure distribution. Supplementary analysis using ordinary least squares (OLS) regression with the expenditure variable log transformed was also conducted (online supplemental appendix F eTable 2). Unconditional quantile regressions were conducted to understand the effect of the independent variables on OOP healthcare expenditure at different points of the expenditure distribution. Results across nine quantiles are presented in the quantile regression analysis to allow for comparison with previous studies of multimorbidity and OOP healthcare expenditure.[18 19]

Complete-case analysis was used for all regression models. For both sets of analyses, a series of models were fitted, first including variables for face validity and to meet the aims of the research, followed by two models including interactions, and then a model including additional demographics. In the probit and gamma models, age and household income were included as squared variables, because the authors hypothesised a potential curvilinear relationship between these variables and expenditure. Interactions between number of conditions and medical card, and number of conditions and PHI were included in the probit and gamma models. A supplementary analysis of the interaction between age and number of conditions was also conducted (online supplemental appendix F eTables 4 and 5). To facilitate interpretable coefficients, household income was divided by one thousand for the relevant probit and gamma models.

Multivariate regression analyses controlled for the following covariates: age, sex, cardholder status (medical card or GP visit cardholder), PHI status, education, household income, marital status and geographical region (urban/rural). These covariates were chosen for face

validity and their association with both multimorbidity[5 29] and healthcare utilisation.[59] In line with previous analysis,[60] medical cardholders and GP visit cardholders were collapsed into one group: cardholders, for the purposes of regression analysis . Long-term illness scheme eligibility was not included in analysis, because, given the eligibility criteria, it is likely collinear with multimorbidity. Statistical analysis was conducted using Stata, V.15.

Patient and public involvement

The research question and the conclusions were developed in consultation with a patient and public involvement panel of people living with multimorbidity.

RESULTS

There were 5899 eligible respondents aged 50 or over. The average age was 68.4 (SD=9.1) years, 55.7% of respondents were female and 24.1% (N=1421) had a primary school education or less. Overall, 3453 (58.5%) individuals had multimorbidity (2+ conditions). Respondents with multimorbidity were more likely to be older, female and have lower education attainment. Table 1 provides details of the sample characteristics.

Excluding expenditure on PHI premia, average reported annual OOP healthcare expenditure was higher for individuals with multimorbidity (€806.8 for those with two conditions, €885.8 for those with three or more conditions) than for those with no conditions (€580.3). Those with no conditions reported spending slightly more on average on PHI (€449.1) than individuals with three or more conditions (€363.2), while those with one condition spent the most (€524.3). Table 2 presents annual unadjusted figures on OOP healthcare expenditure and financial burden for all participants.

Expenditure on medicines was the largest component of OOP healthcare expenditure, especially for people with multimorbidity. The mean annual OOP medicine expenditure for those with three or more conditions was €453.5, representing 51% of their overall OOP expenditure. For those with two conditions it was €393.0,

Table 1 Demographic and entitlement characteristics of sample

				Multimorbidity	
	Overall (N=5899) % (N)	No conditions (N=979) % (N)	One condition (N=1466) % (N)	Two conditions (N=1381) % (N)	Three or more conditions (N=2072) % (N)
Age (years)					
50–59	18.5 (1091)	33.9 (332)	24.4 (357)	15.6 (216)	9.0 (186)
60–69	40.1 (2365)	45.3 (443)	42.2 (618)	41.9 (579)	35.0 (725)
70–79	27.8 (1642)	15.2 (149)	23.7 (348)	30.2 (417)	35.1 (728)
80–89	12.1 (714)	4.9 (48)	8.4 (123)	10.9 (151)	18.9 (391)
90+	1.5 (87)	0.7 (7)	1.4 (20)	1.3 (18)	2.0 (42)
Sex					
Female	55.7 (3285)	47.8 (468)	47.5 (697)	54.9 (758)	65.7 (1361)
Male	44.3 (2614)	52.2 (511)	52.5 (769)	45.1 (623)	34.3 (711)
Education					
Primary/none	24.1 (1421)	15.7 (154)	19.9 (292)	23.6 (326)	31.3 (648)
Secondary	39.4 (2325)	40.7 (398)	40.5 (593)	38.2 (528)	38.9 (806)
Third/higher	36.5 (2153)	43.6 (427)	39.6 (581)	38.2 (527)	29.8 (618)
Location					
Urban	54.3 (3204)	50.5 (494)	53.7 (787)	55.4 (765)	55.8 (1157)
Rural	45.7 (2695)	49.5 (486)	46.3 (679)	44.6 (616)	44.2 (915)
Private health insurance					
Yes	60.1 (3543)	63.8 (624)	64.3 (942)	62.6 (862)	53.7 (1111)
No	39.9 (2353)	36.1 (353)	35.7 (523)	37.5 (516)	46.3 (957)
Healthcare entitlements					
Cardholder	60.1 (3539)	63.9 (624)	64.3 (942)	62.6 (862)	53.7 (1111)
Non-cardholder	39.9 (2349)	36.1 (353)	35.7 (523)	37.5 (516)	46.3 (957)

