ORIGINAL RESEARCH

Impact of chronic disease on quality of life in the Bella Coola Valley

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A B S T R A C T

Introduction: North American rural residents have higher rates of chronic disease and they report being ill more frequently compared to their urban counterparts. We recently studied health-related quality in residents living in the isolated, rural community of Bella Coola, Canada. Objective: to assess health-related quality of life parameters in adults suffering from chronic disease and living in the rural, remote community of Bella Coola.

Methods: Design, mixed methods: (1) mailed health-related survey; (2) retrospective chart review. Study population: people aged 17 years and older living in the Bella Coola Valley and having a chart at the Bella Coola Medical Clinic as of September 2001 were asked to complete a detailed health-related quality of life survey during the period August to December 2001. Main outcome measures: demographics (age, sex, weight [BMI], ethnicity). Health-related quality of life was measured using the MOS 36-item Short Form Health Survey (SF-36), and the US Centers for Disease Control healthy day's items. Chronic diseases studied included diabetes mellitus, hypertension, chronic obstructive lung disease, coronary artery disease, hyperlipidemia, depression/anxiety, cancer, osteoarthritis, inflammatory arthritis and chronic back/neck pain.

Results: Response rate to the survey was 38% (675/1770). Compared to total clinic population relatively more female (57% vs 49%), non-Aboriginal (63% vs 57%) and older people (48.9 vs 43.5 years) answered the survey. The most prevalent chronic diseases among the survey respondents were hypertension (17%), depression/anxiety (13%), hyperlipidemia (11%), chronic back/neck pain (11%), and osteoarthritis (9%). Linear regression analysis was performed for each of the SF-36 domains and CDC healthy day items. The presence of chronic disease is associated with significant differences in HRQOL item scores and the greater the number chronic diseases present the worse the HRQOL item scores.

Conclusion: People living in the rural remote community of Bella Coola who have chronic disease experience significant impairment in their health-related quality of life. The greater the number of coexisting chronic diseases a person has, the more likely that poor HRQOL scores will be reported.

Key words: Aboriginal research, diabetes mellitus.

Introduction

North American rural residents have higher rates of chronic disease and they report being ill more frequently compared with their urban counterparts[1]. These findings suggest rural populations are not as healthy as urban populations. Strictly speaking the term 'health' refers not simply to rates of disease and disability but also refers to a positive state of physical, mental and social wellbeing. Health-related quality of life survey questions have been developed to measure perceived discrepancies between one's expectations and one's actual physical, emotional, and social functioning – that is, one's subjective sense of health. Unfortunately, few if any, rural populations have been surveyed so little is known about how healthy rural residents perceive themselves to be[1].

It is believed that better understanding of the relationship between health-related quality of life and chronic disease will also result in development of treatment strategies which preserve or improve function in every day life and preserve or improve health-related quality of life. It is also believed that improved health-related quality of life will lead to fewer office visits and hospitalizations and, hence, reduce healthcare costs[2-4].

With respect to a chronic disease like diabetes mellitus, for example, this means that healthcare professionals should not just focus on objective vital signs (eg blood pressure), physical examination findings (eg retinopathy, nephropathy, heart disease), and laboratory tests (eg hemoglobin A1c values). Rather, healthcare professionals should strive to also understand the subjective impact diabetes and its management has on a diabetic's physical and mental functioning – that is, their health-related quality of life. Ideally patients should have both improved glycemic control and better health-related quality of life[5].

We recently studied health-related quality in residents living in the isolated, rural community of Bella Coola, Canada[6,7]. Health-related quality of life was measured using the MOS 36-item Short Form Health Survey (SF-36), and the US Centers for Disease Control healthy day's items. Within the Bella Coola Valley population, age, Aboriginal status, and diabetes were all found to be associated with poorer self-reported health-related quality of life scores. Mean scores for Aboriginal people were lower/poorer than mean scores for non-Aboriginal people in all the quality of life questions. Mean scores for these type II diabetic people were also lower than mean scores for non-diabetics in all the quality of life questions. Aboriginal diabetics reported the worst scores of all on almost all of the health-related quality of life questions. The objective of this present study is to build on these initial findings by investigating the relationship between chronic disease and health-related quality of life in this rural patient population.

Methods

Description of community

The Bella Coola Valley is an isolated rural community located in the central coast region of British Columbia (Fig 1)[8,9]. According to the 2001 Census 2285 people live in the Bella Coola Valley, with 46% of these people estimated to be of Aboriginal descent [10,11]. Bella Coola Valley is part

of the traditional territory of the Nuxalk Nation, a tribe of Salish-speaking coastal Indians[12-15].

Community participation

This research project has been carried out in a participatory fashion, following the recommendations outlined in a recently published policy statement entitled *A Guide for Health Professionals Working with Aboriginal Peoples*[16]. A goal of these recommendations is to make the relationship between Aboriginal people and non-Aboriginal healthcare providers a fair and honorable one[16-18].

