

The validity of using self-reported illness to measure objective health

Paul Andrew Bourne

Department of Community Health and Psychiatry
Faculty of Medical Sciences, Mona, Kingston 7, Jamaica W.I.

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Abstract

Background: There is a longstanding discourse on whether self-reported health is a good measure of objective health. This has never been empirically examined in Jamaica. **Aims:** Study seeks to 1) examine the relationship between particular subjective and objective indexes; 2) investigate the validity of a 4-week subjective index in measuring objective indexes; 3) evaluate the differences that exist between the measurement of subjective and objective indexes by the sexes; and 4) provide policy makers, other researchers, public health practitioners as well as social workers with research information with which can be used to inform their directions. **Materials and Methods:** Data published by the Statistical Institute of Jamaica, and the Planning Institute of Jamaica and the Statistical Institute of Jamaica were used for this study. Descriptive statistics were used to provide background information on data. Scatter diagrams were employed to establish 1) statistical associations, and 2) linearity and non-linearity between variables under examination. Multiple regression, using the enter method, was employed to a predictive model of linear associations. **Results:** A strong significant association was found between life expectancy at birth for the Jamaican population and self-reported illness ($r = -0.731$); and this was weaker females ($r = -0.683$) than males ($r = -0.796$). However, the relationship between mortality and self-reported illness was a weak non-linear one. **Conclusions:** Self-reported illness in a 4-week reference period is a good measure of objective health and that self-reported illness for males was a better measure for objective health than for females.

Keywords: Self-reported illness, objective health, subjective health, public health, Jamaica.

Correspondence to: Paul Andrew Bourne, Research Fellow and Social Demographer, Department of Community Health and Psychiatry, Faculty of Medical Sciences, University of the West Indies, Mona Campus, Kingston 7, Jamaica. Tel: (876) 457-6990. Email: paulbourne1@yahoo.com

Introduction

There is a longstanding discourse on whether self-reported health is a good measure of objective health. Objective health indexes include mortality, life expectancy and diagnosed morbidity, which provide a great degree of precision in the measurement of health. Those measures have been used for centuries by mathematicians, demographers and epidemiologists to provide insights into the health of an individual, community or population. While the objective health indexes do have a high probability of mathematical empiricism, which make for

validity and reliability in comparisons across different population characteristics, they are narrow in evaluating a range of issues affecting the health of people. Life expectancy germinates from mortality data, which speaks to lived years and not quality of the lived time. Like life expectancy and mortality, morbidity is caused by some disease causing pathogens that further justify the causal relation between morbidity and health. Historically, policy makers including doctors relied on research findings on the causes of particular dysfunctions in order to formulate measures to address their reduction or eradication. Health

therefore was viewed as the absence of diseases; hence, the alleviation of morbidity meant a healthy person or population. But the absence of diseases still does not imply that an individual or population is healthy, as this is the further extreme of the health continuum. It was this gap in the discourse and the accepted limitation of objective indexes of health that led the World Health Organization (WHO), in the late 1940s, to forward a conceptual definition of health [1].

The WHO's definition of health stipulated that it goes beyond the mere absence of diseases to social, psychological and physical wellbeing. Health was no longer the absence of diseases but different tenets of 'wellbeing'. Although WHO's perspective outlined the way forward, and sought to provide a platform for which an expansion in objective health could begin, some scholars opined that it was too vague and elusive a conceptualization [2,3]. In spite of those critiques, some researchers began using subjective indexes to measure health instead of the traditional objective indexes. The subjective measures are 1) happiness; 2) life satisfaction, 3) self-reported health status, and self-reported illness [4-15].

Diener [5, 6] postulated that happiness can be used to measure subjective wellbeing (i.e. health). He opined that happiness extends beyond and implicitly takes into account more aspects of an individual's life than the objective indexes. Happiness like life satisfaction, self-reported health has a common denominator, people's perception of their general quality of life. Although this is in keeping with that comprehensive broad conceptual definition of health forwarded by the WHO – more than the narrow biomedical approach diagnosed morbidity, life expectancy or mortality – the debate about the validity of those subjective indexes continue.