Table 2 Annual out of pocket (OOP) healthcare expenditure* (€) and financial burden by number of conditions for those with any OOP healthcare expenditure

			Multimorbidity	
	No conditions	One condition	Two conditions	Three or more conditions
Percentage with any OOP healthcare expenditure (N)	78.2% (761)	91.0% (1318)	96.5% (1318)	96.6% (1965)
Total OOP expenditure excluding PHI Mean (SD)	€580.3 (1167.3)	€718.5 (1059)	€806.8 (1014.0)	€885.8 (1222.5)
GP Mean (SD)	€61.4 (87.0)	€60.7 (94.6)	€56.7 (111.5)	€45.9 (113.6)
Medicines Mean (SD)	€161.6 (634.0)	€311.8 (720.8)	€393.0 (534.0)	€453.5 (571.8)
Hospital care† Mean (SD)	€70.2 (195.7)	€106.0 (340.5)	€126.4 (317.7)	€139.2 (573.6)
Other healthcare Mean (SD)	€291.6 (913.3)	€237.1 (578.2)	€233.0 (616.6)	€257.3 (634.5)
PHI Mean (SD)	€449.1 (790.8)	€524.3 (950.5)	€411.8 (698.6)	€363.2 (1,031.7)
Equivalised household income Mean (SD)	€17 710 (20 476)	€16 561 (21 517)	€13 735 (10 734)	€12 932 (9131)
Financial Burden‡ Mean (SD)	5.0% (13.7)	6.5% (15.1)	7.1% (15.1)	9.7% (19.4)
Percentage with financial burden >20% (N)	4.2% (25)	5.3% (55)	5.6% (58)	8.6% (131)

*Median expenditure and IQR for each area can be seen in online supplemental appendix F eTable 1.
†Includes OOP expenditure on emergency department, outpatients, consultants, overnight hospital.
‡Percentage of equivalised household income spent on healthcare in previous 12 months.
GP, general practitioner; PHI, private health insurance.

representing 49% of their overall OOP expenditure. Individuals with no conditions spent €161.1, representing 28% of their overall OOP healthcare expenditure. Individuals with multimorbidity reported higher OOP expenditure on hospital care. Little difference was seen across condition groups for OOP expenditure on GP and 'other' healthcare.

In addition to reporting higher OOP expenditure, individuals with multimorbidity had substantially lower equivalised household income than individuals with no conditions. Consequently, the average financial burden for individuals with multimorbidity was much higher, (7.1% for those with two conditions, 9.7% for those with three or more conditions) than it was for people with no conditions (5.0%).

Probability of any OOP expenditure

Probit models (table 3) were fitted to examine associations with probability of experiencing any OOP healthcare expenditure. A strong positive association was found between number of chronic conditions and probability of any OOP healthcare expenditure, after adjusting for covariates. Compared with those with no health conditions, model 1 showed that having two conditions was associated with a 20% increased probability of any OOP healthcare expenditure, and three or more conditions was associated with a 21% increased probability (online supplemental appendix F eFigure 1). Being a cardholder was associated with being 5% less likely to have any OOP healthcare expenditure (model 1), this association was significant. The interaction effects of being a cardholder and number of chronic conditions were statistically significant. This model therefore provides evidence that being a cardholder had a stronger effect on having any OOP healthcare expenditure, the more conditions an individual had. Having PHI was associated with being 6% more likely to have any OOP healthcare expenditure, this association was significant. The interaction effects on having PHI and number of chronic conditions were statistically significant. This model, therefore, provides evidence that having PHI had a stronger effect on having any OOP healthcare expenditure, the more conditions an individual had. Sex, rurality, income and education were not found to have a significant association with probability of any OOP healthcare expenditure.

