Prevalence and Predictors of Home Health Care Workers' General, Physical, and Mental Health: Findings From the 2014–2018 Behavioral Risk Factor Surveillance System

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Objectives. To determine the prevalence and predictors of US home health care workers' (HHWs') self-reported general, physical, and mental health.

Methods. Using the 2014–2018 Behavioral Risk Factor Surveillance System, we analyzed the characteristics and health of 2987 HHWs (weighted n = 659 000) compared with 2 similar low-wage worker groups (health care aides and health care support workers, not working in the home). We conducted multivariable logistic regression to determine which characteristics predicted HHWs' health.

Results. Overall, 26.6% of HHWs had fair or poor general health, 14.1% had poor physical health, and 20.9% had poor mental health; the prevalence of each outcome was significantly higher than that of the comparison groups. Among HHWs, certain factors, such as low household income, an inability to see a doctor because of cost, and a history of depression, were associated with all 3 aspects of suboptimal health.

Conclusions. HHWs had worse general, physical, and mental health compared with low-wage workers not in home health.

Public Health Implications. Increased attention to the health of HHWs by public health experts and policymakers is warranted. In addition, targeted interventions appropriate to their specific health needs may be required. (*Am J Public Health*. 2021;111(12):2239–2250. https://doi.org/10.2105/AJPH.2021.306512)

Home health care workers (HHWs) are one of the fastest growing workforces in the health care industry. There are currently more than 2 million in the United States, and the field is expected to grow by 38% by 2024.[1] Largely employed by home care agencies, they provide hands-on care to older adults and those with chronic conditions and disabilities in the home. This includes providing assistance with personal care and medically oriented care, and offering emotional support.[2,3] Unlike doctors or nurses, HHWs are with patients in their home on a daily or near-daily basis, giving them a unique vantage point from which to observe, support, and advise patients.

Despite their integral role in patient care, HHWs are an underserved group of health care professionals. Mostly women and minorities, they are poorly compensated and have limited opportunities for career advancement.[4,5] In addition, their own health and safety have not been prioritized.[6–8] This is problematic as this workforce faces unique physical and mental challenges. Although they provide direct patient care like other frontline health care workers, HHWs differ in that they deliver hands-on, manual care alone to patients in their homes, which are not often optimally equipped for the

delivery of care. Studies have shown that HHWs are commonly injured on the job, often lack health insurance, and frequently work multiple jobs to make ends meet, which may create stress and limit their ability to prioritize their own health.[9–12] Indeed, a study found HHWs to have a high burden of clinical comorbidities and adverse health behaviors, compared with both nurses and non–health care clerical workers.[13] In addition, recent studies of HHWs and their experiences caring for patients during the COVID-19 pandemic suggest that they endure high levels of physical, emotional, and financial strain.[8,14] Yet, to our knowledge, how these specific vulnerabilities influence HHWs' overall health status has not been investigated. A better understanding of their health, and the factors that influence it, is needed to better support HHWs' well-being and to ensure their ability to provide hands-on care in the future.

Herein, we used data from the Centers for Disease Control and Prevention's (CDC's) Behavioral Risk Factor Surveillance System (BRFSS) to determine the prevalence and predictors of HHWs' general, physical, and mental health

METHODS

Administered by the CDC and state (and some local) health departments, the BRFSS is a cross-sectional telephone survey designed to collect data about US residents regarding their health, health behaviors, and use of preventive services.[15] The survey is administered by trained interviewers via landline and cellular phones to the US noninstitutionalized adult population (≥ 18 years) from all 50 states, the District of Columbia, and 3 US territories. A multistage design and

random-digit dialing are used to obtain representative samples of non-institutionalized adults. The survey questionnaire assesses the prevalence of medical conditions, health behaviors, and preventive health practices. All data are self-reported.[16]

Starting in 2013, the BRFSS survey included a module sponsored by the National Institute for Occupational Safety and Health to elicit the industry and occupation of participants who are employed for wages, self-employed, or out of work for less than 1 year. Participants were asked, "What kind of work do you do?" followed by, "What kind of business or industry do you work in?" For this study, we coded responses with the 2010 US Census Bureau industry and occupation codes.[17] States and localities can elect to include this module each year; during 2014 to 2018, 38 states included the module at least once, while 17 included the module each year.

Study Population

We included all employed or self-employed noninstitutionalized adults aged 18 years or older who completed the industry and occupation module between 2014 and 2018. Our main population of interest was HHWs, which included employees from 2 occupational groups who worked in home health (e.g., in the patient home): (1) nursing, psychiatric, and home health aides and (2) personal care aides. To contextualize our findings on HHWs, we also included 2 comparison worker groups in our analyses: (1) nursing, psychiatric, and home health aides not working in the home (hereafter referred to as "health care aides (HCAs) not working in the home" and (2) health care support workers (HSWs) not

working in the home (hereafter referred to as "HSWs not working in the home"). The specific types of occupations that comprise these groups are further detailed in Table A (available as a supplement to the online version of this article at http://www.ajph.org). We selected the HCA group as the first comparison group because, although they have similar demographic characteristics and the same job as HHWs, they do not provide care in the home. We selected the HSW group as a second comparison group because, while they also have similar demographic characteristics to HHWs and HCAs, they have different jobs and do not provide care in the home.

Self-Reported General, Physical, and Mental Health

In the BRFSS, general health status was assessed with, "Would you say that in general your health is excellent, very good, good, fair, or poor?" Following the methodology of previous studies, we dichotomized responses to (1) fair or poor versus (2) good, very good, or excellent general health.[12] Physical health status was assessed with, "Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?" Similar to previous studies, we defined participants who reported 14 or more days of not good physical health as having poor physical health. Mental health status was assessed with "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?" Similarly, we defined participants who reported 14 or more days of not good

mental health as having poor mental health.

