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# Informal care and health outcomes in older people: exploring measures of multimorbidity

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# Introduction & PhD project

- Older population in Scotland steadily increasing (by just under 60% in next 20 years) (Scottish Government 2014)
- 65+ demographic cost £4.5 billion in 11/12 to NHS (Audit Scotland 2014)
- Scottish Government integrating health and social care to allow older people to receive treatment at home/ease costs

# Multimorbidity

- Multimorbidity is defined as the presence of more than one condition in the individual
- Multiple conditions at once can lead to increased strain on management of conditions and complications from polypharmacy (Tinetti et al 2004)
- By the age of 65, over half of the population will have more than one condition (Audit Scotland 2014)

# Health and informal care

- My PhD broadly focuses on the relationship between care as a whole with health outcomes (as well as multimorbidity) used linked health and social care data
- This chapter focuses on informal care (users of which can have a number of different characteristics to formal care recipients) and uses a different dataset

# Health and informal care

My preliminary literature review found three main points:

1. Respondents in receipt of informal care have increased likelihood of adverse health outcomes such as admissions (Karlsson et al 2008) and nearing end of life (Pot et al 2009)
2. Multimorbidity underrepresented in studies looking at informal care, usually only as a control or as a self-report scale
3. Those in receipt of informal care are usually more frail (Karlsson et al 2008) and more likely to live with a partner (Pot et al 2009, Kendrick & Conway 2006)

Today I will focus on point #2: understanding the impact of multimorbidity on informal care use and mortality among care users, and comparing multiple methods of measurement.

# How to measure multimorbidity?

- There is no “gold standard” for measuring MM, with the choice of measurement being the target population or outcome variable
- Methods of measurement include condition-based indices, proxy measures via prescription use or self-report methods
- From a sociological perspective, it is also important to consider the cumulative effects of MM on mental health and lifestyle (Grundberg et al 2016, O’Brien et al 2011)

# Methodology

- Dataset consists of 8,334 respondents to the Scottish Health Survey (SHeS) aged 65+ between 2008-2014 and with linked SMR data
- I constructed a number of multimorbidity scores from either data taken at interview or in the 5 years prior to the interview date (admissions data)
- These variables were then added to nested regression models examining mortality or receipt of care, with summary statistics (AIC, BIC, pseudo-R<sup>2</sup>, AUC) compared

# Methodology

Two outcome measures were used:

- Mortality within one year of interview
  - One year window used in other studies (Pot et al 2009, Walker et al 2015)
  - Same health outcome measure used in other chapters of PhD, included for consistency
- Receipt of informal care
  - Derived from question asking member of the same household if, and who, they provide care for
  - As a result, this is only a measure of receipt of informal care from someone who lives with the respondent



