

# Urban–Rural Variation in Satisfaction with Life: Demographic, Health, and Geographic Predictors in Halifax, Canada

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**Abstract** This paper examines how satisfaction with life (SWL) varies in four zones of the urban–rural continuum, for 1,971 residents of the county-sized municipality of Halifax, Nova Scotia, Canada. It also examines whether the predictors of SWL themselves vary by rural–urban. Data are from the STAR project, which is an innovative GPS-assisted time diary survey. ‘Global’ SWL varies significantly by urban–rural zones, being highest in the inner city (IC), and lowest in the outer commuter belt (OCB). Self-rated health is a significant bivariate correlate, as are age, whether married, household size, and household income (all of which vary significantly by U-R zones). Several geographic variables co-vary significantly with SWL, particularly community belonging (strong in IC, weak in OCB), unsafe after dark (worst in IC, best in OCB), and commuting time (least in IC, most in OCB). A regional multivariate model yielded significant predictors related to physical health, mental health, and community geography, but excluded socio-demographic variables. Separate models for each urban–rural zone showed that SWL is more predictable at the zonal level than for the region as a whole, and the predictors vary considerably by zone. Physical health is an important predictor in the inner city and suburbs, unsafe after dark is significant only in the suburbs, and travel-related variables are very important in the inner commuter belt.

**Keywords** Life satisfaction · Quality of life · Urban · Suburban · Rural · Community

## Introduction

In this paper we investigate how satisfaction with life (SWL) varies across different zones of the urban–rural continuum, within the county-sized municipality of Halifax, Nova Scotia, Canada. We also examine whether the predictors of SWL themselves

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vary by regional location. We employ time-use data from an innovative GPS-assisted time-diary survey, and focus on the predictive effects of several geographic variables related to regional location and community character. This geographic approach is considered to have considerable utility for policies related to public health and land-use planning.

SWL is the perceived or subjective aspect of quality of life (QOL, equatable with well-being), and is an important concern for individuals, communities, and society at large (Beesley and Russwurm 1989; Felce 1997; Frey and Stutzer 2005; Helburn 1982; Prutkin and Feinstein 2002; Sirgy et al. 2006). Objective appraisals of QOL typically focus on levels of provision of basic human needs, such as housing, healthcare, education, community safety, and transportation (Dasgupta and Weale 1992). Census data on these objective variables are readily available in spatially aggregated form, and can be combined in composite indices using various weighting schemes. Subjective evaluation of QOL/well-being is more difficult and expensive, since it requires questionnaire data from individual respondents, regarding their feelings of satisfaction with various aspects (“domains”) of their life, and about their life in general (Andrews and McKennell 1980; Chamberlain 1988; Diener 1984, 2000; Diener et al. 1999; Pavot and Diener 1993). The “global” satisfaction-with-life question was first devised by Andrews and Withey (1976), and asks “How do you feel about your life as a whole right now?” It is rated on a 10-point Likert scale, and has become the standard question employed in subjective SWL studies.

Global SWL scores typically show moderately strong correlations with scores for the major components or domains of life satisfaction (Cummins 1993, 1995, 1996; Hsieh 2003), but the domains are inter-related and thus not simply additive (WHOQOL 1998). The five most frequently used domains, rated by perceived importance to respondents, are health, intimacy, emotional well-being, material well-being, and productivity (Cummins 1996). These domains may be influenced by and composed of many individual variables related to the respondent’s genetic inheritance, psychological profile, physical health, spirituality, safety, social status, availability of resources (emotional, social, and financial), work/school activity, and community/neighborhood characteristics. These variables in turn are mediated or partly controlled by standard socio-demographic variables like sex, age, education, and income. De Neve et al. (2010) report that 33 % of variation in happiness/well-being is based on genes, leaving 67 % based on situational and environmental factors, many of which are inherently geographic.

The geography of life quality has been investigated somewhat intermittently over the last 40 years, despite the seemingly obvious importance of situational neighborhood and community environments in shaping people’s lives (Helburn 1982; Wills-Herrera et al. 2009, p.2). Sharpe et al. (2010) analyzed variation in mean SWL levels for Canadian provinces, metropolitan areas, and health districts, and found mean sense of community belonging to be an important predictor. Other studies have been largely urban in scope, typically employing objective indicators of QOL for city census tracts or similar neighborhood units (e.g. Li and Weng 2007; Smith 1973; Stimpson 1982). These studies all show low well-being in the inner city and much higher well-being in the suburbs, and we might expect subjective QOL to vary similarly. A 25-city study by Jensen and Leven (1997) specifically compared U.S. central cities to suburbs over time, using objective ‘key variables’ for QOL domains.

They showed central cities improving relative to suburbs (though remaining lower) in the 1980–1995 period.

QOL studies in rural districts tend to focus on small localities, and employ questionnaire surveys to evaluate subjective aspects of life quality (e.g. Brereton et al. 2011; Garrison 1998; Richmond et al. 2000). Particular attention has been paid to the effects of rural migration and exurbanization processes on community integrity (Auh and Cook 2009; Beesley and Bowles 1991), and access to health services and facilities (Bukenya et al. 2003; Tay et al. 2004).