All 3 questions have been shown to have good construct validity and reasonably good criterion validity with respect to the Medical Outcomes Study Short-Form 36 in healthy and disabled populations.[18,19] In addition, the unhealthy days measures have been validated in previous studies. Finally, the 14-day cutpoint for physical and mental health has been previously shown to be clinically meaningful.[20]

Study Variables

Similar to other studies of health status and quality of life, we used the Andersen's Behavioral Model to guide variable selection;[21] this model has been used to explain how factors relate to health status and outcomes.[22] In this model, variables are grouped into predisposing, need, and enabling variables. Predisposing variables are social and cultural characteristics (e.g., education); need variables are conditions that require medical treatment and health behaviors that have an impact on health (e.g., chronic conditions); and enabling variables are related to the logistical aspects of getting care including financing care (e.g., income or insurance). As such, we included data on sociodemographic characteristics including age (18–34 years, 35–54 years, or ≥ 55 years), gender (women or men), race/ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic other, or Hispanic), education (< high school, high-school graduate, some college or technical school, or ≥ college graduate), household income (< $20 000, $20 000–$34 999, or ≥ $35 000), marital status (married, never married, divorced, separated, or widowed), covered by a health

insurance plan (yes or no), and home-owner status (rent or other arrangement vs own).

We included data on participants' health behaviors as follows: smoking status (current vs former vs never), alcohol use in the past 30 days (yes or no), binge drinking (yes or no), any leisure-time physical activity or exercise in the past month (yes or no), and hours of sleep per day (inadequate vs adequate, with less than 7 hours being inadequate). We included data on clinical comorbidities, which were obtained as self-report of a physician's diagnosis of heart disease (history of heart disease or myocardial infarction), stroke, hypertension, high cholesterol, diabetes, arthritis, cancer, chronic obstructive pulmonary disease (COPD), and asthma. Obesity was defined by body mass index of 30 or higher calculated from self-reported height and weight. We included data on participants' health care access and utilization by assessing whether they had (yes or no) a personal doctor or health care provider, a routine doctor visit in the past year, inability to see a doctor because of cost in the past year, a dental visit in the last year, received the flu shot in the past year, and ever received the pneumonia shot.

Data Analysis

First, we calculated descriptive statistics of all variables, including frequencies and proportions with 95% confidence intervals (CIs), for each worker group; we weighted all estimates to provide population-based estimates. We then used the Rao–Scott χ^2 test to determine differences between HHWs and comparison worker groups. Next, we estimated the prevalence of health status (general, physical, and mental

health) among HHWs by their characteristics. We used the Rao–Scott χ^2 test to determine associations between each characteristic and health status domain. Finally, we used multivariable logistic regression with backward stepwise elimination method in multiple stages to determine the subset of characteristics that best predicted each health status (general, physical, and mental health) among HHWs. In the first stage, we started with all sociodemographic variables and kept those significant at an α of 0.1; in the second and third stages, we added health behavior and health care access variables significant at an α of 0.1; in the final stage, we added clinical comorbidities and retained all characteristics significant at an α of 0.05. We estimated adjusted odds ratios (ORs) along with 95% CIs.

We conducted all analyses with SAS version 9.4 (SAS Institute Inc, Cary, NC) survey procedures and SAS-callable SUDAAN version 11.0.1 (RTI International, Research Triangle Park, NC) to account for the complex survey sampling design. To handle missing data, we used pairwise deletion—that is, participants with missing information on a particular characteristic or outcome were only excluded from analyses involving that characteristic or outcome.

RESULTS

During the period of 2014 to 2018, 2987 participants were identified as HHWs (weighted n = 659 000), 4861 were identified as HCAs not working in the home (weighted n = 983 000), and 9305 were identified as HSWs not working in the home (weighted n = 1 967 000).

Home Health Care Workers vs Other Worker Groups

One in 4 HHWs was aged 55 years or older, 90.6% were women, 29.3% were non-Hispanic Black, 18.8% were Hispanic, and 54.8% had a high-school education or less (Table 1). Compared with both HCAs and HSWs, HHWs were older, more often women, had lower household income, had lower educational attainment, and were less likely to be covered by a health insurance plan. Compared with HSWs (but not HCAs), HHWs were less likely to be non-Hispanic White and less often married. HHWs were less likely than both comparison groups to report consuming alcoholic beverages in the past 30 days, although they were more likely to be current smokers.

Although 76.6% of HHWs had a personal doctor, 31.5% reported they could not see a doctor because of cost, compared with 21.6% and 19.0% among HCAs and HSWs, respectively. Compared with both comparison groups, HHWs were less likely to have had a flu shot (or spray) or a dentist visit in the past year. Compared with both HCAs and HSWs, HHWs had significantly higher prevalence of clinical conditions including stroke, diabetes, arthritis, COPD, asthma, hypertension, and high cholesterol. Compared with HSWs (but not HCWs), HHWs had higher prevalence of obesity, depression, and cancer.

Overall, 26.6% of HHWs rated their health as fair or poor, compared with 14.6% of HCAs and 11.5% of HSWs (Table 1). With respect to physical health, 14.1% of HHWs reported poor physical health, compared with 7.5% of HCAs and 6.6% of HSWs. With respect to mental health, 20.9% of HHWs reported poor mental health,

compared with 14.5% of HCAs and 13.3% of HSWs.

Predictors of General Health

Among HHWs, the following characteristics were associated with reporting fair or poor general health: lower educational attainment; lower household income; renting a home; lacking health insurance; current smoking; being obese; having a history of depression, diabetes, arthritis, or hypertension; being unable to see a doctor because of cost; and not visiting a dentist in the past year (Table 2).

In a fully adjusted model, Hispanic ethnicity (OR = 3.43; 95% CI = 1.81, 6.50; ref: non-Hispanic White), lower household income (OR = 1.82; 95% CI = 1.07, 3.10), having access to a doctor limited by cost (OR = 3.33; 95% CI = 1.94, 5.72), obesity (OR = 1.92; 95% CI = 1.17, 3.17), depression (OR = 2.25; 95% CI = 1.27, 3.98), arthritis (OR = 3.06; 95% CI = 1.80, 5.19), and COPD (OR = 2.71; 95% CI = 1.49, 4.92) were independently associated with higher odds of self-rated fair or poor general health (Table 3).

Predictors of Physical Health

HHWs who were older; women; had lower household income; had no leisure-time physical activity; had inadequate sleep; had a history of heart disease, depression, diabetes, arthritis, cancer, COPD, or hypertension; and were unable to see a doctor because of cost were more likely to have poor physical health (Table 2).

In a fully adjusted model, increased age (OR = 2.71 [95% CI = 1.34, 5.47] for those aged 35 to 54 years and 5.05

[95% CI = 2.09, 12.19] for those aged 55 years or older; ref: those aged 18 to 34 years), lower household income (OR = 4.01; 95% CI = 2.23, 7.21), no leisure-time physical activity (OR = 2.68; 95% CI = 1.51, 4.75), being unable to access a doctor because of cost (OR = 1.80; 95% CI = 1.02, 3.19), and a history of depression (OR = 2.19; 95% CI = 1.29, 3.73) were independently associated with higher odds of poor physical health (Table 3).