Scientific literature on health has revealed that self-rated health status is highly reliable a measure to proxy health and that this 'successfully crosses cultural lines' [16]. O'Donnell and Tait [17] concluded that self-reported health status can be used to indicate wellbeing as they found that all respondents who had chronic diseases reported very poor health. Another group of scholars concurred with the aforementioned findings when their findings revealed that the statistical association between happiness and subjective wellbeing (i.e. self-reported health) was a strong one - correlation coefficient $r = 0.85$ in the 18 OECD countries [18]. In that same study, the research found a weak relation between objective measures of health and self-reported health. This highlights the disparity in measures, the need for more empirical studies and implicitly has not address the biasness in the subjectivity of the subjective indexes.

The subjective indexes introduced the issue of biasness in recall and perception as subjectivity denotes people's perceptions. Perception is highly biased as people can provide an inflated or deflated account of their state in an interview or on a self-administered questionnaire. It is for this reason why empirical researchers avoid and decry its

utilization in the measurement of health. Although subjective indexes are in keeping with the WHO's widened definition of health, their biasness must be understood as challenges for researchers.

The discourse on subjective wellbeing, using survey data, cannot be denied that it is based on person's judgment, and therefore must be prone to systematic and non-systematic biases [19]. In an earlier work, Diener [5] argued that the subjective measure seemed to contain substantial amounts of valid variance; suggesting that this indicated the validity of subjective indexes. Kahneman [20] devised a procedure of integrating and reducing the subjective biases when he found that instantaneous subjective evaluations are more reliable than assessments of recall of experiences. This highlights the biasness therefore that remain in cross-sectional survey that asked people to remember over a long time. Embedded in the aforementioned findings are whether particular subjective indexes that comprised of recall over 2-4 weeks is a good measure for objective indexes of health. Embodied in the literature is the need to carry out empirical research on subjective and objective indexes with emphasis on subjective indexes that are not on instantaneous assessment.

Using data for Jamaica, the aims of this study are to 1) examine the relationship between particular subjective and objective indexes; 2) investigate the validity of 2-4 week subjective index (self-reported illness over a 4-week period) in measuring objective indexes (i.e. life expectancy and mortality); 3) evaluate the differences that exist between the measurement of subjective and objective indexes by the sexes; and 4) provide policy makers, other researchers, public health practitioners as well as social workers with research information with which can be used to inform their directions.

Materials and Methods

The current study utilized secondary published data from the Statistical Institute of Jamaica [21], and the Planning Institute of Jamaica and the Statistical Institute of Jamaica [22]. Life expectancy and mortality were from the Statistical Institute of Jamaica, and self-reported illness from the Planning and Statistical Institutes of Jamaica. Generally, data were for two decades (1989-2007); however, life expectancy data were only available for some of those years. Life expectancy for some years was taken from the Human Development Reports [23].

Data were stored, retrieved and analyzed using SPSS for Windows 16.0 (SPSS Inc; Chicago, IL, USA). Descriptive statistics were used to provide background information on data. Scatter diagrams were employed to establish 1) statistical associations, and 2) linearity and non-linearity between variables under examination. Multiple regression, using the enter method, was employed to a predictive model of linear associations. Models were built for 1) general life expectancy and self-reported illness of Jamaicans; 2) life expectancy and self-reported illness of the sexes. A 95% confidence

interval would be used to examine whether a variable is statistical significant or not.

$$LE_p = f(SPI_{p,\epsilon}) [1]$$

$$LE_m = f(SPI_{m,\epsilon}) [2]$$

$$LE_f = f(SPI_{f,\epsilon}) [3]$$

Where LE_p (life expectancy at birth for the population at a given period) is a function of self-reported illness (SPI_p) of population at a given period and some residual error (ϵ).

LE_m is life expectancy at birth for males at a given period.
 SPI_m is self-reported illness for males at a given period.
 LE_f is life expectancy at birth for females at a given period.
 SPI_f is self-reported illness for females at a given period.

