Household Income and Subjective Well-Being After Spinal Cord Injury: A Longitudinal Study

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Background: Studies regarding subjective well-being (SWB) after spinal cord injury (SCI) are increasing in recent years, but little has been contributed to the relationship between income and SWB. **Objective:** By using longitudinal data, we want to identify (1) the overall trend in SWB over a 10-year period; (2) the association between household income and SWB at baseline; (3) the variation of the trajectory of SWB over 10 years among different household income groups; and (4) the variation of change rates of SWB over 10 years among different household income groups. **Methods:** We conducted a cohort study, including 434 participants who completed 3 measurements in 1998, 2003, and 2008. They were identified from outpatient records of 2 midwestern hospitals and a southeastern specialty hospital. **Results:** People with lower household income experienced more life problems and less life satisfaction at the baseline measurement. During the 10-year period, their health problems and environmental barriers significantly increased compared to persons with higher income. Increasing vocational satisfaction was the only favorable change for the lower income group. **Conclusions:** There were consistent disparities in SWB related to income, and these typically persisted over time. Therefore, with the exception of vocational satisfaction, few changes may be anticipated in SWB that would narrow the gap between high and low income. **Key words:** income, life problem, life satisfaction, spinal cord injury, subjective well-being

Socioeconomic factors may play a powerful role in health outcomes and survival within the general population,¹⁻⁷ so it is likely they also affect subjective well-being (SWB). At the individual level, some studies suggest a positive relationship between income and SWB,^{8,9} whereas others conclude that personal income exerts little influence on SWB.¹⁰⁻¹² Some researchers argue that relative income, instead of absolute income, affects SWB.¹³⁻¹⁵

Persons with physical disability due to spinal cord injury (SCI) require access to finances and resources that not only meet their basic needs, such as high-quality health care, rehabilitation programs, available attendants, house and vehicle modifications, and durable equipment, but also provide support for their adjustment to life after injury. Although SCI literature has identified the relationship between SWB (with an emphasis on life satisfaction) and education,^{16,17} marital status,¹⁸⁻²⁰ race,²¹ injury level,²² mobility,^{23,24} occupational roles,^{25,26} environmental barriers,²⁷ social support,^{16,28,29} weight,³⁰ physical health,^{22-24,26} and mental health,^{22,26,28} little has been contributed

to the study of income and SWB. Because life situations and needs change over time after SCI, the examination of SWB at a single point in time only provides a part of the picture. We should be aware of changes in SWB to better prepare for the future needs. However, descriptions about how SWB changes after SCI are limited in the literature.

Our objective was to use longitudinal data to investigate the relationship between household income and SWB among participants with SCI. We identify (1) the overall trend in SWB over a 10-year period; (2) the association between household income and SWB at the baseline; (3) the variation in the 10-year trajectory of SWB among different household income groups; and (4) the variation in the change rates of SWB over 10 years among different household income groups.

Methods

Participants

Participants were identified from outpatient records of 2 midwestern hospitals and a southeastern

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specialty hospital. There were 4 inclusion criteria at enrollment: (1) traumatic SCI, (2) 18 years of age, (3) minimum of 1 year post injury, and (4) residual effects of the SCI. Participants were enrolled as part of a longitudinal study on SCI initiated in 1973. Because the household income measure was available since 1998, the current study utilized data from those participants who completed 3 measurements: 1998, 2003, and 2008 ($N = 434$).

Procedures

Approval was obtained from the institutional review board prior to data collection. The number of responses decreased from 759 in 1998 to 434 by 2008 with an attrition rate of 43%. Surveys were used to collect data, and similar procedures were followed at each time of measurement. Each participant received an introductory letter describing the study and explaining that materials would be sent 4 to 6 weeks later. Study materials included a cover letter with all elements of informed consent (return of completed materials was implied consent) and the study instrument. Individuals who did not respond were sent 2 follow-up mailings and were contacted with a follow-up phone call. A remuneration of \$30 was offered to participants.