Predictors of Mental Health

HHWs who were younger; were women; had lower household income; consumed alcoholic drinks in the past 30 days; had inadequate sleep; had a history of depression, arthritis, COPD, or asthma; and were unable to access a doctor because of cost were more likely to have poor mental health (Table 2).

In a fully adjusted model, older age (OR = 0.28; 95% CI = 0.14, 0.55 for those aged 55 years and older; ref = those aged 18–34 years) was associated with lower odds of poor mental health; by contrast, lower household income (OR = 2.29; 95% CI = 1.33, 3.96), having access to a doctor limited by cost (OR = 4.04; 95% CI = 2.27, 7.18), history of COPD (OR = 2.41; 95% CI = 1.11, 5.22), history of arthritis (OR = 2.25; 95% CI = 1.26, 4.02), and history of depression (OR = 4.49; 95% CI = 2.60, 7.76) were independently associated with higher odds of poor mental health (Table 3).

DISCUSSION

Using population-representative data from 38 states in the United States from the 2014–2018 BRFSS, we found that 1 out of 4 HHWs rated their general health as fair or poor, 1 in 7

TABLE 1— Characteristics of Home Health Care Workers (HHWs) Compared With Other Workers: Behavioral Risk Factor Surveillance System, United States, 2014–2018

Characteristic	HHWs,[a] Weighted % (95% CI)	HCAs Not Working in Home Health[b] Weighted % (95% CI)	P[d]	HSWs Not Working in Home Health[c] Weighted % (95% CI)	P[d]
Sociodemographics					
Age, y			.002		<.001
18–34	34.1 (27.3, 41.4)	43.5 (40.2, 46.8)		44.0 (41.5, 46.5)	
35–54	40.4 (34.8, 46.2)	40.1 (36.6, 43.6)		40.7 (38.3, 43.2)	
≥55	25.5 (21.5, 29.9)	16.4 (14.5, 18.6)		15.3 (13.9, 16.8)	
Women	90.6 (87.9, 93.0)	85.5 (82.5, 88.2)	.007	86.4 (84.6, 88.2)	.011
Race/ethnicity			.19		.036
Non-Hispanic White	44.9 (38.4, 51.4)	47.6 (44.2, 51.0)		53.6 (51.1, 56.1)	
Non-Hispanic Black	29.3 (24.4, 34.6)	32.0 (29.0, 35.2)		22.7 (20.8, 24.7)	
Non-Hispanic other	6.9 (4.3, 10.5)	6.9 (5.1, 9.1)		6.8 (5.5, 8.2)	
Hispanic	18.8 (15.0, 23.3)	13.5 (11.0, 16.3)		16.9 (14.6, 19.4)	
Not married	65.4 (61.0, 69.6)	62.8 (59.3, 66.1)	.34	57.2 (54.7, 59.6)	.001
Education			<.001		<.001
<high school	23.2 (16.0, 31.7)	10.2 (8.0, 12.9)		6.3 (5.1, 7.8)	
High-school graduate	31.6 (26.9, 36.6)	35.4 (32.3, 38.6)		27.1 (25.0, 29.2)	
Some college or technical school	33.9 (29.0, 39.0)	42.4 (39.1, 45.9)		50.8 (48.4, 53.3)	
≥college graduate	11.3 (8.0, 15.4)	11.9 (10.0, 14.0)		15.8 (14.2, 17.5)	
Household income, $			<.001		<.001
<20 000	41.7 (36.7, 46.8)	20.6 (17.8, 23.7)		14.6 (12.9, 16.5)	
20 000–34 999	33.3 (28.9, 37.9)	40.5 (36.9, 44.3)		35.0 (32.5, 37.6)	
≥35 000	25.0 (20.9, 29.6)	38.8 (35.5, 42.3)		50.3 (47.7, 53.0)	
Does not own home	59.7 (54.0, 65.2)	53.0 (49.6, 56.4)	.04	46.7 (44.2, 49.2)	<.001
Not covered by health plan	23.5 (16.4, 31.9)	13.7 (11.4, 16.2)	.003	11.8 (10.3, 13.5)	<.001
Health behaviors					
Smoking status			.06		.003
Current smoker	26.0 (19.1, 34.1)	21.5 (19.0, 24.1)		18.7 (17.0, 20.6)	
Former smoker	17.5 (13.9, 21.6)	13.9 (11.9, 16.1)		16.1 (14.6, 17.8)	
Never smoked	56.5 (49.7, 63.0)	64.6 (61.6, 67.6)		65.1 (62.8, 67.3)	
Alcohol use					
Any alcoholic beverages in past 30 d	38.8 (33.1, 44.6)	49.1 (45.6, 52.6)	.002	54.3 (51.8, 56.9)	<.001
Binge drinking	10.1 (7.6, 13.1)	15.9 (13.5, 18.6)	.002	17.1 (15.2, 19.1)	<.001
No leisure-time physical activity	29.4 (24.6, 34.5)	28.4 (25.3, 31.7)	.76	25.2 (23.1, 27.5)	.12
Inadequate sleep per day[e]	45.9 (39.1, 52.8)	49.4 (45.2, 53.5)	.37	44.1 (41.2, 47.1)	.64
Health care access and utilization					
No personal doctor	23.4 (16.4, 31.7)	21.2 (18.5, 24.2)	.58	19.9 (17.9, 22.0)	.34
No routine check up within 1 y	22.1 (18.2, 26.4)	25.8 (23.0, 28.8)	.14	27.9 (25.7, 30.3)	.015
Access to doctor limited by cost	31.5 (24.4, 39.3)	21.6 (18.8, 24.5)	.005	19.0 (17.0, 21.2)	<.001
No dentist visit within 1 y[e]	48.0 (41.0, 55.2)	37.4 (33.5, 41.4)	.006	30.9 (28.4, 33.6)	<.001
No adult flu shot (or spray) in past 12 mo	63.3 (57.6, 68.8)	48.8 (45.2, 52.3)	<.001	54.0 (51.5, 56.6)	.003
No pneumonia shot ever	70.7 (64.6, 76.3)	72.2 (68.8, 75.4)	.66	76.0 (73.7, 78.1)	.08