There was consultation with the Nuxalk Band Council, community members and local healthcare providers on our plans to study determinants of health and disease of people living in the Bella Coola valley. Dr Thommasen participated in potlatches asking for community support and explained the types of health projects we were planning to do. Prior to collecting data we obtained letters of support from the Nuxalk Band Council, from the Bella Coola Transitional Health Authority, and from Central Coast Regional District. Ethics approval to collect data was obtained from research ethics committees located at both the University of British Columbia, and at the University of Northern British Columbia. The results and the manuscript were reviewed and approved for publication by both Nuxalk Health professionals and United Church Health Services professionals.

Chart review details

Two retrospective reviews of clinic charts were conducted by HT. The first chart review was performed in July-August 2001 to determine an 'active' September 2001 clinic population. Names and addresses were tabulated onto an electronic spreadsheet and these were used for the mail-out health-related quality of life survey which was happening simultaneously.

The second detailed retrospective review of all clinic charts located in the Bella Coola Medical Clinic took place in the spring of 2003. Charts of patients on the September 2001 clinic population list were reviewed for the following information: age, sex, Aboriginal status; height and weight; and presence or absence of chronic disease. Aboriginal status for the study population was determined from multiple sources – Nuxalk Band lists, a locally available genealogy, clinic chart and from the survey[6,19,20].

The presence of diabetes was based on a physician diagnosis of diabetes which, in turn, was based on the 1998 clinical practice guidelines for the management of diabetes in Canada[21,22], and the presence or absence of the following chronic conditions: chronic obstructive pulmonary disease, hyperlipidemia, hypertension, coronary artery disease, depression/anxiety disorder, cancer, osteoarthritis, inflammatory arthritis and chronic back/neck pain. Definitions used for these chronic conditions have been reported elsewhere[23].

Health-related Quality of Life Survey

A Health and Health Care Survey was offered to all adults living in the Bella Coola Valley between August 2001 and May 2002[6]. The aim of this investigation was to obtain some baseline self-reported data on the health status and overall quality of life of all residents of the Bella Coola Valley of British Columbia aged 17 years or older, and to measure the impact of a set of designated health determinants on their health and quality of life.

Health-related quality of life (HRQOL) was assessed in this study using Medical Outcomes Study Short Form 36-item health survey questions (SF-36)[24-27], and Centers of Disease Control and Prevention (CDC) unhealthy day questions (Appendix I)[3]. Both are well established with good reliability, brevity, validity, responsiveness and comparability. Both were designed to evaluate aspects of functional status and subjective wellbeing.
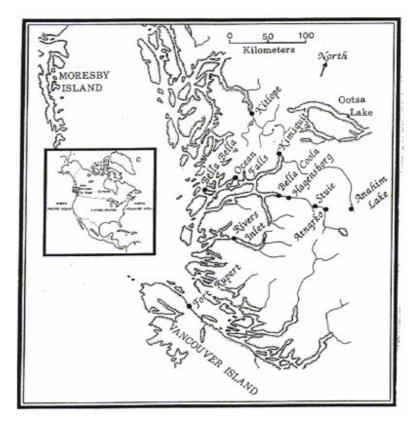
Figure 1: Map of the study area.

The SF-36 scale works best as a health profile measure with eight dimensions, rather than as a single summative measure. The eight different health dimensions/health concepts evaluate the degree to which an individual's health limits or impairs: (i) physical functioning (PF; 10 items); (ii) social functioning (SF; 2 items); (iii) bodily pain (BP; 2 items); (iv) activities due to physical problems – role-physical (RP; 4 items); (v) activities due to emotional problems – role-emotional (RE; 3 items); (vi) emotional wellbeing – mental health (MH; 5 items); (vii) vitality (VT; 4 items); and (viii) general health (GH) perceptions (5 items). Domain scores for the SF-36 instrument were grouped and then computed following the protocol of Ware et al.[24]. The SF-36 scale scores range from 0 to 100, with higher scores indicating better functioning, wellbeing, and state of health.

The SF-36 questions were followed by 8 items from the United States Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (BRFSS) pertaining to number of unhealthy days and special limitations\problems[3].

In the period from August to November 2001, a number of procedures were used to try to get every resident aged 17 years or older of the Bella Coola Valley of British Columbia to fill out the eleven-page questionnaire[6]. There were two mailings to all adults listed on the September 2001 clinic population list. Questionnaires were also distributed at the clinic, the emergency department of the Bella Coola Hospital, and in two local grocery stores. Booths were set up at the grocery stores and at the clinic where research assistants administered the questionnaire to people who might not normally respond to a mail-out survey, including elderly people and those with literacy problems. Questionnaires were also hand delivered on the local reserve and picked up later.

An identification number was given to each questionnaire sent out. A single investigator (HT) was the only one able to link this number to the 2001 clinic patient list. This information was used for the purposes of re-mailing, and for linking questionnaire responses to retrospective clinic chart review information. All recipients were asked to read an informed consent form or were read an informed consent form prior to completion of a questionnaire.

Statistical analysis

Chart and survey derived information was entered into an electronic spreadsheet (EXCEL), with names and addresses removed. Results were summarized using EXCEL. Formal data analysis was done with SPSS Windows software (SPSS Inc, Chicago, IL, USA). In all tests, a 0.05 level of significance was used.

One-way analysis of variance was used to compare the various demographic and chronic diseases with respect to each of the SF-36 domains and each of the unhealthy day's outcomes. Multiple regression analysis was then performed after controlling for age, sex and Aboriginal status[28].

