Quality of Life Research (2006) 15: 83–91
DOI 10.1007/s11136-005-8661-z

Relationship between multimorbidity and health-related quality of life of patients in primary care

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Accepted in revised form 11 June 2005

Abstract

Previous studies about the association of multimorbidity and the health-related quality of life (HRQOL) in primary-care patients are limited because of their reliance on simple counts of diseases from a limited list of diseases and their failure to assess the severity of disease. We evaluated the association while taking into account the severity of the medical conditions based on the Cumulative Illness Rating Scale (CIRS) score, and controlling for potential confounders (age, sex, household income, education, self-perception of economic status, number of people living in the same dwelling, and perceived social support). We randomly selected 238 patients to construct quintiles of increasing multimorbidity (CIRS). Patients completed the 36-item Medical Outcomes study questionnaire (SF-36) to evaluate their HRQOL. Applying bivariate and multivariate linear regression analyses, we used the CIRS as either a continuous or a categorical (quintiles) variable. Use of the CIRS revealed a stronger association of HRQOL with multimorbidity than using a simple count of chronic conditions. Physical more than mental health deteriorated with increasing multimorbidity. Perceived social support and self-perception of economic status were significantly related to all scales of the SF-36 ($p < 0.05$). Increased multimorbidity adversely affected HRQOL in primary-care adult patients, even when confounding variables were controlled for.

Key words: Chronic disease, Family medicine, Health-related quality of life, Multimorbidity or comorbidity

Abbreviations: BP – Bodily pain; CIRS – Cumulative Illness Rating Scale; GH – General health; HRQOL – Quality of life; HT – Health transition; MCS – Mental component summary; MH – Mental health; PCS – Physical component summary; PF – Physical functioning; RE – Role emotional; RP – Role physical; SF – Social functioning; SF-36 – 36-item Medical Outcomes Study questionnaire; VT – Vitality scale

Introduction

Of the 90 million Americans living with a chronic medical condition in 1987, 43% had more than one chronic condition, or multimorbidity [1]. Epidemiological data [2–4] from studies done in several countries confirm that patients with multimorbidity comprise an important portion of family doctors' patients. Estimates of its prevalence vary from 17% for patients aged between 20 and 39 years [3] to 98% for patients aged 65 years and older [4]. However, outcomes associated with multimorbidity have not been studied in depth.

The health-related quality of life (HRQOL), a subjective outcome measure that has been used to

evaluate the impact of multimorbidity, provides a multidimensional perspective that encompasses a patient's physical, emotional, and social functioning [5]. Increasingly, this measure has been used in clinical studies of patients with chronic diseases [6–9]. From a recent systematic review [10] of studies published between 1990 and 2003, we found that multimorbidity was associated with HRQOL. The relationship between multimorbidity and HRQOL in primary care was the main focus of only 7 studies [11–17], despite the large number of patients with concurrent medical conditions seen in this setting. However, methodological limitations considerably weaken the validity of the results of these studies that support the existence of an inverse relationship between multimorbidity and HRQOL. Sources of data, the age range of patients, confounding variables and assessment of multimorbidity were all of concern.

Regarding the sources of data used to assess multimorbidity, only 1 study [11] analyzed data from a chart review, which is the best way to collect information about medical diagnoses, according to de Groot et al. [18]. The age range of patients in the samples analyzed also limited the validity of the findings of these studies. Four of the reviewed studies [11, 14, 16, 17] analyzed samples of a limited age span (age 45 years or older), and 1 study [15] included only 76-year-old participants. Only 2 studies [11, 13] analyzed confounding variables other than age and sex. None of the studies analyzed the perceived social support as a confounding factor affecting the relationship between multimorbidity and HRQOL. In the 7 studies, investigators relied on a simple count of the presence of chronic diseases from a limited list of diseases to measure multimorbidity, regardless of the severity of each medical condition. Moreover, the number and type of medical conditions in these lists varied among the studies. Psychiatric comorbidity was considered in only 2 studies [15, 16]. Given the importance of psychiatric conditions to primary care [19], this limitation would affect the analysis of any association between multimorbidity and HRQOL.

In the current study, we evaluated the effect of the number and severity of multiple concurrent chronic medical conditions on the HRQOL of adult patients seen in the primary-care context, after we controlled for several potential confounding variables.