Several studies have addressed the issue of urban–rural differences in life quality. Comparisons of subjective QOL (SWL) for metro versus non-metro areas in the United States (Mookherjee 1992) and Australia (Best et al. 2000) found no significant differences, while Beesley's (1997) comparison of metro and non-metro fringe areas in southern Ontario found only minor differences. Oppong et al. (1988) found that residents of a small-town in Alberta (High Prairie) showed more life satisfaction than those residing in either big-city Edmonton or remote northern communities. Two recent European studies have also compared urban–rural differences, though at coarse spatial scales: Shucksmith et al. (2009) found little evidence of significant urban–rural differences in subjective well-being throughout Europe, while Campanera and Higgins (2011) found that urban-classified English local authority areas register significantly lower objective quality of life than their rural counterparts. An important recent study by Davern and Chen (2010) mapped subjective well-being (SWB) for 79 local-government areas in the Australian state of Victoria, and tested the significance of variations in metropolitan versus rural levels of well-being. This study found that respondents in “country” areas showed modestly but significantly higher ratings for global well-being and six of its seven domains.

The present study aims to provide a more thorough and nuanced analysis of urban–rural variations in SWL, by employing the notion of an urban–rural continuum (Pahl 1966), grading from fully urban in the inner city to fully rural in isolated peripheral areas. Ways of life and access to modern amenities and services vary greatly along this continuum, and it is therefore reasonable to expect that these differences are linked to variation in life satisfaction. Specifically, we wish to investigate whether there is significant variation in SWL by regional location relative to the central city, and whether the predictors of SWL themselves vary by regional location. The paper is exploratory in nature, in that we do not proceed from a particular theoretical viewpoint, or with a specific set of expectations. Owing to the complex web of influences on SWL, its geographic variation may not be simply or linearly related to degrees of rurality or urbanity. We also expect that such variation may largely reflect the operation of underlying social, economic, and demographic variables, which are themselves spatially patterned.

Nevertheless, there are also inherently geographic or locational variables, related to environment, livelihood, community, and accessibility, which may have independent effects on SWL. Environmentally, there are urban–rural differences in housing and employment densities, land cover, land use, and pollution levels (e.g. air and noise pollution). Types of livelihood also vary regionally and locally, with resource-based employment (in farming, fishing, forestry, and mining) remaining important in the rural periphery, and forming the basis for distinct lifestyles. At the community and neighborhood levels, too, there are a range of variables which have potential impacts

on SWL, such as crime rates, school quality, ethnicity, land-use mix, housing quality and mix, housing tenure, sense of community, and the presence of amenities (e.g. parks, public transport) and disamenities (e.g. traffic noise, heavy industry). Economists have taken the lead in investigating such geographic variables: Blomquist et al. (1988) employed multivariate statistics to model the effects of many amenities and disamenities at the county level for all major U.S. urban areas. Not surprisingly, they found the most influential geographic factor to be climate (and particularly sunshine and precipitation), but they also noted the importance of teacher-pupil ratios and violent-crime rates. More recently, Brereton et al. (2008) modeled SWL across Ireland at the district level, and included both geographic and non-geographic sets of predictor variables; the most significant geographic variables related to climate, proximity to the coast, and proximity to major roads and airports.

Geographic variation in SWL may also result from residential self-selection. Households self-sort themselves by residential preferences and constraints (Bagley and Mokhtarian 1999; Cao et al. 2009; Walker and Li 2007), such that the predictors of SWL are likely to vary by regional location and community character. For example, those choosing to live in peripheral zones seek “country living,” and trade accessibility for larger lots (and/or cheaper housing). They presumably have a high tolerance for the extra travel required. In contrast inner-city residents, whether through choice or mobility constraints, place a premium on convenient access to workplace, services, and amenities. They may pay more for housing, but enjoy greater access not only to employment, but also to “third places” such as coffee shops, bars, restaurants, and other public gathering spots (Jeffres et al. 2009; Oldenburg 1989; Rogers et al. 2011).

The literature demonstrates that individual SWL scores are most closely tied to aspects of personal psychology and health, but even with comprehensive psychological profiling and health assessment it is notoriously difficult to accurately estimate or predict these scores: they are dependent on a host of personal moods, characteristics, and circumstances, and liable to change from day to day (Dolan et al. 2008). Many studies therefore focus on mean SWL scores for social, economic, or geographic groups, but such an approach masks much variation, and carries risks related to the ‘ecological fallacy’ (Piantadosi et al. 1988). In the present study, we restrict ourselves to bivariate and multivariate analysis of individual SWL scores, but since our survey did not employ personality profiling, we do not expect SWL to be well-estimated. We focus therefore on statistical significance and order of importance of the independent variables, rather than their proportions of variation ‘explained’. For the multivariate analysis, we gauge urban–rural differences by modeling SWL scores separately for each of the four urban–rural zones, and comparing those results to the overall model. To our knowledge, this approach has not been employed elsewhere. Given the size and richness of the STAR data, the results should be highly indicative for other urban-focused regions in North America.