Results

A total of 675 useable health and health care surveys were returned. An estimated 1770 Bella Coola adult residents were eligible to complete this survey, so the estimated overall response to the survey was 38% (675/1770). Compared with the total clinic population, relatively more females (57% vs 49%), non-Aboriginals (63% vs 57%) and older people (48.9 vs 43.5 years) answered the survey (Table 1). The most prevalent chronic diseases among the survey respondents were hypertension (17%), depression/anxiety (13%), hyperlipidemia (11%), chronic back/neck pain (11%) and osteoarthritis (9%).

Demographic information for each chronic disease/disability variable studied is summarized (Table 2). With respect to diabetes, for example, the data reveal that the average age of diabetics is older than average of age of non-diabetics living in the Bella Coola Valley; the male to female ratio among diabetes is approximately 1 (ie 49% of diabetics are female and 51% diabetics are male); and proportionately more diabetics are Aboriginal (61%) compared with the non-diabetic population (34%).

A description of co-morbidities associated with each chronic disease/disability variable is summarized (Table 3). The data show, for example that 50% of people with diabetes also have hypertension and 31% of people with hypertension have diabetes. The most commonly listed coexisting chronic diseases in those people with four or more chronic diseases are diabetes (68%), hypertension (86%), hyperlipidemia (79%) and depression/anxiety (50%).

The relationship between demographic variables and average SF-36 domain scores are summarized (Table 4). A detailed statistical analysis of this information has already been performed and reported elsewhere[6]. The average SF-36 domain scores for each of the chronic diseases/illnesses studied are shown (Table 5), and a summary of the statistical analyses of this data are also shown (Tables 6,7). For most of the chronic diseases studied, the presence of chronic illness is associated with significant worsening of HRQOL item scores, even after correcting for age, sex and Aboriginal status. In addition, we also found that the greater the number of coexisting chronic disease the worse the HRQOL item score.

The relationship between each demographic variable studied and the average number of healthy days for each healthy days item studied is summarized (Table 8). A detailed statistical analysis of this information has also already been performed and reported elsewhere[6]. The average number of healthy days for each healthy day item scores for each of the chronic diseases/illnesses studied are shown (Table 9), and a summary of the statistical analyses of these data are shown (Tables 10,11). For most of the chronic diseases studied, the presence of chronic illness is associated with significant increases in the number of unhealthy days and significant decreases in the number of healthy days, even after

correcting for age, sex and Aboriginal status. In addition, we also found that the greater the number of coexisting chronic disease the greater the number of unhealthy days, and the fewer the number of healthy days reported.

Table 1: Summary of clinic population and survey responders/non-responders

	Total population	Survey responders	Survey non-responders
N	1770	675	1095
Age (years)	43.5	48.9	40.1
Female	49%	57%	43%
Aboriginal	43%	37%	46%
Diabetes mellitus	7%	11%	5%
Hypertension	12%	17%	9%
COPD	2%	3%	1%
Hyperlipidemia	8%	11%	6%
Coronary artery disease	3%	4%	3%
Depression/anxiety	9%	13%	7%
Cancer	3%	5%	2%
Osteoarthritis	5%	9%	3%
Inflammatory arthritis	2%	4%	2%
Back /neck pain	7%	11%	5%

COPD, Chronic obstructive pulmonary disease.

Table 2: Chronic disease and demographic information

Variable		*N*	Age (years)	Female	Aboriginal
No. answering		675	675	675	675
Diabetes mellitus	No	603	47.5	58%	34%
Diabetes mellitus	Yes	72	60.6	51%	61%
Hypertension	No	559	45.7	57%	39%
Hypertension	Yes	116	64.2	60%	30%
COPD	No	657	48.2	58%	38%
COPD	Yes	18	76.1	44%	17%
Hyperlipidemia	No	600	47.3	58%	38%
Hyperlipidemia	Yes	75	62.1	57%	31%
Coronary artery disease	No	648	48.0	58%	37%
Coronary artery disease	Yes	27	71.0	56%	37%
Depression/anxiety	No	587	48.7	55%	37%
Depression/anxiety	Yes	88	50.6	74%	36%
Cancer	No	641	48.1	57%	38%
Cancer	Yes	34	64.0	71%	26%
Osteoarthritis	No	616	47.4	57%	38%
Osteoarthritis	Yes	59	65.0	63%	36%
Inflammatory arthritis	No	651	48.7	57%	36%
Inflammatory arthritis	Yes	24	54.7	71%	71%
Back/neck pain	No	604	48.4	58%	38%
Back/neck pain	Yes	71	53.5	56%	35%
Coexisting disease	0	360	41.7	56%	38%
Coexisting disease	1	163	50.9	57%	35%
Coexisting disease	2	77	62.5	65%	43%
Coexisting disease	3	47	65.5	60%	30%
Coexisting disease	≥ 4	28	64.9	61%	39%

COPD, Chronic obstructive pulmonary disease.