Measure

Self-reported illness: The percent of people who reported having had an illness/injury in the 4-week period of the survey for a given year.

Mortality: The number of death of people in Jamaica for a given year.

Life expectancy at birth.

The average number of years of new-born would live if subject to the mortality patterns of the cross-sectional population at the time of his/her birth.

Subjective health is self-evaluated (or assessed) illness of an individual.

Objective health: This variable constitutes life expectancy and mortality of a given population at a particular time.

Results

In 1989, life expectancy at birth for the Jamaican population was 72.5 years and this has increased to 73.12 year in 2007 (Table 1). Disaggregating population life expectancy at birth revealed that in 1989, a female child was likely to outlive a male-child by 3 years. One and one-half decades later this difference increased to 6 years. Over the 2 decades, the self-assessed difference in ill status of females increased from 3.5% (in 1989) to 4.7% in 2007. Concurrently, general self-reported illness over a 4-week period declined from 16.8% to 15.5%, with a mean self-reported illness of 12.5% (SD = 2.6%). Mortality declined by 9.2%; with a mean mortality over the 2 decades being 15,829 people (SD = 1,616 people).

Life expectancy of population by self-reported illness (for a 4-week period)

Assessing illness from a 4-week period, Figure 1 found a strong significant association between life expectancy at birth for the Jamaican population and self-reported illness (correlation coefficient, $r = -0.731$). Fifty-four percent of life expectancy can be accounted for by self-reported illness ($R^2 = 0.535$).

Based on Table 2, if all other things remain constant (i.e. not change) which denotes that self-reported illness would be naught, a Jamaican child at birth on average would be expected to live for 75.6 years (95% confidence interval: 73.9, 77.3 years). With every 1% increase in self-reported illness, life expectancy is expected to decline by 0.17 years (i.e. 2 months).

Table 1 Life expectancy at birth for the sexes, self-reported illness, and mortality, 1989-2007

Year	Life expectancy at birth (e ⁰)			Ill-health (in %)			Mortality
	Male	Female	Total	Male	Female	Total	
1989	69.97	72.64	72.5	15.0	18.5	16.8	16400
1990	69.97	72.64	72.5	16.3	20.3	18.3	14900
1991	69.97	72.64	72.5	12.1	15.0	13.7	13300
1992			73.6 ^a	9.9	11.3	10.6	13200
1993			73.7 ^a	10.4	13.5	12.0	13900
1994				11.6	14.3	12.9	13500
1995			74.1 ^a	8.3	11.3	9.8	15400
1996				9.7	11.8	10.7	15800
1997				8.5	10.9	9.7	15100
1998			75.0 ^a	7.4	10.1	8.8	17000
1999	70.94	75.58	73.25	8.1	12.2	10.1	18200
2000	70.94	75.58	73.25	12.4	16.8	14.2	17400
2001	70.94	75.58	73.25	10.8	15.9	13.4	17800
2002	71.26	77.07	74.13	10.4	14.6	12.6	17000
2003	71.26	77.07	74.13	NI	NI	NI	16900
2004	71.26	77.07	74.13	8.9	13.6	11.4	16300
2005			73.33	NI	NI	NI	17000
2006			73.24	10.3	14.1	12.2	16400
2007			73.12	13.1	17.8	15.5	14900

^a These were taken from the United Nations Development Program

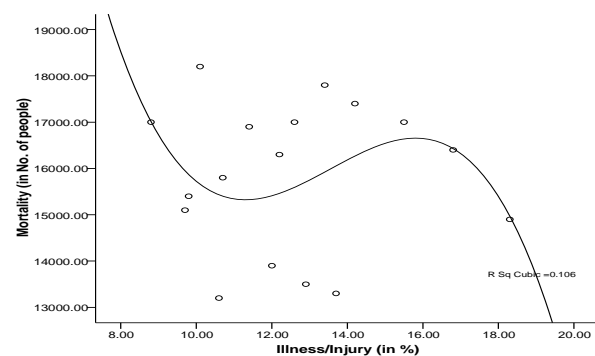


Fig. 1 Mortality (in No of people) and self-reported illness/injury (%)

Based on Figure 1 the data for mortality (in number of people) and self-reported illness (%) is best fitted by a non-linear curve. Concomitantly, when self-reported illness of the population (%) is less than 11%, the significant statistical correlation between self-reported illness and mortality is a negative one. When self-reported illness lies between 11% and 16%, mortality begins to increase indicating the direct statistical association between both variables. When self-reported illness exceeds 16%, the association between the two variables changes to a negative one.