## Study Area and Methods

This study employs data from the Halifax Regional Municipality (HRM), a county-sized metropolitan area in Nova Scotia, Canada, with a census population of 373,000

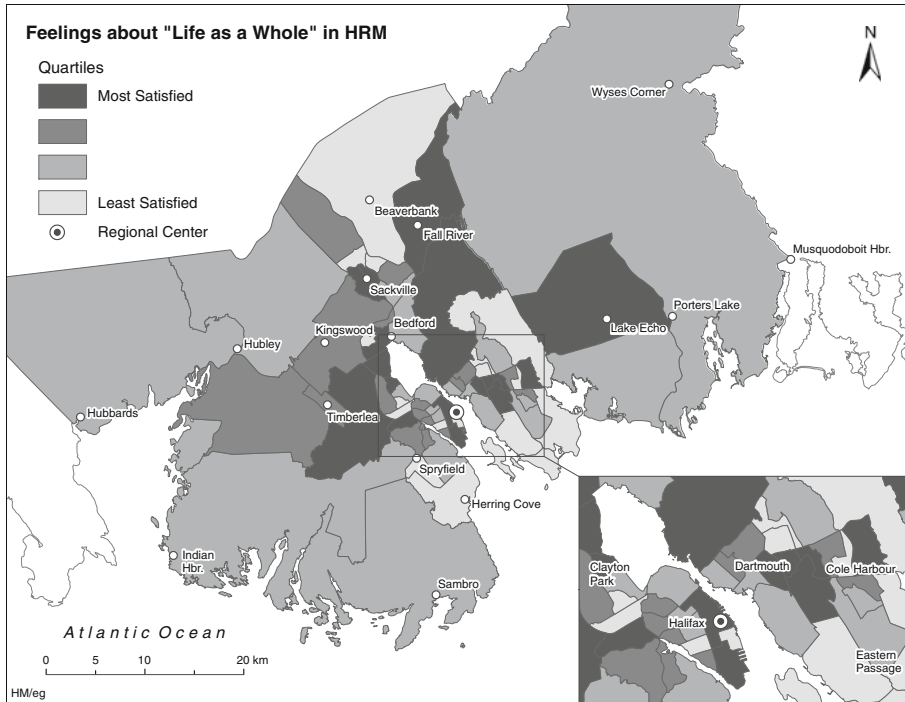
in 2006. The Halifax region is representative of Canadian, and more broadly North American, mid-sized metropolitan areas, having a diverse and moderately prosperous economy, with population growth of about 0.5 % per year. Unlike many US cities, there is little inner-city decay, but unlike many Canadian cities there is widespread exurban development within an extensive commuter belt (Millward 2002, 2010). Large-lot exurban development has been encouraged by cheap land and lax planning controls, both related to the lack of farmable land (most districts have glacially-scoured igneous and metamorphic bedrock). With the exception of a few remote fishing villages, rural households throughout HRM are largely dependent on urban employment.

Data are derived from the Halifax Space-Time Activity Research (STAR) project, which was an innovative survey of both time use and travel activity (Spinney and Millward 2010), and the world's first large-scale application of a GPS-assisted prompted recall survey. The survey data collection period began in April 2007 and concluded in May 2008. The primary sampling unit was a randomly-selected household, while the secondary sampling unit was a randomly selected individual member of the household, over the age of 15, who acted as the primary respondent and completed a computer-assisted telephone interview (CATI) questionnaire, carried a cellular-assisted global positioning system (GPS) device for a 48-h reporting period, and completed a 2-day time-diary survey. GPS data were displayed within the diary interface, in both map and tabular form, during the data retrieval interview, thus enabling the interviewer to “prompt” the respondent regarding activity, location, and timing information. Results indicate that these survey techniques dramatically improved the accuracy and precision of timing and location information compared to traditional surveillance techniques.

Time-diary and questionnaire data were collected from 1,971 randomly selected respondents. The sample design stratified for season, day of week, age, sex, and geographic zones, but owing to low response rates it was not possible to obtain proportional samples for all groups—younger adults in particular were under-sampled. Geographic zones were based on the urban–rural fringe concept (Beesley 2010; Furuseh and Lapping 1999; Pryor 1968; Wehrwein 1942), and more specifically on the extent of suburban and exurban development (Bruegmann 2005; Clark et al. 2009; Lamb 1983). The four zones were delimited operationally on the basis of both settlement form (i.e., residential density and percentage of area developed) and commuting linkages to the urbanized area, and defined as follows:

- **Inner City (IC):** Developed urban areas within walking range (c. 5 km) of downtown. They contain 95,000 residents (25.5 % of the regional population).
- **Suburbs:** Other contiguous built-up (“urbanized”) areas within the urban sewer/water service boundary (50.4 % of population).
- **Inner Commuter Belt (ICB):** Other areas within 25 km road distance of downtown Halifax (16.1 % of population).
- **Outer Commuter Belt (OCB):** Areas between 25 km and 50 km road distance from downtown Halifax (5.4 % of population).

A map of the zones appears in Millward and Spinney (2011, Fig. 1). It should be noted that the commuter belts for Halifax, so defined, do not overlap with commuter belts for other towns or cities, so that the OCB is largely rural in character and only



**Fig. 1** Feelings about life-as-a-whole, Halifax Regional Municipality, quartiles of mean scores for Census tracts

moderately impacted by commuter development. In contrast, the ICB has seen extensive housing development over the last 20 years, and it is transitional in character (Millward 2002). An extensive “remote rural” area lies beyond 50 km from the city center, but was not sampled in the STAR survey. The survey included a suite of questions typically employed in satisfaction-with-life (SWL) research and another suite of questions on ‘time stress’, both of which are investigated here. These questions required subjective self-rating by respondents. Time-diary information on a variety of activities, objectively verified through GPS tracking, is also employed.

## Bivariate Analysis

Using individual response data, we first compare SWL ratings for urban–rural zones with respondent characteristics. Since many of the variables considered are highly skewed, rank correlation was employed, and the non-parametric Mann–Whitney difference-of-ranks test was used, in preference to alternative parametric tests. We investigated whether there are significant inter-zonal differences in ranked SWL scores, and in ranked scores for respondent characteristics. We also tested the statistical significance of bivariate rank correlations between SWL and other respondent characteristics.

