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Theories of Financial Hardship and Measures of the Construct in Health Datasets: Empirical Applications for Illinois and the Metro/Nonmetro Populations of the Nation

1

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Abstract

This paper shows how the construct “financial hardship” should be measured based on its role in the theory. Theories from economics, psychology, and sociology guided the search for existing measures of the construct in published databases such as the Medicare Beneficiary Survey. Results of data analysis show that perceptual measures of financial hardship such as the ones in the Medicare Beneficiary Survey lack content validity – the semantic correspondence of the measures with the construct’s definition is inadequate.

Introduction

Financial hardship is one’s inability to meet real-life obligations because of one’s limited economic resources². Healthcare researchers are attempting to understand how healthcare consumers, both purchasers and users of healthcare³, experience and cope with financial hardship. Researchers, guided by theories in economics, psychology, and sociology, have constructed measures of financial hardship; for example, the National Health and Aging Trend Study⁴ has a four-item perceptual measure of the construct. This paper reviews relevant theories of financial hardship,

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2 Athiyaman, A. (2023). An Empirical Analysis of Financial Hardship Associated with Alzheimer’s Disease and Related Dementia: Metro and Nonmetro Patients. *Research Brief*, 3(17), September 7. Available: http://www.iira.org/wp-content/uploads/2023/09/RB5_17-Financial-Hardship-with-Alzheimer-disease.pdf.

3 This statement recognizes that the purchaser of healthcare could be different from the user of healthcare; for example, the head of family purchasing healthcare for use by her family members.

4 <https://www.nhats.org/researcher/nhats>.

demonstrates how the construct should be operationally measured based on its role in the theory, lists health datasets that contain measures of 'financial hardship' and assesses the content validity⁵ of perceptual measures using the C-OAR-SE framework⁶.

Theories that Explain Financial Hardship

In social sciences, a theory is a systematic deduction of secondary principles from primary postulates⁷. For the purposes of this research, a theory consists of concepts and structural frameworks; the latter relate concepts as descriptive models or descriptive micro theories⁸.

5 Content validity explores the semantic correspondence of the measures with the construct's definition; see Athiyaman, A. (2022). Rural Illinois in Numbers: Content-Valid Indicators for Governance. *Research Brief*, 4(11). Available: http://www.iira.org/wp-content/uploads/2022/06/Rural-Illinois-in-Numbers-Content-Valid-Indicators-for-governance_RB4_11_2.pdf

6 The acronym C-OAR-SE stands for Construct, Object, Attribute, Rater, Scaling and Enumeration. Hierarchically, construct definition comes first followed by the specification of object, attribute, and rater entities. Finally, scaling and enumeration are completed. See, Rossiter, J. R. (2002). The C-OAR-SE procedure for scale development in marketing. *International Journal of Research in Marketing*, 19, 305-335.

7 Athiyaman, A. (2018). Developing the US biomass residential heating market: insights from research. *International Journal of Social Ecology and Sustainable Development (IJSESD)*, 9(4), 18-44.

8 Haley, E., & Pittman, M. (2022). Remembering the FCB grid: Thinking, feeling, and involvement in the age of social media. *Journal of Advertising*, 51(3), 323-335.

Economics

A structural framework that is used to study income distribution in a geography is the Lorenz curve: a 2-dimensional graph of variables 'cumulative income' and 'families'. Lorenz curve provides a "bird's eye view" of income inequality among families in a geography; an operational definition of the construct 'financial hardship' would be "families at the lowest 10% of the income scale".

To demonstrate, Figure 1 shows the Lorenz curve for Illinois; data are from the ACS, 2017-2021 five-year estimates, PUMS data. The ACS variables are: HINCP: household income, past 12 months, and WGTP: housing unit weight⁹.