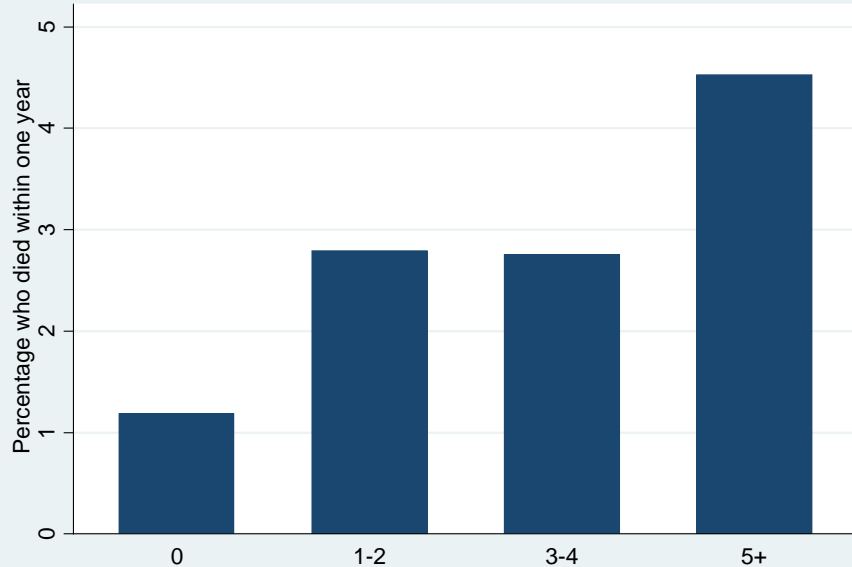
# Methodology - multimorbidity

- The interview data allows respondents to report up to six conditions (from a list of 42) and whether or not the condition limits their day-to-day activities
- In addition, the SMR data gives initial admissions (and accompanying ICD-10 codes) for a select list of conditions ranging from cardiovascular problems to types of cancer
- From this report data I constructed a number of multimorbidity scales, three of which I performed further analysis with – weighted self-report, Charlson Index and unique SMR episodes

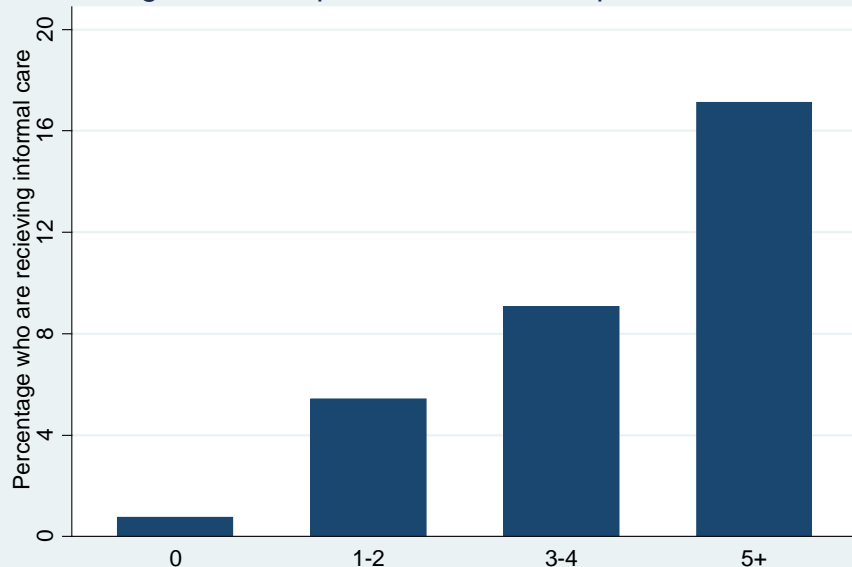
## Weighted self report measure

- Respondents can select up to six conditions from a list of 41, and also state whether it “limits activities”
- Based on Sangha et al (2003) I created a score where participants were given one point per condition and a further point if said condition “limits activities”, to a total of 12