Table 3: Chronic disease co-morbidity

Variable		DM	HT	COPD	Hlipid	CAD	Dep/anx	CA	OA	RA	Bk/Nk
Total population (*n* = 675)		11%	17%	3%	11%	4%	13%	5%	9%	4%	11%
Diabetes mellitus	No		13%	2%	7%	3%	12%	4%	8%	3%	10%
Diabetes mellitus	Yes		50%	4%	43%	13%	24%	11%	18%	6%	14%
Hypertension	No	6%		2%	7%	2%	12%	4%	6%	3%	10%
Hypertension	Yes	31%		7%	32%	16%	17%	11%	21%	4%	15%
COPD	No	11%	16%		11%	4%	13%	4%	9%	4%	10%
COPD	Yes	17%	44%		28%	17%	0%	33%	17%	0%	17%
Hyperlipidemia	No	7%	13%	2%		2%	12%	4%	8%	4%	10%
Hyperlipidemia	Yes	41%	49%	7%		21%	24%	11%	17%	4%	16%
Coronary artery disease	No	10%	15%	2%	9%		13%	4%	8%	3%	10%
Coronary artery disease	Yes	33%	67%	11%	59%		22%	19%	37%	7%	19%
Depression/anxiety	No	9%	16%	3%	10%	4%		5%	9%	3%	10%
Depression/anxiety	Yes	19%	23%	0%	20%	7%		3%	7%	7%	13%
Cancer	No	10%	16%	2%	10%	3%	13%		9%	3%	11%
Cancer	Yes	24%	38%	18%	24%	15%	9%		12%	6%	6%
Osteoarthritis	No	10%	15%	2%	10%	3%	13%	5%		3%	10%
Osteoarthritis	Yes	22%	41%	5%	22%	17%	10%	7%		8%	20%
Inflammatory arthritis	No	10%	17%	3%	11%	4%	13%	5%	8%		10%
Inflammatory arthritis	Yes	17%	21%	0%	13%	8%	25%	8%	21%		25%
Back/neck pain	No	10%	16%	2%	10%	4%	13%	5%	8%	3%	
Back/neck pain	Yes	14%	24%	4%	17%	7%	15%	3%	17%	8%	
Coexisting disease	0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Coexisting disease	1	9%	18%	2%	6%	1%	29%	4%	8%	4%	20%
Coexisting disease	2	21%	42%	8%	31%	1%	23%	14%	26%	12%	22%
Coexisting disease	3	47%	64%	11%	43%	28%	19%	23%	32%	9%	26%
Coexisting disease	≥ 4	68%	86%	14%	79%	43%	50%	18%	39%	18%	36%

DM, Diabetes mellitus; HT, hypertension; COPD, chronic obstructive pulmonary disease; Hlipid, hyperlipidemia; CAD, coronary artery disease; Dep/Anx, depression/anxiety; CA, cancer; OA, osteoarthritis; RA, inflammatory arthritis; Bk/Nk, back/neck pain.

Table 4: Demographic information and average SF-36 domain scores

SF-36 Scores	N	Physical functioning	Role physical	Bodily pain	General health	Vitality	Social functioning	Role emotional	Mental health
Total popn	675	662	668	666	660	666	667	658	665
Total popn	675	81.7	67.7	65.4	67.7	56.2	78.4	75.5	73.5
Male	287	81.7	66.7	63.0	66.9	57.4	79.3	76.3	73.8
Female	388	81.8	68.5	67.0	68.4	55.3	77.7	75.0	73.3
Non-Aboriginal	423	83.8	70.2	67.0	72.1	57.6	80.6	78.3	75.4
Aboriginal	252	78.3	63.6	62.6	60.4	53.9	74.7	70.9	70.4
Age (17–39.9 years)	212	89.8	77.5	70.9	71.0	56.7	80.3	77.6	72.9
Age (40–64.9 years)	343	83.2	69.0	63.4	66.7	56.6	76.9	76.0	72.2
Age (> 65 years)	120	62.5	46.4	61.2	64.7	54.2	79.3	70.5	78.6

Popn, Population.