9 For purposes of this research, the terms family and household are used interchangeably.

Figure 1: Lorenz Curve for Illinois Families

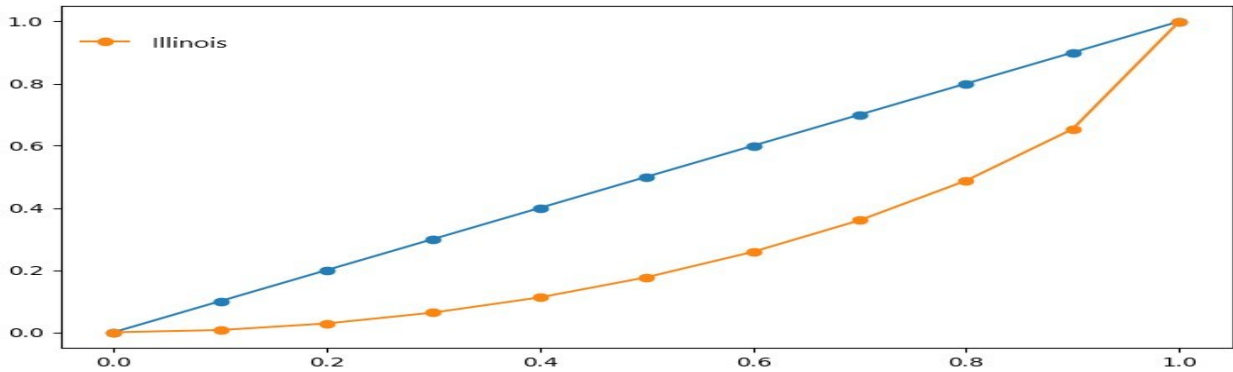


Table 1 shows the distribution of Illinois households' money income. Approximately 1.97mil households, 11% of

the total number, could be experiencing financial hardship; a profile of these households is in Table 2.

Table 1: Distribution of Illinois Households' Money Income

Households Ranked by In- come	Cumulative No. of House- holds	Income level (Low)	Income level (High)
1%	493,025	-15,200	1,500
2%	986,050	1,501	27,000
3%	1,479,075	27,001	40,000
5%	1,972,100	40,001	52,500
7%	2,465,126	52,501	67,400
8%	2,958,151	67,401	84,400
10%	3,451,176	84,401	105,000
13%	3,944,201	105,001	135,000
16%	4,437,225	135,001	190,000
35%	4,930,251	190,001	1,923,000

Table 2: Profile Analysis of Illinois Households in Financial Hardship, Central Tendency Statistics of Household and Head-of-Household Variables

Variable	Typical Value
Metro residence	86%
Number of people in the family	2
Household income	\$26,898
Income to poverty ratio	1.69
Race of the head of household	White, 66%
Female head of household	57%
Age of the head of household	54
Marital status: Never married	35%
Education: ≤ High School	47%
N	1,973,523

Source: ACS 2017-2021; PUMS

To address the question, how truthfully does the measure, “families at the lowest 10% of the income scale” represent the construct ‘financial hardship’, we use the Engel’s theorem; the theorem predicts that lower the income, the greater is the proportion of it spent on food¹⁰. So, we assess the extent to which food expenditure dominates the target families’ income. Table 3 shows the results of this exercise; the validity of the financial hardship measure is supported by empirical analysis.

¹⁰ The theorem is Engel’s law; see, Matsuyama, K. (2019). Engel’s law in the global economy: Demand-induced patterns of structural change, innovation, and trade. *Econometrica*, 87(2), 497-528.

Table 3: Predictive Validity of the Financial Hardship Measure: Ratio of Food Expenditure to Income

Household Income, Quartiles	n	Mean	Lower 95% CL for Mean	Upper 95% CL for Mean
≤ \$31,614	4795	9.3780251	2.0590045	16.6970458
> \$31,614 and ≤ \$65,500	4796	0.1327243	0.1298017	0.1356469
> \$65,500 and ≤ \$125,000	4835	0.0870024	0.0850688	0.088936
> \$125,000	4755	0.0560367	0.0546816	0.0573919

Note: CES, 2022; PUMS interview files; see, https://www.bls.gov/cex/pumd_data.htm. The variables used in the computation were food expenditure (the “FOODPQ” variable in CES) and household income (the “FINCBTXM” variable).

