Multimorbidity and the health-related quality of life among people 50 years and up: results of a longitudinal study in New Zealand

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Abstract

Objective

This study aimed to examine the association of Health-Related Quality of Life (HRQOL) and multimorbidity (MM) and its correlates over time in New Zealand.

Methods

People aged 55 years and over were invited to participate in a nationally representative population-based longitudinal study in 2006 and followed up biennially until 2016. GEE models, adjusted for both time-constant and time-varying factors used baseline and five subsequent waves of data, to compare a range of factors related to changes in MM and HRQOL.

Results

At baseline, 957 of the participants were classified as “MM participants”; 570 had two, and the rest had three chronic conditions. The results of the GEE modelling demonstrated that SF12-PCS decreased over time and there was a significant difference in SF12-PCS between MM and Non-MM participants. Having MM was negatively associated with HRQOL-PCS [-3.00 (95%CI -3.60, -2.49); p <0.001)]. Although the results showed an increase in SF12-MCS over time, the score of the mental dimension of HRQOL was lower among MM participants compared to Non-MM participants [-2.60, 95%CI -3.09, -2.11].

Conclusions

According to this longitudinal study, there is an inverse association between MM and one of the most important health outcomes; HRQOL, in older adults.

Introduction

Multimorbidity (MM) is defined as “coexistence of two or more chronic diseases within an individual” (1). It is an emerging health problem due to the ageing of the population and the high prevalence and burden of chronic diseases (2, 3). The prevalence of MM in the general population worldwide ranges from 13.1% to 71.8% (4).

Health-Related Quality of Life (HRQOL) is the dominant outcome measure in clinical research for assessment of the burden of illness as well as the evaluation of care and treatment effectiveness (5). Cross-sectional studies have shown an inverse association between the Quality of Life (QOL) and MM. Fortin et al. (6) conducted a systematic review to clarify the association between MM and HRQOL in the primary care setting. They screened published manuscripts from 1993 to 2003 to confirm the negative impact of the MM on HRQOL. A systematic review of published studies from South Asian countries (7) also reported lower quality of life among people with MM. Results of a large and nationally representative study in the US (8) showed that individuals with MM had a poorer performance in HRQOL compared to

those without MM which was significantly more remarkable in those with three or more chronic conditions. A more recent systematic review (9) including studies conducted in the general population aged 45-64 years old confirmed the association of MM with poorer HRQOL.

Despite cross-sectional support for impact of multiple chronic illenesses on HRQOL, longitudinal data examining change in HRQOL among people with MM is rare. Only one recent publication was found using a longitudinal approach. Gu et al. (10) conducted a 24-month longitudinal study among 437 individuals aged 60 years and over in China, to show that MM was associated with lower HRQOL. Certain patterns of MM impacted on different dimensions of HRQOL. However, the duration of the study and the low sample size limited the conclusions of this study.

Because HRQOL varies over time, longitudinal analysis can contribute to improved understanding of the impact of multiple illnesses on QOL. This study aimed to examine the HRQOL changes related to MM over time and to identify potential epidemiological and clinical correlates of these differences. Data from 6 waves of the New Zealand Health, Work and Retirement Study (HWR) were used.

Methods And Materials

Study Population

The HWR is a prospective cohort study of community-dwelling older adults. It commenced in 2006 as a postal survey of a representative national sample aged 55-70, randomly selected from the New Zealand electoral roll. Of the original cohort (N=6662), 2632 consented to be invited to participate in subsequent waves. Of these, 1609 (41%) were lost to follow up over the five waves of the study (212 to death, and remaining unknown). Data has been collected biennially. The core questionnaire assesses domains of health and well-being; family and social support; work and retirement; financial well-being; and cultural identity.