The STAR questionnaire probed for subjective feelings about quality-of-life using a standard set of questions, identical to those employed by Statistics Canada (2006) in

the 2005 General Social Survey. These questions are the ‘global’ question (“feelings about life as a whole right now”), feelings of happiness, and feelings about four key ‘domains’ of SWL (health, job or main activity, other time, and finances). Scores for all these feelings variables are inter-correlated with significance levels of 99.9 % or higher, typically with Kendall’s correlations of 0.25 to 0.30. The global SWL variable is most highly related to the others, at correlations ranging from 0.39 (with health) to 0.49 (with happiness). For all zones combined, mean scores for the feelings variables range between 7.30 and 8.11 on a 10-point scale, which accords well with findings reported in the literature (e.g. Cummins 1996). SWL has an overall mean of 8.11, and zonal means of 8.15 (IC), 8.11 (suburbs), 8.15 (ICB), and 7.94 (OCB). It is notable that the OCB scores lower than other zones on all six feelings variables, though significantly so only for job/main activity. Inner-city respondents have mean scores that are higher than the overall mean for all six variables, and significantly so for feelings about health.

Figure 1 provides a more nuanced view of geographic variations in global SWL, using quartile groupings of mean scores aggregated by census tracts. Tracts in the inner city and suburbs tend to have a wide diversity of scores, with many in both the 1st and 3rd quartiles, while areas in the commuter belt typically group in the 2nd and 3rd quartiles. Inner-city tracts with high satisfaction include both wealthy and poor areas, while tracts with lowest satisfaction are mostly in poorer suburbs (e.g. Eastern Passage, Fairview) and ICB areas with large trailer parks (Beaverbank). Surprisingly, however, the tract containing both the low-income Afro-Canadian communities of Preston and the adjacent modest-income exurb of Lake Echo is in the highest quartile.

### Socio-Demographic Correlates

In seeking reasons for urban–rural variations in SWL feelings, we may suppose the existence of urban–rural variations in the causative variables underlying such feelings. From the literature, we know that SWL scores are consistently and significantly related to a group of socio-economic and demographic ‘control’ variables (chiefly income, partner relationship, and vocational situation), although with only modest levels of estimative/predictive power (e.g. Fugl-Meyer et al. 2002; Michalos 1979; Palmore and Luikart 1972). It may be, therefore, that higher SWL scores in the inner city and lower scores in the OCB simply reflect socio-economic variations between these zones. Table 1 shows Kendall’s rank correlations between socio-demographic variables and global SWL. There are four statistically significant relationships, two marginally-significant ones, and two which lack statistical significance. Older respondents have significantly higher SWL ratings, as do those with higher household incomes. Married people (formal or common-law) and those living with others also have higher SWL. The availability of a household vehicle adds to SWL, whereas those in full-time work or education have lower SWL. Somewhat surprisingly, education and sex have no effect on SWL. All of these variables show significant variation by urban–rural zones, and thus contribute to inter-zonal variations in SWL. Of particular importance is age: the inner city has the oldest population (boosting its SWL), while the ICB and OCB have much younger populations. Working against this effect, however, household incomes are highest in the commuter belts, boosting their

**Table 1** Mean scores for Socio-Demographic variables, by Urban–rural Zones

Control Variables	Kendall Correlation with 'global' SWL*	Urban–rural Zones ( <i>n</i> =no. of valid responses)				
		All Zones <i>n</i> =1,971	Inner City <i>n</i> =397	Suburbs <i>n</i> =1,063	Inner Commuter Belt <i>n</i> =343	Outer Commuter Belt <i>n</i> =168
Sex (1 male, 2 female)	0.00	1.54	1.57	<u>1.52</u>	1.53	<u>1.62</u>
Age (1 to 15, 5-year cohorts)	0.10	8.02	<u>8.68</u>	<u>8.12</u>	<u>7.32</u>	<u>7.35</u>
Married/common-law (yes 1, no 0)	0.08	0.80	<u>0.72</u>	0.79	<u>0.85</u>	<u>0.89</u>
Household size (one 1, more 2)	0.06	1.88	<u>1.81</u>	1.88	<u>1.91</u>	<u>1.93</u>
Education level (highest 1, lowest 9)	-0.01	3.20	<u>2.82</u>	<u>3.32</u>	3.30	3.17
Household vehicle (yes 1, no 0)	0.03	0.97	<u>0.92</u>	<u>0.98</u>	<u>1.00</u>	0.99
Working or student (yes 1, no 0)	-0.03	0.59	<u>0.53</u>	0.60	0.64	0.56
Household income (lowest 1, highest 6)	0.06	4.33	4.19	<u>4.24</u>	<u>4.59</u>	<u>4.61</u>

\*Critical values are 0.06 (significant at  $p=0.01$ ) and 0.035 ( $p=0.05$ )

Underlined figures: respondents within and outside the zone have signif. different score rankings at  $p=0.05$  (Mann–Whitney, 2-tailed)

SWL scores. Also, inner-city residents are less likely to be married and more likely to live alone, thus reducing their SWL scores.

