Chronic Inequities

Measuring Disease Cost Burden Among Older Adults in the U.S.

A Health and Retirement Study Analysis

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In a recent series of research briefs, we segmented a nationally representative sample of older Americans into quartiles based on net wealth to assess the profile of individuals currently experiencing or at high risk of economic insecurity.[1,2,3,4] The findings shed light on how prevalent economic insecurity is among most older adults in the U.S. as well as the stark racial/ethnic and gender disparities in financial vulnerability. These analyses also uncovered the role that health plays in economic insecurity. Individuals with multiple chronic conditions, those who assessed their health status to be poor, and people with behavioral health or cognitive issues were most likely to be economically insecure**.**

These prior analyses raised a question: Is there an efficient and accurate way to characterize the population in terms of overall health status? Typically, population health is described by multiple measures that are not homogeneous. For example, how do we compare the health status of a group characterized by obesity with a group that has diabetes? Is one group less healthy than the other group, and if so, is there a way to measure the difference? An overall measure of disease burden would allow us to segment the older population into health risk quartiles. Such a measure would enable a deeper understanding of the association between health risk, health and economic trajectories during old age, and overall economic security among older adults.

Purpose

The purpose of this analysis was to develop a method to identify and classify older adults in terms of their overall health risk based on a combined measure of health indicators. Existing research characterizing health status tends to rely on the use of one or more of the following approaches to determine wellbeing:[5] a single subjective measure of one's overall health (i.e. self-reported health ranging from excellent to poor); a focused analysis of one specific health condition (e.g. heart disease); and/or simple counts of a person's total chronic conditions. The approach of counting chronic conditions comes the closest to comprehensively measuring overall health, because individuals with greater numbers of chronic conditions tend to be among the sickest in the population. Despite being a reliable indicator of general

[1] Popham, L. Silberman, S. Tavares, J. and Cohen, M. (2021). Food Insecurity among Older Adults and the Role of the Supplemental Nutrition Program (SNAP) Lessons from the Great Recession of 2008. National Council on Aging. Issue Brief. May. **https://assets-us-01.kc-usercontent.com/ffacfe7d-10b6-0083-2632-604077fd4eca/32b64f77-3964-4707-9ee1-b1a0555b9711/2021-SNAP_Food%20Insecurity%20Brief%201_FINAL.pdf**

[2] Cohen, M., Tavares, J. Popham, L. and Silberman, S. (2020). Economic Insecurity for Older Adults in the Presence of the COVID-19 Pandemic: What can we learn from the most recent major economic downturn? National Council on Aging. **https://d2mkcg26uvg1cz.cloudfront.net/wp-content/uploads/2020-C19-DG06_COVID-19-Issue-Brief_4-14.pdf**

[3] Popham, L. Silberman, S. Tavares, J. and Cohen, M. (2020). The 80% -- The True Scope of Financial Insecurity in Retirement. Research Brief. National Council on Aging, Washington, DC May. **https://www.ncoa.org/economic-security/money-management/the-80-addressing-the-nations-retirement-crisis/**

[4] Cohen, M., Tavares, J. Popham, L. and Silberman, S. (2020). Economic Insecurity for Older Adults in the Presence of the COVID-19 Pandemic: What can we learn from the most recent major economic downturn? National Council on Aging. **https://d2mkcg26uvg1cz.cloudfront.net/wp-content/uploads/2020-C19-DG06_COVID-19-Issue-Brief_4-14.pdf**

[5] Diederichs, C., Berger, K., Dorothee, B. & Bartels (2011). The Measurement of Multiple Chronic Diseases—A Systematic Review on Existing Multimorbidity Indices, The Journals of Gerontology, 66A(3), 301–311. **https://doi.org/10.1093/gerona/glq208**

health, this measure treats all conditions equally, no matter the severity or impact of each specific condition or disease. For example, heart disease and hypertension are weighed equally even though heart disease has both a higher physical burden and mortality rate, and it often requires far more intervention by the health system.

We sought to develop a better way to assess disease burden. To do this, we needed a common way to value the burden associated with specific chronic conditions. From the point of view of both the individual and the health system, the overall costs associated with a condition—including the costs of providing care to address the issue as well as the opportunity costs associated with time away from work or forced retirement—represent this consistent measure. At a high level, one can differentially weigh the impact of the most common chronic conditions among older adults by looking at their total costs. This creates an overall health measure that can more precisely identify and segment individuals into various risk categories by level of disease burden.