In summary, financial hardship is defined at a macro or group level using the structural framework of Lorenz curve; the operational definition of the construct is “families at the lowest 10% of the income scale”. The predictive validity of the construct is established by Engel’s theorem; households in financial hardship spend a large proportion of their income on food.

occur when resources are lacking. Appraisal-based theories recognize the salience of cognition (appraisal of the situation) and argue that the best proximal indicator of stress is personal appraisal. Figure 2 positions financial hardship within these theoretical frameworks.

Psychology

There are two types of theoretical frameworks that include financial hardship in their network of constructs: resource-based theories and appraisal-based theories of stress¹¹. Resource-based theories argue that the “fit” of personal, economic, and social resources with external demands determines stress. Resources are defined as those stimuli that are valued because they aid in achievement of life goals (Table 4). Thus, resources are necessary and stress will

¹¹ Hobfoll, S. E. (1988). *The ecology of stress*. Taylor & Francis.

Figure 2: Nomological Net of Financial Hardship

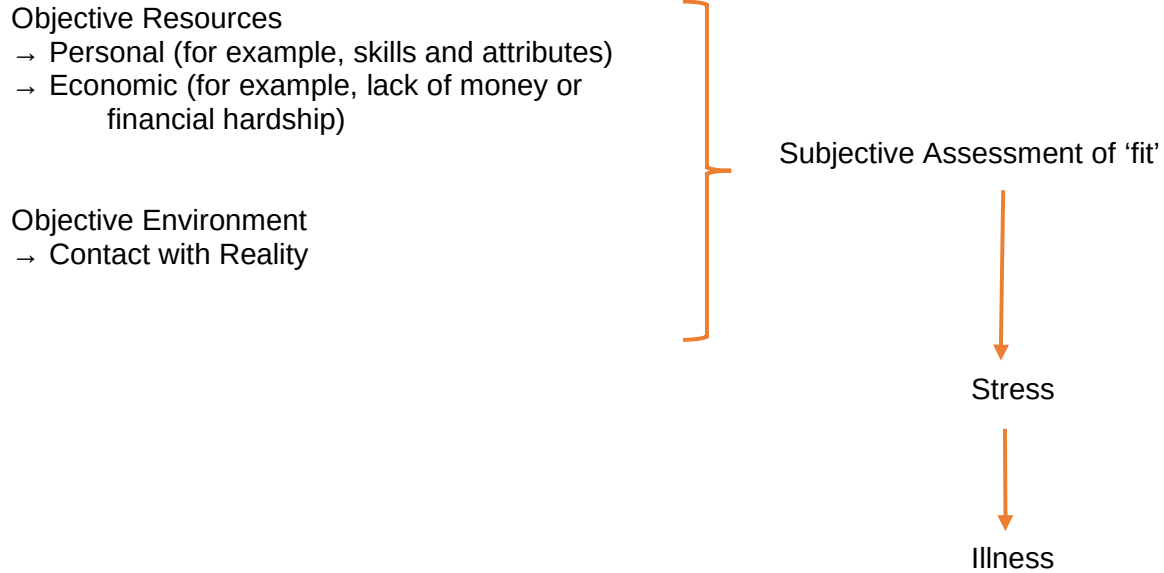


Table 4: List of Resources, Economic Facet¹²

Resources	Resources
Personal transportation (for example, car)	Adequate clothing
Necessary home appliances	Housing that suits my needs
Adequate food	Adequate home furnishings
Money for extras	Savings or emergency money
Adequate income	Adequate financial credit
Financial assets (property, stocks, etc.)	Financial stability
Money for transportation	Medical insurance
Retirement security (financial)	Money for advancement or self-improvement (education, starting a business, etc.)
Financial help if needed	

¹² Adapted from, Hobfoll, S. E. (2004). *Stress, culture, and community: The psychology and philosophy of stress*. Springer Science & Business Media.