### Health Correlates

Physical and mental health are both strongly associated with perceived quality of life (Bukanya et al. 2003; Cummins 1996; Michalos et al. 2000; Raphael et al. 1996; Sharpe et al. 2010; WHOQOL 1998), and the STAR data contain several objective and subjective indicators of health. Of the four variables related to physical health, self-reported state of health has the highest correlation with global SWL, and this variable also exhibits significant variation by urban–rural zones (Table 2). The mean rating is highest in the inner city, and lowest in the suburbs. The suburbs also score poorly for physical disabilities and regular sports participation (both self-rated), while the rural areas score slightly better on these measures. An objective variable computed from the time diaries, minutes per day engaged in sport and recreation activities, shows more time per respondent in the inner city, and less in the commuter belt. Perplexingly, however, this variable has no significant correlation with global SWL.

The STAR questionnaire contained five questions related to time stress (standard questions used by Statistics Canada), and two questions related to group/social activity, all of which provide indirect indications of mental health. We should also



**Table 2** Mean scores for ‘Physical Health’ SWL-related variables, by Urban–rural Zones

Variables & Coding	Kendall Correlation with ‘global’ SWL*	Urban–rural Zones ( <i>n</i> =no. of valid responses)				
		All Zones <i>n</i> =1,971	Inner City <i>n</i> =397	Suburbs <i>n</i> =1,063	Inner Commuter Belt <i>n</i> =343	Outer Commuter Belt <i>n</i> =168
State of health, self-rated (1 poor, 5 excellent)	0.23	3.81	<u>3.94</u>	<u>3.77</u>	3.80	3.80
Difficulty hearing, seeing, walking etc. (1 often, 3 no)	0.12	2.53	2.54	<u>2.50</u>	<u>2.62</u>	2.55
Regular sports participation, self- rated (1 yes, 0 no)	0.08	0.60	0.61	0.59	0.64	0.63
Sport and recreation time (mins/day)	−0.00	26.1	28.0	26.7	23.1	23.6

\*Critical values are 0.06 (significant at  $p=0.01$ ) and 0.035 ( $p=0.05$ )

Underlined figures: respondents within and outside the zone have signif. different score rankings at  $p=0.05$  (Mann–Whitney, 2-tailed)

consider the marital status and household size variables as indicators of social intercourse, and hence mental health. Perceived time stress (a.k.a . ‘time crunch’) is known to negatively affect mental health (Hamermesh and Jungmin 2007). Results indicate that time stress variables are strongly correlated to global SWL, and several of them show significant variation by urban–rural zones (Table 3). Inner-city residents score lowest on all time-stress measures, and significantly less than other zones on two measures. In contrast, highest levels of stress are reported in both the inner and outer commuter zones. On average, residents in these zones feel significantly more rushed, and have insufficient time with friends and family. These results are understandable, since respondents in the commuter zone are more likely to be employed, and to be married with children, than inner-city residents. They have more demands on their time, and need to juggle time-schedules with other household members. On average they have longer journeys-to-work, and spend more time overall in travel, than do those in the inner-city and suburbs (Millward and Spinney 2011).

Leisure time is synonymous with recreation, and thus contributes to mental health (Stathi et al. 2002; Vemuri and Costanza 2006). Time spent in the company of others is also known to promote, or at least influence, mental health (Lloyd and Auld 2002; Miller et al. 1998). The STAR time diaries allowed computation of leisure time, time with others, and non-work time with others (Table 3). These three variables are all significantly related to global SWL, and also vary significantly by urban–rural zones. The inner city shows much leisure time, but also the lowest amounts of time with others (recall that residents here are more likely to be older, not in employment, and living alone). By contrast, the ICB shows least time in leisure, and most time overall with others. Non-work time with others, however, is higher in both the OCB and the suburbs. Volunteer and group activities are both significantly related to global SWL, and vary significantly by urban–rural zones. Activity is highest in the inner city where residents have more free time and more access to “third places” (Jeffres et al. 2009;

**Table 3** Mean scores for ‘Mental Health’ SWL-related variables, by Urban–rural Zones

Variables & Coding (* yes=1, no=0)	Kendall Correlation with ‘global’ SWL*	Urban–rural Zones ( <i>n</i> =no. of valid responses)				
		All Zones <i>n</i> =1,971	Inner City <i>n</i> =397	Suburbs <i>n</i> = 1,063	Inner Commuter Belt <i>n</i> =343	Outer Commuter Belt <i>n</i> =168
Often feel rushed (1 daily, 5 never)	0.16	2.11	2.19	<u>2.16</u>	<u>1.85</u>	2.15
Not enough time with family or friends*	−0.23	0.33	<u>0.29</u>	0.32	<u>0.38</u>	<u>0.43</u>
Under stress trying to accomplish more*	−0.24	0.23	0.20	0.23	0.23	0.26
Trapped in a daily routine*	−0.25	0.21	0.18	0.22	0.21	0.26
Just do not have time for fun*	−0.24	0.24	<u>0.18</u>	0.25	0.28	0.24
Leisure time (mins/day)	0.06	364	370	<u>373</u>	<u>341</u>	<u>340</u>
All time with others (mins/day)	0.07	469	<u>420</u>	473	501	497
Non-work time with others (mins/day)	0.07	344	<u>322</u>	<u>351</u>	338	358
Avg hrs/month volunteering (0 zero, 4 >15)	0.05	1.26	<u>1.38</u>	<u>1.19</u>	1.32	1.27
Frequency of group activities and meetings (0 zero, 5 weekly)	0.07	2.58	<u>2.79</u>	<u>2.46</u>	2.73	2.51

\*Critical values are 0.06 (significant at  $p=0.01$ ) and 0.035 ( $p=0.05$ )

Underlined figures: respondents within and outside the zone have signif. different score rankings at  $p=0.05$  (Mann–Whitney, 2-tailed)

Oldenburg 1989), and lowest in the suburbs. The ICB shows above-average activity, despite high time-stress in this zone.

