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Assessing the Impact of Behavioral Risk Factors and Known-Groups Validity of the SF-12 in a US Chinese Immigrant Population

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Abstract

Background—Health status measures are being used in increasingly diverse populations. However, there are no known studies to date that examine the SF-12 in US Chinese populations. This study reports on the performance and validity of the SF-12 among Chinese immigrants residing in New York City, and evaluates the impact of multiple behavioral risk factors on physical and mental health status.

Methods—We used cross-sectional survey data from a multistage probability sample of 2537 Chinese adults. SF-12 scores were examined according to sociodemographic, cultural, and clinical characteristics. Regression analyses were used to examine associations between health status and co-occurring behavioral risk factors of smoking, risky drinking, physical inactivity, and overweight/ obesity.

Results—SF-12 scores were significantly lower among women, those with less education, lower incomes, and more health problems ($P < 0.001$). Older adults had worse physical but better mental health ($P < 0.05$). Individuals with 1, 2, 3, and 4 behavioral risk factors reported decreases of 1.91, 2.92, 4.86, and 9.21 points on the PCS-12, respectively, in comparison with the reference group having zero risk factors ($P < 0.01$). Similar trends up to 2 co-occurring risks were observed with MCS-12 scores ($P < 0.01$).

Conclusions—The SF-12 exhibited known-groups validity in a US Chinese immigrant population. Co-occurring behavioral risk factors were associated with progressive declines in physical health, independent of sociodemographic and clinical characteristics traditionally

associated with impairments in health status. Targeting patients with multiple risks for behavior change may be effective in improving health across diverse populations.

Keywords

SF-12; health status; risk behaviors/factors; immigrants; Asian health issues

Health status is an important clinical indicator that is being assessed in diverse ethnic populations. Comprising nearly a quarter of the world's population, the Chinese are the single largest ethnic group and constitute the largest Asian subgroup in the United States.^{1,2} According to Census estimates, there are over 3.1 million Chinese individuals residing in the United States and almost half a million are located in New York City (NYC).³ Despite their presence, the health status of Chinese Americans, and particularly recent Chinese immigrants, is poorly understood as they remain underrepresented in health surveys.^{4,5} Furthermore, participants who are included in studies are typically English-speaking and socioeconomically advantaged, thereby perpetuating a "model minority" myth of having few health problems or needs.⁶⁻⁹

Increasing research on this underrepresented population will enable clinicians to better understand the health status of at-risk groups, evaluate their health needs, and inform policy regarding the clinical effectiveness of interventions.¹⁰ Although health status instruments such as the SF-12 have been examined among low-income whites, blacks, and Hispanics,¹¹⁻¹³ less is known about how such instruments perform in low-income Chinese communities in the United States.¹⁴ While the SF-12 has been translated and validated for use among Chinese individuals in Hong Kong, to date there are no known studies that examine the SF-12 in a representative sample of Chinese adults living in the United States or outside of Asia.^{15,16}

This study extends current research by examining the SF-12 among Chinese immigrants residing in NYC. The study reports on known-groups validity of the instrument and tests hypotheses based on the literature that respondents who are female,^{17,18} less educated or affluent,^{13,19} and who have more medical problems²⁰ will have lower health status, whereas older individuals will have worse physical health but potentially better mental health.²⁰⁻²³ The study also expands on prior research, which has typically focused on sociodemographic and clinical correlates of health status, by examining behavioral risk factors and their associations with physical and mental health. Smoking, risky drinking, physical inactivity, and overweight/obesity are targeted as they contribute heavily to chronic disease and are currently the leading causes of preventable death and disability in the United States.²⁴⁻²⁶ Because these risks are known to be a highly related group of problems that tend to co-occur,²⁷⁻³⁵ we will examine the effect of multiple co-occurring risk factors on SF-12 measures of health status.

Methods

This study used cross-sectional survey data from a multistage probability sample of Chinese adults residing in NYC. Eligible households from 2 communities with high concentrations of Chinese residents were obtained from the white pages, using native surnames identified in

consultation with Chinese linguists. A stratified systematic sampling procedure was applied by zip code to all listed households, resulting in a sample frame of households representative of the communities. A random sample cohort of Chinese households was selected, and participants were administered a screening questionnaire that included informed consent to the full survey. The unit of analysis was the individual and the final individual weight was a product of 2 components: a household-level (screener) weight component and a within-household person-weight component. The response rate for the screener was 59% and for the extended interview was 78.5%. Further details of this sampling design and response rates are included in the Appendix (available online, <http://links.lww.com/A627>).