Table 5: Chronic disease and average SF-36 domain scores

Variable		Physical function	Role physical	Bodily pain	General health	Vitality	Social function	Role emotional	Mental health
No. responded		662	668	666	660	666	667	658	665
Total population		81.7	67.7	65.4	67.7	56.2	78.4	75.5	73.5
Diabetes mellitus	No	83.1	70.5	66.4	69.5	57.0	79.2	77.6	73.9
Diabetes mellitus	Yes	70.1	43.9	56.2	52.5	49.8	71.4	57.4	70.8
Hypertension	No	84.8	72.3	67.0	70.0	57.4	79.0	77.8	73.8
Hypertension	Yes	67.0	45.4	57.2	56.6	50.6	75.5	64.3	72.3
COPD	No	82.7	69.0	65.5	68.1	56.5	78.5	75.9	73.4
COPD	Yes	45.9	19.1	59.2	52.6	45.5	75.0	60.4	80.4
Hyperlipidemia	No	83.3	70.1	66.1	69.0	57.2	79.1	77.0	73.9
Hyperlipidemia	Yes	69.3	48.6	59.1	57.2	48.7	73.1	63.5	70.8
Coronary artery disease	No	82.7	69.1	65.7	68.2	56.6	78.5	76.4	73.6
Coronary artery disease	Yes	58.3	32.7	55.7	57.2	47.5	77.4	55.1	72.9
Depression/anxiety	No	82.6	70.5	66.8	69.8	58.6	80.9	79.1	76.1
Depression/anxiety	Yes	76.3	48.9	55.9	54.4	40.5	61.8	52.1	57.0
Cancer	No	82.3	69.0	65.6	68.3	56.6	78.8	76.2	73.6
Cancer	Yes	70.6	43.2	60.4	57.1	49.0	72.1	62.6	72.4
Osteoarthritis	No	83.3	69.8	66.6	68.1	56.4	78.5	75.9	73.2
Osteoarthritis	Yes	65.2	46.6	52.2	63.6	53.9	77.6	72.0	76.8
Inflammatory arthritis	No	82.6	68.7	66.0	68.5	56.6	78.8	75.9	73.7
Inflammatory arthritis	Yes	57.3	40.6	47.7	45.9	46.1	67.9	66.7	68.0
Back/neck pain	No	82.9	69.9	66.8	68.3	56.6	78.9	76.4	73.7
Back/neck pain	Yes	71.6	49.6	53.2	62.7	53.5	74.5	68.1	72.4
Coexisting disease	0	88.9	81.0	70.8	73.8	60.5	82.1	82.4	75.7
Coexisting disease	1	81.7	62.8	63.7	65.7	55.2	76.2	72.8	71.4
Coexisting disease	2	67.7	48.7	54.0	56.4	46.2	70.1	64.4	70.2
Coexisting disease	3	67.4	42.8	59.8	60.4	53.5	83.3	71.3	76.3
Coexisting disease	≥ 4	52.3	18.8	44.6	42.3	38.4	58.9	39.3	62.8

COPD, Chronic obstructive pulmonary disease.

Table 6: Summary of SF-36 one-way ANOVA analysis

	Physical functioning	Role physical	Bodily pain	General health	Vitality	Social functioning	Role emotional	Mental health
Age	< 0.0001	< 0.0001	0.0004	0.0015	NS	NS	NS	0.0047
Sex	NS	NS	NS	NS	NS	NS	NS	NS
Race	0.004	0.043	< 0.001	< 0.001	0.033	0.004	0.016	0.001
Diabetes mellitus	< 0.001	< 0.001	0.005	< 0.001	0.010	0.020	< 0.001	NS
Hypertension	< 0.001	< 0.001	0.001	< 0.001	0.004	NS	0.001	NS
COPD	< 0.001	< 0.001	NS	0.013	0.055	NS	NS	NS
Hyperlipidemia	< 0.001	< 0.001	0.033	< 0.001	0.002	0.078	0.005	NS
Coronary artery disease	< 0.001	< 0.001	NS	0.006	0.033	NS	0.007	NS
Depression/anxiety	0.021	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cancer	0.009	< 0.001	NS	0.002	0.037	NS	NS	NS
Osteoarthritis	< 0.001	< 0.001	< 0.001	NS	NS	NS	NS	NS
Inflammatory arthritis	< 0.001	0.001	0.001	< 0.001	0.022	0.050	NS	NS
Back/neck pain	< 0.001	< 0.001	< 0.001	0.043	NS	NS	NS	NS
Sum	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0021

NS, Not significant; COPD, chronic obstructive pulmonary disease.

Table 7: Regression analysis of SF-36 scores after controlling for age, sex, race

Disease	Physical functioning	Role physical	Bodily pain	General health	Vitality	Social functioning	Role emotional	Mental health
Diabetes mellitus	NS	0.0012	NS	< 0.0001	NS	NS	0.0005	NS
Hypertension	0.0028	< 0.0001	0.025	< 0.0001	0.0106	NS	0.0033	NS
COPD	0.0009	0.0021	NS	NS	NS	NS	NS	NS
Hyperlipidemia	NS	0.0354	NS	0.0033	0.0045	NS	0.0186	0.0321
Coronary artery disease	0.0319	0.0072	NS	NS	NS	NS	0.0198	NS
Depression/anxiety	0.0452	< 0.0001	0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Cancer	NS	0.0111	NS	0.0037	NS	NS	NS	NS
Osteoarthritis	0.0096	0.0491	0.0012	NS	NS	NS	NS	NS
Inflammatory Arthritis	< 0.0001	0.0066	0.0028	< 0.0001	0.0688	NS	NS	NS
Back/neck pain	0.0024	0.0007	< 0.0001	NS	NS	NS	NS	NS
Sum	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001

NS, Not significant; COPD, chronic obstructive pulmonary disease.

Discussion

At the present time, health data is not routinely collected or analyzed at the rural community level in Canada, so no-one really knows which communities are 'sickest', or which factors are responsible for poor community health. We believe that communities need to have a clearer picture of the health problems they are facing before they can make changes. This study demonstrates that it is possible to calculate rural community prevalence rates for a number of different diseases and disabilities by simply reviewing clinic charts. This information can be used to explore relationships between chronic disease and subjective sense of health at the rural community level.