Methods

This study was the second phase of a project aimed at developing a better understanding of multimorbidity in primary-care patients. Details of the methods and sampling strategies used are described in the publication of the results of the first phase of this project [4]. In brief, we conducted the first phase of the study in the Saguenay region of Quebec, Canada, from January to July 2003. Of the 1085 adult patients solicited during consecutive consultation periods from 21 family physicians' practices, 90.3% (980 patients: 320 men, 660 women) participated in this first phase of the study. We included all patients attending appointments over a period of several weeks who gave their informed consent.

Diagnoses of chronic medical conditions for all patients enrolled in the study were compiled and counted from a chart review, based on the World Health Organization's definition of chronic conditions, namely "health problems that require ongoing management over a period of years or decades" [20]. Multimorbidity was measured in 2 ways: with a simple count of the number of chronic diseases for each patient and with the comorbidity index called the Cumulative Illness Rating Scale (CIRS) [21–23] which measures the severity of each condition. The CIRS uses a scoring system that encompasses 14 anatomical domains. The CIRS assigns a value from 0 (no condition in this domain) to 4 (extremely severe problem) to determine a severity score for each domain. Our group recently validated the use of the CIRS as a tool for quantifying multimorbidity for patients in primary care [24].

Patient recruitment and data collection

For this second, current phase of the study, we randomly selected patients from those recruited during the first phase, stratified according to their CIRS scores. Our goal was to recruit 60 patients for each CIRS quintile to provide sufficient power for multivariate analyses.

A research associate met the patients at their convenience, either at home or at our office. After signing an informed consent form, patients completed the self-administered 36-item short form of the Medical Outcomes Study questionnaire (SF-36) [25] to assess physical and mental functioning. The psychometric properties of this questionnaire are excellent and well documented [26]. Higher scores for the SF-36 represent better health, and normal values are available for many populations. For this study, we used the French Canadian adaptation of the SF-36 [27].

The SF-36 comprises 8 multi-item scales that measure domains separated into 2 main groups: physical and mental health. The physical health group comprises scales that measure physical functioning (PF), role limitations caused by physical health problems (RP), bodily pain (BP), and general health perceptions (GH). A physical component summary (PCS) scale is obtained from the 4 latter scales. The second group, the mental health group scales, measure vitality, energy, or fatigue (VT); social functioning (SF); role limitations caused by emotional problems (RE); and general mental health (MH). A mental component summary (MCS) scale is calculated from this second group. A ninth scale, the health transition (HT) is not included in any of the 2 main groups.

The research associate, blinded to each patient's CIRS score, stayed with the patients while they completed the questionnaire to ensure that they answered all questions on the SF-36 questionnaire. Patients were given the opportunity to ask questions to clarify the questionnaire when necessary. As a consequence, the reject rate for the questionnaires was zero. These data were collected from November 2003 to February 2004.

The Sagamie Hospital Research Ethics Board approved this study.

Potential confounders

Perceived social support was measured with the Social Provisions Scale [28]. It is a 24-item scale that explores six dimensions of perceived social support: attachment, social integration, reassurance of worth, reliable alliance, guidance and opportunity for nurturing. This scale has been translated and adapted for a French Canadian context. The translated version has good psychometric properties (internal consistency, up to 0.88; test–retest reliability, 0.66) [29]. The scale generates scores from 0 to 96, where the higher the score, the greater the perception of social support.

Data for other potential confounders were collected either from the patients' record in the first study (age and sex) or by a questionnaire (education, household income, self-perception of economic status, and number of people living in the same dwelling).

Data analysis

We analyzed the data collected with bivariate and multivariate linear regression analyses. First, we used the counted number of chronic conditions as the independent variable. Then, we used the CIRS scores as either a continuous or a categorical variable. All SF-36 scales and 2 summary scores were successively used as dependent variables We calculated regression coefficients when the independent variable was continuous, and means and standard deviations when the independent variable was categorical. Analyses with SAS Proc Mixed (SAS version 8.02, SAS Institute, Inc, Cary, NC, USA) accounted for the clustering of patients by physician. We used residual and diagnostic analyses to check for violation of the assumptions underlying multiple regression analysis, and set the α significance level at 0.05