Measures

We used the Life Situation Questionnaire-Revised (LSQ-R)^{31,32} to measure multiple aspects of SWB. Although Diener's Satisfaction With Life Scale (SWLS)³³ is the most frequently used measure of SWB after SCI, its brevity (5 items) limits the measurement depth and scope. On the contrary, the LSQ-R includes 20 life satisfaction items and 30 life problems items. All items were measured using a 5-point scale. Satisfaction items were scored from 1 = *very dissatisfied* to 5 = *very satisfied*. Problems items were scored from 1 = *no problem* to 5 = *major problem*. The LSQ-R has been validated recently with a new 9-subscale structure.^{34,35} The 9 subscales within the LSQ-R include 3 life satisfaction subscales: home life satisfaction (4 items on family, living circumstances, and relationship status), vocational satisfaction (3

items about employment, financial means, and job opportunities), and global satisfaction (11 items on general life, emotion, health, and recreation). Six life problem subscales are included in the LSQ-R: health problems (6 items on pain, skin sores, spasticity, sweat, and urinary tract infections), social isolation (5 items on loneliness, lack of control, boredom, dependency, and difficulty making new friends), emotional distress (5 items on emotional pain, stress, worries, sadness, and depression), environmental barriers (3 items on negative attitudes toward the disabled, lack of accessibility), money problems (3 items on lack of adequate income, inadequate employment), and lack of opportunities (3 items on lack of job skills and learning opportunities). The details regarding the 9-subscale structure can be found elsewhere.^{34,35}

All independent variables were measured at baseline. Annual household income was categorized into 3 groups: less than \$10K, \$10K to less than \$25K, and \$25K and more. Eight control variables were used: chronological age, age at injury, race (White vs others), gender (male vs female), level of injury (C1-4, C5-8, and noncervical), completeness (yes vs no), years of education, and marital status (married vs others). For easy interpretation, we re-centered the 2 aging variables to their sample means before performing the analysis.

Analysis

We first examined the participants' characteristics. Then we used the standardized alpha coefficients to estimate the internal consistency of the 9 LSQ-R subscales and calculated the intraclass correlation coefficient (ICC) to estimate their test-retest reliability. The ICC theoretically ranges from 0 to 1, with 0 to 0.2 indicating poor reliability, 0.2 to 0.4 fair, 0.4 to 0.6 moderate, 0.6 to 0.8 substantial, and greater than 0.8 almost perfect.^{36,37}

Next, we presented the mean scores of the LSQ-R for 3 income groups measured at 3 different time points to compare their changes across 10 years. To conduct a longitudinal analysis with 3 repeated measurements of 9 LSQ-R subscales, we used the SAS 9.3 PROC MIXED procedure to implement

Table 1. Standardized alpha coefficients and intraclass correlation coefficient (ICC) of 9 subscales from the Life Situation Questionnaire-Revised

	$\alpha(1998)$	$\alpha(2003)$	$\alpha(2008)$	ICC
Home life satisfaction	0.79	0.79	0.78	0.53
Vocational satisfaction	0.84	0.86	0.84	0.70
Global satisfaction	0.92	0.93	0.92	0.68
Health problems	0.74	0.74	0.77	0.78
Social isolation	0.82	0.84	0.83	0.73
Emotional distress	0.91	0.93	0.93	0.80
Environmental barriers	0.69	0.73	0.71	0.59
Money problems	0.87	0.88	0.88	0.78
Lack of opportunities	0.78	0.82	0.79	0.73

the multilevel model. The multilevel model is expressed as the sum of 2 parts: a fixed part with 4 fixed effects and a random part that estimates 3 variance components. The following equation summarizes our basic multilevel model:

$$Y_{ij} = \gamma_{00} + \gamma_{01} \text{INCOME_LOW}_i + \gamma_{02} \text{INCOME_MID}_i \\ + \gamma_{10} \text{TIME}_{ij} + \gamma_{11} \text{INCOME_LOW}_i * \text{TIME}_{ij} \\ + \gamma_{12} \text{INCOME_MID}_i * \text{TIME}_{ij} + (\gamma_{ij} + \gamma_{0i} + \gamma_{1i} \text{TIME}_{ij})$$

