

Self-Rated Health Predicts Mortality in Very Old Men—the Manitoba Follow-Up Study



Christian R. Hanson, MD¹, Philip D. St John, MD^{1,2}, Robert B. Tate, PhD^{2,3}

¹Section of Geriatric Medicine, the Centre on Aging² and the Department of Community Health Sciences³, Max Rady College of Medicine, University of Manitoba, Winnipeg, MB

DOI:<https://doi.org/10.5770/cgj.22.391>

ABSTRACT

Background

Self-rated health (SRH) predicts death, but there are few studies over long-time horizons that are able to explore the effect age may have on the relationship between SRH and mortality.

Objectives

1. To determine how SRH evolves over 20 years; and 2. To determine if SRH predicts death in very old men.

Methods

We analyzed a prospective cohort study of men who were fit for air crew training in the Second World War. In 1996, a regular questionnaire was administered to the 1,779 surviving participants. SRH was elicited with a 5-point Likert Scale with the categories: excellent, very good, good, fair and poor/bad. We examined the age-specific distribution of SRH in these categories from the age of 75 to 95 years, to the end of the follow-up period in 2018. We constructed age-specific Cox proportional hazard models with an outcome of time to death.

Results

SRH declined with age. The gradient in risk of death persisted across all ages; those with poor/fair/bad SRH had consistently higher mortality rates. However, the discrimination between good and excellent was less in those aged 85+.

Conclusions

SRH declines with advancing age, but continues to predict death in older men.

Key words: self-rated health, subjective health, mortality, cohort study

INTRODUCTION

Self-rated health (SRH) is an important measure of health perception which has been used widely in gerontological research. (1) It is a simple, global measure of health status that was originally found to be a strong predictor of mortality in the *Aging in Manitoba Study*. Mossey & Shapiro found that older adults who rated their health as poor were 2.92 times as likely to die within two years as those who rated their health as excellent. Furthermore, the late mortality risk (up to six years) was 2.77 times as great. (2) Subsequently, a large body of population-based research has replicated these findings in many settings and after adjustment for a range of potential confounding factors. (3,4) Moreover, SRH has been shown to predict a wide variety of adverse outcomes—functional decline, (5) hospitalization, (6) resource utilization, (6,7) and cognitive impairment. (8,9)

There is some controversy around what SRH is measuring, with some stating that SRH is a spontaneous global summation of health, while others stating that SRH encompasses other non-medical aspects of health, (10,11) providing additional information beyond that which is objectively measurable by a clinician. Regardless, there is a direct association between SRH and death. Indeed, SRH is a simple, straightforward measure of global health which is easily gathered and has proven useful in clinical settings, epidemiological surveys, and for health service research. Blazer states: “There is no better way to know the person than to explore the subjective feelings of the person—exactly what clinicians do when they ask, “How do you feel?” (12)

There are different ways of eliciting SRH; some consider age-based references (e.g., “How is your health compared to others your age?”), while others consider time-based references (e.g., “How is your health compared to a year ago?”). Still others have no explicit reference point (e.g., “How is your health these days?”). The response options to the question are commonly offered on a Likert scale ranging from “excellent”, “very good”, “good”, “fair,” to “poor”. (13) All methods of elicitation predict death, although the unreferenced item seems to be the strongest predictor of health status. (14,15)

While SRH has been proved a valid predictor in many populations in many settings, there remain some concerns. Notably, SRH does not appear to predict mortality in those with substantial cognitive impairment,⁽¹⁶⁾ perhaps because those with cognitive impairment may not understand the question of self-rating. As well, there may be differential effects in different sociocultural groups,⁽¹⁷⁾ and in those with differing socioeconomic status.⁽¹⁸⁾ However, SRH appears to have the same effect on mortality amongst those with and without depressive symptoms.⁽¹⁹⁾

Despite these variations in findings, SRH remains appealing since it is easy to collect, cost-effective, and reliable.⁽²⁰⁾ Some advocate that The World Health Organization include SRH in health interview surveys.^(21,22) Given the relationship between SRH and mortality, measurement of SRH may have potential clinical merit as it provides useful prognostic information that could be used in decisions regarding health interventions and long-term care planning, as well as possibly identifying individuals and populations at a high risk of adverse outcomes. Since the association between SRH and mortality may be influenced by age,⁽²²⁾ further examination of this relationship may help determine more precisely whether or not SRH measurement is useful in a given age cohort, and which increments of SRH are the most predictive of mortality.