### Geographic Correlates

The literature tends to treat geographic variation in SWL as an outcome of the socio-demographic and health factors reviewed above. With the exceptions noted earlier (Blomquist et al. 1988; Brereton et al. 2008), inherently-geographic variables related to location, access, and community character are typically treated as incidental or residual influences on SWL, not amenable to analysis. Several questions in the STAR survey allow some assessment of geographic influences, and are reported in Table 4. Four of the seven have highly significant correlations with global SWL, all in expected directions. Particularly important here is “sense of community belonging,” which correlates more highly than do any of the socio-demographic variables in Table 1, and accords well with findings by others (e.g. Bramston et al. 2002; Brehm et al. 2004; Prezza and Constantini 1998; Sharpe et al. 2010; Theodori 2001; Townshend and Hungerford 2010). The inner city scores highest on community

**Table 4** Mean scores for ‘Geographic’ SWL-related variables, by Urban–rural Zones

Variables & Coding	Kendall Correlation with ‘global’ SWL*	Urban–rural Zones ( <i>n</i> =no. of valid responses)				
		All Zones <i>n</i> =1,971	Inner City <i>n</i> =397	Suburbs <i>n</i> =1,063	Inner Commuter Belt <i>n</i> =343	Outer Commuter Belt <i>n</i> =168
Sense of community belonging 1(very weak), 4 (very strong)	0.14	3.03	<u>3.11</u>	<u>3.01</u>	3.06	2.96
Unsafe walking after dark 1 (safe) to 3 (dangerous)	−0.08	1.71	<u>1.89</u>	<u>1.76</u>	<u>1.50</u>	<u>1.38</u>
Prefer to live in different n’hood 1 (yes), 0 (no)	−0.08	0.16	0.14	0.16	0.16	0.12
Commute time to work (mins, self-rated, workers only)	−0.06	21.0	<u>15.5</u>	21.4	<u>22.1</u>	<u>26.4</u>
Road-distance to regional centre(km)	−0.01	13.7	<u>4.0</u>	<u>12.1</u>	<u>21.3</u>	<u>31.5</u>
Travel duration, all modes (min/day)	−0.01	97.1	<u>92.3</u>	<u>94.3</u>	<u>107.6</u>	<u>104.3</u>
Travel duration, by car (min/day)	−0.02	73.1	<u>56.3</u>	71.6	<u>90.9</u>	<u>85.2</u>

\*Critical values are 0.06 (significant at  $p=0.01$ ) and 0.035 ( $p=0.05$ )

Underlined figures: respondents within and outside the zone have signif. different score rankings at  $p=0.05$  (Mann–Whitney, 2-tailed)

belonging, whereas both the suburbs and the OCB score more poorly, but the zonal means are quite similar. Mapping by census tracts, however, revealed considerable within-zone variation, seemingly unrelated to social status or period of development.

“Unsafe walking after dark” is used as a measure of community safety. There is a smooth urban–rural gradation in perceptions of safety, with the inner city viewed as least safe, and the OCB as most safe. Most rural/peripheral census tracts have mean ratings in the highest safety quartile. The most notable exception is the Beaverbank area, which has several large trailer parks and lower incomes. Areas perceived to be least safe tend to be poorer inner-city rental neighborhoods, whereas wealthier urban areas are viewed as safe.

Preference for residence in a different neighborhood has a significant negative correlation with global SWL, as we might expect. It is a measure of geographic dissatisfaction (i.e., an outcome rather than a cause), and is specific to localized areas. Average levels of neighborhood dissatisfaction are similar across most zones, though respondents in the OCB are least likely to prefer a different neighborhood (despite their low sense of community).

Mean commute time to work (self-assessed) is a specific measure of inconvenience and expense, and has a significant inverse correlation with global SWL, which confirms findings by Frey and Stutzer (2005). The inner city fares very well in this respect, while the OCB fares poorly. Road distance to the regional centre (a crude

measure of access to services and amenities) varies significantly and predictably across the zones, but has negligible correlation with global SWL. However, we should bear in mind here that households tend to self-sort themselves by residential preferences, so that those choosing to live in peripheral zones often willingly trade accessibility for larger lots (and/or cheaper housing) and “country living”.

We might expect that time spent travelling is viewed negatively, but objective travel duration data computed from the STAR time diaries have negligible correlation with global SWL. Time durations vary greatly by urban–rural zones for travel by car, but travel time by all modes (including bus, ferry, bicycle, and walking) is perhaps of greater concern to most people, and this is fairly similar across all zones. Also, self-selection would suggest that residents of the commuter zones have a higher tolerance for travel.

### Multivariate Analysis

There are many inter-correlations between the socio-demographic, health, and geographic variables that co-vary with (and in most cases influence) life satisfaction. But what are the separate statistical effects of each independent variable on SWL? Multivariate modeling, despite its many deficiencies, is the necessary next step to answer this question. Multiple regression analysis takes account of inter-correlations among independent variables, and identifies those with the highest partial correlations with the dependent variable. In effect, the operation of all other variables is held constant (Spicer 2005, ch. 4). In this section, we report results from stepwise forward multiple regressions, using default  $F$ 's to enter and remove ( $p=0.05$  to enter and 0.10 to remove). We first model SWL for the entire Halifax region, using data across all urban–rural zones. These results are then compared with those for separate models of each urban–rural zone.