1. γ_{00} represents the average initial status of a LSQ-R subscale for an individual with annual household income of \$25K or more at 1998.
2. γ_{01} represents the estimated differential in the initial status of a LSQ-R subscale between an individual with income of less than \$10K and an individual with income of \$25K or more.
3. γ_{02} represents the estimated differential in the initial status of a LSQ-R subscale between an individual with income of \$10K to \$24,999 and an individual with income of \$25K or more.
4. γ_{10} represents the average rate of change for a LSQ-R subscale for an individual with income of \$25K or more.
5. γ_{11} represents the estimated differential in the rate of change for a LSQ-R subscale between an individual with income of less than \$10K and an individual with income of \$25K or more.

6. γ_{12} represents the estimated differential in the rate of change for a LSQ-R subscale between an individual with income of \$10K to \$24,999 and an individual with income of \$25K or more.
7. ϵ_{ij} , ζ_{0i} , and $\zeta_{1i} \text{TIME}_{ij}$ represents 3 different variance components.

Our final models added 8 control variables (chronological age, age at injury, gender, race, years of education, completeness and level of injury, and marital status) to the basic models.

Results

At baseline (1998), participants averaged 44 years of age (SD 11) and 14 years of education (SD 3). The mean (SD) age at injury was 26 (11). The majority of participants were White (81%) and male (68%). Nine percent reported C1-4 level injuries, 42% C5-8 injuries, and 49% noncervical injuries. Forty-eight percent were complete injuries. Forty-three percent were married. About half (52%) had an annual household income of \$25K or more, 27% had between \$10K and \$24,999, and 21% had household income less than \$10K.

All scales had an acceptable internal consistency with alpha ranging from 0.69 to 0.93 (**Table 1**). The ICC of the 9 LSQ-R subscales indicated that 2 subscales, home life satisfaction and environmental barriers, had moderate test-retest reliability, as defined by a range of 0.4 to 0.6, whereas the other 7 had substantial reliability (0.6 to 0.8).

Table 2. Mean scores for the 9 subscales of the Life Situation Questionnaire-Revised across 10 years by income group

Subscales	Household income								
	< \$10K			\$10K-\$25K			≥ \$25K		
	1998	2003	2008	1998	2003	2008	1998	2003	2008
Home satisfaction	14.58	14.62	15.14	15.33	14.94	15.40	16.32	15.93	15.77
Vocational satisfaction	6.70	7.35	7.64	8.44	8.15	8.44	11.19	10.88	10.74
Global satisfaction	37.41	37.54	36.32	38.45	37.12	35.73	41.07	40.24	39.65
Health problems	14.36	14.68	15.91	14.19	14.64	15.19	12.95	13.25	13.46
Social isolation	11.31	11.25	11.36	10.52	10.31	11.04	9.10	9.11	9.63
Emotional distress	11.01	10.902	10.89	11.38	10.46	11.14	10.03	9.71	9.72
Environmental barriers	5.76	5.43	5.87	5.91	5.71	5.67	5.46	4.93	5.02
Money problems	10.15	9.20	9.99	9.30	8.55	8.49	5.75	5.76	6.04
Lack of opportunities	6.50	6.13	6.99	6.14	5.95	6.07	4.79	4.65	5.09

Although global satisfaction mean scores for all groups dropped across 10 years, the average global satisfaction score of participants with an income of \$25K or more was consistently higher than others (Table 2). There was little change in home satisfaction scale scores over the 10 years. For vocational satisfaction, higher income was associated with higher vocational satisfaction. However, vocational satisfaction for the low-income group increased modestly over the 10-year period, whereas the other 2 groups did not have clear trends of changes. Health problems for all 3 income groups increased to some extent during 10-year period, but the low-income group appeared to increase faster than other groups. Participants with an income of \$25K or more also had lower social isolation and emotional distress mean scores than the other 2 groups, but no income group showed a clear change in trends. As expected, higher income was associated with less money problems and more opportunities. For environmental barriers, it appeared that the participants with an income of \$25K or more experienced a decrease, whereas those with an income less than \$10K had a modest increase across 10 years.