Table 8: Demographic information and healthy day items

No. days	N	Unhealthy physical	Unhealthy mental	Restricted by health	Felt pain	Felt sad	Felt tense	Poor sleep	Felt healthy
Total population	675	634	636	639	634	631	633	625	605
Total population	675	6.4	5.4	3.9	4.9	4.8	6.6	9.4	16.5
Male	287	7.2	5.1	3.8	5.1	4.6	5.7	8.9	17.0
Female	388	5.9	5.6	4.0	4.8	4.9	7.1	9.7	16.1
Non-Aboriginal	423	5.7	4.7	3.1	4.0	4.3	6.0	8.9	16.9
Aboriginal	252	7.7	6.4	5.5	6.5	5.7	7.5	10.2	15.7
Age (17–39.9 years)	212	4.4	5.4	3.2	2.9	4.7	6.2	10.3	17.1
Age (40–64.9 years)	343	7.0	5.9	4.2	5.1	5.3	7.2	9.8	16.1
Age (> 65 years)	120	8.8	3.7	4.5	7.9	3.5	5.1	6.4	16.4

Table 9: Chronic disease and average healthy days item scores

No days		Unhealthy physical	Unhealthy mental	Restricted by health	Felt pain	Felt sad	Felt tense	Poor sleep	Felt healthy
No. responded		634	636	639	634	631	633	625	605
Total population		6.4	5.4	3.9	4.9	4.8	6.6	9.4	16.5
Diabetes mellitus	No	6.0	5.1	3.6	4.4	4.7	6.3	9.1	16.6
Diabetes mellitus	Yes	10.5	7.4	6.9	9.7	6.3	9.0	11.8	15.2
Hypertension	No	5.6	5.2	3.6	4.4	4.7	6.3	9.4	16.9
Hypertension	Yes	10.5	6.1	5.6	7.5	5.5	7.7	9.4	14.6
COPD	No	6.2	5.4	3.8	4.8	4.8	6.6	9.4	16.6
COPD	Yes	18.3	4.1	7.8	11.0	5.7	5.9	9.6	9.7
Hyperlipidemia	No	6.0	5.1	3.6	4.4	4.5	6.2	9.2	16.6
Hyperlipidemia	Yes	10.1	7.5	6.4	9.1	7.0	9.0	10.5	15.4
Coronary artery disease	No	6.4	5.4	3.9	4.8	4.9	6.6	9.2	16.6
Coronary artery disease	Yes	6.6	3.5	5.3	7.8	2.8	6.1	12.4	14.0
Depression/anxiety	No	5.8	4.5	3.2	4.2	3.9	5.5	8.5	17.4
Depression/anxiety	Yes	10.4	10.7	8.4	9.3	10.6	13.2	14.9	10.7
Cancer	No	6.1	5.3	3.7	4.8	4.8	6.5	9.2	16.7
Cancer	Yes	12.8	6.5	7.6	7.8	4.4	7.6	12.8	12.4
Osteoarthritis	No	6.3	5.5	3.9	4.5	5.0	6.6	9.3	16.8
Osteoarthritis	Yes	8.4	3.7	4.1	9.2	2.5	5.5	10.1	13.1
Inflammatory arthritis	No	6.3	5.3	3.9	4.7	4.7	6.5	9.4	16.7
Inflammatory arthritis	Yes	10.9	7.0	6.0	11.1	6.8	8.3	8.6	11.1
Back/neck pain	No	5.8	5.2	3.8	4.4	4.8	6.3	9.2	16.7
Back/neck pain	Yes	11.6	6.6	5.3	9.5	5.1	8.9	10.9	14.5
Coexisting disease	0	3.9	4.4	2.6	3.0	4.0	5.2	8.6	18.2
Coexisting disease	1	7.8	5.8	4.9	4.8	5.1	7.3	9.6	16.0
Coexisting disease	2	11.4	8.2	6.1	9.7	7.5	9.5	10.6	11.5
Coexisting disease	3	7.3	4.0	2.8	6.1	3.4	6.4	8.2	16.4
Coexisting disease	≥ 4	17.0	9.8	12.1	15.8	9.0	11.5	17.0	9.5

COPD, Chronic obstructive pulmonary disease.

Table 10: Summary of healthy days one-way ANOVA analysis

	Unhealthy physical	Unhealthy mental	Restricted by health	Felt pain	Felt sad	Felt tense	Poor sleep	Felt healthy
No. responded	634	636	639	634	631	633	625	605
Age	< 0.0001	NS	NS	< 0.0001	NS	NS	0.0027	NS
Sex	NS	NS	NS	NS	NS	NS	NS	NS
Race	0.011	0.015	< 0.001	0.001	0.026	NS	NS	NS
Diabetes mellitus	< 0.001	0.061	0.002	< 0.001	0.042	0.003	0.051	NS
Hypertension	< 0.001	NS	0.009	0.001	NS	NS	NS	NS
COPD	< 0.001	NS	NS	0.028	NS	NS	NS	NS
Hyperlipidemia	0.001	0.028	0.007	< 0.001	0.019	0.024	NS	NS
Coronary artery disease	NS	NS	NS	NS	NS	NS	NS	NS
Depression/anxiety	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cancer	0.001	NS	0.015	NS	NS	NS	NS	0.037
Osteoarthritis	NS	NS	NS	< 0.001	0.032	NS	NS	0.015
Inflammatory arthritis	0.037	NS	NS	0.002	NS	NS	NS	0.032
Back/neck pain	< 0.001	NS	NS	NS	NS	0.040	NS	NS
Sum	< 0.0001	0.0022	< 0.0001	< 0.0001	0.002	< 0.0001	0.0127	< 0.0001

NS, Not significant; COPD, chronic obstructive pulmonary disease.