Method

We analyzed data from the 2018 wave of the nationally representative Health and Retirement Study (HRS) for those 60 years of age and older (N=11,820). The HRS provides comprehensive information on various demographic, health, and economic variables. More specifically, the HRS contains self-reported data on whether an individual has any of these nine chronic conditions: hypertension, diabetes, cancer, lung disease, heart disease, stroke, arthritis, Alzheimer's disease/dementia, and depression.

According to the Centers for Disease Control (2018),[6] six of these chronic conditions (diabetes, cancer, lung disease, heart disease, stroke, and Alzheimer's disease/dementia) are among the top 10 leading causes of death among older adults across race/ethnic groups. Of the other three chronic conditions, hypertension and arthritis are among the top 10 most prevalent diseases in later life across race/ethnic groups, and depression is the most common mental health problem among older adults.[7] By focusing on these conditions, we can classify the vast majority of the population because most people will have at least one of these conditions over their lives.

In order to weight the impact levels of these chronic conditions and combine them into a single quantitative measure, we focused on the yearly per-person cost associated with each condition provided by the Milken Institute (2018),[8] which estimated lost wage costs (i.e. from number of missed work days due to illness) and health treatment costs for each illness (see Table 1). The Milken Institute cost estimates were provided for 2016, so we adjusted the cost estimates to reflect 2018 values by accounting for inflation and medical cost changes reflected in the Consumer Price Index (2018).[9] Then, using the 2018 HRS data, we created a disease cost burden profile for each participant by assigning the adjusted Milken Institute estimates to the corresponding HRS chronic conditions. For individuals with multiple chronic conditions, we summed the costs for all of their conditions. To maintain cost accuracy, we only applied lost wage costs of chronic conditions to participants who were still in the workforce (i.e. not fully retired) or who reported they had retired because their health issues prevented them from working.

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[6] Centers for Disease Control (2018). Older American Health. **https://www.cdc.gov/nchs/fastats/older-american-health.htm**

[7] **https://www.cdc.gov/aging/pdf/mental_health.pdf**

[8] Milken Institute (2018). The Cost of Chronic Disease in the U.S. **https://milkeninstitute.org/sites/default/files/reports-pdf/ChronicDiseases-HighRes-FINAL.pdf**

[9] **https://www.bls.gov/news.release/archives/cpi_01112019.pdf**

TABLE 1. 2018 Estimated Yearly Per Person Costs of Chronic Disease in the U.S.			
Chronic Condition	2018 Yearly Average Total Per Person Cost (Treatment + Lost Wage Costs)	2018 Yearly Average Per Person Treatment Cost	2018 Yearly Average Per Person Lost Wage Cost
Alzheimer's / Dementia	$48,701	$33,746	$14,955
Cancer	$30,028	$17,697	$12,331
Diabetes	$20,137	$7,251	$12,886
Depression	$16,967	$6,548	$10,419
Hypertension	$13,531	$860	$12,671
Stroke	$12,303	$6,070	$6,233
Heart Disease	$12,063	$4,416	$7,647
Lung Disease	$10,858	$6,254	$4,604
Arthritis	$7,384	$2,115	$5,268

Table 2 shows the 2018 prevalence of each chronic condition for those aged 60 and older in the HRS (all those with a condition automatically have the treatment cost burden associated with it) and the percentage of individuals who have lost wage cost burden in addition to treatment costs for each illness. As noted above, hypertension and arthritis are among the most prevalent chronic conditions for older adults, impacting about two thirds of the sample at 69% and 68% respectively. Heart disease and diabetes are the next most prevalent chronic conditions, both impacting approximately one third of the sample. Alzheimer's disease/dementia is the least prevalent chronic condition at approximately 3%.