In summary, there are some outstanding questions. First, the association between SRH and death has not been shown in a population of very old adults where the underlying rate of death is very high, regardless of health status. Second, the population norms for SRH of older adults are not clear (particularly the population of men over the age of 85). To address these issues, we used SRH data collected over a 22-year window as part of the *Manitoba Follow-up Study*.⁽²³⁾ This is a prospective cohort study of men who qualified for air crew training during the Second World War, and who have been followed at regular intervals since then. We used data from 1996 to the present time to determine how age affected the distribution of SRH, and the relationship between SRH and subsequent mortality.

METHODS

The *Manitoba Follow-up Study* (MFUS)⁽²³⁾ is the longest running study of cardiovascular disease and aging in Canada. The initial cohort consists of 3,983 men recruited from the Royal Canadian Air Force following the Second World War. The cohort was sealed on July 1, 1948 and the study is continuing to the present day. Details and general methods of the study are reported elsewhere.⁽²³⁻²⁵⁾ One strength of this study is its ability to keep in contact with all study participants. Fewer than one per cent of the cohort is lost, as defined as no confirmed date of death or in arrears with contact with the study for more than three years. In 1996, a detailed questionnaire was developed to collect information regarding quality of life, mental health, physical health and function. These questions were included in a Successful Aging Questionnaire (SAQ).

As part of the SAQ, participants were asked for their age-referenced SRH on a Likert Scale. Responses were coded as “excellent,” “very good,” “good,” “fair,” and “poor/bad”. The SAQ was distributed in 1996, 2000, 2002, and annually since 2004. There were 1,779 participants who responded to the 1996 SAQ, and the annual response rate is greater than 80%. In addition to the SAQ, an annual health survey is sent to the participants. Data from routine health visits and hospitalizations are also collected. Medical diagnoses are coded by volunteer physicians. We used time to death as our outcome variable. This time was calculated from the date of the SAQ when SRH was reported to the date of death or date of last contact with the study for living participants.

We created Kaplan-Meier curves to graphically illustrate the survival estimates for men in different SRH categories. These curves were stratified by age at SRH measurement, and presented for illustration at ages 75, 80, 85, and 90 years. Log-rank tests were used to determine differences in survival time between these SRH groups. We also constructed Cox proportional hazard models, stratified by age at SRH measurement. Hazard ratios (HR) were calculated for mortality given SRH measurements of “very good,” “good,” and “fair/poor/bad” as compared to “excellent.” We combined the lowest categories to ensure adequate numbers for comparison to the “excellent” category.

RESULTS

Just over half of the original cohort (2,043 of 3,983) was alive in 1996. Among these men, 1,779 responded to the SAQ in 1996.⁽²³⁾ The mean age of respondents at the time of the first mailing of the 1996 SAQ was 78 years, with 21% under the age of 75 years, over half (53%) aged 75–79 years, and 464 (26%) respondents aged over 80 years. Over three quarters (78%) reported living with other adults. A large proportion, 81%, reported no limitations with basic activities of daily living (ADLs), whereas 53% reported no limitations with instrumental activities of daily living (IADLs).⁽²⁶⁾

Figure 1 shows the change in categories of SRH over the course of the study from age 75 to age 99. There is a shift to

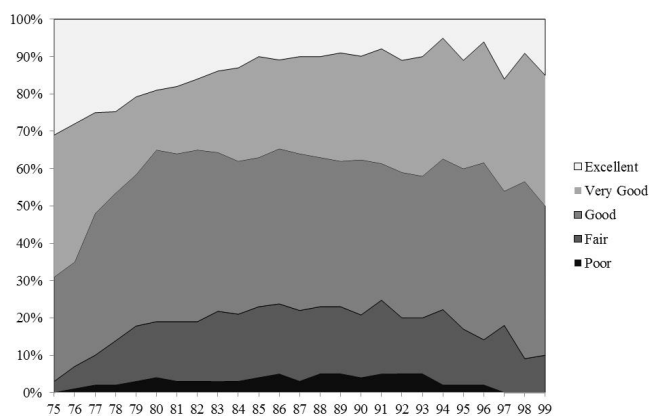


FIGURE 1. Categories of SRH over the course of the study

lower SRH between the ages of 75 to 80. Subsequently, however, there is some stability in self-ratings of health. Note that this display is a series of cross-sectional views of SRH, and does not represent an individual's trajectory. These results also represent the survivors, and those with declining SRH may be more likely to die. Nevertheless, it is worth noting that SRH remains fairly high even amongst surviving very old men.