In Figure 2, financial hardship is an appraisal, a judgment or evaluation about the fit between economic resources and external demand. The consumer of healthcare is the *object*; it is her financial hardship that is the focus of this research. The dimension of the object's evaluation is financial hardship, the *attribute*. It is abstract – raters' answers could differ if asked about its characteristics - and the attribute has components (for example, money for transportation, savings, etc.; see Table 4). Rater's responses to these components add up to form the attribute; *raters* would be a sample of healthcare consumers.

If we assume that resources listed in Table 4 is a census of components, then one measurement item is needed for each component. Research in marketing suggest that Likert response formats should not be used – they provide ambiguous scores¹³. To illustrate, consider the MCBS question “Dr. checks everything when examining”¹⁴, scored on a Likert-type scale. For this item, the Likert answer format “agree a lot” could mean that the physician always performs a comprehensive physical exam, for example, checks cranial nerves when examining the rater, or checks only the most common things such as lung sounds, a focused exam. A better

measurement practice would be to think about the response dimensions that characterize the attribute and build intensity of responses into the ‘leaves’ of the item. Continuing with the MCBS example, the response dimension for the “Dr. checks everything when examining” item should be probability, unipolar. For probability ratings, descriptors such as “unlikely” (0), “tossup” (.50), and “certain” (1.0) provide good interval-level measures¹⁵.

Table 5 lists financial hardship measures that can be sourced from the MCBS; the database does not contain all the components of the construct (resources) listed in Table 4, so technically it is not 100% content valid. However, a partially content valid financial hardship measure can be constructed from the MCBS and used to test Figure 2.

13 Baumgartner, H., & Steenkamp, J. B. E. (2001). Response styles in marketing research: A cross-national investigation. *Journal of marketing research*, 38(2), 143-156.

14 MCBS, 2020; public use file; see, <https://www.cms.gov/data-research/statistics-trends-and-reports/mcbs-public-use-file>.

15 Wallsten, T. S., Budescu, D. V., & Zwick, R. (1993). Comparing the calibration and coherence of numerical and verbal probability judgments. *Management Science*, 39(2), 176-190.

Table 5: Indicators of Financial Hardship in MCBS

Component	MCBS Variable, Variable Label, and Value Label
Personal transportation	HOU_TRANPROB: "Do You Have Access to Transportation" 2 = Yes; 1 = No
Adequate income	DEM_IPR_IND: "Income Poverty Ratio, Medicare Threshold" Five levels: 5 = $\leq 100\%$; 4 = $> 100\% - \leq 120\%$; 3 = $120\% - \leq 135\%$; 2 = $> 135\% - \leq 200\%$; 1 = $> 200\%$
Medical insurance	INS_D_MADV: "Enrolled in Medicare Advantage". 2 = Yes; 1 = No.

Note: MCBS have multiple indicators for the components, but for the purposes of this research the author chose one indicator for each available component; face validity was the criterion for the choice of indicator.

An index of the construct would be the summation of item scores; the financial hardship scale (Table 5) has a minimum score of 3 and a maximum of 9. It confirms to the psychological theory in Figure 2, perceptual assessments are used as items. The reliability or precision of the scale scores can be gleaned from confidence intervals of scale scores. The predictive validity of the scale can be assessed by correlating scale scores with 'stress' or depression scores.

Application of Figure 2, Psychological Theory, to the Metro / Nonmetro Populations

Microdata from the Medicare Beneficiary Survey (MCBS), 2020, were extracted to assess the reliability and the predictive validity of the financial hardship scale given in Table 5¹⁶. The MCBS is a longitudinal survey that polls a representative sample of Medicare beneficiaries aged 65 and over. Table 6 presents the respondents' profile – majority female, White, and lives in the metro.

¹⁶ See footnote 14.