For clear data presentation with our multilevel models, we showed only the fixed effects of income variables – the variables of interest in the study (Table 3). The linear trajectory over 10 years is represented by 2 parameters: initial status and

rate of change. The initial status intercept (γ_{00}) is the average initial status for participants with income of \$25K or more when all the other control variables are equal to 0 (column 1, Table 3). All initial status intercepts (γ_{00}) were statistically significant, indicating all mean scores for the LSQ-R subscales measured in 1998 for this income group were significantly higher than 0.

The 10-year home satisfaction trajectories were basically the same for the 3 income groups after controlling for the other 8 variables. The high-income group scored 3.27 points and 2.01 points higher in vocational satisfaction scale than the low- and middle-income groups, respectively, at the initial status. However, the low-income group's vocational satisfaction increased over 10 years ($\gamma_{11} = .14^*$), whereas the rates of change for the other 2 groups did not change significantly. For the global satisfaction scale, the low-income group was statistically lower ($\gamma_{01} = -2.67^*$) than the group with an income of \$25K or more. For all 3 groups, global satisfaction decreased over 10 years at the same rate of change.

For the health problem scale, the 3 income groups were nearly identical at the initial status. However, health problems for the low-income group increased significantly over time ($\gamma_{11} = .12^*$), whereas the other 2 groups remained the same during the 10-year period. For the social isolation scale, the low-income group scored

Table 3. Results (unstandardized coefficients) of the multilevel models for the 9 subscales of the Life Situation Questionnaire-Revised ^a

Subscales	Initial status			Rate of change		
	Intercept (γ_{00}) ^b	<\$10K (γ_{01})	\$10K-\$25K (γ_{02})	Intercept (γ_{10}) ^c	<\$10K (γ_{11}) ^d	\$10K-\$25K (γ_{12}) ^e
Home satisfaction	13.82*	-0.25	-0.50	-0.04	0.09	0.06
Vocational satisfaction	5.88*	-3.27*	-2.01*	-0.03	0.14*	0.03
Global satisfaction	37.03*	-2.67*	-2.23	-0.14*	0.04	-0.11
Health problems	16.44*	0.45	0.64	0.05	0.12*	0.04
Social isolation	10.50*	1.29*	0.84	0.04	-0.04	0.00
Emotional distress	12.77*	0.42	0.98	-0.04	0.05	0.00
Environmental barriers	6.03*	-0.10	0.40	-0.05*	0.07*	0.02
Money problems	9.99*	3.34*	2.83*	0.02	-0.04	-0.10*
Lack opportunities	9.43*	0.63	0.79*	0.03	0.03	-0.04

Note: The reference groups was income $\geq$ \$25K.

^aThe multilevel models also controlled 8 variables: chronological age, age at injury, gender, race, years of education, completeness and level of injury, and marital status.

^bThe average initial status of a Life Situation Questionnaire-Revised (LSQ-R) scale for an individual with annual household income of $\geq$ \$25K at 1998.

^cThe average rate of change for a LSQ-R scale for an individual with income of $\geq$ \$25K. A positive coefficient means the outcome increased over time on average, whereas a negative one means the decreasing trend.

^dIf the sum of γ_{11} and γ_{10} is positive, the outcome increased for the group with income of <\$10K; if it is negative, the outcome decreased over time.

^eIf the sum of γ_{12} and γ_{10} is positive, the outcome increased for the group with income of \$10K-\$25K; if it is negative, the outcome decreased over time.