#### Whole Region

Our initial multiple regression included all available predictor variables for global SWL, excluding only the co-dependent feelings variables. For those pairs of independent variables with simple correlations exceeding  $\pm 0.7$ , we then excluded those variables which performed least well on the initial run, in order to avoid problems with multicollinearity. The three excluded variables were Married/Common-law (related to Household Size), Personal Income (related to Household Income), and Travel Time by Car (related to Total Travel Time). The results appear in Table 5. Eleven independent variables entered the model, and yielded a coefficient of multiple determination ( $R^2$ ) of 0.378. Several indicators of the weight of contribution are provided, all showing similar rankings, but we will focus here on the beta-weights (standardized coefficients).

It is remarkable that key socio-demographic variables of sex, education, and income fail to enter the model, and even age has only a weak positive effect on SWL. The most important predictor is self-reported state of health, which accords well with results in the literature. In addition, those reporting difficulties hearing, seeing, walking etc. have lower SWL. The model includes two variables related to mental health (household size and frequency of group activities), both with positive

**Table 5** Multiple regression of SWL on all predictor variables, for whole region, Model 9 ( $R^2=0.378$ )

Variable	Beta Rank	Beta Weight	Signif. of t (p)	Partial Correl-ation	Change to $R^2$
State of health (self-reported) (1 poor, 5 excellent)	1	0.189	0.000	0.180	0.058
Worry not enough time with family/friends	2	-0.156	0.000	-0.136	0.076
Household size (one 1, more 2)	3	0.141	0.000	0.136	0.019
Trapped in a daily routine	4	-0.120	0.000	-0.105	0.031
Difficulty hearing, seeing, walking, etc. (1 often, 3 no)	5	0.111	0.000	0.102	0.009
Just do not have time for fun	6	-0.105	0.002	-0.088	0.011
Sense of community belonging	7	0.094	0.001	0.092	0.012
Sport and Recreation Time (mins/day)	8	-0.093	0.001	-0.092	0.007
Under stress trying to accomplish more	9	-0.068	0.035	-0.058	0.004
Frequency of group activities and meetings	10	0.060	0.033	0.059	0.003
Age (5-year categories)	11	0.003	0.049	0.054	0.003

partial correlations, as one would expect. The second-ranked predictor relates to time-stress, as do the 4th, 6th and 9th, and all four time-stress variables have the expected coefficient signs: that is, greater time pressure predicts lower SWL. Among geographic variables only sense of community belonging entered this model, ranked 7th and with the expected sign.

Employing perceived time-stress variables as predictors is somewhat problematic, since they are in part reflective of the respondent's personality and psychological profile, and thus unlikely to be independent of SWL. When time-stress variables were excluded from the analysis,  $R^2$  fell to 0.142, the beta rankings changed considerably, and two new variables entered the model (Table 6). Age was promoted to rank second in importance, and community belonging also strengthened, while household size

**Table 6** Multiple regression of SWL excluding time-stress variables, for whole region, Model 7 ( $R^2=0.142$ )

Variable	Beta Rank	Beta Weight	Signif. of t (p)	Partial Correl-ation	Change to $R^2$
State of health (self-reported) (1 poor, 5 excellent)	1	0.198	0.000	0.188	0.065
Age (5-year categories)	2	0.155	0.000	0.146	0.014
Difficulty hearing, seeing, walking etc. (1 often, 3 no)	3	0.118	0.000	0.110	0.010
Sense of community belonging	4	0.104	0.000	0.101	0.019
Household size (one 1, more 2)	5	0.102	0.001	0.096	0.014
Non-work time with others (mins/day)	6	0.086	0.004	0.083	0.005
Sport & recreation time (mins/day)	7	-0.082	0.006	-0.079	0.004
Regular sports participation	8	0.075	0.015	0.071	0.005
Frequency of group activities & meetings	9	0.073	0.014	0.071	0.006

declined in importance. Non-work time with others entered at rank 6 and regular sports participation at rank 8, both with partial correlations in expected directions. Geographic variables relating to travel, neighborhood safety, and neighborhood preference all failed to enter the model, as did the rural–urban zonation variable. An interesting result is the lack of relationship between time spent commuting (travel by all modes) and life satisfaction; it seems that the disutility of commuting is lower than frequently supposed.

### Urban–Rural Zones

We earlier suggested that residents of the commuter zones may have a higher tolerance for travel than urban residents. Households have a tendency to self-sort themselves by residential preferences (Bagley and Mokhtarian 1999; Cao et al. 2009; Lindberg et al. 1992; Walker and Li 2007), so that those choosing to live in peripheral zones are trading accessibility for larger lots (and/or cheaper housing) and “country living”. Does locational self-selection mean that the predictors of SWL vary by urban–rural zone? To address this question, we ran separate multiple regressions to model life satisfaction in each urban–rural zone, employing the same input variables in each case, and compared these models with the overall regional model. Again, we employed a stepwise procedure, excluded the time-stress and three highly-correlated independent variables, and used the default F values to enter and remove. It also made sense to exclude the category variable for urban–rural zonation.