Weighted self-report score and death within one year

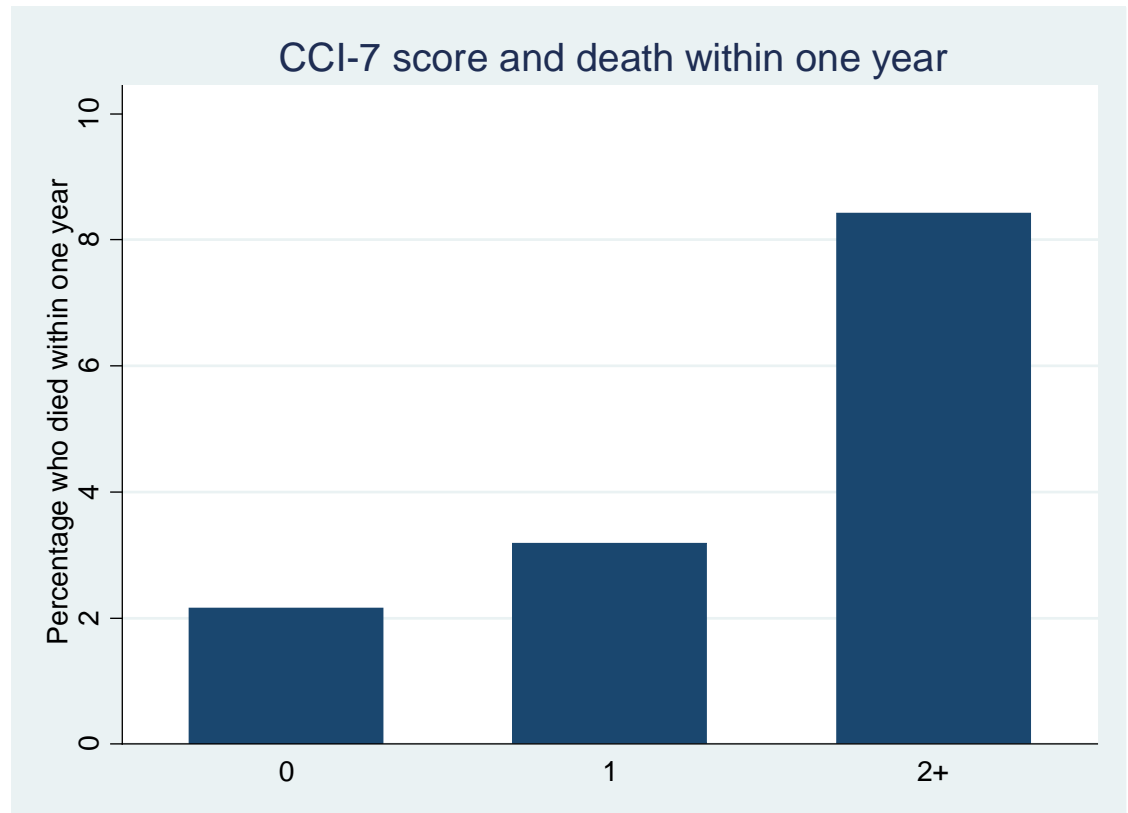


Weighted self-report score and receipt of informal care

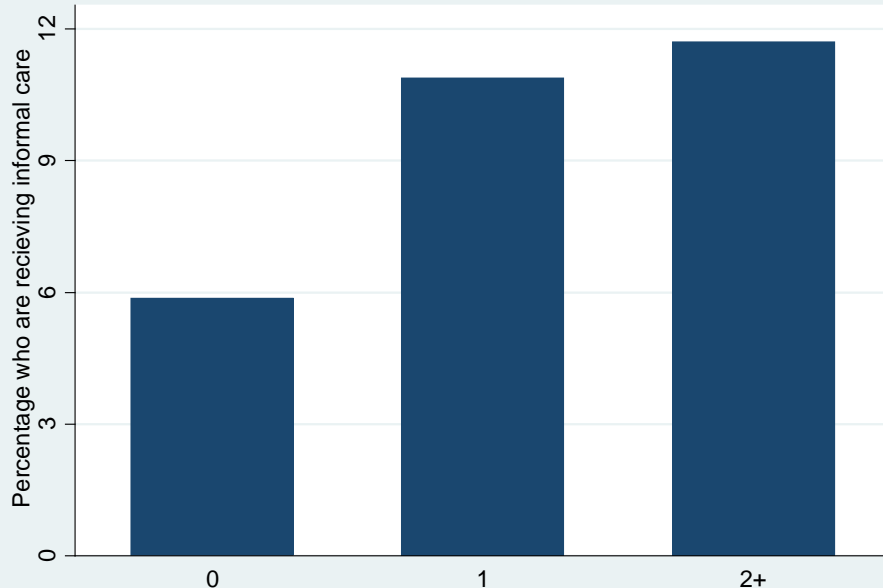


## 7-condition Charlson Comorbidity Index (CCI-7) *(mortality only)*

- List of 17 weighted conditions derived from ICD-10 codes, used to predict mortality (Charlson et al 1987):
- Consistently outperforms similar methods (Walker et al 2015, Huntley et al 2011)
- Limited nature of dataset means the CCI only identified 7 conditions