Results

Of the 419 patients we tried to contact by phone, 66 could not be reached, despite repeated attempts. Of the remaining 353 patients, 238 agreed to participate (a participation rate of 67%). Patients who refused to participate did not have time available (66 patients), or were not interested (42 patients); 7 patients were judged to be in an acute state of their illness and were not included. Because the highest number of refusals came from patients in the first and second CIRS quintiles, we decided to group them together. The final number of subjects in the CIRS groups was 64 in the first and second quintiles combined; 55 in the third quintile; 55 in the fourth quintile; and 64 in the fifth quintile. A set of 3 dummy variables were defined to index the 4 categories of the CIRS when

Table 1. Characteristics of the sample

Characteristic	Refusals (n = 115)	Participants (n = 238)	*p* value
Mean (SD)[a] age, *y*	56.5 (17.4)	59.0 (14.3)	0.169[b]
Mean (SD) CIRS score	10.3 (6.2)	10.3 (5.7)	0.998[b]
Mean (SD) diagnoses,	5.5 (3.2)	5.3 (2.8)	0.485[b]
Male, %	33.9	29.0	0.389[c]
Educational level, %			
<8 *y*		21.8	
8 to 12 *y*		38.2	
Higher level (college or university)		39.5	
Missing data		0.5	
Household income in Canadian dollars, %			
< $10,00		8.8	
$10,000–$29,99		35.3	
$30,000–$49,99		20.5	
≥$50,00		20.2	
Missing data		15.2	
Self-perception of economic status, %			
Poor		15.6	
Adequate		61.3	
Wealthy		22.7	
Missing data		0.4	
Persons living in the same dwelling, %			
0		18.9	
1		46.2	
≥2		34.9	

[a]SD = Standard Deviation
[b]*t*-test.
[c]χ^2-test.

the CIRS was used as a categorical variable in the multivariate analyses. The characteristics for all 353 patients sampled for the study are summarized in Table 1. The number of diagnoses of chronic diseases in the patients ranged from 0 to 13. The most prevalent diseases were hypertension, hypercholesterolemia and musculoskeletal problems followed by problems of kidneys-urinary tract and heart diseases.

Because bivariate analyses revealed that clustering patients by physician had no effect on the results, this consideration was omitted from further analysis. All potential confounders, with the exception of sex, were related to the CIRS scores. However, we decided to keep sex as a confounding variable because multimorbidity reportedly has a more detrimental effect on women's HRQOL [17]. Because bivariate analyses showed that all the scales of the SF-36 were related to at least 1 confounding factor (Table 2), all confounding factors were retained for the final model. The analyses also showed that perceived social support and patients' perception of their economic status were highly related to all scales measuring physical and mental health (Table 2).

Multivariate analyses (Table 3) showed that multimorbidity measured by a simple count of chronic health problems adjusted for confounding factors was related to the physical component of the SF-36, specifically to the PF, RP, BP, GH, and PCS scales. A simple count of chronic conditions was not significantly related to any scale of the mental component of the SF-36, although 101 (42%) of the 238 patients had a score other than zero in the psychiatric domain of the CIRS.

Multimorbidity measured by the CIRS as a continuous variable was also related to all the physical scales, and to 3 (VT, SF, and RE scales) of the 4 scales evaluating the mental aspect of HRQOL. Multimorbidity measured by the CIRS as a categorical variable (quintiles) yielded almost similar results, with 2 exceptions: the RE scale was not related ($p = 0.15$) and the HT scale was significantly related ($p = 0.03$) to the CIRS. The R^2 values for the 33 models ranged from 0.10 (for the RE vs. the number of conditions relationship) to 0.40 (for the PF vs. the CIRS relationship).

Figure 1 depicts the impact of multimorbidity on the domains of HRQOL. It compares the adjusted mean scores of each scale of the SF-36 questionnaire for each CIRS group (see Table 3) with normal values reported for the Canadian general population [30]. From the lowest quintile (quintile 1/2) of the CIRS measurement of multimorbidity to the highest (quintile 5), the differences between scores were greater for the scales evaluating physical functioning (PF, RP, BP, and GH scales) than for those evaluating mental health (SF, MH, RE, and VT scales). This pattern suggests that physical HRQOL is more affected than mental HRQOL for patients with multimorbidity.