As Table 7 shows, the zonal models vary considerably from the regional model, though three of them have  $R^2$  values similar to those for the whole region. In all

**Table 7** Multiple regressions of SWL for urban–rural zones, excluding time-stress and urban–rural variables

Variable	Whole Region	Inner City	Suburbs	Inner Commuter Belt	Outer Commuter Belt
State of health (self-reported) (1 poor, 5 excellent)	0.198	0.260	0.279		
Sense of community belonging	0.104		0.118		0.239
Household size (one 1, more 2)	0.102	0.142	0.081		
Age – 5-year categories	0.155	0.295			
Difficulty hearing, seeing, walking etc. (1 often, 3 no)	0.118			0.184	
Non-work time with others (mins/day)	0.086		0.093		
Regular sports participation	0.075				0.209
Sports & recreation time (mins/day)	–0.082				
Frequency of group activities & meetings	0.073				
All time with others (mins/day)					0.288
Travel by all modes (mean mins/day)				–0.174	
Unsafe walking after dark (1 safe, 3 dangerous)			–0.090		
$R^2$	0.142	0.150	0.134	0.064	0.147
$n$	1,971	397	1,063	343	168

Beta-weights for significant variables

zones, key socio-demographic variables of sex, education, and income fail to enter. The whole-region model is more complex than the zonal models, since the larger sample size allows more variables to meet the significance threshold. Models for the inner city and suburbs are somewhat similar to the regional model, though simpler, while models for the ICB and OCB are quite dissimilar, in that they exclude both state of health and age. Intrinsically geographic variables related to travel, safety, and community belonging play an important role in the two commuter zones.

The inner city has a simple model for SWL: in order of beta weights, the three significant variables are age, self-rated health, and household size. The model may reflect the zone's unusual demography, in that younger and older residents are over-represented here, as are those living alone. Health status is also important in the suburbs, as is social intercourse, modeled by both household size and non-work time with others. This is the only zone where concern for safety after dark contributes to SWL. Suburban areas typically have large numbers of youth, and in some districts within the study area there are issues with gangs, drugs, and vandalism. Regression results for the two commuter zones are very different from those of the inner city and suburbs. Perhaps because these zones are more socially and demographically homogenous, the models exclude age, state of health, and household size. However, health/fitness is modeled in the ICB by difficulty hearing etc., and in the OCB by regular sports participation, while social intercourse is modeled in the OCB by time with others. Intrinsically geographical variables assume importance in these commuter zones. Travel time has a strong negative effect on SWL in the ICB, as one might expect, since lengthy commutes are a major issue in this zone. In contrast, sense of community belonging is very important in the OCB, suggesting that traditional solidarity feelings remain high in more remote communities.

## Summary and Conclusion

This research examined how satisfaction with life (SWL) varies for residents in different zones of the urban–rural continuum, within the county of Halifax, Nova Scotia. It makes original contributions to our understanding of the predictors of SWL in three main ways. First, it employs time-use data collected in an innovative manner to indicate lifestyle characteristics, drawing on a large GPS-assisted time diary survey. Secondly, it employs the notion of the rural–urban continuum to define degrees of urbanity and rurality in a more nuanced fashion than the usual dichotomous urban–rural split. And thirdly, it employs several new geographic variables relating to both regional location and community character.

We first compared individual SWL ratings for urban–rural zones with respondent characteristics. We used the Mann–Whitney test to investigate whether there are significant inter-zonal differences in ranked SWL scores, and in ranked scores for respondent characteristics. Key findings can be summarized as follows.

- ‘Global’ SWL varies significantly by Urban–rural zones
- Highest SWL is found in the inner city (IC), and lowest in the outer commuter belt (OCB)

- The main socio-demographic covariates are age, whether married, household size, and household income (all of which vary significantly by U-R zones)
- Self-rated health is an important predictive factor for SWL, and is highest in the IC
- Time-stress is also important. It is lowest in the IC, and high in the commuter belt
- Several geographic variables co-vary significantly with SWL, particularly community belonging (strong in IC, weak in OCB), unsafe after dark (worst in IC, best in OCB), and commuting time (least in IC, most in OCB)

Multiple regression analysis was employed to gauge the separate statistical effects of each predictor variable on SWL. Perceived time-stress variables were found to be important, but may be considered as co-dependent rather than independent variables. When these were excluded from the analysis, the regional model was comprised of predictors related to physical health, mental health, and community geography. Separate modeling for each U-R zone revealed that the predictors vary considerably by zone. In particular, we note:

- In all zones, the separate effects of sex, education, and income are insignificant
- Physical health is an important predictor in the inner city and suburbs
- Community belonging is important in the suburbs and OCB
- Travel-time is significant only in the ICB
- Neighborhood safety is significant only in the suburbs

The above findings throw new light on life-satisfaction research by clearly demonstrating the importance of geographic variables related to neighborhood and community character, and to regional location. Not only do we see that the predictors of SWL are different for urban and rural residents, but there are also important differences between SWL models for the inner city and suburbs, and between models for urban fringe (ICB) and remote rural areas (OCB). These findings have important implications for the formulation of both land-use and health policies aimed at improving perceived life satisfaction. They lend credence to the notion that appropriate regional planning and community design can greatly improve the lives of citizens, both objectively and subjectively, particularly through travel reduction, enhanced safety, and increased opportunities for social interaction.

Clearly, further work is needed on this topic, and a larger range of geographic variables should be considered, to better understand the drivers of SWL. Personal psychological profiles, along with physical health, are undoubtedly of fundamental importance to individual SWL scores. Our results suggest, however, that individuals with similar personality and health characteristics (and hence similar expectations and preferences) tend to select similar residential locations. We therefore need to integrate the approaches and findings of SWL research with insights and findings from the inter-disciplinary fields of residential location behavior and transportation modeling. What links these fields together is the notion of residential locational choice, subject to personal values and utilities, and constrained by personal economic and mobility conditions.



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