Continued

TABLE 1— Continued

Characteristic	HHWs,[a] Weighted % (95% CI)	HCAs Not Working in Home Health[b]		HSWs Not Working in Home Health[c]	
		Weighted % (95% CI)	P[d]	Weighted % (95% CI)	P[d]
Clinical comorbidities					
Heart disease	3.9 (2.2, 6.3)	2.8 (1.8, 4.1)	.29	2.0 (1.5, 2.7)	.022
Stroke	3.2 (1.7, 5.4)	1.2 (0.8, 1.7)	.002	1.0 (0.7, 1.4)	< .001
Obesity	46.5 (39.7, 53.4)	39.8 (36.4, 43.3)	.07	36.9 (34.4, 39.4)	.005
Depression	27.0 (22.2, 32.3)	22.9 (19.9, 26.2)	.16	22.0 (20.0, 24.2)	.06
Diabetes	12.0 (8.5, 16.2)	7.5 (5.9, 9.4)	.018	6.3 (5.3, 7.5)	< .001
Arthritis	24.6 (20.3, 29.3)	18.1 (16.0, 20.4)	.007	16.0 (14.5, 17.5)	< .001
Cancer	5.1 (3.8, 6.7)	3.6 (2.6, 4.9)	.11	3.4 (2.8, 4.2)	.029
COPD	6.8 (4.8, 9.4)	4.3 (3.1, 5.8)	.041	3.6 (2.8, 4.5)	.001
Asthma	14.6 (11.2,18.6)	8.9 (7.4,10.6)	.002	10.5 (9.1,12.0)	.021
Hypertension[f]	30.8 (25.3, 36.7)	22.6 (18.7, 27.0)	.019	20.2 (17.5, 23.2)	< .001
High cholesterol[f]	38.4 (30.5, 46.9)	24.2 (19.7, 29.1)	.001	22.8 (19.4, 26.5)	< .001
Self-reported health status					
General health fair or poor	26.6 (19.6, 34.7)	14.6 (12.5, 16.9)	< .001	11.5 (10.1, 13.1)	< .001
≥ 14 days physical health not good	14.1 (10.3, 18.5)	7.5 (6.2, 9.1)	< .001	6.6 (5.6, 7.6)	< .001
≥ 14 days mental health not good	20.9 (16.2, 26.1)	14.5 (12.2, 17.0)	.012	13.3 (11.7, 15.0)	< .001

Note. CI = confidence interval; COPD = chronic obstructive pulmonary disease; HCA = health care aide; HSW = health care support worker.

[a]2010 Census occupation = 3600 or 4610, and 2010 Census industry = 8170. No. (weighted no.) = 2987 (659 000).

[b]HCAs not working in home health; defined as nursing, psychiatric, and home health aides not working in home setting; 2010 Census occupation = 3600, and 2010 Census industry not 8170. No. (weighted no.) = 4861 (983 000).

[c]HSWs excluding home health industry; 2010 Census occupation = 3600–3655, and 2010 Census industry not 8170. No. (weighted no.) = 9305 (1 967 000).

[d]Rao–Scott χ^2 test of differences in characteristic distribution in home care workers and each comparison group.

[e]Only data from 2014, 2016, and 2018 available.

[f]Only data from 2015 and 2017 available.

reported poor physical health, and 1 in 5 reported poor mental health. Each of these prevalences was significantly higher compared with those of HCAs and HSWs, which is striking, because both comparison worker groups are frontline, low-wage workers with similar health care responsibilities and job functions. We also note that these groups differed meaningfully by demographic factors, certain health behaviors, health care access, and clinical comorbidities, which may contribute to the differences we found in the self-rated health status of each group. In addition, we found that, among HHWs, certain factors, such as low household income, an inability to see a doctor because of cost, and a history of depression, were associated with all 3 aspects of suboptimal health. Taken together, our findings suggest that increased attention to the health of HHWs is urgently needed and targeted interventions appropriate to their specific health needs may be required.

To date, only a few studies have characterized the health of HHWs at a statewide or national level, and these studies have generally found that HHWs have higher burdens of chronic conditions than other low-wage frontline health care workers not providing care in the home. For example, Silver et al. found that home health aides fared worse than nursing home aides and hospital aides with respect to health behaviors (less exercise, more smoking) and burden of chronic conditions.[13] Similarly, Howard and Marcum found that HHWs in Washington State were more likely to be overweight, smoke, have serious mental illness, and have more arthritis and diabetes compared with non–home-based health care providers.[23]

Our study confirms and expands this body of literature in a few key ways. First, we also found that HHWs' burden of chronic conditions is high, with nearly half of HHWs in our study having

TABLE 2— Weighted Prevalence of Suboptimal General, Physical, and Mental Health by Home Health Care Workers' Characteristics: Behavioral Risk Factor Surveillance System, United States, 2014–2018