Life expectancy of female child at birth by self-reported illness of females (for a 4-week period)

Life expectancy at birth of female Jamaica and self-reported illness of female (assessed based on a 4-week period) are moderately negatively correlated with each other (correlation coefficient, $r = -0.683$). Forty-seven

percent of the variance in life expectancy at birth of a female child in Jamaica can be explained by 1% change in self-reported illness of females (Fig. 2).

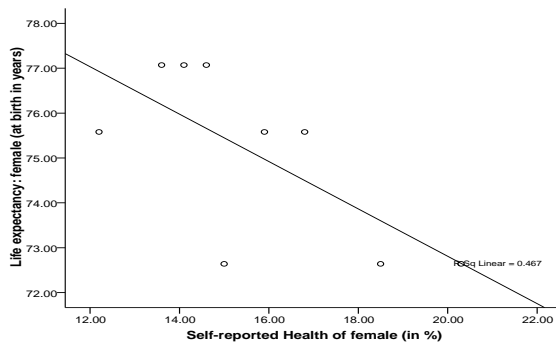


Fig. 2 Life expectancy at birth for female by self-reported illness of female (%).

There is a negative moderate correlation between life expectancy at birth of a female and self-reported illness of female (%) – correlation coefficient = 0.683. Forty-seven percent of the variance in life expectancy at birth of a female can be accounted for by 1% change in self-reported illness females (%).

Table 2 revealed that if self-reported illness were equals to zero, life expectancy of a female child at birth on average would be 83.3 years (9% % Confidence interval = 75.4, 91.3 years). With every 1% increase in self-reported illness, life expectancy will decline by 0.53 years (or 6 months) (95% confidence interval = -1.031, -0.024 years).

Life expectancy of male child at birth by self-reported illness of males (for a 4-week period)

Life expectancy at birth for a male is strongly associated with self-reported illness of males (in %) – correlation coefficient, $r = -0.796$. Sixty-three percent of the variance in life expectancy at birth of a male can be explained by self-reported illness (in %) (Fig. 3).

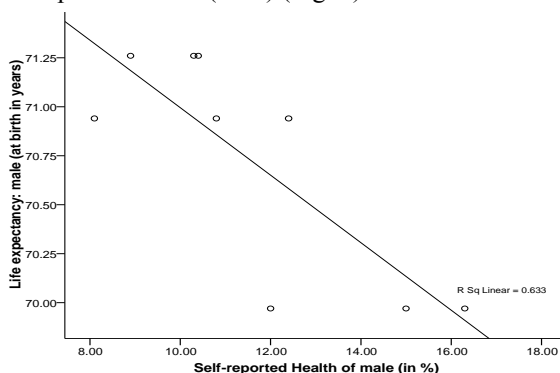


Fig. 3 Life expectancy at birth for male by self-reported illness of male (%).

There is a strong negative significant statistical correlation between life expectancy at birth of a male and self-reported illness of male (in %) - correlation coefficient, $r = -0.796$. Sixty-three percent of the variance in life expectancy at birth of a male can be explained by self-reported illness (%).

If self-reported illness were zero, average life expectancy of a male child in Jamaica would be 72.7 years (95% Confidence interval = 71.3, 74.1 years) (Table 2). With each additional increase in self-reported illness (i.e. 1%), life expectancy of a male will decline by 0.17 year (2 months) – (95% confidence interval = 0.289, 0.055).