Measures

Multimorbidity

Participants with MM were selected based on their response to a question ‘Has a doctor, nurse or other healthcare worker told you that you have any of the following health problems (a list of conditions was provided)? We selected nine groups of diseases for this analysis according to the availability of data in all waves including: heart disease, stroke, other neurologic diseases (epilepsy, Parkinson, migraine headache, Alzheimer/dementia), musculoskeletal (arthritis, osteoporosis, hip/knee replacement), diabetes mellitus, respiratory diseases (Chronic Obstructive Pulmonary Disease (COPD), asthma), chronic liver conditions (cirrhosis), cancer, and mental disorder (depression, anxiety and other mental diseases). Participants were classified as 1) “MM participants”; those who answered “yes” to at least two diseases in this list, 2) “Non-MM participants” defined as participants who were without MM in any of the study

waves and the baseline. MM was also categorised as no. of chronic diseases (up to 3+). We also analysed the HRQOL over the time according to the number of chronic diseases (0, 1, 2, 3+).

Health-Related Quality of Life

HRQOL was assessed using the SF12, a short version of the HRQOL measures developed within the framework of the Medical Outcome Study (11). SF-12 items are rated 1-5 and standardised norm based orthogonal factor weights calculated to form a Physical Component Score [Physical Component Scale (PCS); positive weights for physical functioning (2 items), role physical (2 items), pain and general health] and Mental Component Score [Mental Component Scale (MCS); positive weights for vitality, social functioning, relationships (2 items) and mental health (2 items)] (12). Higher values represent a higher QOL.

Demographic Variables

Age, provided as a continuous variable, was categorised as 55-64 years and 65 and over. Marital status was considered as two groups: married/living with a partner, divorced/ separated/single/ widow; ethnicity was classified as priority ethnic groups in New Zealand, Maori and non-Maori (Europeans, Asians, Pacific people and other ethnicities). Socioeconomic status indicators included educational qualification categorised as no secondary, secondary, post-secondary and tertiary; and annual personal income (0-25000, 25001-50000, 50001-70000, >70000 NZ$). Smoking was defined by asking respondents to identify themselves as a regular smoker or not.

Behavioural Variables

Alcohol consumption was assessed by the frequency of drinking, from never, through up to four times a month, to two or more times a week, and then classified into two groups; regular consumption (2 or more drink per week) and occasional consumption (less than two drinks) per week. Physical activity was measured by the number of moderate activities including brisk walking, and vigorous activity in the last seven days that was categorised into two levels: two or more times per week, once per week/none. Body Mass Index (BMI, kg/m^2) was measured only in 2008 and categorised as normal weight (<25), overweight (25-29.9), obese (≥30).

Clinical variables

Hypertension and eye problems (including cataracts, glaucoma and blindness) were included as dichotomous variables (yes/no), based on the responses to a question about the doctor-diagnosed health problems. Vision problems were also measured by asking about the ability to see an ordinary newspaper (with glasses or contact lenses if worn).

Statistical analysis

Differences in the characteristics of people with and without MM at baseline were determined by Student's t-test for continuous variables and the chi-square test for categorical variables. Generalized Estimating Equations (GEE) with an exchangeable correlation matrix and robust standard errors were used to analyse the data. The results are presented as estimates (with 95 percent confidence intervals) of the difference between the two groups (those with/without MM). The difference of two components of the HRQOL; PCS, MCS, between groups was estimated after adjusting for baseline values in the first model and baseline values for age, sex, ethnicity, education, marital status, hypertension, alcohol consumption, smoking, and physical activity in the second model. We repeated the analysis according to the number of chronic conditions separately.

Data were analysed using the STATA statistical package Version14, all estimates were reported with 95% confidence interval and a significance level 0.05.

Results

At baseline, 957 of the participants were classified as "MM participants", of whom 570 had two chronic conditions, and the remainder had three chronic conditions. Figure 1 shows that the prevalence of MM increased over time from about 34% in 2006 to about 62% in 2016.

Table 1 displays the range of epidemiological and clinical variables within the two study groups. Relative to Non-MM participants, MM participants were older (61.8±4.5 vs 60.7±4.5 respectively, P <0.001), less educated, had lower annual income (P<0.001), and identified as Maori, (P<0.001). The frequency of overweight/obesity, irregular alcohol consumption, insufficient physical activity (less than two times moderate/vigorous activity per week), was higher among MM participants compared to Non-MM participants. The frequency of hypertension and sight problems were higher among MM participants relative to Non-MM participants (P <0.001).