	Fair or Poor Health		≥ 14 Days Physical Health Not Good		≥ 14 Days Mental Health Not Good	
	Weighted % (95% CI)	P[a]	Weighted % (95% CI)	P[a]	Weighted % (95% CI)	P[a]
Demographics						
Age, y		.75		.004		.049
18–34	29.7 (13.1, 51.5)[b]		6.6 (3.7, 10.7)		25.9 (16.4, 37.5)	
35–54	26.2 (18.8, 34.6)		16.8 (10.4, 25.0)		22.3 (14.7, 31.6)	
≥ 55	23.2 (17.7, 29.4)		19.9 (12.2, 29.7)		11.8 (7.9, 16.7)	
Gender		.06		.001		.028
Men	16.1 (8.4, 27.0)		4.7 (1.9, 9.4)[b]		12.0 (6.7, 19.4)	
Women	27.7 (20.0, 36.4)		15.1 (11.0, 20.0)		21.8 (16.7, 27.6)	
Race/ethnicity		.50		.42		.31
Non-Hispanic White	25.6 (12.3, 43.4)		11.2 (7.6, 15.9)		18.4 (12.7, 25.4)	
Non-Hispanic Black	23.7 (15.5, 33.6)		13.2 (6.9, 22.3)		25.4 (15.3, 37.7)	
Non-Hispanic other	18.8 (8.4, 34.1)[b]		c		11.3 (5.0, 21.2)[b]	
Hispanic	35.0 (24.1, 47.3)		19.7 (10.0, 33.0)		23.2 (13.0, 36.2)	
Marital status		.12		.92		.15
Married	19.2 (13.2, 26.4)		15.1 (8.9, 23.4)		17.5 (11.2, 25.4)	
Not married	25.9 (20.7, 31.7)		14.7 (10.2, 20.3)		24.5 (18.5, 31.2)	
Education		< .001		.34		.18
< high school	51.4 (30.3, 72.1)		20.8 (10.1, 35.6)		31.9 (16.6, 50.7)	
High-school graduate	18.7 (13.9, 24.3)		13.6 (7.6, 21.8)		17.7 (11.4, 25.5)	
Some college or technical school	19.2 (14.1, 25.3)		9.8 (6.5, 14.1)		16.9 (12.2, 22.4)	
≥ college graduate	20.8 (6.2, 44.3)[b]		c		19.9 (5.6, 43.7)[b]	
Household income, $		.030		< .001		.005
< 20 000	32.6 (25.1, 40.9)		25.3 (16.6, 35.7)		30.8 (22.2, 40.5)	
20 000–34 999	19.6 (13.9, 26.5)		7.3 (5.0, 10.1)		13.1 (9.1, 18.0)	
≥ 35 000	18.2 (8.7, 31.6)[b]		8.6 (4.8, 13.9)		19.1 (9.3, 32.9)	
Housing status		.049		.70		.09
Own home	19.6 (13.6, 26.9)		15.1 (9.5, 22.4)		16.1 (10.3, 23.5)	
Does not own home (rents home or other arrangement)	31.2 (20.5, 43.6)		13.5 (8.8, 19.7)		24.4 (17.6, 32.3)	
Not covered by health plan		.001		.28		.89
Yes	46.3 (24.8, 69.0)		18.9 (8.0, 34.9)[b]		21.5 (10.0, 37.7)[b]	
No	20.6 (16.6, 25.0)		12.5 (9.2, 16.6)		20.6 (15.9, 25.9)	
Health behaviors						
Smoking status		.051		.44		.30
Current smoker	39.0 (18.6, 62.7)[b]		15.4 (8.5, 24.8)		26.5 (15.5, 40.2)	
Former smoker	30.4 (18.9, 44.0)		19.0 (11.6, 28.5)		24.7 (13.3, 39.3)	
Never smoked	20.4 (15.4, 26.2)		12.4 (7.2, 19.6)		17.6 (11.9, 24.6)	
Any alcoholic beverages in past 30 d		.77		.87		.025
Yes	26.0 (19.0, 34.0)		14.9 (9.3, 22.1)		27.3 (19.3, 36.5)	
No	27.9 (17.2, 40.9)		14.2 (9.1, 20.7)		16.5 (11.3, 23.0)	
Binge drinking		.63		.89		.40
No	27.5 (19.4, 36.8)		14.3 (10.1, 19.3)		20.3 (15.2, 26.3)	

Continued

TABLE 2— Continued

	Fair or Poor Health		≥ 14 Days Physical Health Not Good		≥ 14 Days Mental Health Not Good	
	Weighted % (95% CI)	P^a	Weighted % (95% CI)	P^a	Weighted % (95% CI)	P^a
Yes	23.9 (13.2, 37.8)		15.1 (6.2, 28.8)[b]		25.4 (15.0, 38.3)	
Any leisure-time physical activity		.66		< .001		.09
Yes	25.9 (16.3, 37.4)		9.5 (6.1, 13.8)		18.5 (13.4, 24.5)	
No	28.9 (20.9, 37.9)		26.3 (17.4, 36.9)		27.4 (18.1, 38.5)	
Inadequate sleep[d]		.56		< .001		< .001
Yes	29.3 (21.4, 38.2)		23.7 (15.3, 34.0)		31.2 (21.9, 41.7)	
No	24.6 (12.8, 39.9)		6.8 (4.4, 10.0)		11.2 (7.6, 15.7)	
Health care access and utilization						
No personal doctor		.07		.66		.63
Yes	40.1 (18.0, 65.6)		12.3 (4.8, 24.6)[b]		18.6 (9.1, 32.0)	
No	22.6 (18.1, 27.6)		14.7 (10.6, 19.5)		21.7 (16.6, 27.4)	
No routine check-up within 1 y		.85		.68		.63
Yes	25.6 (17.9, 34.7)		15.6 (8.1, 26.2)		22.9 (14.9, 32.5)	
No	26.8 (18.1, 37.1)		13.7 (9.5, 18.8)		20.4 (15.0, 26.8)	
Access to doctor limited by cost		< .001		.041		< .001
Yes	48.5 (31.6, 65.7)		21.0 (11.6, 33.5)		38.0 (23.8, 53.9)	
No	16.6 (13.5, 20.1)		10.9 (7.5, 15.2)		13.1 (10.1, 16.5)	
Adult flu shot (or spray) in past 12 mo		.08		.68		.28
Yes	20.6 (15.5, 26.5)		13.3 (7.8, 20.7)		17.7 (11.9, 24.8)	
No	30.4 (19.6, 43.1)		15.1 (9.9, 21.6)		22.8 (16.1, 30.8)	
Pneumonia shot ever		.97		.72		.09
Yes	27.4 (18.1, 38.3)		15.4 (8.0, 25.7)		28.5 (17.6, 41.6)	
No	27.0 (16.6, 39.7)		13.7 (8.9, 19.8)		18.5 (13.2, 24.9)	
No dentist visit within 1 y[d]		.019		.22		.87
Yes	34.7 (21.6, 49.7)		17.4 (9.7, 27.8)		20.9 (13.7, 29.8)	
No	19.4 (13.6, 26.4)		11.7 (7.4, 17.3)		20.0 (12.8, 29.1)	
Clinical comorbidities						
Heart disease		.80		.04		.84
Yes	28.7 (12.7, 49.8)[b]		32.5 (12.0, 59.4)[b]		19.4 (7.2, 38.2)[b]	
No	26.3 (18.9, 34.7)		13.4 (9.6, 17.9)		21.0 (16.2, 26.4)	
Stroke		.41		.66		.59
Yes	36.2 (14.4, 63.1)[b]		17.4 (5.0, 38.7)[b]		16.3 (4.4, 37.2)[b]	
No	26.3 (19.0, 34.7)		14.0 (10.2, 18.6)		21.0 (16.3, 26.5)	
Obesity		< .001		.20		.63
Yes	37.9 (24.5, 52.9)		11.9 (7.9, 17.0)		22.4 (14.3, 32.3)	
No	18.3 (13.3, 24.2)		16.7 (10.6, 24.5)		19.8 (14.1, 26.6)	
Depression		.024		< .001		< .001
Yes	39.5 (29.2, 50.5)		26.6 (17.2, 38.0)		49.2 (38.7, 59.7)	
No	21.8 (12.9, 33.2)		9.5 (6.2, 13.7)		10.5 (7.1, 14.8)	
Diabetes		.025		< .001		.08
Yes	44.8 (28.5, 61.9)		34.9 (18.1, 55.1)		33.3 (16.6, 53.8)	
No	24.3 (16.4, 33.6)		11.2 (8.0, 15.0)		19.2 (14.6, 24.4)	