Discussion

In this study, we found that HRQOL was adversely affected by multimorbidity when we controlled for confounding variables such as age, sex,

Table 2. Bivariate analyses

Characteristic	Scale (p values*)										
	PF	RP	BP	GH	VT	SF	RE	MH	HT	PCS	MCS
Perceived social support	< 0.0001	0.0011	0.0004	< 0.0001	0.0036	0.0005	0.0080	< 0.0001	0.0037	< 0.0001	0.0071
Age	< 0.0001	0.0080	0.1504	0.2944	0.5446	0.7056	0.8567	0.6149	0.0274	< 0.0001	0.0262
Sex	0.0136	0.2944	0.0113	0.3443	0.0374	0.0143	0.2603	0.0018	0.6203	0.1109	0.0367
Education	< 0.0001	0.1814	0.0940	0.1420	0.0386	0.3202	0.5187	0.1603	0.0023	0.0068	0.7410
Household income	0.0078	0.0431	0.0251	0.0736	0.0304	0.0489	0.0334	0.0003	0.0954	0.0599	0.0114
Self-perception of economic status	0.0007	0.0161	0.0064	0.0003	0.0001	0.0004	0.0051	< 0.0001	0.0094	0.0117	< 0.0001
Number of persons in same dwelling	0.0263	0.1391	0.2778	0.6672	0.1565	0.1288	0.0692	0.0019	0.1403	0.1508	0.0089

*p values are for each relationship.
PF = physical functioning; RP = role physical; BP = bodily pain; GH = general health; VT = vitality; SF = social functioning; RE = role emotional; MH = mental health; PCS = physical component summary; MCS = mental component summary; HT = health transition.

perceived social support, household income, self-perception of economic status, education, and number of people living in the same dwelling. Some, but not all, scales of the SF-36, were related to multimorbidity when it was measured by a simple count of chronic conditions and when the severity of each condition was taken into account. When measured by a simple count of chronic conditions, however, multimorbidity was adversely related only to physical functioning. When measured by the CIRS, multimorbidity resulted in poorer scores on all physical and some mental scales of the SF-36. Use of the CIRS revealed a stronger association of HRQOL with multimorbidity than using a simple count of chronic conditions.

To our knowledge, ours is the first study to use the CIRS as a measure of severity of the medical conditions in the analysis of the association between multimorbidity and HRQOL in a primary-care context. The CIRS is a user friendly but comprehensive evaluation of medical problems by organ system that can be scored from chart review by trained nurses [24]. As the CIRS takes into account disease severity, it is a better measure of patients' burden of disease than the disease count. This may explain the better correlations of the CIRS with all scales of the SF-36, as compared to the disease count (Table 3). Indeed, the CIRS revealed a relationship of multimorbidity with some scales evaluating mental health that was missed by the simple count of diseases.

Instead of using a pre-established list of chronic conditions, as other studies did [11–17], we used all the diagnoses found in our patients' medical records to provide a more comprehensive evaluation of the patients' burden of disease, and controlled for several confounding factors to help eliminate their potential effect on the relationship. Controlling for several confounding factors showed that patients' perception of social support and their economic status were highly related to multimorbidity, and to all scales evaluating physical and mental health (Table 2).

Unlike other studies, our analyses linked multimorbidity, HRQOL, and perceived social support in family practice. Because of the strong relationship between perceived social support and HRQOL, we believe that any analysis of HRQOL for patients with multimorbidity would be incomplete if perceived social support is not considered. Our findings support the recommendations of the World Health Organization (WHO) for better ways to cope with chronic diseases [20]. The WHO recognizes that although successful outcomes for acute health problems can occur with the help of a single health provider, positive outcomes for chronic diseases are achieved only when communities and health care organizations help patients and their families.