Table 3 Probit model assessing associations with any out-of-pocket healthcare expenditure†

	Model 1 (N=5815) Marginal Effect (SE)	Model 2 (N=5815) Marginal Effect (SE)	Model 3 (N=5815) Marginal Effect (SE)	Model 4 (N=4690) Marginal Effect (SE)
No Conditions (comparator: 0 conditions)				
One condition	0.140* (0.016)	0.141* (0.017)	0.141* (0.016)	0.139* (0.018)
Multimorbidity				
Two conditions	0.199* (0.015)	0.198* (0.016)	0.201* (0.015)	0.197* (0.017)
Three or more conditions	0.205* (0.015)	0.204* (0.016)	0.206* (0.015)	0.199* (0.017)
Age	0.002** (0.001)	0.002** (0.001)	0.002** (0.001)	0.002** (0.001)
Age^2	−0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)
Female	0.003 (0.007)	0.003 (0.007)	0.003 (0.007)	0.004 (0.008)
Cardholder	−0.051* (0.008)	−0.051* (0.008)	−0.050* (0.008)	−0.044* (0.009)
Private health insurance	0.060* (0.008)	0.060* (0.008)	0.061* (0.008)	0.056* (0.009)
One condition#cardholder		0.042** (0.019)		
Two conditions#cardholder		0.111* (0.017)		
Three conditions#cardholder		0.123* (0.015)		
One condition#PHI			0.301* (0.026)	
Two conditions#PHI			0.329* (0.026)	
Three conditions#PHI			0.336* (0.026)	
Equivalised household income‡				0.274 (0.445)
Equivalised household $income^2$				−0.000** (0.000)
Education (comparator=primary)				
Secondary				0.003 (0.010)
Third level or higher				0.007 (0.011)
Rural (comparator=urban)				−0.002 (0.007)
Marital status (comparator=married)				
Living with partner				−0.032 (0.027)
Single				−0.024 (0.014)
Separated				−0.037 (0.020)
Divorced				0.002 (0.017)
Widowed				−0.015 (0.012)

*P<0.001, **p<0.05.
†PHI expenditure is not included in the calculation of any out-of-pocket healthcare expenditure
‡Scaled variable where coefficient is associated with €1000 change in income.
PHI, private health insurance.

Level of OOP expenditure

GLMs with log link and gamma distributed errors (table 4) were fitted to examine associations with the level of OOP healthcare expenditure among those with any OOP healthcare expenditure. A strong positive association was found between number of chronic conditions and OOP healthcare expenditure, after adjusting for covariates. Having three or more conditions was associated with 79% (exp(0.580)) higher OOP healthcare expenditure than people with no conditions (model 1), which in absolute terms is €425 higher annual OOP expenditure (online supplemental appendix F eFigure 2). Having two conditions was associated with 43% (exp(0.356)) higher OOP healthcare expenditure than people with no conditions, which in absolute terms is €231 higher annual OOP expenditure.

In model 1, being a cardholder was associated with a 48% (exp(−0.647)) reduction in OOP expenditure compared with non-cardholders. The interaction effects on being a cardholder and number of chronic conditions was statistically significant; a greater number of conditions was associated with cardholder status having a stronger negative effect on OOP healthcare expenditure (online supplemental appendix F eFigure 3). Having PHI was associated with a 97% (exp(0.676)) increase in OOP healthcare expenditure compared with individuals

Table 4 Gamma model assessing associations with out-of-pocket Healthcare expenditure†