Table 6: Typical Respondent, MCBS, 2020 (N = 57.6mil, weighted cases)

Variable	Type of Central Tendency	Statistics
Residential Location, Metro	Mode	82%
Gender, Female	Mode	55%
Age, 65-74	Mode	52%
Race, White	Mode	76%
Education, Higher than High School	Mode	58%

Metro and nonmetro differences in profile variables exist; the nonmetro is home to more men than the metro, has more

Medicare beneficiaries less than 65 years of age, and fewer minorities compared to the metro (Table 7).

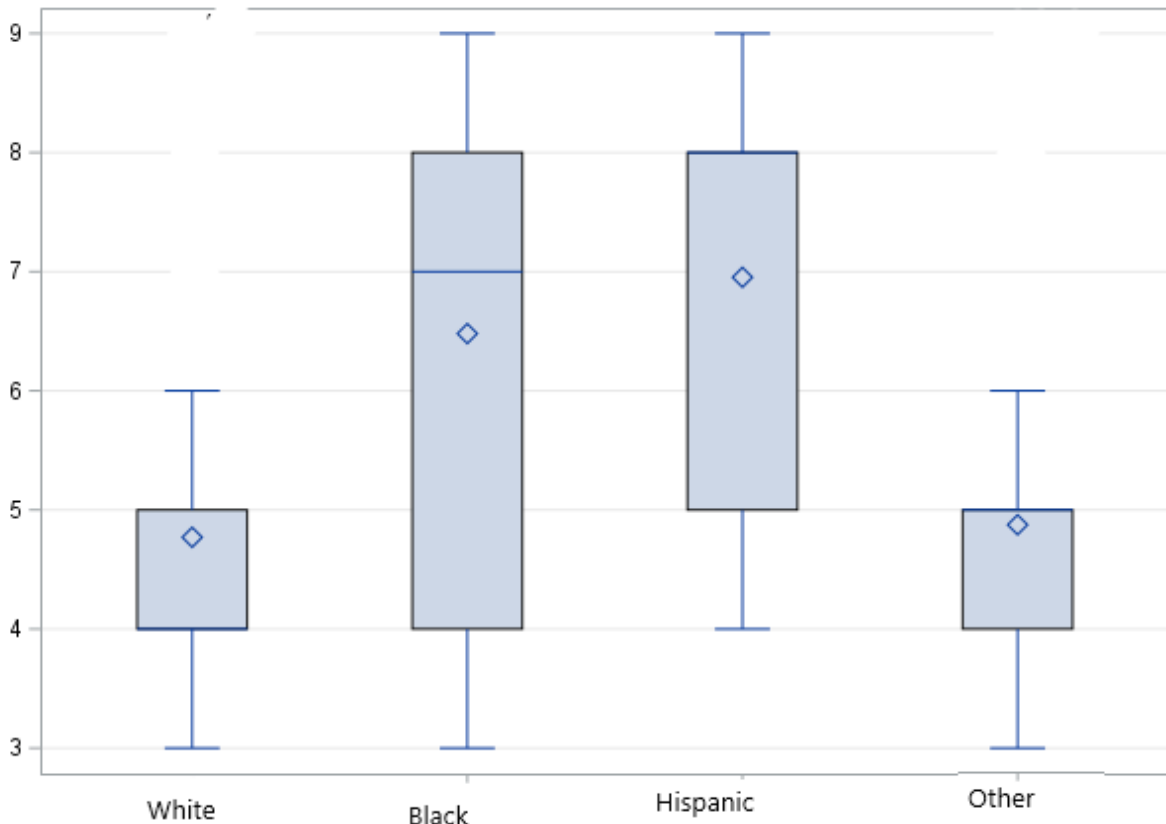
Table 7: Impact of Geography on Demographic Variables (N = 57.6mil, weighted cases)