Figure 2 shows the changes in both physical and mental dimensions of SF12 over time. The mean score of the physical dimension decreased over time in both MM and Non-MM participants. The mean SF12-PCS was lower in the MM group than in the Non-MM group at every time point (Figure 2a). In contrast, the SF12-MCS mean score showed a steady increase over time in both groups. However, MM participants had significantly poorer performance on the SF12-MCS than Non-MM participants at every time point (Figure 2b). The mean scores of both SF12 dimensions over time according to the number of chronic conditions are also shown. Those with a higher number of chronic conditions recorded lower scores of both components of SF12 at every time point (p<0.001) (Figure 2c and 2d).

Table 2 shows the results of the GEE modelling which demonstrates that SF12-PCS decreased over time [β=-0.23 (SE=0.03), p<0.001] for all, while there was a significant difference in SF12-PCS between MM and Non-MM participants. Having MM was negatively associated with HRQOL-PCS [(difference, (95 percent confidence interval, -3.00 (-3.60, -2.49); p <0.001)]; individuals with MM, on average, had a score 3 points lower on the HRQOL-PCS than those without MM. Further adjustment for other variables (age, sex,

ethnicity, education, income, marital status, BMI, hypertension, alcohol consumption, smoking, physical activity, and sight problem) had little effect on the difference, reducing it to -2.21.

The results showed an increase in SF12-MCS (β=0.17 (SE=0.03, p<0.001) over time, however, the score of the mental dimension of HRQOL was lower among MM participants compared to Non-MM participants [difference, 95 %CI, -2.60 (-3.09, -2.11)]. After adjustment for all other variables the effect size decreased but remained significant (difference, 95%CI, -1.85 (-2.44, -1.27).

This analysis was repeated according to the number of chronic diseases. The difference in SF12-PCS mean scores increased as the number of chronic diseases increased from an average -2.29 for those with one chronic condition compared to individuals without chronic conditions, to -6.29 for those with three and more chronic conditions. Adjustment for other variables had little effect on the effect size. The difference in mean score of SF12-MCS increased as the number of chronic diseases increased from -0.79 in those with one chronic condition to -4.61 in those with three and more chronic conditions compared to individuals without chronic conditions. The difference did not remain significant among those with one chronic condition after adjustment for other variables.

Discussion

This study examined the impact of MM on HRQOL using data from a longitudinal study in New Zealand. The prevalence of the MM at the baseline was lower than a Chinese study (10) (34% vs 56.5%) which can be partly explained by the age group of the participants; our participants were five years younger than the Chinese study.

We found that physical quality of life scores decreased over time for all, however, individuals with MM had a lower mean score on HRQOL-PCS than those without MM, in both crude and adjusted statistical models. Moreover, the results showed an increase in mental health related quality of life over time in both groups, while the score of the mental health dimension of HRQOL was lower among MM participants compared to Non-MM participants. These findings are similar to the results of the study by Gu et al. (10) among community-dwelling elderly in China which reported an inverse association of MM with HRQOL. Our study had a higher number of participants (2632 vs 437 at the baseline), and longer duration of follow-up (10 years vs two years) which provides stronger support for these relationships.

When this analysis was repeated according to the number of chronic diseases reported by participants, the difference in mean scores of both physical and mental dimensions of HRQOL increased as the number of chronic diseases increased. This negative association of number of chronic conditions with mental and physical HRQOL has been observed in other cross sectional studies (13). Our participants were classified at baseline and the analysis shows how the initial incidence of multiple conditions continues to impact negatively on HRQOL over time. Future longitudinal studies will be able to follow the trajectories of those whose MM status changes across time.

The strength of the present study is the longitudinal nature. However, an important issue, the consistent definition of MM, must be resolved before developing complex longitudinal designs. In our study, as in others, we used a list of chronic diseases developed for general health research purposes. The wide variation in reported incidence of MM world-wide is probably due to heterogeneity in data collection methods and the operational definition of MM (4). Fortin et al. (6) concluded their systematic review by suggesting that the heterogeneity in the definition and measurement of MM must be addressed to help clarify the impact of MM on HRQOL. Others (7) have also commented on the heterogeneity in the operational definition of MM and a Canadian cross-sectional study (14) showed how this impacts findings; the length of the list of conditions has an impact on the estimated prevalence of MM and on the level of the physical component of HRQOL. These authors recommend the use of a comprehensive list. Certainly, a more focussed approach to the assessment of MM is required in future research.