The survey was informed by focus groups and gathered information on health status, reported illnesses, and other health indicators, including tobacco use, alcohol consumption, physical activity, height, and weight. Questions were adapted from validated national health survey instruments, translated into Chinese and back-translated by 3 independent bilingual translators, then pilot tested among 50 Chinese individuals.^{36–40} Final in-person interviews were conducted in English, Mandarin, Cantonese, and Fukinese, with a total of 2537 representative adults aged 18 to 74 completing the survey.

Measures

Outcome Variables—Health status was measured using the SF-12, an abbreviated version of the Medical Outcomes Study SF-36 health survey.^{11,41,42} Physical component summary (PCS-12) and mental component summary (MCS-12) scores were generated based on a mean of 50 and standard deviation of 10, with higher scores representing better health.^{16,36}

Independent Variables—Respondents were identified as smokers if they reported having smoked 100 cigarettes in their lifetime and currently smoke everyday or some days. Risky drinking was defined by gender-specific criteria of consuming more than 2 alcoholic beverages on average per day for men, and more than one alcoholic beverage per day for women.⁴³ Physical inactivity was measured as a composite of 2 questions: one inquiring about activity for recreational purposes and a second inquiring about activity apart from recreation on a normal day. Scores were averaged with lower values (eg, corresponding to “hardly any exercise”), indicating physical inactivity. Obesity/overweight was calculated based on body mass index (BMI) standards for Asian populations that define overweight as $>23 \text{ kg/m}^2$ and obesity as $>25 \text{ kg/m}^2$.⁴⁴ All variables were coded “1” in the presence and “0” in the absence of each individual risk factor. The number of co-occurring risks was summed to create an index of multiple behavioral risk factors for each respondent.

Sociodemographic variables such as gender, age, education, and household income were included for analysis. Based on prior studies, which found that language was the most important predictor of acculturation,^{45–47} we used a composite of 2 linguistic variables available in our survey: speaks English in the home and/or reads English newspapers most or every day. Also, proportion of lifetime in the United States was calculated as the respondent’s number of years lived in the United States divided by age at the time of interview. Illnesses related to the risk factors studied were measured by whether the respondent had ever been told by a physician that he/she had the following: diabetes, heart

disease, high blood pressure, bronchitis, emphysema, or cancer. Last, we included health insurance status as an indicator of access to health care.

Statistical Analysis

All data were analyzed using the weighted survey procedure in Stata 9.0. Descriptive statistics for the sample were calculated, followed by analysis of SF-12 scores by sample characteristics, using adjusted Wald tests and analysis of variance corrected for survey design. Regression analyses were used to examine associations between multiple co-occurring behavioral risk factors and health status, adjusting for related illnesses, sociodemographic, and cultural characteristics.

Results

Table 1 describes sociodemographic, cultural, and clinical characteristics of the study sample. Of note, most individuals (97%) were foreign-born, with 85% having spent less than half of their lifetime in the United States at the time of interview. Table 2 examines bivariate relationships between mean SF-12 scores and sample characteristics. Mean PCS-12 scores were significantly lower among women, older adults, and those with lower education levels and lower household incomes ($P < 0.001$), while older adults and men had higher mean MCS-12 scores ($P < 0.05$). More acculturated respondents and those born in the United States had significantly higher mean PCS-12 but lower MCS-12 scores ($P < 0.05$). Individuals who reported having illnesses such as diabetes and heart disease had lower mean PCS-12 scores ($P < 0.001$), and those with health insurance had lower mean PCS-12 but higher MCS-12 scores ($P < 0.05$).

Table 3 presents relationships between multiple behavioral risk factors and mean SF-12 scores. Independent of related illnesses, sociodemographic, and cultural characteristics, significant declines in physical health were observed with each additionally occurring risk factor. Individuals with 1, 2, 3, and 4 behavioral risk factors had progressive decreases of 1.91, 2.92, 4.86, and 9.21 points on the PCS-12, respectively, compared with the reference group having zero risk factors ($P < 0.001$). A similar trend was observed with MCS-12 scores up to 2 co-occurring risks ($b = 1.87, 2.32; P < 0.01$). Regression results for sociodemographic characteristics were consistent with the bivariate results previously reported, except for moderate household income, which was significantly related to higher mean MCS-12 but not PCS-12 scores ($P < 0.01$). Heart disease, high blood pressure, and cancer remained negatively related to mean PCS-12 scores ($P < 0.01$), and high blood pressure was associated with lower mean MCS-12 scores ($P < 0.05$).