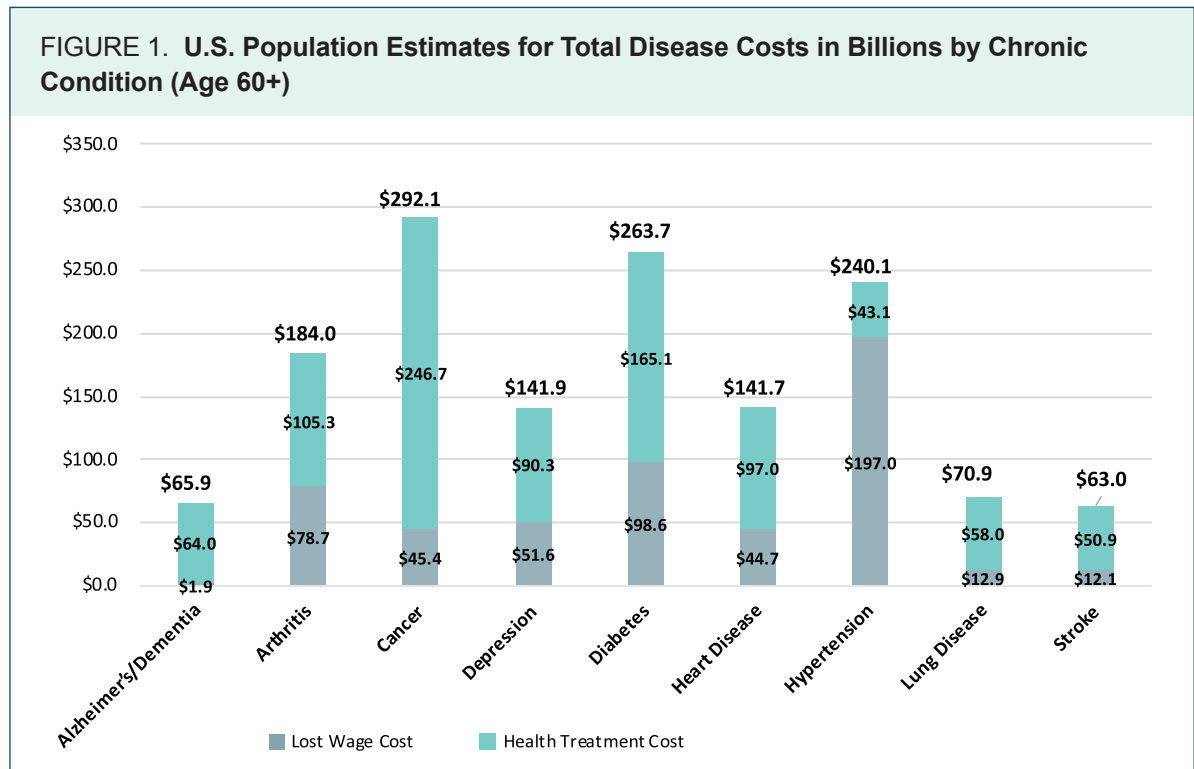| TABLE 2. 2018 Prevalence of Chronic Diseases for Those 60 and Older in the HRS		
Chronic Condition	Prevalence (% with Health Treatment Burden)	% with Condition who have Additional Lost Wage Burden
Hypertension	68.7%	31.0%
Arthritis	68.2%	30.0%
Diabetes	31.2%	33.6%
Heart Disease	30.1%	26.6%
Cancer	19.1%	26.4%
Depression	18.9%	35.9%
Lung Disease	12.7%	30.3%
Stroke	11.5%	23.1%
Alzheimer's / Dementia	2.6%	6.7%

With the exception of Alzheimer's/dementia, at least one quarter to one third of individuals in the sample who have any of the listed chronic conditions are incurring lost wage costs due to illness.

In order to better understand the relationship between this disease burden measure and the socio-demographic characteristics of individuals, we segmented the sample into quartiles based on their total yearly disease cost burden. Quartile 1 represents the lowest 25% of the sample in terms of disease cost burden, followed by the 25–50% of the sample in Quartile 2, the 50–75% of the sample in Quartile 3, and the 75–100% of the sample in Quartile 4. We then measured the following demographic, health, and economic characteristics for each disease burden quartile:

- **Demographic measures:** age, gender, race/ethnicity, marital status, education, live alone status, residence type
- **Health measures:** chronic conditions count, self-reported health, activities of daily living limitations (ADLs), instrumental activities of daily living limitations (IADLs), cognitive impairment, and out-of-pocket medical expenditures
- **Economic measures:** household income, net total wealth, net financial assets (non-property), value of primary residence, net value of primary residence, retirement status, federal poverty level status