In conclusion, this longitudinal study has supported the importance of understanding the long term effects of MM on HRQOL for older adults and raised questions about possible trajectories. These findings can contribute useful information for health policy. The present study supports further research in this area with an initial focus on better definitions of MM.

Abbreviations

MM: Multimorbidity; HRQOL: Health-Related Quality of Life; HWR: Work and Retirement Study; BMI: Body Mass Index; GEE: Generalized Estimating Equations; Physical Component Scale (PCS); Mental Component Scale (MCS); COPD: Chronic Ostructive Pulmonary Diseases; CI: Confidence Intervals; OR: Odds Ratio; ORadj: Adjusted Odds Ratio; ORcrude: Crude Odds Ratio

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the declaration of Helsinki and had ethics approval from the Massey University Human Ethics Committee (MUHEC Southern B 09/70). At the beginning of the study, informed consent was obtained in written forms from all of the participants after thorough explanation of the procedures involved.

Consent for publication

Not applicable.

Availability of data and materials

The data or analysis generated during this study is available upon request.

Competing interests

Authors have no conflict of interest to declare.

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Authors' contributions

All authors were involved in design of the protocol and all drafts of the manuscript. NA and SMS were responsible for data preparation and analysis and CS, FA supervised and supported data collection. All authors reviewed and contributed to all drafts of the manuscript.

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Tables

Table 1. Baseline characteristics of people with/without MM* among adults 55 years and up

Characteristics (2006)	Group				P value
	without MM		with MM		
	N	%	N	%	
Age group					
55-64	1284	76.8	647	67.6	<0.001
64+	398	23.3	310	32.4	
Sex					
Male	868	51.9	536	56.0	0.041
Female	805	48.1	421	44.0	
Education					
No secondary	441	26.6	313	33.0	0.002
Secondary	471	28.4	245	25.8	
Post- secondary/tertiary	747	45.0	391	41.2	
Marital status					
Married/partner	1238	75.2	634	67.0	<0.001
Divorced/separated/single/ Widowed	408	24.8	313	33.1	
Personal income (Annual)					
0-25000	489	34.8	414	53.8	<0.001
25001-50000	523	37.2	220	28.6	
50001-70000	205	14.6	83	10.8	
>70000	190	13.4	52	6.8	
Ethnicity					
European/others	1006	61.2	488	56.7	<0.001
Maori	637	38.8	463	49.3	
Current smoker					
No	881	93.8	445	92.3	0.357
Yes	60	6.4	37	7.7	
Alcohol consumption					
No	259	26.6	100	21.6	0.012
Yes	716	73.4	386	79.4	
BMI					
Normal weight (<25)	496	35.3	183	22.4	<0.001
Overweight (25-29.9)	523	37.2	291	35.6	
Obese (≥30)	386	27.5	344	42.1	
Physical activity					
insufficient	211	13.0	148	16.0	<0.001
sufficient	1411	87.0	779	84.0	
Hypertension					
No	455	45.0	135	25.6	<0.001
Yes	556	55.0	392	74.4	
Sight problem					
No	1442	91.2	763	84.0	<0.001
Yes	139	8.8	392	16.0	

*MM: Multimorbidity; 2+ chronic conditions (heart, neurological, respiratory, musculoskeletal, and mental diseases, cancer, diabetes, chronic liver conditions)

Table 2. Scores of SF12 dimensions and differences between groups during the study period, adults 50 years and up, New Zealand