Discussion

This study finds that the SF-12 performed well and exhibited known-groups validity among a representative sample of Chinese immigrants residing in NYC. The instrument was sensitive to differences in sociodemographic and clinical variables, and our findings were consistent with the literature on characteristics associated with health status among both Chinese and general US populations.^{9,13,14,20,48} Our hypotheses were supported in that women reported worse health status than men, and physical health declined with age, while

mental health improved. Individuals with lower household incomes, lower educational attainment, and more health problems reported worse health, especially physical health status.

Apart from the effects of related illnesses and sociodemographic traits, behavioral risk factors were associated with independent, measurable, and significant impacts on health status. Observed effect sizes of multiple risk factors were in some cases larger than those of individual sociodemographic and clinical features. These results highlight behavioral risk factors as important priorities for clinical care. Findings suggest that healthcare providers target patients with multiple risks for behavior change, as these negative effects were observed independent of characteristics traditionally associated with impairments in health status.

Co-occurring behavioral risks were also associated with “dose-response” patterns of decline in physical health. Compared with having zero risk factors, each additional occurrence of smoking, risky drinking, physical inactivity, and obesity/overweight was associated with progressive decreases in mean PCS-12 scores. Decrements associated with having 3, and especially 4, behavioral risk factors were both statistically and clinically significant. This was judged in accordance with a minimum clinically important difference (MCID) definition of 0.5 standard deviations, which, for the SF-12, would be equivalent to a 5-point change in summary scores.⁴⁹

The trend observed with the MCS-12 may be explained in part by the small number of individuals in our study sample who reported low rates of 2 of the 4 risk factors (ie, overweight/obesity and alcohol use). Prior studies have also found that the relationship between risk factors and mental health tends to be weaker than that of physical health.^{50–52} One study examined the impact of cardiometabolic risk factors on SF-12 and EQ-5D scores, and noted that the impact of these risk factors was greater on physical function health-related quality of life (compared with mental function).⁵⁰ Similarly, obesity as a risk factor has been associated with PCS-12 but not MCS-12 scores.⁵¹ Yet another study examining the effects of single and combinations of chronic diseases on SF-36 scores noted that combinations of particular diseases affected physical, but not mental, functioning.⁵² Taken together with our findings, these studies suggest that the link between multiple risk factors and mental health status may be weaker and less synergistic compared with that of physical health status.

Some limitations of this study include our reliance on self-report data, which may have resulted in underreporting of certain risk behaviors. Another limitation includes study location, which may affect generalizability; findings may be most likely to apply to Chinese immigrants residing in large metropolitan areas. Additionally, our sample frame was derived from the white pages that may have excluded unlisted households. A comparison of our survey estimates with Census data on the targeted neighborhoods is provided in the online Appendix. Last, the cross-sectional study design limits the ability to make causal inferences. Longitudinal study is warranted to further explore the relationship between health status and behavioral risk factors, adjusting for temporal effects of immigration. Follow-up data, including more comprehensive measures of acculturation among this cohort have been collected, and will enable future analysis of changes in health status over time.

Conclusions

This study reports on the novel use of the SF-12 among US Chinese immigrants, and finds that the instrument performs well and demonstrates known-groups validity. We also examined the impact of multiple behavioral risk factors on health status in this population, and found that physical health may be as much a function of behavioral and lifestyle choices as it is of existing disease states. This highlights the importance for clinicians and healthcare professionals to target patients with multiple risks for behavior modification. Addressing behavioral risk factors may improve health and create tangible health benefits, even beyond the effects normally attributable to treating illness in diverse populations.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE 1

Characteristics of Study Sample (N = 2537)