Findings

Figure 1 shows U.S. population estimates of total annual cost burden by each chronic condition for the 73 million Americans age 60 and older[10] based on the disease prevalence observed in the 2018 HRS sample (Table 2). Cancer had the highest yearly cost burden for the sample at $292.1 billion, with 84% of the total costs being treatment costs. Diabetes ($263.7 billion) and hypertension ($240.1 billion) had the next highest yearly costs, with hypertension having the highest percentage of lost wage costs of

FIGURE 1. **U.S. Population Estimates for Total Disease Costs in Billions by Chronic Condition (Age 60+)**

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10 **https://acl.gov/sites/default/files/Aging%20and%20Disability%20in%20America/2019ProfileOlderAmerica ns508.pdf**

any chronic condition at 82%. Stroke had the lowest yearly cost burden at $63 billion and was the second least prevalent condition in the sample behind Alzheimer's/dementia (Table 2).

Figure 2 shows the distribution of the total number of chronic conditions reported for the 2018 sample (age 60 and older). Nearly half the sample has either two (26.1%) or three (24.4%) chronic conditions. About a quarter of the sample has no conditions (5.1%) or only one (16.4%) chronic condition, whereas the other quarter of the sample has four (16.1%) or five or more (12.1%) chronic conditions.

FIGURE 2. **2018 Sample (Age 60+) Distribution of Total Number of Reported Chronic Conditions**
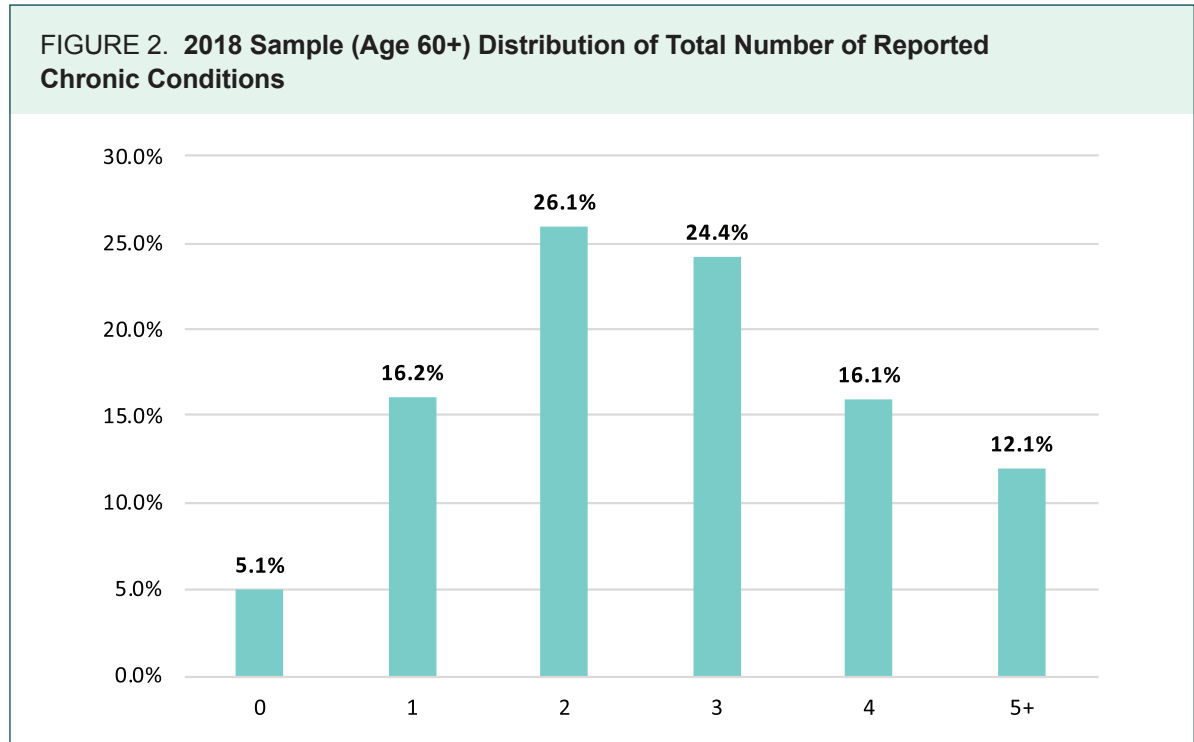

Table 3 presents demographic, health, and economic characteristic for the age 60 and older sample by the total yearly disease cost burden quartiles. In this case, Quartile 1 represents the 25% of the sample with the lowest disease cost burden, less than $6,930. In contrast, Quartile 4 represents the 25% of the sample with the highest disease cost burden, exceeding $25,808.