Mortality and self-reported illness of population (in %)

Based on Figure 1 the data for mortality (in number of people) and self-reported illness (in %) is best fitted by a non-linear curve. Concomitantly, when self-reported illness of the population (in %) is less than 11%, the significant statistical correlation between self-reported illness and mortality is a negative one. When self-reported illness lies between 11% and 16%, mortality begins to increase indicating the direct statistical association between both variables. When self-reported illness exceeds 16%, the association between the two variables changed to a negative one.

Limitation

The use of a single variable to explain the objective indexes may create the impression that only one explanatory variable is important. This is a limitation of the study as the researcher wants to examine one independent variable (i.e. self-reported illness in a 4-week reference period) in order to establish whether it is a good measure of objective indexes and whether differences exist between the sexes.

Discussion

Empirical analyses have examined the subjective and objective wellbeing phenomenon, and have provided some platform for a partial resolution of the matter. Using cross-sectional data, researchers established that there was a significant statistical relation between subjective wellbeing (self-reported wellbeing) and objective wellbeing [5, 6, 19]. Diener [5] found a strong correlation between the two variables, which disagreed with Kahneman and Riis [18], who found correlation coefficient between subjective happiness and self-reported health to be strong; but the statistical association between self-reported health and objective health. The current research concurs with both Diener and not Kahneman and Riis in one instance as the correlation between self-reported illness (i.e. subjective index) and objective health (i.e. life expectancy) for the population was a strong one, correlation of coefficient, $r = 0.731$. The evidence here is both that the association is a strong one and that it is negative, suggesting that life expectancy deteriorates with more self-reported illness. This justifies the increase in life expectancy at birth for Jamaicans in 2007 over 1989 as the percentage of self-reported illness declined by 1.3%. However on the other hand, when the objective index is mortality, the statistical association between objective health and self-reported illness (i.e. subjective index) was very weak.

Table 2. Life expectancy at birth of population and sex of children by self-reported illness

Explanatory variable	Coefficient	Std. Error	Beta	t statistic	P	95% CI
Population						
Constant	75.604	0.738		102.425	< 0.001	73.934, 77.274
Self-reported illness	-0.173	0.054	-0.731	-3.217	0.011	-0.295, -0.051
F statistic [1, 9] = 10.350, P = 0.011 R = - 0.731 R ² = 0.535						
Female children						
Constant	83.363	3.375		24.700	< 0.001	75.382, 91.344
Self-reported illness	-0.528	0.213	-0.684	-2.478	0.042	-1.031, -0.024
F statistic [1, 7] = 6.138, P = 0.042 R = - 0.684 R ² = 0.467						
Male children						
Constant	72.718	0.587		123.840	< 0.001	71.330, 74.107
Self-reported illness	-0.172	0.050	-0.796	-3.478	< 0.010	-0.289, -0.055
F statistic [1, 7] = 12.096, P = 0.010 R = - 0.796 R ² = 0.633						

The studies of Diener and Kahneman and Riis assume that the sexes operate in the same manner which means that what applies to the general populace is the same across the sexes. This study did not make that assumption; instead the researcher examined whether there was a disparity between the sexes and if there were any, what these were. This work revealed that strong significant correlation between objective health (i.e. life expectancy at birth for Jamaicans) and self-reported illness of both sexes differs by male and female. The findings showed that self-reported illness was more an explanation of life expectancy of males than of females. Interestingly to note that self-reported illness accounted for less than one-half of life expectancy of females but close to two-thirds for males.

Kahneman [20] suggested that instantaneous self-assessment of health is a good measure of subjective health unlike self-evaluations that occur over a longer period of time. This study found that self-reported illness over a 4-week period of time is not immediate and is still a good measure of life expectancy; but not mortality. Embedded in this finding is the fact that subjective index can be instantaneous unlike Kahneman's finding. The current study did not examine beyond a 4-week period and while it was not immediate does not say that we can totally disregard time in recall. The matter may not show any difference for the general population; but this would be different for particular age cohorts – elderly. Evolutionary biology has shown that cells degenerate with ageing, suggesting that functional capacity in particular mental faculties will not on average be as good as in earlier years [24-29]. It is within the context of ageing that Kahneman's perspective may be even more potent as a 4-week period will not seek challenges in recall for the young or middle age people but this could be so for the aged.