	Model 1 (N=5144) Coefficient (SE)	Model 2 (N=5144) Coefficient (SE)	Model 3 (N=5144) Coefficient (SE)	Model 4 (N=4198) Coefficient (SE)
No Conditions (comparator: 0 conditions)				
One condition	0.288* (0.079)	0.287* (0.094)	0.180 (0.130)	0.315* (0.086)
Multimorbidity				
Two conditions	0.356* (0.079)	0.515* (0.100)	−0.096 (0.128)	0.334* (0.086)
Three or more conditions	0.580* (0.576)	0.880* (0.104)	0.236** (0.119)	0.589* (0.083)
Age	0.040 (0.036)	0.030 (0.035)	0.038 (0.034)	0.058 (0.040)
Age^2	−0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)
Female	0.082 (0.049)	0.072 (0.046)	0.082 (0.045)	0.110* (0.054)
Cardholder	−0.647* (0.061)	−0.325* (0.134)	−0.668* (0.057)	−0.661* (0.068)
Private health insurance	0.676* (0.052)	0.690* (0.049)	0.255** (0.128)	0.476* (0.061)
One condition#cardholder		−0.099 (0.157)		
Two conditions#cardholder		−0.410* (0.158)		
Three conditions#cardholder		−0.581* (0.155)		
One condition#PHI			0.161 (0.158)	
Two Conditions#PHI			0.695* (0.157)	
Three conditions#PHI			0.557* (0.146)	
Equivalised household income‡				9.063** (3.628)
Equivalised household $income^2$				−29.815 (29.909)
Education (comparator=primary)				
Secondary				0.152** (0.070)
Third level or higher				0.242* (0.077)
Rural (comparator=urban)				−0.151* (0.053)
Marital status (comparator=married)				
Living with partner				−0.018 (0.177)
Single				−0.162 (0.092)
Separated				−0.156 (0.131)
Divorced				0.097 (0.142)
Widowed				−0.140 (0.080)
Intercept	4.284* (1.266)	4.508* (1.214)	4.636* (1.191)	3.385* (1.417)

*p<0.001, **p<0.05.
†Health insurance expenditure is not included in the calculation of out of pocket healthcare expenditure. Results presented as coefficients and can be interpreted as percentage changes by converting to an exponent
‡Scaled variable where coefficient is associated with €1000 change in income.
PHI, private health insurance.

without PHI (model 1). The interaction effects on having PHI and number of chronic conditions was statistically significant, a greater number of conditions was associated with PHI status having a stronger positive effect on OOP healthcare expenditure (online supplemental appendix F eFigure 4). Higher income, higher educational attainment and living in an urban area were also found to have a positive association with OOP healthcare expenditure. The sensitivity analysis using OLS models (online supplemental appendix F eTable 2) revealed similar results to those found in the gamma models.

Effect of independent variables at different points of the OOP expenditure distribution

Unconditional quantile regression models were conducted to examine whether the association between number of conditions and OOP healthcare expenditure (among those with any OOP healthcare expenditure) differed across the OOP healthcare expenditure distribution (online supplemental appendix F eTable 3). A strong positive association between multimorbidity and OOP healthcare expenditure was found (figure 1). For example, while three or more conditions was associated with OOP expenditure being €143.52 higher per annum

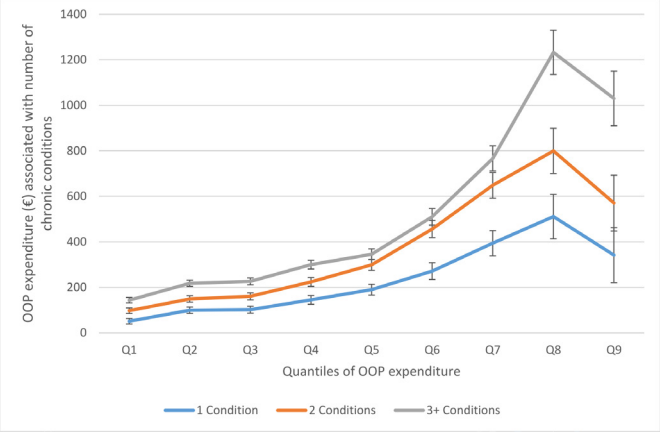

Figure 1 Quantile regression coefficients for effect of number of conditions on out-of-pocket (OOP) healthcare expenditure (error bars represent SE).

for individuals in quantile 1, in the highest quantile it was associated with annual OOP expenditure being €1029.98 higher.