As would be expected, individuals with the highest disease cost burden (Quartile 4) are older (mean age of 78.9) and in the worst overall health with the highest reported fair/poor heath (49.9%), average chronic conditions (4.8), average ADLs (0.8) and IADLs (1.7), and cognitive impairment (16.3%) compared to those in the other quartiles. These health differences are particularly stark when comparing Quartile 1 to Quartile 4. People in Quartile 4 experience more than 16 times the rate of cognitive impairment than those in Quartile 1. People in Quartile 4 pay the highest average out-of-pocket health care costs at $4,558, nearly double that of Quartile 1 .

The analysis shows that financial assets decrease as disease cost burden increases. Those with the highest disease cost burden (Quartile 4) have the lowest level of financial assets across economic measures, with nearly half the financial assets of those with the lowest disease cost burden (Quartile 1). Further, the poverty rate increases as disease cost burden increases. Those in Quartile 4 have the highest poverty rate of any quartile at 14.3%, which is double that of Quartile 1.

Demographic differences are significant between the groups. Women, racial/ethnic minorities, people who lost a spouse, and people with less education are disproportionately represented in Quartile 4, with the highest disease cost burden. In contrast, Quartile 1 (with the lowest disease cost burden) has the highest percentages of men, non-Hispanic whites, and married individuals as well as those with the highest mean education.

TABLE 3. Sample Characteristics by Total Yearly Disease Cost Burden Quartiles (Age 60+)

2018 Sample Characteristics	Quartile 1 Lowest Burden	Quartile 2 Moderate Burden	Quartile 3 High Burden	Quartile 4 Highest Burden
AGE				
Mean	76.2*	77.3	77.6	78.9*
Age 60 to 64	0.6%	0.7%	0.6%	1.8%*
Age 65 to 74	43.9%*	35.4%*	34.7%*	30.3%*
Age 75 to 84	41.9%*	47.9%*	48.0%*	49.6%*
Age 85+	13.6%*	16.0%*	16.8%*	18.3%*
GENDER				
Female	54.6%*	61.5%*	63.0%*	67.4%*
Male	45.4%*	38.5%*	37.0%*	32.6%*
RACE/ETHNICITY				
Non-Hispanic White	75.2%*	69.0%*	65.0%*	61.1%*
Non-Hispanic Black	12.6%*	16.1%*	18.2%*	20.4%*
Hispanic	9.8%*	12.6%*	14.6%*	15.1%*
Non-Hispanic Other	2.4%	2.3%	2.2%	3.4%*
MARITAL STATUS				
Married	55.4%*	48.0%*	46.9%*	45.1%*
Divorced/Separated	13.2%	15.0%	15.7%	14.4%
Widowed	27.8%*	33.0%*	34.2%*	36.3%*
Never Married	3.6%	3.6%	3.2%	4.2%
EDUCATION				
Years (Mean)	13.4*	12.8*	12.2*	11.9*
ECONOMIC				
Household Income (Mean)	$79,794*	$59,045*	$53,283*	$47,954*
Net Total Wealth (Mean)	$985,922*	$633,345*	$403,132*	$389,459*
Net Financial Assets (Mean)	$598,030*	$287,534*	$194,749*	$152,715*
Value Primary Residence (Mean)	$296,422*	$213,540*	$193,048*	$152,170*
Net Value Primary Residence (Mean)	$267,422*	$181,709*	$166,486*	$142,632*

TABLE 3. Sample Characteristics by Total Yearly Disease Cost Burden Quartiles (Age 60+)