Table 11: Regression analysis of healthy days scores after controlling for age, sex, race

	Unhealthy physical	Unhealthy mental	Restricted by health	Felt pain	Felt sad	Felt tense	Poor sleep	Felt healthy
No. responded	634	636	639	634	631	633	625	605
Diabetes mellitus	0.0139	0.0458	0.0382	0.004	0.0317	0.0215	0.0067	NS
Hypertension	0.0021	NS	0.0429	NS	NS	NS	NS	NS
COPD	0.0022	NS	NS	NS	NS	NS	NS	NS
Hyperlipidemia	0.0433	0.0036	0.0215	0.0038	0.0025	0.0065	0.048	NS
Coronary artery disease	NS	NS	NS	NS	NS	NS	0.0267	NS
Depression/anxiety	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Cancer	0.0053	NS	0.0309	NS	NS	NS	0.0138	0.0454
Osteoarthritis	NS	NS	NS	0.015	0.042	NS	NS	0.0208
Inflammatory arthritis	NS	NS	NS	0.0158	NS	NS	NS	NS
Back/neck pain	< 0.0001	NS	NS	< 0.0001	NS	0.0282	NS	NS
Sum	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001

NS, Not significant; COPD, chronic obstructive pulmonary disease.

We found that increasing number of coexisting chronic disease was a powerful predictor of poor health-related quality of life as measured using the Medical Outcomes Study Short Form 36-item health survey (SF-36) questions and the CDC unhealthy day questions. All the chronic diseases studied impacted at least some of the HRQOL items studied and the impacts made sense for the most part. For example, people with depression/anxiety were more likely to report lower scores on mental health related items – for example, SF-36 mental health, unhealthy mental days, SF-36 role-emotion, SF-36 social functioning, unhealthy mental days, and number of days feeling sad or tense. People with arthritis were more likely to report lower physical health related items – for example, SF-36 physical health, SF-36 role physical, SF-36 bodily pain, and feeling pain days.

Our findings are consistent with those from studies which have explored the relationship between HRQOL and specific chronic illnesses[2,29-35]. Stewart[2] reported that for eight of nine common chronic medical conditions, patients with the chronic condition showed markedly worse physical, role, and social functioning, mental health, health perceptions, and/or bodily pain compared with patients with no chronic conditions. A number of studies assessing HRQOL in diabetics have shown that lower HRQOL scores are associated with worsening severity of complications/comorbidity[29-35]. Ahroni examined the relationship between SF-36 domain scores and over 25 diabetic complication characteristics (eg eye changes, poor vision, laser photocoagulation, high blood pressure, stroke, angina, heart attack, kidney disease, proteinuria, dialysis, circulation problem, claudication, numbness, foot ulceration, amputation) and found that an increase of greater than one diabetes complication characteristic was associated with an average loss of 7.2 to 11.8 points on six SF-36 scales (GH, PF, SF, RP, BP, VT)[34]. Renal and neuropathy complications have the greatest effects on the SF-36. Woodcock summarized HRQOL survey responses of 131 type 2 diabetics and found that people with illness related to or unrelated to diabetes scored significantly lower on most SF36 dimensions – physical functioning, physical role limitation, vitality, general health, mental health, social functioning, emotional role limitation[35].

Lloyd studied an even larger number of type 2 diabetics ($n = 1233$) and found that the presence of even mild diabetic complications had a significant impact on all the SF-36 domains – especially the physical ones; that is, physical functioning, role physical, bodily pain, general health. A theoretical implication of such findings is that aggressive management of blood sugar, blood pressure, cholesterol, and even depression, in diabetes will not only prevent the development of diabetic complications but will also prevent irreversible deteriorations in HRQOL[29,30,36,37].

Some studies suggest hypertension does not have a significant impact SF-36 domains and this has been attributed to the fact that hypertension is asymptomatic in the majority of patients[2,33]. Table 5, however, reveals that in our patient population a high proportion of people with hypertension have coexisting chronic disease and, we believe, this probably accounts for the significant differences found between hypertensive and non-hypertensive HRQOL scores. Bardage et al. studied 5404 Swedish people with and without hypertension and they also found that hypertensive people scored lower in most of the eight SF-36 domains than those without hypertension even after controlling for age, sex, sociodemographic factors and comorbidity[38]. Presence of diabetes and angina pectoris was associated with even lower SF-36 scores.

There are some limitations in this study. Not everyone living in the valley completed the health questionnaire. However we did calculate prevalence rates by reviewing all clinic charts, so it is known how much the survey prevalence rates differ from the overall clinic recorded prevalence. The generalizability of the study is also an issue, because the Bella Coola Valley is a rural, remote community with over 40% of the residents being of Aboriginal descent. Another limitation to our study is that we did not include diseases such as stroke, blindness, end-stage renal disease, or congestive heart failure which presumably also have an impact on HRQOL[30,39]. Also we did not look at others things which can impact HRQOL – for example, marital status, education, physical activity levels, obesity or income[30,35,37,39,40].