TABLE 2— Continued

	Fair or Poor Health		≥ 14 Days Physical Health Not Good		≥ 14 Days Mental Health Not Good	
	Weighted % (95% CI)	P^a	Weighted % (95% CI)	P^a	Weighted % (95% CI)	P^a
Arthritis		.01		.002		< .001
Yes	41.4 (31.7, 51.6)		24.3 (16.4, 33.6)		38.0 (27.5, 49.5)	
No	21.5 (12.7, 32.7)		10.6 (6.6, 15.9)		15.4 (11.1, 20.5)	
Cancer		.16		.008		.76
Yes	36.7 (24.3, 50.5)		30.4 (16.0, 48.3)		22.7 (12.0, 36.8)	
No	26.1 (18.7, 34.7)		13.3 (9.5, 17.9)		20.8 (15.9, 26.3)	
COPD		.63		.005		.002
Yes	30.0 (18.2, 44.1)		30.2 (16.8, 46.6)		42.0 (26.0, 59.3)	
No	26.4 (18.9, 35.1)		12.9 (9.1, 17.6)		19.3 (14.6, 24.9)	
Current asthma		.36		.06		< .001
Yes	32.1 (21.7, 44.0)		22.4 (12.8, 34.8)		39.8 (26.0, 54.9)	
No	25.5 (17.4, 35.1)		12.7 (8.7, 17.6)		17.6 (13.1, 23.0)	
Hypertension[e]		< .001		.047		.13
Yes	36.7 (27.2, 47.1)		15.3 (8.5, 24.6)		21.2 (13.5, 30.7)	
No	13.3 (8.4, 19.7)		8.3 (5.5, 12.0)		14.3 (9.8, 19.9)	
High cholesterol[e]		.12		.20		.81
Yes	26.4 (15.9, 39.3)		13.2 (6.5, 23.1)		15.3 (7.9, 25.8)	
No	16.7 (10.9, 24.1)		8.3 (5.4, 12.2)		14.1 (9.3, 20.1)	

Note. CI = confidence interval; COPD = chronic obstructive pulmonary disease.

[a]Rao–Scott χ^2 test of association between each characteristic and each outcome.
[b]Estimates with relative standard error (RSE) of > 30% to ≤ 50% and should be interpreted with caution.
[c]Estimates with RSE > 50% were suppressed because of low precision.
[d]Only data from 2014, 2016, and 2018 available.
[e]Only data from 2015 and 2017 available.

a history of obesity, one third with hypertension and hyperlipemia, and a quarter with arthritis. Second, like other studies, we found that HHWs, who were mostly women and racial/ethnic minorities, had lower household incomes and were less likely to have health insurance compared with both HCAs and HSWs. And, despite their chronic disease burden, more than a third of HHWs were unable to see a doctor because of cost, a prevalence that was significantly greater than that of HCAs and HSWs. These findings highlight not only the financial vulnerability of this workforce compared with other similar workforces but also the occupational health disparities that likely contribute to suboptimal health status we observed. Third, we found that nearly two thirds of HHWs did not receive the flu shot (or spray) in the past year. While there are several potential reasons for this (e.g., decentralized workforce, lack of paid time off) the finding suggests that HHWs and their employers may be an important target for current and future vaccination campaigns. Finally, some factors like low household income, an inability to see a doctor because of cost, and a history of depression were associated with higher odds of fair or poor general health, and poor physical and mental health, whereas other characteristics, like having a history of obesity, was only associated with higher odds of poor general health.

The reason HHWs had suboptimal health in general, and relative to other frontline low-wage health care workers, is likely multifactorial. Confirming national trends, we found that HHWs experienced even greater financial disadvantages than similar low-wage health care workers providing care outside of the home, including having low incomes and inadequate health insurance.[7,24] These circumstances may not only predispose HHWs to developing medical conditions but also may limit

TABLE 3— Final Models for the Associations Between Home Health Care Workers' Characteristics and Suboptimal General, Physical, and Mental Health: Behavioral Risk Factor Surveillance System, United States, 2014–2018

Characteristic	AOR (95% CI)
Fair or poor general health[a]	
Race/ethnicity	
Non-Hispanic White (Ref)	1
Non-Hispanic Black	1.24 (0.58, 2.17)
Non-Hispanic other	1.56 (0.62, 3.95)
Hispanic	3.43 (1.81, 6.50)
Household income < $20 000	1.82 (1.07, 3.10)
Access to doctor limited by cost	3.33 (1.94, 5.72)
Obesity	1.92 (1.17, 3.17)
Depression	2.25 (1.27, 3.98)
Arthritis	3.06 (1.80, 5.19)
COPD	2.71 (1.49, 4.92)
Poor physical health[a,b]	
Age group, y	
18–34 (Ref)	1
35–54	2.71 (1.34, 5.47)
≥ 55	5.05 (2.09, 12.19)
Household income < $20 000	4.01 (2.23, 7.21)
Access to doctor limited by cost	1.80 (1.02, 3.19)
No leisure-time physical activity	2.68 (1.51, 4.75)
Depression	2.19 (1.29, 3.73)
Poor mental health[a,c]	
Age group, y	
18–34 (Ref)	1
35–54	0.55 (0.29, 1.04)
≥ 55	0.28 (0.14, 0.55)
Household income < $20 000	2.29 (1.33, 3.96)
Access to doctor limited by cost	4.04 (2.27, 7.18)
COPD	2.41 (1.11, 5.22)
Arthritis	2.25 (1.26, 4.02)
Depression	4.49 (2.60, 7.76)

Note. AOR = adjusted odds ratio; CI = confidence interval; COPD = chronic obstructive pulmonary disease. Final model was derived from backward stepwise model selection in 4 stages that sequentially added variables from the following: stage 1: sociodemographics (age, gender, race/ethnicity, marital status, household income, housing), stage 2: health behaviors (smoking, alcohol, leisure-time physical activity), stage 3: health care access and utilization (insurance status, personal doctor, routine doctor visit, access to doctor limited by cost), and stage 4: clinical comorbidities (stroke, heart disease, obesity, depression, diabetes, arthritis, cancer, COPD, asthma). Dentist visit, hypertension, and high cholesterol were not included because they were not available in all 5 years.