DISCUSSION

This study provides evidence on the differences in OOP healthcare expenditure between those with and those without multimorbidity. The results show that having multimorbidity in Ireland increases an individual's likelihood of having OOP healthcare expenditure by over 20%. The results also show that having multimorbidity is associated with a large absolute increase in OOP healthcare expenditure, even controlling for several sociodemographic factors. Our adjusted analyses found that, on average, people with two chronic conditions spent €771 per annum on OOP healthcare expenditure while those with three or more conditions spent €965. This places a large financial burden (percentage of household income spent on healthcare) on those with multimorbidity. The study identifies a subset of high OOP spenders; 8.6% of people with three or more conditions spent 20% or more of their equivalised household income on healthcare. Using unconditional quantile regressions, when looking at the highest spending quantile, people with multimorbidity spent much more per annum (€570 for those with two conditions and €1030 for those with three or more conditions) than those with no conditions.

To put these results into context, a 2017 study found that people with colorectal cancer had OOP healthcare expenditure of almost €1600 per annum.[61] However, this included indirect costs such as clothing and childcare, which were not accounted for in our analysis. Also, in 2019, across all health and social care, OOP spending equated to €580 per person in the general population.[62] However, this included long-term care costs which make up a substantial proportion of OOP costs in Ireland.[60]

The findings of higher financial burden among people with multimorbidity is particularly concerning. It is likely caused by the association between multimorbidity and healthcare utilisation,[7] polypharmacy,[8] socioeconomic deprivation[29 30] and having to leave paid employment.[63] An Australian study of older adults with multimorbidity[16] found similar levels of financial burden to those found in this study. This is unsurprising as there are many similarities between the two countries' health systems.[64 65] The association between number of conditions and greater OOP healthcare expenditure is consistent with findings from studies in HICs[1 16] and MICs.[18–20 66] However, the unadjusted results show that multimorbidity (is associated with a less than two-fold increase in OOP healthcare expenditure, compared with those with no conditions. Studies in the USA and Australia showed far greater increases in expenditure associated with multimorbidity.[1 16] The stronger effect in high spenders is consistent with two recent studies conducted in MICs.[18 19] This may be accounted for by specific combinations of conditions associated with high OOP healthcare expenditure,[14] or simply with discordant multimorbidity (conditions that require different management approaches and/or have different aetiology) as opposed to concordant multimorbidity (conditions that require similar management approaches and/or have similar aetiology).[6]

Similarly to the results found in the USA[1] and Australia,[16] our results found that pharmacy-dispensed medicines were the greatest contributor to OOP expenditure, particularly for people with multimorbidity. This is despite many people with multimorbidity being eligible for heavily subsidised or free medicines in Ireland through medical card or long-term illness scheme eligibility (where patients with diabetes represent a majority within the scheme and are entitled to free diabetes-related medicines).[67] However, for those not eligible for these schemes, the high OOP expenditure may be due to the high caps on medicine expenditure. At the time of data collection, individuals who were not eligible for a medical card or the long-term illness scheme were required to pay up to €144 per month per family through the Drugs Payment Scheme.[68] Though it should be noted that the Drugs Payment Scheme cap reduced to €100 per month in January 2022.[69] Current plans for health system reform in Ireland involve a commitment to free (at the point of delivery) GP and hospital care and introducing a different Drugs Payment Scheme threshold for single-headed households of €72.[70] Given that medicines were a large contributor to OOP healthcare expenditure, interventions to reduce unnecessary or inappropriate prescribing should be considered given the positive effects this could have on both OOP healthcare expenditure and health outcomes. These could include clinical guidelines which account for people with multimorbidity,[71] deprescribing interventions[72] or interventions that reduce interactions between the pharmaceutical industry and physicians.[73] Interventions to increase levels of generic prescribing[74] and reduce the costs of medicines[75] would also be beneficial.