Variable	Metro	Nonmetro	χ^2	<i>p</i>
Gender				
□ Male	45%	42%	19.263	<.01
□ Female	55%	58%		
Age				
□ LT 65	13%	16%	66,866	<.01
□ 65 – 74	52%	52%		
□ GTE 75	35%	33%		
Race				
□ White	74%	84%	64,047	<.01
□ Black	10%	7%		
□ Hispanic	10%	3%		
□ Other	6%	6%		
Education				
□ LT High School	11%	15%	98,652	<.01
□ High School	28%	41%		
□ GT High School	61%	44%		
Income				
□ LT \$25,000	29%	36%	22,629	<.01
□ GTE \$25,000	71%	64%		

The financial hardship scale scores could range from a low of “3” to a high of “9”; the higher the score, the larger is financial hardship. The mean scale score for the population, metro and nonmetro, is 4.95 (95% CI: 4.82 – 5.07). Differences in

mean scale scores exist among the races (Figure 3); compared to the Whites, both Blacks and Hispanics register higher financial hardship scores (Table 8).

Figure 3: Mean Differences in Financial Hardship among the Races



Note: Mean scale scores for the races are: Whites: 4.77; Blacks: 6.48; Hispanics: 6.95, and Others: 4.87.

Table 8: Mean Differences in Financial Hardship Scores: Scheffe’s Multiple Comparison Tests

Race Comparison	Differences Between Means	Simultaneous 95% Confidence Limits
Whites vs Blacks	-1.71	-2.51 to -0.90*
Whites vs Hispanics	-2.18	-3.05 to -1.31*
Whites vs Others (for example Asians),	-0.10	-0.92 to 0.71

Note: * significant at the <.05 level.

Finally, the predictive validity of the financial hardship score was assessed using correlational procedures; the scale score was correlated with a self-reported depression score¹⁷. The result, $r = .14$, $p < .01$, suggests that the success rate of prediction for depression given financial hardship is 57%¹⁸.

In summary, the MCBS-grounded financial hardship scale, although low in content validity, helps predict at above-chance level depression among people who experience financial hardship. While the severity of financial hardship doesn't differ between metro and nonmetro residents, differences in financial hardship exist among races; Hispanics and Blacks suffer the most.

Sociology

The fundamental-cause theory offers a functionalist perspective to the study of financial hardship; the theory attempts to explain the empirical generalization that socioeconomic status (SES) is inversely associated with mortality¹⁹. The theory is

built on the reasoning that a fundamental social cause of health inequalities influences many diseases and outcomes and it involves access to resources that that can be deployed to avoid risks or to minimize the consequences of disease.

Key resources that can be used to avoid risks, or minimize the consequences of disease, include knowledge, money, power, prestige, and social connections. These resources operate at both the individual and the contextual levels. For example, the wealthy can afford a host of health-enhancing products. Similarly, they can live in a neighborhood where pollutants, for example, traffic noise, and crime are kept at a minimum and the best healthcare facilities, parks, and food stores are located nearby.

Recently, the theory has been extended to include structural conditions such as racism²⁰. Figure 4 shows the data generating process: the 'structural condition' is a common cause of both resources and health inequalities; structural condition is a confounding covariate. In this scenario, race, for example, would cause differential endowment of resources; race would also impact one's health.

17 The MCBS variable that assessed depression was: HLT_OCDEPRSS: has the respondent been depressed, ever.

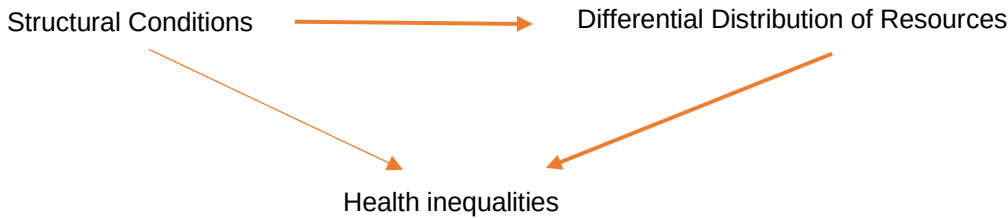
18 Based on r-based binomial effect size computations; see, Rosenthal, R., Rosnow, R. L., & Rubin, D. B. (2000). *Contrasts and effect sizes in behavioral research: A correlational approach*. Cambridge University Press.