A limitation of our study is that the first and second quintiles of CIRS were grouped together due to insufficient number of patients. We surely lost information about differences between the two quintiles by merging them. This probably explains the observation that SF-36 scores of normal subjects [30] and the merged quintile Q1/2 were very similar (Figure 1). Our results suggest that increased multimorbidity causes greater deterioration in patients' physical functioning than in their

Table 3. Multivariate analyses of multimorbidity and HRQOL

Dimensions of SF36[f]	Multimorbidity measure[a]					
	Number of chronic health problems		CIRS[d]		CIRS Quintile[e]	
	β[b] (SE)[c]	*p* Value	β[b] (SE)[c]	*p* Value	Adjusted Means (SE)[c]	*p* Value
PF	−2.5182 (0.9037)	0.0059	−2.3617 (0.4075)	< 0.0001	Q1/2: 85.4 (4.2) Q3: 77.2 (4.1) Q4: 68.2 (4.1) Q5: 49.9 (4.4)	< 0.0001
RP	−3.0817 (1.4638)	0.0366	−3.2095 (0.6710)	< 0.0001	Q1/2: 84.0 (6.9) Q3: 60.9 (6.7) Q4: 53.3 (6.8) Q5: 33.8 (7.3)	< 0.0001
BP	−2.6480 (0.9261)	0.0047	−1.7708 (0.4355)	< 0.0001	Q1/2: 72.5 (4.5) Q3: 61.8 (4.4) Q4: 52.4 (4.4) Q5: 45.4 (4.7)	0.0007
GH	−3.0429 (0.7199)	< 0.0001	−1.9532 (0.3323)	< 0.0001	Q1/2: 75.9 (3.4) Q3: 69.4 (3.3) Q4: 57.9 (3.4) Q5: 47.0 (3.6)	< 0.0001
VT	−1.0495 (0.6522)	0.1093	−1.0865 (0.3051)	0.0005	Q1/2: 63.2 (3.1) Q3: 64.9 (3.1) Q4: 57.6 (3.1) Q5: 49.3 (3.3)	0.0022
SF	−0.9856 (0.8872)	0.2681	−1.4681 (0.4137)	0.0005	Q1/2: 87.0 (4.3) Q3: 80.0 (4.1) Q4: 71.2 (4.2) Q5: 63.8 (4.5)	0.0025
RE	0.6377 (1.2757)	0.6177	−1.5470 (0.6025)	0.0110	Q1/2: 82.0 (6.3) Q3: 75.3 (6.1) Q4: 78.5 (6.2) Q5: 62.8 (6.6)	0.1456
MH	−0.5076 (0.5927)	0.3928	−0.3714 (0.2822)	0.1899	Q1/2: 72.8 (2.9) Q3: 71.0 (2.8) Q4: 69.7 (2.9) Q5: 66.1 (3.1)	0.4528
HT	−1.3123 (0.7984)	0.1020	−0.3457 (0.3856)	0.3711	Q1/2: 48.7 (3.9) Q3: 38.3 (3.8) Q4: 49.8 (3.8) Q5: 38.1 (4.1)	0.0248
PCS	−1.3567 (0.3817)	0.0005	−1.0787 (0.1707)	< 0.0001	Q1/2: 50.5 (1.8) Q3: 45.3 (1.7) Q4: 40.6 (1.7) Q5: 34.1 (1.9)	< 0.0001
MCS	0.0525 (0.3343)	0.8753	−0.1593 (0.1592)	0.3185	Q1/2: 50.1 (1.7) Q3: 50.2 (1.6) Q4: 50.2 (1.6) Q5: 48.1 (1.7)	0.7389

[a]Independent variable: multimorbidity, adjusted for perceived social support, age, sex, education, household income, self-perception of economic status, number of persons in the same dwelling.
[b]Regression coefficient (linear relation).
[c]SE = standard error.
[d]CIRS = Cumulative Illness Rating Scale.
[e]Q1/2 = first and second quintiles; Q3 = third quintile; Q4 = fourth quintile; Q5 = fifth quintile.
[f]SF-36 = 36-item Medical Outcomes Study questionnaire; PF = physical functioning; RP = role physical; BP = bodily pain; GH = general health; VT = vitality; SF = social functioning; RE = role emotional; MH = mental health; PCS = physical component summary; MCS = mental component summary; HT = health transition.