The results highlight the contrasting impact of medical cards and PHI on OOP expenditure across the Irish health system. The medical card, which entitles people to free or heavily subsidised healthcare, was found to reduce OOP healthcare expenditure, by 48%. This mitigating effect was found to be stronger for people with multimorbidity. A Chinese study[66] of multimorbidity and OOP healthcare expenditure found a strong association between public entitlements and reduced OOP expenditure. Our study found that PHI was associated with 61% higher OOP healthcare expenditure (excluding expenditure on PHI premia), and strikingly this increase was significantly greater for people with multimorbidity. The strong association between PHI and increased OOP healthcare expenditure likely speaks to the supplementary role PHI plays in Irish healthcare.[76] In a supplementary market, PHI offers access to services covered by public entitlements, but gives the PHI purchaser the choice of a private provider and the ability to skip waiting lists for publicly funded treatments.[76] The supplementary market may be increasing expenditure for people with PHI because of the higher co-payments associated with private care. Though, it is also possible that this relationship is being driven by people with PHI being enabled to afford, use and pay for certain healthcare services, relative to people without PHI.[77] PHI is also thought to play a complementary role in Ireland[76] (covering services not covered by public entitlements and reimbursing some statutory charges) and therefore should offer some financial protection. However, given the strong association between PHI and increased OOP healthcare expenditure, this complementary role seems to be outweighed by the supplementary role.

Given that those on a low income without a medical card or PHI are more likely to report an unmet healthcare need[77] increasing the income threshold for the medical card, which includes free GP and hospital care and heavily subsidised medicines, would likely be beneficial to people with multimorbidity. The benefits of this measure are further emphasised by this study's results that the medical card is associated with a significant reduction in OOP healthcare costs, and that people with multimorbidity have lower incomes and higher expenditure, on average. Another useful measure for people with multimorbidity would be to address known barriers to medical card uptake including 'lack of awareness of entitlement, potential stigma and large administrative burdens'[33] as there is evidence that 31% of those entitled to a medical card are not availing of it.[33] However, reduced OOP costs will not address access issues completely if uncoordinated care[13] and long waiting lists for public services[78] are not addressed.[77]

With regard to future research, a similar study of other groups, for example, those with disabilities who do not have multimorbidity could provide interesting findings as they may have different levels of income and OOP healthcare expenditure. For similar reasons a study of those aged under 50 years, who may also have different patterns of multimorbidity could provide valuable findings. Future research could stratify the OOP healthcare expenditure analysis by entitlement status. Also, analysis using direct measures of expenditure such as insurance databases or medical records could provide more valid findings. This would address the potential recall bias limitation of this study. This may also help facilitate greater access to data on people with cognitive impairment or people who speak a language other than English. However, the IT infrastructure in Ireland would need to be improved and made more accessible to researchers in order to conduct these types of studies.

Strengths and limitations

This study has several strengths and limitations. First, a major strength of this study is that TILDA captures a nationally representative sample of community-dwelling adults in Ireland. A limitation of this study is the use of self-reported survey-based data, which can create a recall bias. Specifically, it can result in under-reporting of chronic conditions[79 80] and misreporting of routine healthcare utilisation.[81] This is likely to be more problematic for those with higher expenditure due to the greater volume of information involved. However, a recent study of TILDA data found that patient self-report for healthcare utilisation was accurate for several health services.[82] However, these findings are not directly applicable to expenditure data. Calculating 12-month expenditure for home care services and prescription drugs by multiplying monthly amounts by 12 is also a limitation. Another limitation is that household adaptations, medical devices and travel costs to access healthcare were not included in this analysis meaning that OOP healthcare expenditure is likely to be underestimated. Overall, the regression models are vulnerable to unobserved heterogeneity, and therefore, require cautious interpretation. A measure of the proportion of non-subsistence income (income not spent on subsistence) spent on healthcare, which is not available within TILDA, may have allowed for increased understanding of financial burden.[83 84] Using disease count to represent multimorbidity has both strengths and limitations; its primary limitation is that severity of each condition is not considered.[85] Its primary strength is that it is the only multimorbidity measure associated with all three essential outcomes from the core outcomes set for multimorbidity research: mortality, mental health outcomes and health related quality of life.[85] Finally, the observational nature of this study means it is vulnerable to residual confounding and selection bias.

CONCLUSION

Multimorbidity is associated with significantly increased OOP healthcare expenditure, particularly for those who spend more on healthcare, and leads to higher financial burden, particularly for those in more socioeconomically disadvantaged groups. High financial burden can have a range of negative effects, which include adverse

clinical outcomes and cost-related non-adherence/non-attendance. Eligibility for free healthcare and heavily subsidised medicines greatly reduces these OOP healthcare costs. Therefore, broader access to free healthcare has the potential to reduce the high financial burden experienced by people with multimorbidity.

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