* $P < .05$.

significantly higher ($\gamma_{01} = 1.29^*$) than the group with income of \$25K or more at the initial status. Their rates of change were basically the same over time. The 3 income groups did not vary on the trajectory for the emotional distress scale. During the 10-year period, participants with income of \$25K or more saw environmental barriers drop ($\gamma_{10} = -.05^*$), whereas those with low-income saw an increase in environmental barriers ($\gamma_{11} = .07^*$). As expected, the lower the household income, the higher the money problems at initial status ($\gamma_{01} = 3.34^*$, $\gamma_{02} = 2.83^*$). However, the money problems for the group with an income of \$10K to \$24,999 were mitigated over time ($\gamma_{12} = -.10^*$). This group also felt disadvantages in future opportunities at the initial status (γ_{02} of lack opportunities scale = .79*).

For other control variables not shown in **Table 3**, years of education was significantly associated with higher vocational satisfaction and global satisfaction, lower emotional distress,

and less health problems, money problems, and opportunities problems. Married people enjoyed better home life and lower social isolation. Whites had higher vocational satisfaction, more opportunities, and less money problems. Males reported less health problems and lower emotional distress. Complete injury was related to more health problems, more environmental barriers, and higher social isolation.

Discussion

High expenses associated with medical care, attendant care, and therapeutic equipment, along with the indirect costs related to low income and lost earnings, can place a financial burden on persons with SCI. These costs combined with low family income and depleted wages can exacerbate the economic circumstances of individuals with SCI, especially when employment rates are

typically under 30% for this population and a high proportion of individuals live in poverty.³⁸⁻⁴¹ Because we know little about income's effect on SWB for people with SCI, we initiated this first study on the changes in trajectory of SWB over time related to household income.

The study results presented a mixed picture. For most variables, individuals in the highest income group reported higher satisfaction and lower self-reported problems. However, the pattern of change over time was less consistent. Global satisfaction declined for each of the 3 income groups over the 10-year study timeframe. Participants in the lowest income groups experienced increases in health problems and environmental barriers over 10 years. The initial disparities in social isolation and money problems between the low-income group and high-income group remained unchanged over time. However, the gap between high and low income for vocational satisfaction decreased over time. It did appear possible for the middle-income group to bridge the gap with the high-income group in money problems.

Although the results were not unequivocal in terms of changes in SWB over time, there are several important implications of the findings. There were consistent disparities in SWB related to income; for 7 out of 9 indicators, the gap between income groups persisted or even increased over time. Therefore, with the exception of vocational satisfaction, few changes may be anticipated to narrow the gap in SWB between high and low income. Rehabilitation professionals should be aware of the lower levels of SWB that accompany low income and the likely persistence of poor outcomes. They should also look for ways to enhance educational and income opportunities as a means of promoting better SWB outcomes.

Limitations

There are several limitations of this study. First, income was self-reported, which is susceptible to intentional or unintentional reporting bias. However, because of the nature of the study, it is unlikely that there was any motivation to misreport income. Second, most of the non-White participants were African Americans. Therefore,

we should be cautious about generalizing our study results to other racial/ethnic groups, such as Hispanic or American Indian. Third, we experienced attrition due to the difficulties of follow-up in this special population over 10 years and due to mortality, which is higher among people with SCI^{42,43}; it is possible to have selection bias due to attrition. Fourth, it might be ideal to measure the average household income per person. However, the number of people within the same household was not available in 1998. Last, the income breakdowns were rather arbitrary, and we chose those that were conservative in terms of differentiating between low, middle, and high income. This was partially due to having enough participants in each of the 3 groups, yet it likely led to highly conservative estimates of the differences in SWB outcomes between high and low income.

Conclusion

This is the first study to analyze 10-year trajectories in SWB as the function of annual household income for people with SCI. We found that SWB was relatively stable over the study time frame in general. However, the average trend moderated the ups and downs of individual SWB. Our study identified the differential changes among different income groups. Future research would benefit from inclusion of a larger and more diverse participant cohort, specifically participants in the higher income ranges (substantially exceeding \$25K). The use of different cutoffs would likely reveal more significant patterns, the nature of which can only be subject to speculation based on the current data. Incorporation of different measures of outcomes, in addition to satisfaction and problems, will help us better understand the relationship between socioeconomic factors and important outcomes after SCI.

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