2018 Sample Characteristics	Quartile 1 Lowest Burden	Quartile 2 Moderate Burden	Quartile 3 High Burden	Quartile 4 Highest Burden
LIVING STATUS				
Retired	84.6%*	79.4%*	77.4%*	67.0%*
Below Federal Poverty Level (FPL)	7.4%*	9.7%*	13.1%*	14.3%*
Lives Alone	25.1%*	30.0%*	31.9%*	35.9%*
HEALTH				
Chronic Conditions (Mean)	1.4*	2.5*	3.3*	4.8*
Fair/Poor Health	10.3%*	22.9%*	38.2%*	49.9%*
ADLs (Mean)	0.1*	0.3*	0.5*	0.8*
IADLs (Mean)	0.3*	0.7*	1.2*	1.7*
Cognitive Impairment	0.0%	0.1%	0.5%*	16.5%*
Out-of-Pocket Medical Expenses (Mean)	$2,543*	$3,144*	$3,654*	$4,558*
RESIDENCE TYPE				
Urban	53.3%*	49.1%*	46.1%*	42.5%*
Suburban	22.2%*	24.3%*	26.0%*	27.6%*
Rural	24.5%*	26.6%*	27.9%*	29.9%*

*significant t-test difference at $p < 0.05$.

Because health treatment costs for chronic conditions are primarily paid through health insurance, we wanted to specifically analyze lost wage cost burden (which reflects lost economic productivity) among the older adult population; these costs are not covered by insurance. Table 4 presents demographic, health, and economic characteristics for the age 60 and older sample by yearly lost wage cost burden quartiles. Only 33.9% of the sample met the criteria for incurring lost wage cost burden, only those who could incur lost wages due to illness were included in the quartile analysis with the characteristics of those who only incurred treatment costs (66.1% of the sample) shown for comparison purposes. Quartile 1 represents the lowest 25% with lost wage cost burden less than $12,886. Quartile 4's lost wage cost burden exceeds $31,819.

As shown in Table 4, those with the highest lost wage cost burden (Quartile 4) were in the worst overall health with a staggering 69.9% reporting fair/poor health as well the highest average chronic conditions (4.3), average ADLs (0.9) and IADLs (2.1), nearly four times as much as those in Quartile 1. Those in Quartile 4 pay the highest average out-of-pocket health care costs at $4,312, more than twice that of Quartile 1.

Once again, there are significant gender and racial/ethnic disparities between groups with women and racial/ethnic minorities being disproportionately represented among older adults with the highest lost wage cost burden (Quartile 4). In contrast, Quartile 1 (with lowest lost wage cost burden) has the highest percentages of men and non-Hispanic whites.

TABLE 4. Sample Characteristics by Yearly Lost Wage Cost Burden Quartiles (Age 60+)					
2018 Sample Characteristics	Health Treatment Burden Only	Quartile 1 Lowest Burden	Quartile 2 Moderate Burden	Quartile 3 High Burden	Quartile 4 Highest Burden
AGE					
Mean	75.8*	65.4*	66.9	67.1	67.5*
Age 60 to 64	11.4%*	54.1%*	42.7%*	40.6%*	38.3%*
Age 65 to 74	31.8%*	36.8%*	43.6%*	46.6%*	49.9%*
Age 75 to 84	40.2%*	8.9%*	12.2%*	11.0%*	9.7%*
Age 85+	16.6%*	0.2%*	1.5%*	1.8%*	2.1%*
GENDER					
Female	38.3%*	51.8%*	54.1%*	57.6%*	60.0%*
Male	61.7%*	48.1%*	45.9%*	42.4%*	40.0%*
RACE / ETHNICITY					
Non-Hispanic White	67.1%*	60.7%*	59.7%*	48.4%*	44.3%*
Non-Hispanic Black	17.5%*	19.8%*	21.1%*	25.5%*	29.5%*
Hispanic	12.6%*	15.4%*	15.8%*	22.1%*	22.4%*
Non-Hispanic Other	2.8%*	4.1%*	3.4%	3.7%	3.8%
MARITAL STATUS					
Married	50.6%*	61.9%*	56.7%*	54.8%*	46.0%*
Divorced / Separated	15.1%*	20.9%*	23.9%*	24.6%*	28.0%*
Widowed	29.70%*	9.8%*	12.5%*	14.3%*	16.9%*
Never Married	4.6%*	7.4%*	6.9%	6.3%	9.1%*
EDUCATION					
Years (Mean)	12.9	13.5*	13.2*	12.9	12.5