Figures 2 to 5 show the Kaplan-Meier plots for survival. At all ages, age-referenced SRH is a strong predictor of mortality over the course of the observation period. However, the differentiation between the ratings of SRH does change over time. At a younger age, there is a clear demarcation between "excellent" and "very good." However, with advancing age, this differentiation diminishes. After the age of 80, the effect of SRH of "very good" and "excellent" are similar; whereas there continues to be a differential effect between the other

ratings. The baseline risk of death also obviously increases over these ages.

Table 1 displays the results of the Cox proportional hazards model. This shows the higher risk of death for "fair"/"poor"/"bad" SRH, ranging from across all age groups. At younger ages, there is a clear differentiation in mortality between those with "excellent" SRH compared to "very good". However, this differentiation lessens at older ages.

DISCUSSION

We have conducted an analysis of our population-based cohort study of aging men and shown that age-referenced SRH is a strong predictor of subsequent mortality over a long time frame and at all ages. The predictive value of SRH on mortality is preserved from age at time of measurement of

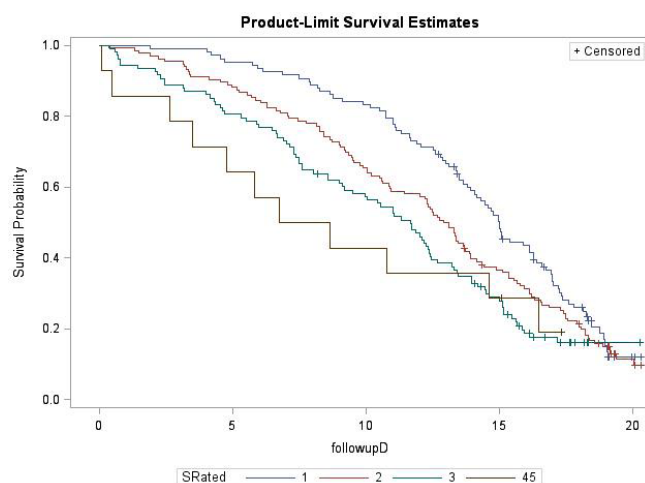


FIGURE 2. The Kaplan-Meier plot for survival in categories of self-rated health at the age of 75: 1 is excellent, 2 is very good, 3 is good, and 45 is fair/poor/bad

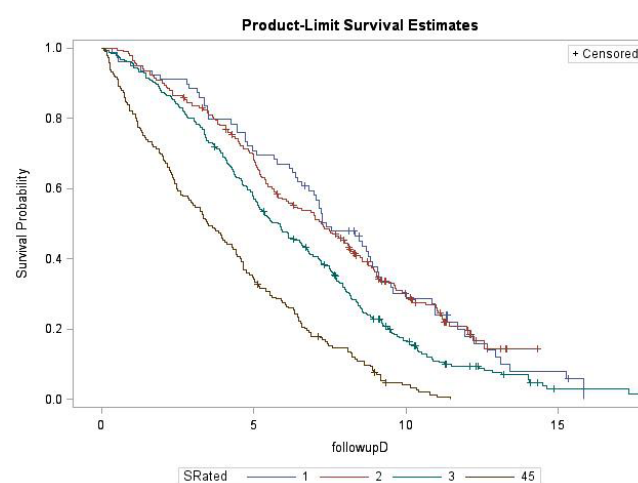


FIGURE 4. The Kaplan-Meier plot for survival in categories of self-rated health at the age of 85: 1 is excellent, 2 is very good, 3 is good, and 45 is fair/poor/bad