Group	Baseline score	Average follow-up score	Difference adjusted for baseline value (95% CI)	*P* value	Fully adjusted** difference (95% CI)	P value
SF12 -Physical dimension score						
Without MM*	49.98± 7.95	47.55± 7.92	-3.00 (-3.60, -2.49)	<0.001	-2.21 (-2.76, -1.67)	<0.001
With MM	41.94± 11.03	39.81± 10.01				
SF12 -Mental dimension score						
Without MM	51.20± 9.38	51.06± 7.66	-2.60 (-3.09, -2.11)	<0.001	-1.85 (-2.44, -1.27)	<0.001
With MM	45.68± 11.77	45.85± 10.11				
SF12 -Physical dimension score						
Without chronic conditions	52.27± 6.03	49.65± 6.54	ref		ref	
1	48.06± 8.80	45.73± 8.55	- 2.29 (-2.84, -1.75)	<0.001	-2.01 (-2.65, -1.37)	<0.001
2	44.66± 9.97	42.46± 9.07	-3.96 (-4.58, -3.34)	<0.001	-3.03 (-3.75, -2.31)	<0.001
3+	37.84± 11.30	35.91± 10.07	-6.39 (-7.14, -5.69)	<0.001	-5.11 (-5.99 , -4.24)	<0.001
SF12 -Mental dimension score						
Without chronic conditions	52.67± 8.39	52.08± 7.17	ref			
1	49.96± 9.97	50.18± 8.32	-0.76 (-1.32, -0.20)	0.008	-0.40 (-1.10, 0.29)	0.257
2	48.49± 10.13	48.44± 8.62	-2.33 (-2.97, 1.68)	<0.001	-1.55 (-2.35, -	<0.001

					0.75)	
3+	41.45±12.77	42.02± 10.91	-4.61 (-5.41, -3.81)	<0.001	-3.26 (-4.24, -2.28)	<0.001

* MM: Multimorbidity; 2+ chronic conditions (heart, neurological, respiratory, musculoskeletal, and mental diseases, cancer, diabetes, chronic liver conditions)
** fully adjusted for age, sex, ethnicity, education, income, marital status, BMI, hypertension, alcohol consumption, smoking, physical activity, and sight problem