[a]Fair or poor general health report complete case n = 2354/2987; poor physical health report complete case n = 2476/2987; poor mental health report complete case n = 2534/2987.
[b]Poor physical health defined as self-report of ≥ 14 days in the past month with physical health not good.
[c]Poor mental health defined as self-report of ≥ 14 days in the past month with mental health not good.

their ability to adequately manage them. Although we were unable to quantify condition severity and duration, it is likely that a lack of access to regular medical care, as well as insufficient funds, contribute to worse health.[21,25] In addition, aspects of the job are also likely to contribute to worse overall health. HHWs are known for working multiple jobs and having erratic hours and shifts.[24] Unlike the comparison groups who work in hospitals, clinics, or nursing homes,[25] HHWs often care for their patients in isolation, with less access to standardized equipment (e.g., ramps, elevators, bed lifts), and without shift breaks, which may negatively affect their physical and mental health.[26–29] All of these factors may contribute to poor self-care, which, in turn, can worsen chronic conditions and negatively affect physical and mental health.

Public Health Implications

A conceptual framework by Zarska et al. elucidates how various factors, including policies that govern HHWs' employment, as well as the working conditions in which they provide care, influence workers' health.[30] This framework and our findings highlight the need for higher minimum wages across states, as well as paid sick days and overtime pay.[31]

Unfortunately, median hourly wages for HHWs have remained stagnant over the past decade, and substandard wages combined with lack of affordable health insurance impede HHWs' access to health care. Although we were unable to examine organization-level factors in this study (e.g., training, workplace practices), our findings suggest the need for programs that address both physical and mental health

hazards experienced by HHWs. Current research on interventions ranges from equipping the home environment to reduce physical occupational hazards to mobile health applications that encourage HHWs and their patients (dyads) to engage in physical activity.[32–34] Other possibilities include instituting screening programs at the state or agency level to detect adverse health conditions or programs that incentivize HHWs to carry out healthy behaviors. Collectively, these initiatives might improve the ability of HHWs to adequately address their existing medical conditions by engaging in preventive and self-care.

Strengths and Limitations

This study had several strengths. BRFSS is a large health survey administered by trained interviewers and uses standardized weighting methodology across states and years. The data allowed for the assessment of health conditions, behaviors, and status of HHWs and the comparison with other frontline health care worker groups, which have been understudied in the literature. We also note several limitations. First, all data in the BRFSS were self-reported and are therefore subject to recall and social desirability biases. Future studies are needed that can objectively quantify the duration and severity of HHWs' clinical comorbidities, in addition to adjudicating their health outcomes. Second, the industry and occupation module was optionally administered by states, with different states participating each year; thus, the findings are not nationally representative. Because the data are cross-sectional, we cannot make causal inferences on the basis of the results. Lastly, recent studies have shown that COVID-19 has exacerbated many of the underlying vulnerabilities of

this workforce.[8,14] Future studies are needed to understand how working during COVID-19 affected specific aspects of HHWs' health.

Conclusions

As the population ages, and as people with disabilities and chronic diseases want to remain at home, the demand for HHWs will continue to grow. Yet, the health of this workforce is suboptimal, which limits their own well-being as well as their ability to meet the needs of their patients. Using data from the BRFSS, we found that HHWs had significantly worse general, physical, and mental health compared with other similar low-wage health care workers not working in the home setting. Increased attention to the health status of HHWs by public health experts and policymakers is warranted. In addition, targeted policies and programs appropriate to their specific health needs may be required. **AJPH**

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CONFLICTS OF INTEREST

None of the authors have any conflicts of interest.

HUMAN PARTICIPANT PROTECTION

BRFSS was approved as exempt research including human participants by the Centers for Disease Control and Prevention institutional review board (protocol 2968), and data were collected with Office of Management and Budget approval (control number 0920-1061).

REFERENCES

1. PHI. US home care workers: key facts (2019). Available at: https://phinational.org/resource/u-s-home-care-workers-key-facts-2019. Accessed May 21, 2020.

2. Reckrey JM, Tsui EK, Morrison RS, et al. Beyond functional support: the range of health-related tasks performed in the home by paid caregivers in New York. *Health Aff (Millwood)*. 2019;38(6):927–933. https://doi.org/10.1377/hlthaff.2019.00004

3. Sterling MR, Shaw AL. Sharing the care—a patient and her caregivers. *JAMA Intern Med*. 2019;179(12):1617–1618. https://doi.org/10.1001/jamainternmed.2019.4231

4. Bercovitz A, Moss A, Sengupta M, Park-Lee EY, Jones A, Harris-Kojetin LD. An overview of home health aides: United States, 2007. *Natl Health Stat Report.* 2011;(34):1–31.

5. Stone R, Wilhelm J, Bishop CE, Bryant NS, Hermer L, Squillace MR. Predictors of intent to leave the job among home health workers: analysis of the National Home Health Aide Survey. *Gerontologist.* 2017;57(5):890–899. https://doi.org/10.1093/geront/gnw075

6. Shotwell JL, Wool E, Kozikowski A, et al. "We just get paid for 12 hours a day, but we work 24": home health aide restrictions and work related stress. *BMC Health Serv Res.* 2019;19(1):907. https://doi.org/10.1186/s12913-019-4664-2

7. PHI. Caring for the future: the power and potential of America's direct care workforce. Available at: https://phinational.org/resource/caring-for-the-future-the-power-and-potential-of-americas-direct-care-workforce. Accessed January 18, 2021.