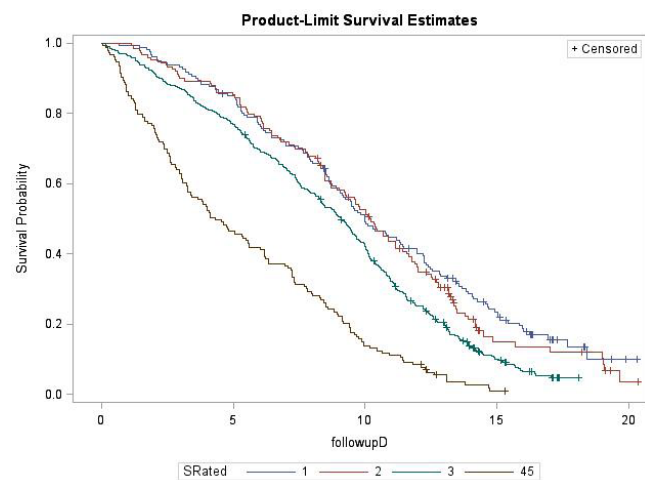


FIGURE 3. The Kaplan-Meier plot for survival in categories of self-rated health at the age of 80: 1 is excellent, 2 is very good, 3 is good, and 45 is fair/poor/bad

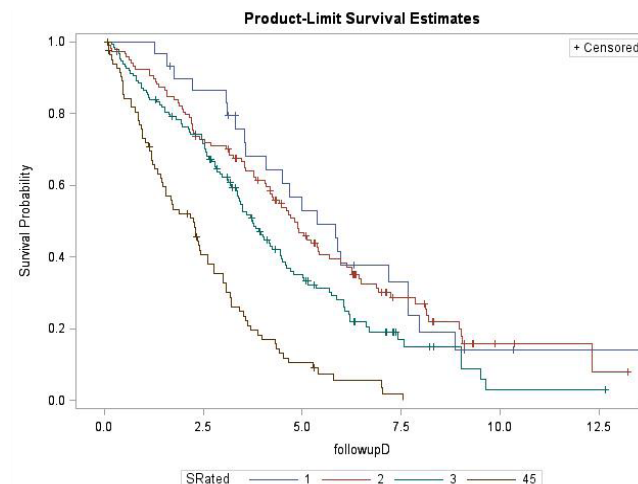


FIGURE 5. The Kaplan-Meier plot for survival in categories of self-rated health at the age of 90: 1 is excellent, 2 is very good, 3 is good, and 45 is fair/poor/bad

TABLE 1.
Results of proportional hazard model for mortality for self-rated health at different ages; reference category is “excellent”

Age	Sample Size	Very Good	Good	Fair/Poor/Bad
75	366	1.31 ^a	1.28 ^a	1.97 ^a
76	475	1.56 ^a	1.52 ^a	2.68 ^a
77	641	1.72 ^a	1.65 ^a	2.72 ^a
78	744	1.67 ^a	1.66 ^a	2.83 ^a
79	806	1.35 ^a	1.52 ^a	2.56 ^a
80	855	1.08	1.50 ^a	3.20 ^a
81	879	1.25	1.54 ^a	3.67 ^a
82	861	1.39 ^a	1.82 ^a	3.43 ^a
83	849	1.21	1.52 ^a	3.39 ^a
84	811	0.94	1.27	2.61 ^a
85	781	0.98	1.42 ^a	2.79 ^a
86	717	1.35 ^a	1.82 ^a	3.29 ^a
87	655	1.27	1.61 ^a	2.87 ^a
88	568	1.04	1.73 ^a	3.23 ^a
89	479	0.94	1.46 ^a	2.82 ^a
90	382	0.82	1.49	3.56
91	323	1.18	1.69 ^a	3.69 ^a
92	259	0.93	1.12	2.61 ^a
93	193	0.90	1.35	3.13 ^a
94	142	1.07	1.27	3.89 ^a
95	96	1.67	1.43	3.71 ^a

^aDenotes $p < .05$

75 through age 90. However, the difference between a SRH measurement of “very good” and “excellent” becomes less significant with increased age. Age-referenced SRH may be one useful measure when considering prognosis and end-of-life decision-making in patients with declining health.

There are some strengths and limitations to the approach we have taken. First, the long length of follow-up in this prospective cohort study enables examination of the relationship between SRH and mortality over many years, with Kaplan-Meier survival curves extending as far as 20+ years. Second, the loss to follow-up for vital statistics has been very low due to the high level of engagement and interest of the participants over the years. As well, the annual response rate to the survey is very high.