19 Link, B. G., & Phelan, J. (1995). Social conditions as fundamental causes of disease. *Journal of*

health and social behavior, 80-94.

20 Williams, D. R., & Collins, C. (2016). Racial residential segregation: a fundamental cause of racial disparities in health. *Public health reports*.

Figure 4: Fundamental-Cause Theory, Causal Paths



Note: The direct path from 'structural conditions' to 'health inequalities' is theorized to be weaker than the path through the mediating variable.

The construct of interest, financial hardship, is a component of the resources facet in Figure 4. The National Health Interview Survey²¹, 2022, contains data that could be used to construct measures of 'resources', mainly financial hardship, and test the theory.

of the respondents, for both the metro and the nonmetro. Compared to the metro, the nonmetro residents are less educated, older, poorer, and suffer more from chronic illness such as cancer.

For the causal order shown in Figure 4, structural condition is assessed using the NHIS 'race' variable, HISPALLP_A. Differential distribution of resources is assessed using the NHIS variable, POVRATTC_A, family poverty ratio; this is also the operational definition for financial hardship. Health inequalities were assessed using multiple indicators: ever been told you had COPD, emphysema, or chronic bronchitis; ever had arthritis; ever had dementia; ever had anxiety disorder; ever had depression; ever been told you had angina; ever had diabetes; ever been told you had coronary heart disease; ever had Chronic Fatigue Syndrome; ever been told you had cancer.

The NHIS, 2022, had 27,651 observations, weighted equivalent of 255.37mil responses. Table 9 is a profile

²¹ https://www.cdc.gov/nchs/nhis/about_nhis.htm.

Table 9: Respondents' Profile, NHIS, 2022

Variable	Metro	Nonmetro	χ^2	p
Gender:				
□ Male	48%	50%	29,519	<.01
□ Female	52%	50%		
Race:				
□ White	59%	80%	7,798,80	<.01
□ Black	13%	8%		
□ Asian	7%	1%		
□ Hispanic	19%	6%		
□ Other	2%	5%		
Education:				
□ Grade 1-11	8%	11%	4,974,49	<.01
□ 12th grade, no diploma	2%	2%		
□ GED or equivalent	2%	4%		
□ High School Graduate	24%	32%		
□ Some college, no degree	16%	16%		
□ Associate degree: vocational program	3%	5%		
□ Associate degree: academic program	9%	11%		
□ Bachelor's degree (Example: BA)	22%	12%		
□ Master's degree (Example: MA)	10%	5%		
□ Professional School or Doctoral degree (Example: MD, PhD)	4%	1%		
Has / had cancer	9%	11%	135.765	<.01
Median Age	53	59		
Median Income to Poverty Ratio	3.68	2.58		
N, Weighted	220,300,000	35,342,254		

To test the directed acyclic graph in Figure 4, the indicator of structural conditions, race, was recoded as “Whites = 2” and “Non-Whites = 1”; the health outcomes indicators, all ten binary variables, were each recoded to reflect a higher value for the presence of disease (2); absence of disease was

assigned the value “1”. The sum of all 10 binary indicators of health outcomes was the criterion, an index of health. As mentioned earlier, financial resources were measured using the variable “income-to-poverty ratio”.

Figure 5 and Table 10 show the results of the causal analysis. One's race has both direct and indirect effects on one's health, all positive, meaning that the Whites, who live in large numbers in the nonmetro,

suffer from poor health. The impact of one's financial resources on one's health is -0.19; it implies that financial resources help one achieve and maintain good health.