Gaspart [30] opined on the difficulty of using objective quality of life in measuring wellbeing and put forward a perspective that self-reported wellbeing should replace this measurement. He wrote, "So its objectivism is already contaminated by post-welfarism, opening the door to a mixed approach, in which preferences matter as well as objective wellbeing" [30] which speaks to the necessity of using a measure that captures more of the multidimensional construct of health than the traditional income per capita. Wellbeing depends on both the quality and the quantity of life lived by people, which argues more for subjective indexes than objective ones [14]. The current study revealed that self-reported health is a good measure of life expectancy but a poor measure of mortality in Jamaica. Therefore those studies that have used self-rated illness (or health conditions) [31-34] to evaluate health of Jamaicans or particular sub-groupings with the population were good in capturing health; but that researchers must be cognizant of the differences that do exist between the validity of particular objective indexes used and self-reported illness as well as the sex disparity in validity of subjective index in measuring health. Self-reported illness therefore is a good measure of health as self-rated health status or life expectancy. But the former is a better measure for health of males than females. Hence, this must be taken into consideration in the interpretation of health. Simply put, using self-reported illness to evaluate health of females is less reliable than of assessing males' health; and that subjective health (self-reported illness) is a good measure of objective health (life expectancy) in Jamaica.

Conclusions

Life expectancy at birth is widely used to measure quality of life in a country or of a people in particular geographic region. It is among the objective indexes used by some

demographers and economists to evaluate health status of people and a population. This study found that self-reported illness in a 4-week reference period is a good measure of objective health (life expectancy at birth for the population of Jamaica). However, self-reported illness is a poor measure of mortality. On disaggregating life expectancy and self-reported illness data by sexes, it was revealed that self-reported illness for males was a better measure for objective health than for females. The literature revealed that subjective indexes of health is a good measure if people are asked to report on their health current and not over any long period of time. The current study disagrees with the literature that for subjective index (i.e. self-reported illness) to be a good measure of health it must be instantaneous as this work found that subjective index over a 4-week was a good measure of life expectancy. This does not denote that the period extends beyond 4 weeks; but that 1) self-reported illness is a good measure of objective index (life expectancy); 2) subjective index is a better measure of objective index (life expectancy) for males than females; 3) subjective index is not a good measure for mortality, and 4) self-reported illness can be used to measure health as self-rated health status, happiness, or life satisfaction.