8. Sterling MR, Tseng E, Poon A, et al. Experiences of home health care workers in New York City during the coronavirus disease 2019 pandemic: a qualitative analysis. *JAMA Intern Med.* 2020;180(11):1453–1459. https://doi.org/10.1001/jamainternmed.2020.3930

9. McCaughey D, McGhan G, Kim J, Brannon D, Leroy H, Jablonski R. Workforce implications of injury among home health workers: evidence from the National Home Health Aide Survey. *Gerontologist.* 2012;52(4):493–505. https://doi.org/10.1093/geront/gnr133

10. Hewko SJ, Cooper SL, Huynh H, et al. Invisible no more: a scoping review of the health care aide workforce literature. *BMC Nurs.* 2015;14(1):38. https://doi.org/10.1186/s12912-015-0090-x

11. Muramatsu N, Sokas RK, Lukyanova VV, Zanoni J. Perceived stress and health among home care aides: caring for older clients in a Medicaid-funded home care program. *J Health Care Poor Underserved.* 2019;30(2):721–738. https://doi.org/10.1353/hpu.2019.0052

12. Shockey TM, Zack M, Sussell A. Health-related quality of life among US workers: variability across occupation groups. *Am J Public Health.* 2017;107(8):1316–1323. https://doi.org/10.2105/AJPH.2017.303840

13. Silver S, Boiano J, Li J. Patient care aides: differences in healthcare coverage, health-related behaviors, and health outcomes in a low-wage workforce by healthcare setting. *Am J Ind Med.* 2020;63(1):60–73. https://doi.org/10.1002/ajim.23053

14. Bandini J, Rollison J, Feistel K, Whitaker L, Bialas A, Etchegaray J. Home care aide safety concerns and job challenges during the COVID-19 pandemic. *New Solut.* 2021;31(1):20–29. https://doi.org/10.1177/1048291120987845

15. Centers for Disease Control and Prevention. About BRFSS. Available at: http://www.cdc.gov/brfss/annual_data/annual_2015.html. Accessed March 1, 2020.

16. Centers for Disease Control and Prevention. BRFSS survey data and documentation. Available at: https://www.cdc.gov/brfss/data_documentation/index.htm. Accessed March 1, 2020.

17. National Institute for Occupational Safety and Health. Industry and occupation coding: about the NIOSH Industry & Occupation Computerized Coding System (NIOCCS). Available at: https://csams.cdc.gov/nioccs/Default.aspx. Accessed June 10, 2020.

18. Odom EC, Fang J, Zack M, Moore L, Loustalot F. Associations between cardiovascular health and health-related quality of life, Behavioral Risk Factor Surveillance System, 2013. *Prev Chronic Dis.* 2016;13:E99. https://doi.org/10.5888/pcd13.160073

19. Ford ES, Mokdad AH, Li C, et al. Gender differences in coronary heart disease and health-related quality of life: findings from 10 states from the 2004 Behavioral Risk Factor Surveillance System. *J Womens Health (Larchmt).* 2008;17(5):757–768. https://doi.org/10.1089/jwh.2007.0468

20. Dwyer-Lindgren L, Mackenbach JP, Van Lenthe FJ, Mokdad AH. Self-reported general health, physical distress, mental distress, and activity limitation by US county, 1995–2012. *Popul Health Metr.* 2017;15(1):16. https://doi.org/10.1186/s12963-017-0133-5

21. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav.* 1995;36(1):1–10. https://doi.org/10.2307/2137284

22. Babitsch B, Gohl D, von Lengerke T. Re-revisiting Andersen's Behavioral Model of Health Services Use: a systematic review of studies from 1998–2011. *Psychosoc Med.* 2012;9:Doc11. https://doi.org/10.3205/psm000089

23. Howard N, Marcum J. Comparison of BRFSS data between home-based care providers and health care support workers in clinical environments in Washington State [erratum in *Workplace Health Saf.* 2020;68(5):251–252. *Workplace Health Saf.* 2020;68(2):92–102. https://doi.org/10.1177/2165079919857448

24. Scales K. It's time to care: a detailed profile of America's direct care workforce. Available at: https://phinational.org/resource/its-time-to-care-a-detailed-profile-of-americas-direct-care-workforce. Accessed June 10, 2020.

25. Ayanian JZ, Weissman JS, Schneider EC, Ginsburg JA, Zaslavsky AM. Unmet health needs of uninsured adults in the United States. *JAMA.* 2000;284(16):2061–2069. https://doi.org/10.1001/jama.284.16.2061

26. Faucett J, Kang T, Newcomer R. Personal service assistance: musculoskeletal disorders and injuries in consumer-directed home care. *Am J Ind Med.* 2013;56(4):454–468. https://doi.org/10.1002/ajim.22133

27. Galinsky T, Waters T, Malit B. Overexertion injuries in home health care workers and the need for ergonomics. *Home Health Care Serv Q.* 2001;20(3):57–73. https://doi.org/10.1300/J027v20n03_04

28. Franzosa E, Tsui EK, Baron S. "Who's caring for us?": understanding and addressing the effects of emotional labor on home health aides' well-being. *Gerontologist.* 2019;59(6):1055–1064. https://doi.org/10.1093/geront/gny099

29. Spetz J, Stone RI, Chapman SA, Bryant N. Home and community-based workforce for patients with serious illness requires support to meet growing needs. *Health Aff (Millwood).* 2019;38(6):902–909. https://doi.org/10.1377/hlthaff.2019.00021

30. Zarska A, Avgar AC, Sterling MR. Relationship between working conditions, worker outcomes, and patient care: a theoretical model for frontline health care workers. *Am J Med Qual.* 2021; epub ahead of print July 21, 2021. https://doi.org/10.1097/01.JMQ.0000735508.08292.73

31. Landers S, Madigan E, Leff B, et al. The future of home health care: a strategic framework for optimizing value. *Home Health Care Manag Pract.* 2016;28(4):262–278. https://doi.org/10.1177/1084822316666368

32. Bien E, Smith R. The unique occupational environment of the home healthcare worker. NIOSH Science Blog. Available at: https://blogs.cdc.gov/niosh-science-blog/2020/09/29/hhcws. Accessed March 8, 2021.

33. Sun C, Buchholz B, Quinn M, Punnett L, Galligan C, Gore R. Ergonomic evaluation of slide boards used by home care aides to assist client transfers. *Ergonomics.* 2018;61(7):913–922. https://doi.org/10.1080/00140139.2017.1420826

34. Danilovich MK, Diaz L, Saberbein G, Healey WE, Huber G, Corcos DM. Design and development of a mobile exercise application for home care aides and older adult Medicaid home and community-based clients. *Home Health Care Serv Q.* 2017;36(3-4):196–210. https://doi.org/10.1080/01621424.2017.1381869