TABLE 4. **Sample Characteristics by Yearly Lost Wage Cost Burden Quartiles (Age 60+)**					
2018 Sample Characteristics	**Health Treatment Burden Only**	**Quartile 1 Lowest Burden**	**Quartile 2 Moderate Burden**	**Quartile 3 High Burden**	**Quartile 4 Highest Burden**
FINANCES					
Household Income (Mean)	$82,257*	$108,421*	$94,730*	$80,753*	$61,888*
Net Total Wealth (Mean)	$650,363*	$608,858*	$591,240*	$526,411*	$248,803*
Net Financial Assets (Mean)	$330,133*	$243,070*	$224,459*	$196,364*	$78,342*
Value Primary Residence (Mean)	$210,108*	$253,410*	$224,903*	$221,888*	$127,542*
Net Value Primary Residence (Mean)	$183,805*	$177,194*	$172,892*	$170,445*	$98,119*
LIVING STATUS					
Retired	84.3%*	11.3%*	22.1%*	30.2%*	56.4%*
Below Federal Poverty Level (FPL)	10.6%*	7.7%*	10.1%*	12.2%*	21.1%*
Lives Alone	23.3%*	16.3%*	18.6%*	21.2%*	34.5%*
MEDICAL					
Chronic Conditions (Mean)	2.8*	1.1*	2.0*	2.8*	4.3*
Fair/Poor Health	27.5%*	15.1%*	26.2%*	39.5%*	69.9%*
ADLs (Mean)	0.5*	0.1*	0.2*	0.4*	0.9*
IADLs (Mean)	1.5*	0.3*	0.6*	1.1*	2.1*
Cognitive Impairment	2.3%*	0.0%*	0.2%*	0.3%*	1.5%*
Out-of-Pocket Medical Expenses (Mean)	$3,750*	$2,043 *	$2,636 *	$2,857*	$4,312*
RESIDENCE TYPE					
Urban	52.4%*	56.3%*	52.2%*	50.1%*	49.3%*
Suburban	22.9%*	20.5%*	22.7%*	24.1%*	24.7%*
Rural	24.7%*	23.2%*	25.1%*	25.8%*	26.0%*

*significant t-test difference at $p < 0.05$.

As was observed in the total disease cost burden analysis (Table 3), financial assets (Table 4) decrease as lost wage cost burden increases. Those with the highest lost wage cost burden have the lowest level of financial assets across economic measures. The poverty rate also increases as lost wage cost burden increases. Quartile 4 has the highest poverty rate at 21%, triple that of Quartile 1 and double that of those who only incurred treatment costs. Given that lost wage costs reflect lost economic productivity, this pattern is not surprising.

Conclusions

The approach of estimating the cost burden of poor health and then analyzing it by segmenting the population into quartiles is a novel and valuable way to identify at-risk groups of older adults. Creating a health status index with individual components that are weighted by a common factor—the treatment costs and lost wage costs associated with the conditions themselves expressed in dollars—allows us to conduct more granular analyses of disease burden groups.

Our results are in line with those in the existing health status literature. Older adults who have more chronic conditions tend to have greater physical limitations[11] as well as fewer financial resources to cope with higher health care costs.[12,13] In addition, our findings highlight and further support other findings related to gender and racial inequalities that are prevalent in our health care system. By segmenting the sample into quartiles based on disease cost burden, we can examine more systematically the demographics, health, and economic status of individuals with varying levels of disease cost burden, and we can begin to track how disease burdens change over time.

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[11] Ralph, N. L., Mielenz, T. J., Parton, H., Flatley, A. M., & Thorpe, L. E. (2013). Multiple chronic conditions and limitations in activities of daily living in a community-based sample of older adults in New York City, 2009. Preventing chronic disease, 10, E199. **https://doi.org/10.5888/pcd10.130159**

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[13] Tucker-Seeley, R.D., Li, Y., Sorensen, G. et al. Lifecourse socioeconomic circumstances and multimorbidity among older adults. BMC Public Health 11, 313 (2011). **https://doi.org/10.1186/1471-2458-11-313**

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