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References

1. WHO. Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, June 19-22, 1946; signed on July 22, 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on April 7, 1948. "Constitution of the World Health Organization, 1948." In Basic Documents, 15th ed. Geneva, Switzerland: WHO, 1948.
2. Crisp R. Wellbeing. The Stanford Encyclopedia of Philosophy; 2008.
3. Bok S. Rethinking the WHO definition of health. Harvard Center for Population and Development Studies, Harvard School of Public Health. Working Paper Series 2004; 14(7).
4. Di Tella R, MacCulloch R, Oswald AJ. 1998. The Macroeconomics of Happiness, mimeo, Harvard Business School.
5. Diener E. Subjective well-being. Psychological Bulletin 1984; 95: 542-75.
6. Diener E. Subjective well-being: the science of happiness and a proposal for a national index. Am Psychologist 2000; 55: 34-43.
7. Borghesi S, Vercelli A. Happiness and health: two paradoxes. DEPFID Working papers; 2008.
8. Kashdan TB. The assessment of subjective well-being (issues raised by the Oxford Happiness Questionnaire). Personality and Individual Differences 2004; 36:1225-1232.
9. Blanchflower DG, Oswald AJ. 2004. Well-Being Over Time In Britain And The USA. J of Public Economics 2004; 88:1359-1386.
10. Frey BS, Stutzer A. happiness and economics. Princeton University Press: Princeton; 2002.
11. Grossman M. The demand for health – a theoretical and empirical investigation. New York: National Bureau of Economic Research; 1972.
12. Hambleton IR, Clarke K, Broome HL, Fraser HS, Brathwaite F, Hennis AJ. Historical and current predictors of self-reported health status among elderly persons in Barbados. Rev Pan Salud Public 2005; 17: 342-352.
13. Hutchinson G, Simeon DT, Bain BC, Wyatt GE, Tucker MB, LeFranc E. Social and Health determinants of well-being and life satisfaction in Jamaica. Inter J of Social Psychiatry 2004; 50:43-53.
14. Easterlin RA. Income and happiness: towards a unified theory. Economic J 2001; 111:465-484.
15. Graham C. Happiness and health: Lessons – A Question – For Public Policy. Health Affairs 2008; 27:72-87.
16. Ringen S. Wellbeing, measurement, and preferences. Scandinavian Sociological Association 1995; 38, 3-15.
17. O'Donnell V, Tait H. Wellbeing of the non-reserves Aboriginal population. Statistics Canada Catalogue 2003; 89-589.
18. Kahneman D, Riis J. Living, and thinking about it, two perspectives. In: Huppert FA, Kaverne B, Baylis N. The Science of Well-being. Oxford University Press: New York; 2005.
19. Schwarz N, Strack F. Reports of subjective well-being: judgmental processes and their methodological implications. In: Kahneman D, Diener E, Schwarz N, editors. Well-being: The Foundations of Hedonic Psychology. Russell Sage Foundation: New York, 1999: 61-84.
20. Kahneman D. Objective happiness. In: Kahneman D, Diener E, Schwartz N, editors. Well-being: Foundations of hedonic psychology. Russell Sage: Foundation, New York; 1999.
21. Statistical Institute of Jamaica, (STATIN). Demographic statistics, 1989-2007. Kingston, STATIN; 1989-2008.
22. Planning Institute of Jamaica, (PIOJ), Statistical Institute of Jamaica, (STATIN). Jamaica Survey of Living Conditions, 1989-2007. Kingston: PIOJ, STATIN; 1989-2008.
23. United Nations Development Program, (UNDP). Human Development Report 1990-2003. New York: UNDP; 1990-2003.
24. Gavrilov LA, Gavrilova NS. The reliability theory of aging and longevity. J. theor. Biol 2001; 213:527-545.
25. Gavrilov LA, Gavrilova NS. The biology of life Span: A Quantitative Approach. New York: Harwood Academic Publisher; 1991.
26. Charlesworth B. Evolution in Age-structured Populations, 2nd ed. Cambridge: Cambridge University Press; 1994
27. Carnes BA, Olshansky JS. Evolutionary perspectives on human senescence. Population Development

- Review 1993; 19: 793-806.
28. Carnes BA, Olshansky SJ, Gavrilov L A, Gavrilova NS, Grahn D. Human longevity: Nature vs. nurture - fact or fiction. *Persp. Biol. Med* 1999; 42: 422-441.
 29. Medawar PB. Old age and natural death. *Mod Q* 1946; 2:30-49.
 30. Gaspart F. Objective measures of wellbeing and the cooperation production problem. *Social Choice and Welfare* 1998; 15:95-112.
 31. Bourne PA. Childhood Health in Jamaica: changing patterns in health conditions of children 0-14 years. *North Am J Med Sci* 2009; 1:160-168.
 32. Bourne PA. A theoretical framework of good health status of Jamaicans: using econometric analysis to model good health status over the life course. *North Am J Med Sci* 2009; 1: 86-95.
 33. Bourne PA. Impact of poverty, not seeking medical care, unemployment, inflation, self-reported illness, health insurance on mortality in Jamaica. *North Am J Med Sci* 2009; 1:99-109.
 34. Bourne PA. An epidemiological transition of health conditions, and health status of the old-old-to-oldest-old in Jamaica: a comparative analysis. *North Am J Med Sci* 2009; 1:211-219.