Figure 5: Results of Path Analysis

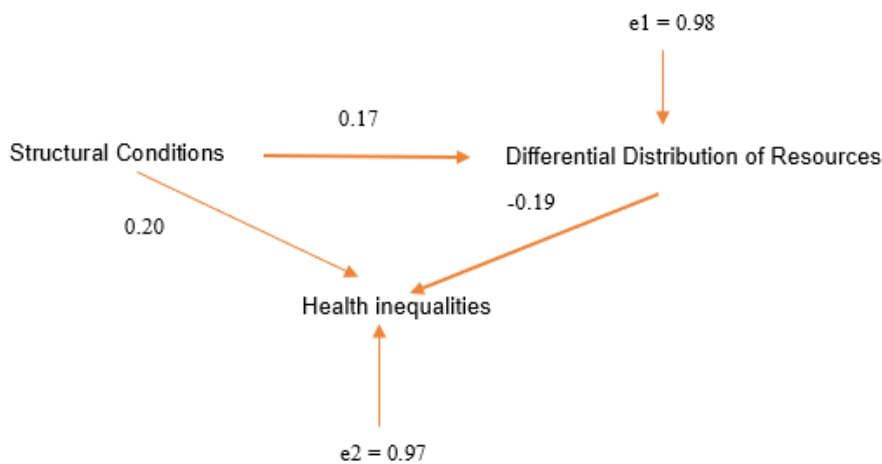


Table 10: Maximum Likelihood Estimates of Effects

		Total	Direct	Indirect
Resources	Effect	-0.19	-0.19	0
	Std. Error	.0058	.005	
	t Stat	-32.94	-32.94	
	p	<.01	<.01	
Race	Effect	0.17	0.20	-0.03
	Std. Error	.005	.005	.001
	t Stat	28.41	34.54	-22.18
	p	<.01	<.01	<.01

Summary and Conclusion

Healthcare researchers are attempting to understand how healthcare consumers, both purchasers and users of healthcare, experience and cope with financial hardship. Researchers, guided by theories in economics, psychology, and sociology, have constructed measures of financial hardship. This paper shows how the construct should be measured based on its role in the theory.

In **economics**, a structural framework that is used to study income distribution in a geography is the Lorenz curve. It provides a “bird’s eye view” of income inequality among families in a geography; an operational definition of the construct ‘financial hardship’ would be “families at the lowest 10% of the income scale”. Application of this measure for Illinois suggests that approximately 1.97mil households, 11% of the total number, could be experiencing financial hardship.

In **psychological sciences**, there are two types of theoretical frameworks that include financial hardship in their network of constructs: resource-based theories and appraisal-based theories of stress. The argument of these theories is that financial hardship is an appraisal, a judgment or evaluation about the fit between economic resources and external demand. The consumer of healthcare is the *object* of the construct; the *attribute* is financial hardship. It is abstract – raters’ answers could differ if asked about its characteristics - and the attribute has components (for example, money for

transportation, savings, etc.). An index of financial hardship was constructed using measures from the Medicare Beneficiary Survey, 2020, and metro / nonmetro differences in financial hardship were studied. Results show that differences in mean scale scores exist among the races; compared to the Whites, both Blacks and Hispanics register higher financial hardship scores.

In **sociology**, the fundamental-cause theory offers a functionalist perspective to the study of financial hardship. The theory is built on the reasoning that a fundamental social cause of health inequalities influences many diseases and outcomes and it involves access to resources that that can be deployed to avoid risks or to minimize the consequences of disease. An empirical test of the theory using National Health Interview Survey data shows that one’s race has both direct and indirect effects on one’s health, all positive, meaning that the Whites, who live in large numbers in the nonmetro, have poor health.

There are two takeaways from this research: (i) it is possible to assess financial hardship of the population using published data, specifically using the objective indicator “income-poverty ratio”, and (ii) perceptual measures of financial hardship, for example, the MCBS measures, lack content validity – the semantic correspondence of the measures with the construct’s definition is woefully inadequate.

References

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