However, non-response may be due to illness rather than disinterest in the study; the missing data may not be missing at random. This bias would likely result in a stronger association between SRH and death than we actually observed. Another limitation of the study is its generalizability, given that the cohort consists of exclusively men recruited into the Royal Canadian Air Force in the Second World War. There is reported mixed evidence of gender and/or sex differences in SRH,⁽²⁷⁻²⁹⁾ which we cannot explore. This is also a population-based study and the findings may not apply in clinical

populations where the health status may be more homogeneous. A third limitation is that we did not consider the cognition of the participants in their response. A Canadian five-year prospective cohort study previously demonstrated that SRH assessments can be used to predict survival in subjects with mild-to-moderate cognitive impairment, but not with severe cognitive impairment.⁽¹⁶⁾ Another limitation is the use of an age-referenced SRH item. Indeed, when asked “How do you rate your health compared to others your age?” some participants have begun noting that they do not know any other 100-year-olds with whom to compare themselves. Finally, these findings represent a series of cross-sectional analyses, and the trajectory of SRH may yield important prognostic information⁽³⁰⁾ over and above the baseline state—as do the health-related, quality-of-life trajectories in this data set.⁽³¹⁾

CONCLUSIONS

In spite of these limitations, our findings are important. First, SRH is a useful predictor of mortality from age 75 through to age 90. Second, SRH seems to decline somewhat with age, and the differentiation between excellent and very good may diminish as fewer and fewer men respond “excellent.” Nevertheless, SRH is an attractive potential question to elicit

global health in health surveys. Further study is needed into clinical populations to determine if this simple, inexpensive, and non-intrusive measure is useful in clinical practice. Further study is also needed into determining trajectories of SRH in relation to changes in objective health measures, and the prognostic implications of changing SRH.

ACKNOWLEDGEMENTS

These analyses were funded by the Canadian Institute for Health Research Project Grant Number PJT-152874. The *Manitoba Follow-Up Study* also received bridge funding from the Dean's Fund (Max Rady College of Medicine, University of Manitoba) and charitable donations from the participants and families of the *Manitoba Follow-Up Study*. We would like to thank the participants of the MFUS, some of whom have been actively engaged in this study for more than 70 years. We would also like to posthumously acknowledge Evelyn Shapiro and Betty Havens for their helpful and supportive comments on the *Manitoba Follow-Up Study* over the decades. We would also like to thank the staff and volunteers of MFUS, past and present. This work was completed when Dr. Hanson was a subspecialty resident in Geriatric Medicine at the University of Manitoba.

CONFLICT OF INTEREST DISCLOSURES

The authors declare that no conflicts of interest exist.