	Weighted N (%)	SE	95% CI
Sociodemographic characteristics			
Gender			
Male	1398 (55.1)	1.08	(53.0–57.2)
Female	1139 (44.9)	1.08	(42.8–47.0)
Age, yrs			
18–39	1078 (42.5)	1.46	(39.5–45.2)
40–64	1251 (49.3)	1.43	(46.4–52.0)
65	208 (8.17)	0.77	(6.65–9.69)
Education			
High school graduate	1649 (65.0)	1.43	(61.7–67.3)
Some college	355 (14.0)	0.98	(11.9–15.7)
Bachelor's degree	533 (21.0)	1.24	(18.6–23.4)
Household income			
<\$20,000	1238 (48.8)	1.68	(45.5–52.1)
\$20,000 to <\$40,000	705 (27.8)	1.43	(25.0–30.6)
\$40,000 to <\$60,000	320 (12.6)	1.03	(10.5–14.6)
\$60,000	274 (10.8)	1.09	(8.69–13.0)
Cultural characteristics			
Place of birth			
United States	76 (3.00)	0.53	(1.96–4.05)
Not United States	2461 (97.0)	0.53	(96.0–98.0)
Percentage of lifetime spent in the US			
<50%	2151 (84.8)	1.14	(82.6–87.1)
50%	386 (15.2)	1.14	(12.9–17.4)
Linguistic acculturation			
Acculturated	558 (22.0)	1.19	(19.6–24.3)
Not acculturated	1979 (78.0)	1.19	(75.7–80.4)
Related illnesses and health insurance			
Diabetes	94 (3.69)	0.53	(2.66–4.73)
Heart disease	76 (3.00)	0.41	(2.19–3.81)
High blood pressure	330 (13.0)	0.98	(11.1–14.9)
Bronchitis	165 (6.52)	0.73	(5.10–7.95)
Emphysema	25 (0.98)	0.22	(0.55–1.41)
Cancer	8 (0.30)	0.10	(0.11–0.50)
Has health insurance	1768 (69.7)	0.01	(0.67–0.72)
Behavioral risk factors			
Cigarette smoking	449 (17.7)	0.84	(16.0–19.3)
Risky drinking	24 (0.93)	0.21	(0.52–1.33)
Physical inactivity	822 (32.4)	1.30	(29.8–34.9)

	Weighted N (%)	SE	95% CI
Overweight/obesity	150 (5.93)	0.61	(4.74–7.12)

SE indicates standard error; CI, confidence interval.

TABLE 2

Mean SF-12 Scores According to Sample Characteristics

	PCS-12 (Mean)	F-Stat.*	MCS-12 (Mean)	F-Stat.*
Sociodemographic characteristics				
Gender		12.39 [§]		8.87 [‡]
Male	53.40		50.82	
Female	52.01		49.70	
Age, yrs		86.97 [§]		3.87 [‡]
18–39	52.25		49.91	
40–64	52.12		50.47	
65	48.94		51.50	
Education		21.33 [§]		2.01
HS graduate	52.08		50.30	
Some college	53.40		49.91	
Bachelor's degree	54.43		50.63	
Household income		25.20 [§]		1.99
<\$20,000	51.52		50.14	
\$20,000 to <\$40,000	53.17		50.12	
\$40,000 to <\$60,000	54.39		51.50	
\$60,000	54.30		50.94	
Cultural characteristics				
Place of birth		4.55 [‡]		2.31
United States	55.14		47.88	
Not United States	52.70		50.39	
Percentage of lifetime spent in the US		1.38		0.25
<50%	52.56		50.46	
50%	53.43		50.17	
Linguistic acculturation		21.16 [§]		0.04
Acculturated	54.23		50.39	
Not acculturated	52.36		50.29	
Related illnesses and health insurance				
Diabetes		16.71 [§]		1.17
Yes	47.95		49.22	
No	52.95		50.37	
Heart disease		39.91 [§]		4.21 [‡]
Yes	44.28		48.20	
No	53.40		50.36	
High blood pressure		37.91 [§]		3.29
Yes	48.10		49.36	
No	53.43		50.43	