Figures

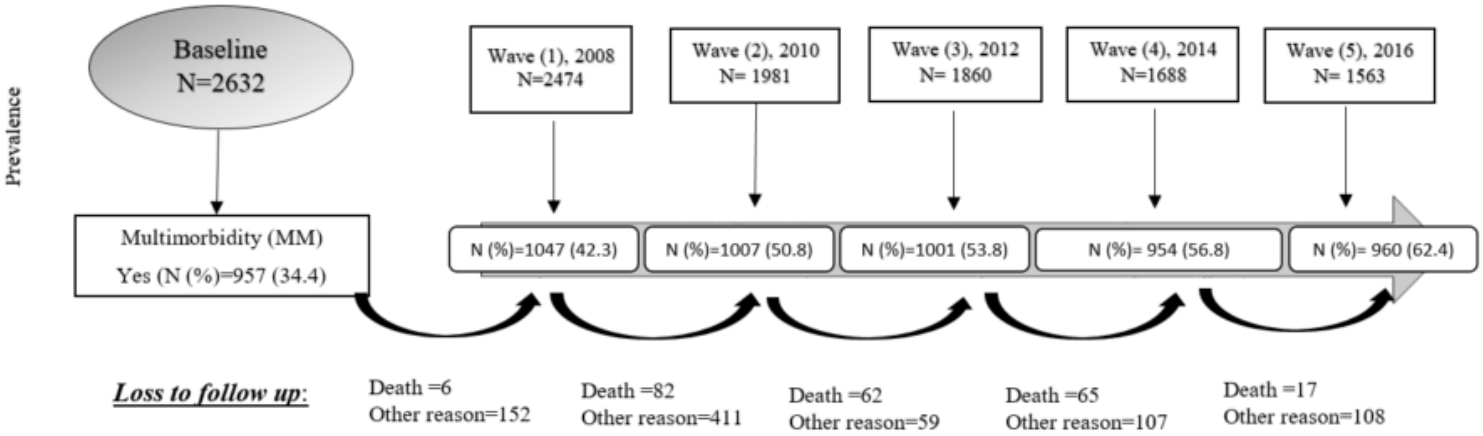

Figure 1

Flowchart of study participants and the prevalence of multimorbidity, 2006-2016

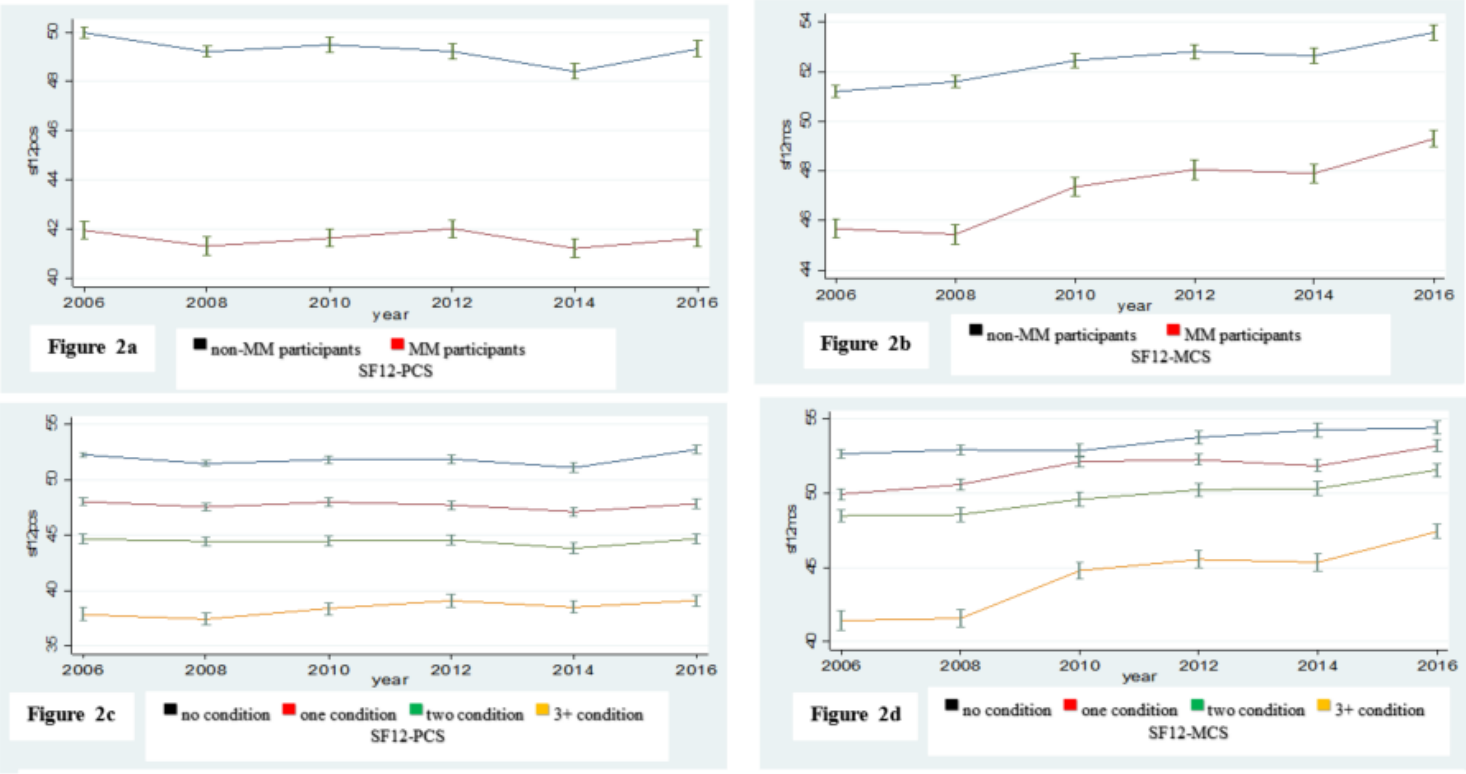

Figure 2

Changes in physical and mental dimensions of SF12 over time. Figure 2a changes in the mean SF-PCS in people with/without MM; Figure 2b changes in the mean SF12-MCS in people with/without; Figure 2c changes in the mean SF12-PCS by number of chronic conditions, Figure 2d changes in the mean SF12-MCS by number of chronic conditions