REFERENCES

- McDowell I. Measuring health: a guide to rating scales and questionnaires, 3rd edition. New York: Oxford University Press; 2006.
- Mossey JM, Shapiro E. Self-rated health: a predictor of mortality among the elderly. *Am J Public Health*. 1982;72(8):800–08.
- Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behavior*. 1997;38(1):21–37.
- DeSalvo KB, Blosner N, Reynolds K, *et al*. Mortality prediction with a single general self-rated health question: a meta-analysis. *J Gen Intern Med*. 2006;21(3):267–75.
- Hirosaki M, Okumiya K, Wada T, *et al*. Self-rated health is associated with subsequent functional decline among older adults in Japan. *Int Psychogeriatr*. 2017;29(9):1475–83.
- DeSalvo KB, Fan VS, McDonnell MB, *et al*. Predicting mortality and healthcare utilization with a single question. *Health Serv Res*. 2005;40(4):1234–46.
- DeSalvo KB, Jones TM, Peabody J, *et al*. Health care expenditure prediction with a single item, self-rated health measure. *Med Care*. 2009;47(4):440–47.
- St John P, Montgomery P. Does self-rated health predict dementia? *J Geriatr Psychiatry Neurol*. 2013;26(1):41–50.
- Montlahuc C, Soumare A, Dufouil C, *et al*. Self-rated health and risk of incident dementia: a community-based elderly cohort, the 3C study. *Neurology*. 2011;77(15):1457–64.
- Jylha M. What is self-rated health and why does it predict mortality? Towards a unified conceptual model. *Soc Sci Med*. 2009;69(3):307–16.
- Bailis DS, Segall A, Chipperfield JG. Two views of self-rated general health status. *Soc Sci Med*. 2003;56(2):203–17.
- Blazer DG. How do you feel about...? Health outcomes in late life and self-perceptions of health and well-being. *Gerontologist*. 2008;48(4):415–22.
- Sanchez-Santos MT, Zunzunegui MV, Otero-Puime A, *et al*. Self-rated health and mortality risk in relation to gender and education: a time-dependent covariate analysis. *Eur J Ageing*. 2011;8(4):281–89.
- Vuorisalmi M, Lintonen T, Jylha M. Comparative vs. global self-rated health: associations with age and functional ability. *Aging-Clin Exp Res*. 2006;18(3):211–17.
- Vuorisalmi M, Lintonen T, Jylha M. Global self-rated health data from a longitudinal study predicted mortality better than comparative self-rated health in old age. *J Clin Epidemiol*. 2005;58(7):680–87.
- Walker JD, Maxwell CJ, Hogan DB, *et al*. Does self-rated health predict survival in older persons with cognitive impairment? *J Am Geriatr Soc*. 2004;52(11):1895–900.
- Assari S, Lankarani MM, Burgard S. Black–white difference in long-term predictive power of self-rated health on all-cause mortality in United States. *Ann Epidemiol*. 2016;26(2):106–14.
- Singh-Manoux A, Dugravot A, Shipley MJ, *et al*. The association between self-rated health and mortality in different socioeconomic groups in the GAZEL cohort study. *Int J Epidemiol*. 2007;36(6):1222–28.
- St John P, Montgomery P. Does self-rated health predict death in older adults with depressive symptoms? *Can J Aging/La Revue canadienne du vieillissement*. 2012;31(1):49–54.
- Kaplan G, Baron-Epel O. What lies behind the subjective evaluation of health status? *Soc Sci Med*. 2003;56(8):1669–76.
- Subramanian SV, Huijts T, Avendano M. Self-reported health assessments in the 2002 World Health Survey: how do they correlate with education? *B World Health Organ*. 2010;88(2):131–38.
- Szybalska A, Broczek K, Puzianowska-Kuznicka M, *et al*. Self-rated health and its association with all-cause mortality of older adults in Poland: The PolSenior project. *Arch Gerontol Geriatr*. 2018;79:13–20.
- Tate RB, Cuddy TE, Mathewson FA. Cohort Profile: The Manitoba Follow-up Study (MFUS). *Int J Epidemiol*. 2015;44(5):1528–36.
- Mathewson FA, Brereton CC, Keltie WA, *et al*. The University of Manitoba Follow-up Study: a prospective investigation of cardiovascular disease. I. General description—mortality and incidence of coronary heart disease. *Can Med Assoc J*. 1965;92(18):947–53.
- Mathewson FA, Brereton CC, Keltie WA, *et al*. The University of Manitoba Follow-up Study: a prospective investigation of cardiovascular disease. II. Build, blood pressure and electrocardiographic factors possibly associated with the development of coronary heart disease. *Can Med Assoc J*. 1965;92(19):1002–06.

26. Tate RB, Lah L, Cuddy TE. Definition of successful aging by elderly Canadian males: the Manitoba Follow-up Study. *Gerontologist*. 2003;43(5):735–44.
27. af Sillen U, Nilsson JA, Mansson NO, *et al*. Self-rated health in relation to age and gender: influence on mortality risk in the Malmo Preventive Project. *Scand J Public Health*. 2005;33(3):183–89.
28. Assari S. Gender differences in the predictive role of self-rated health on short-term risk of mortality among older adults. *SAGE open medicine*. 2016;4:2050312116666975.
29. Etherington N. Re-evaluating gender differences in self-rated health: the importance of cohort. *J Women Aging*. 2017;29(2):150–62.
30. Nielsen AB, Siersma V, Kreiner S, *et al*. The impact of changes in self-rated general health on 28-year mortality among middle-aged Danes. *Scand J Prim Health Care*. 2009;27(3):160–66.
31. St John PD, Jiang D, Tate RB. Quality of life trajectories predict mortality in older men: the Manitoba Follow-Up Study. *J Aging Health*. 2018;30(2):247–61.

Correspondence to: Philip D. St John, MD, MPH, FRCPC, Section of Geriatric Medicine, Max Rady College of Medicine, Room GE547 Health Sciences Centre, University of Manitoba, 820 Sherbrook St., Winnipeg, MB R3A 1R9
E-mail: pstjohn@hsc.mb.ca