Conclusion

People living in the rural remote community of Bella Coola who have chronic disease experience significant impairment in their health-related quality of life. The greater the number of coexisting chronic diseases a person has, the more likely that poor HRQOL scores will be reported. Healthcare administrators should realize that higher rates of chronic disease/illness reported for rural populations also implies greater subjective suffering among these people.

Acknowledgements

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Appendix I: Health and Quality of Life Survey Questions

GENERAL HEALTH

SF1.   How would you rate your health, in general, now? (*Please circle your response*)
1. Excellent
2. Very good
3. Good
4. Fair
5. Poor

SF2.   Compared to one year ago, how would you rate your health in general now? (*Please circle your response*)
1. Much better now than one year ago
2. Somewhat better now than one year ago
3. About the same
4. Somewhat worse now than one year ago
5. Much worse now than one year ago

SF3.   The following question lists activities you might do during a typical day. **Does your health limit you** in these activities? If so, how much? *(Please put a check (>) in the appropriate column)* ***For mean calculations, 1="No, not limited at all" and 3="Yes, limited a lot".***

		Yes, limited a lot (3)	Yes, limited a little (2)	No, not limited at all (1)
a)	Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports			
b)	Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling or playing golf			
c)	Lifting or carrying groceries			
d)	Climbing several flights of stairs			
e)	Climbing one flight of stairs			
f)	Bending, kneeling or stooping			
g)	Walking more than 1.6 kms (1 mile)			
h)	Walking several blocks			
i)	Walking one block			
j)	Bathing or dressing yourself			

SF4.   During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**? *(Please put a check (>) in the appropriate column)*

		Yes (1)	No (2)
a)	Cut down on the *amount of time* you spent on work or other activities		
b)	*Accomplished less* than you would like		
c)	Were limited in the *kind* of work or other activities		
d)	Had *difficulty* performing the work or other activities (e.g., It took extra effort)		

SF5.   During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)? *(Please put a check (>) in the appropriate column)*

		Yes (1)	No (2)
a)	Cut down the *amount of time* you spent on work or other activities		
b)	*Accomplished less* than you would like		
c)	Didn't do work or other activities as *carefully* as usual		

SF6.   During the **past 4 weeks**, to what extent has your **physical health or emotional problems** interfered with your normal social activities with family, friends, neighbours or groups? *(Please circle your response)*

1. Not at all	2. Slightly	3. Moderately	4. Quite a bit	5. Extremely

SF7.   How much **bodily pain** have you had during the **past 4 weeks**? *(Please circle your response)*

1. None	2. Very mild	3. Mild	4. Moderate	5. Severe	6. Very severe

SF8.   During the **past 4 weeks**, how much did **pain** interfere with your normal wo rk (including work both outside the home and housework)? *(Please circle your response)*

1. Not at all	2. A little bit	3. Moderately	4. Quite a bit	5. Extremely

SF9. These questions are about how you feel and how things have been with you **during the past 4 weeks**. How much of the time during the past 4 weeks, (For each question, please check (∪) the one answer that comes closest to the way you have been feeling.) *For mean calculations, 1="All of the time" and 6="None of the time"*

		All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	None of the time (6)
a)	Did you feel full of pep?						
b)	Have you been a very nervous person?						
c)	Have you felt so down in the dumps that nothing could cheer you up?						
d)	Have you felt calm and peaceful?						
e)	Did you have a lot of energy?						
f)	Have you felt downhearted and blue?						
g)	Did you feel worn out?						
h)	Have you been a happy person?						
i)	Did you feel tired?						

SF10. During the **past 4 weeks**, how much of the time has your **physical health or emotional problems** interfered with your social activities (like visiting with friends, relatives, etc.)? (*Please circle your response*)
1. All of the time
2. Most of the time
3. Some of the time
4. A little of the time
5. None of the time

SF11.   How **true or false** is each of the following statements for **you**? (Please put a check (U) in the appropriate column) *For mean calculations, 1="Definitely true" and 5="Definitely false"*

		Definitely True (1)	Mostly True (2)	Don't Know (3)	Mostly False (4)	Definitely False (5)
a)	I seem to get sick a little easier than other people.					
b)	I am as healthy as anybody I know.					
c)	I expect my health to get worse.					
d)	My health is excellent.					

Unhealthy Days and Special Problems

U1. Thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health **not** good?

U2. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health **not** good?

U3. During the past 30 days for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

U9. During the past 30 days, for about how many days did pain make it hard for you to do your usual activities, such as self-care, work or recreation?

U10. During the past 30 days, for about how many days have you felt sad, blue or depressed?

U11. During the past 30 days, for about how many days have you felt worried, tense or anxious?

U12. During the past 30 days, for about how many days have you felt you did not get enough rest or sleep?

U13. During the past 30 days, for about how many days have you felt very healthy and full of energy?

DESCRIPTION OF SAMPLE

The following questions are used to generally describe the sample of people who have taken part in this survey and for statistical purposes.

D1.   Are you: Female (1) Male (2)

D3.   Your present age:

D6.   How would you name your cultural or ethnic background? (eg, Italian, Nuxalk, Métis, English Canadian, etc.)

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