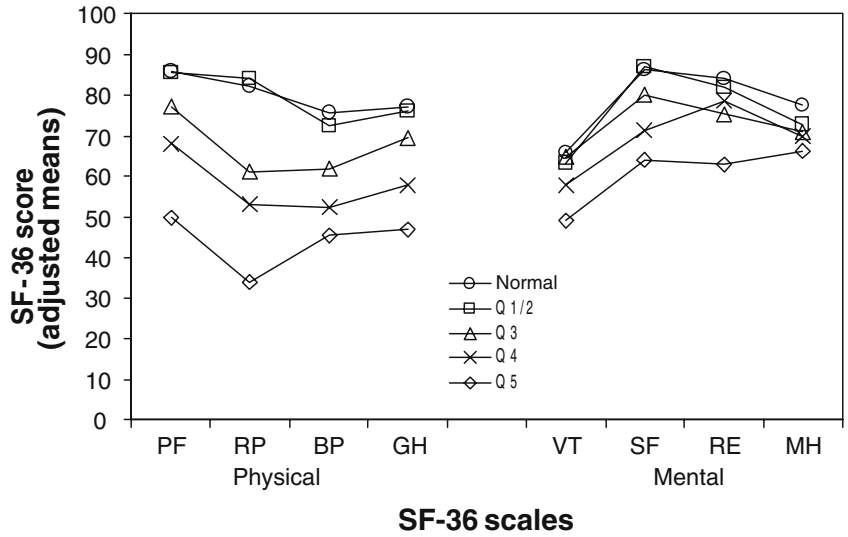

Figure 1. Effect of multimorbidity on health-related quality of life. Normal values are those described by Hopman et al. [30]. PF = physical functioning; RP = role physical; BP = bodily pain; GH = general health; VT = vitality; SF = social functioning; RE = role emotional; MH = mental health; Q1/2 = first and second quintiles CIRS; Q3 = third quintile CIRS; Q4 = fourth quintile CIRS; Q5 = fifth quintile CIRS.

mental health (Figure 1 and Table 3). This finding may be explained by patients' psychological adaptation to situations imposed by the increased number or severity of their chronic diseases over long periods of time [31]. Alternatively, this finding may be explained by limitations in the measurement tools that we used in the study. The sensitivity to change of the mental scores of the SF-36 is reported to be lower than that of its physical scores [32]. The presence of the evaluator while the patients completed their SF-36 questionnaires may also have been a factor. Patients may have tended to hide psychological problems that could harm their social acceptability or others' opinions of them, a situation described by the expression ''social desirability'' [33]. If this were true, it would result in an underestimation of the mental scores of the SF-36. Moreover, psychiatric conditions are represented by only 1 of the 14 anatomical domains in the CIRS instrument, which could minimize the effect mental disorders has on this measure of multimorbidity and may have contributed to the finding.

The lack of simultaneous measurement of HRQOL (SF-36) and multimorbidity (CIRS) may have affected our measure of their relationship. The CIRS was measured during the first phase of the research project from January to July 2003 (previously published; see reference 4); the SF-36, during the second phase from November 2003 to February 2004 (i.e., for this study). As a consequence, one or both variables may have been modified during the time elapsed between measurements. However, patients in an acute state of their illness during measurement of HRQOL were not included in this study. We believe that any error introduced by the difference in the timing of the measurements would be minor because the time elapsed was relatively short compared with the length of time patients had these chronic conditions.

Regional differences are usually a source of concern when research results are generalized. Although the Saguenay region where the current study took place has a high prevalence of multimorbidity, its prevalence was not a factor in our analysis of the relationship between multimorbidity and HRQOL for patients in primary-care practice. An uneven distribution of the burden of disease among primary-care practices should not limit the generalization of our findings to other regions.

In conclusion, our results show that multimorbidity adversely affected HRQOL, even when we controlled for age, sex, perception of social support, household income, self-perception of economic status, education, and number of people

living in the same dwelling. Among these confounding variables, perception of social support and self-perception of economic status had particular relevance because they were related to all scales evaluating physical and mental HRQOL. Increased multimorbidity (in number or severity of the medical conditions) was associated to greater deterioration in physical functioning than in mental health. However, this finding could be a consequence of limitations in the SF-36 and/or the CIRS instruments. Use of the CIRS revealed a stronger association of HRQOL with multimorbidity than using a simple count of chronic conditions.

Acknowledgements

This paper was prepared with the editorial assistance of Sharon Nancekivell, Guelph, Ontario. Sources of support: Fonds de la Recherche en Santé du Québec (Grant number: 24300-2028) and Pfizer Canada (Independent Research Grant).

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