	PCS-12 (Mean)	F-Stat.*	MCS-12 (Mean)	F-Stat.*
Bronchitis		18.60 ^{\$}		1.20
Yes	49.28		49.62	
No	53.00		50.34	
Emphysema		12.94 ^{\$}		1.38
Yes	45.11		48.35	
No	52.86		50.32	
Cancer		11.52 ^{\$}		0.41
Yes	41.26		48.51	
No	52.81		50.31	
Has health insurance		6.46 [†]		4.36 [‡]
Yes	52.48		50.57	
No	53.42		49.68	
Behavioral risk factors				
Cigarette smoking		7.62 [‡]		1.74
Yes	52.66		50.88	
No	53.71		50.24	
Risky drinking		15.40 ^{\$}		0.66
Yes	52.76		52.53	
No	56.78		50.31	
Physical inactivity		21.90 ^{\$}		33.53 ^{\$}
Yes	50.76		48.31	
No	53.43		50.96	
Overweight/obese		1.48		0.45
Yes	51.38		51.33	
No	52.81		50.29	
Number of co-occurring behavioral risk factors		21.22 ^{\$}		13.96 ^{\$}
0 risk factors	53.90		51.23	
1 risk factor	51.72		49.30	
2 risk factors	50.84		49.26	
3 risk factors	48.60		49.90	
4 risk factors	45.16		53.35	

SE indicates standard error; CI, confidence interval.

* Adjusted Wald test for 2 categories, ANOVA for multiple categories.

[†] $P < 0.05$,

[‡] $P < 0.01$,

^{\$} $P < 0.001$.

TABLE 3

Multiple Regression Analyses for SF-12 Summary Scores

	SF-12 (PCS)				SF-12 (MCS)			
	Beta	SE	T-Stat.	P	Beta	SE	T-Stat.	P
Number of co-occurring risk factors (Ref: 0 risk factors)								
1 risk factor	-1.91 [‡]	0.43	-4.45	<0.001	-1.87 [‡]	0.39	-4.71	<0.001
2 risk factors	-2.92 [‡]	0.68	-4.26	<0.001	-2.32 [‡]	0.71	-3.24	0.001
3 risk factors	-4.86 [‡]	1.42	-3.41	0.001	-1.59	1.28	-1.24	0.215
4 risk factors	-9.21 [‡]	0.48	-19.04	<0.001	0.74	0.46	1.61	0.108
Sociodemographic characteristics								
Gender (Ref: Male)	-1.91 [‡]	0.40	-4.72	<0.001	-1.42 [‡]	0.39	-3.59	<0.001
Age, yrs (Ref: 18–39)								
40–64	-0.86 [*]	0.35	-2.43	0.015	0.68	0.42	1.61	0.109
65	-2.34 [‡]	0.78	-2.96	0.003	2.06 [‡]	0.73	2.80	0.005
Education (Ref: HS grad)								
Some college	0.30	0.59	0.51	0.611	-0.56	0.70	-0.81	0.418
Bachelor's degree	1.03 [*]	0.54	2.42	0.016	-0.48	0.57	-0.84	0.403
Household income (Ref: <\$20k)								
\$20,000 to <\$40,000	0.02	0.54	0.04	0.967	0.14	0.48	0.31	0.760
\$40,000 to <\$60,000	0.79	0.48	1.66	0.098	1.67 [‡]	0.61	2.70	0.007
\$60,000	0.44	0.67	0.66	0.507	0.75	0.73	1.02	0.310
Cultural characteristics								
Linguistic acculturation (Ref: Not acculturated)	0.62	0.46	1.35	0.176	0.33	0.55	0.60	0.549
Percentage of lifetime spent in the US (Ref: <50%)	-0.25	0.74	-0.35	0.727	-0.64	0.63	-1.00	0.316
Related illnesses and health insurance								
Diabetes	-1.40	1.19	-1.18	0.239	-0.56	1.01	-0.56	0.578
Heart disease	-5.57 [‡]	1.50	-3.70	<0.001	-1.78	1.29	-1.38	0.169
High blood pressure	-3.27 [‡]	0.94	-3.47	0.001	-1.37 [*]	0.64	-2.13	0.033
Bronchitis	-1.93	1.01	-1.91	0.057	-0.01	0.74	-0.01	0.998

	SF-12 (PCS)			SF-12 (MCS)		
	Beta	SE	T-Stat.	Beta	SE	T-Stat.
Emphysema	-3.36	2.10	-1.60	-1.52	2.04	-0.75
Cancer	-9.10 [*]	3.51	-2.59	-0.73	3.16	-0.23
Has health insurance	-0.95 [†]	0.36	-2.60	0.93 [*]	0.43	2.13
Constant	56.1 [‡]	0.54	102.4	50.9 [‡]	0.55	91.4

0.455

0.815

0.034

<0.001

PCS indicates physical component summary; MCS, mental component summary; HS, high school; SE, standard error.

^{*} $P < 0.05$,

[†] $P < 0.01$,

[‡] $P < 0.001$.