Unique SMR admissions and receipt of informal care



## Unique SMR admissions for specific conditions *(informal care use only)*

- A count of how many “initial” admissions were recorded for the 14 conditions specified in the limited SMR dataset (mostly cancer or cardiovascular related)
- This proxy method outperformed the CCI-7 in preliminary tests for association with informal care

# Multimorbidity and 1-year mortality (nested regression models)

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Weighted self-report score	Null	+ age & sex	+ multimorbidity & informal care	+ control variables†††	+ interaction variables
OR of multimorbidity variable†			***1.12	***1.11	1.00
OR of informal care variable††			***2.28	***2.55	**0.82
AIC	2006	1914	1870	<b>1861</b>	1859
BIC	2013	1935	1905	<b>1938</b>	1957
Pseudo-R <sup>2</sup>	0.000	0.048	0.079	0.092	<b>0.093</b>
AUC	0.500	0.688	0.721	0.734	<b>0.740</b>

CCI-7	Null	+ age & sex	+ multimorbidity & informal care	+ control variables†††	+ interaction variables
OR of multimorbidity variable†			***1.72	***1.72	0.99
OR of informal care variable††			***2.62	***2.87	0.82
AIC	2006	1914	1856	<b>1843</b>	1846
BIC	2013	1935	1891	<b>1920</b>	1945
Pseudo-R <sup>2</sup>	0.000	0.048	0.079	0.092	<b>0.093</b>
AUC	0.500	0.688	0.732	0.743	<b>0.746</b>

\* p<0.05 \*\* p<0.01 \*\*\* p<0.001 † age\*multimorbidity in interaction model

†† informal care\*multimorbidity in interaction model

††† Determined via prior univariate significance testing with outcome variable. Includes SIMD, NS-SEC, education level and marital status

# Multimorbidity and informal care use (nested regression models)

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Weighted self-report score	Null	+ age & sex	+ multimorbidity & informal care	+ control variables††	+ interaction variables
OR of multimorbidity variable†			***1.33	***1.36	1.00
AIC	4123	4088	3734	<b>3483</b>	<b>3483</b>
BIC	4130	4109	3762	<b>3574</b>	3589
Pseudo-R <sup>2</sup>	0.000	0.001	0.096	0.161	<b>0.162</b>
AUC	0.500	0.578	0.760	<b>0.805</b>	<b>0.805</b>

Unique SMR admissions	Null	+ age & sex	+ multimorbidity & informal care	+ control variables††	+ interaction variables
OR of multimorbidity variable†			***1.45	***1.45	1.01
AIC	4123	4088	4053	<b>3834</b>	3837
BIC	4130	4109	4081	<b>3926</b>	3942
Pseudo-R <sup>2</sup>	0.000	0.001	0.019	<b>0.076</b>	<b>0.076</b>
AUC	0.500	0.578	0.600	<b>0.714</b>	<b>0.714</b>

\* p<0.05 \*\* p<0.01 \*\*\* p<0.001

† age\*multimorbidity in interaction model

†† Determined via prior univariate significance testing with outcome variable. Includes SIMD, NS-SEC, education level and marital status

# Discussion

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## CONCLUSIONS

- Both self-report and ICD-10 based measures of multimorbidity are associated with both mortality and use of informal care
- By far the strongest association is the self-report measure with informal care, but the CCI is more predictive of mortality (even in a limited format)
- Informal care is also significantly associated with mortality

## FUTURE RESEARCH

- This is a paper in progress – I will perform additional analysis such as survival and factor analysis
- Analyse the impact of specific two-condition interactions on mortality and informal care
- Explore the possibility of using prescription-based measures using a smaller dataset