ORIGINAL RESEARCH

Understanding Wheelchair Use in Older Adults From the National Health and Aging Trends Study

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Abstract

Objective: To identify the trends of wheelchair use and physical characteristics among older people who used wheelchairs relative to those who did not.

Design: Cohort and survey.

Setting: General community.

Participants: 7026 participants (N=7026) were selected from the 2011 cohort of the National Health and Aging Trends Study (NHATS), which is made up of Medicare beneficiaries over the age of 65. Repeated observations among participants in the 2011 cohort were analyzed in the 4 following rounds: 2013 (N=4454), 2015 (N=3327), 2017 (N=2623), and 2019 (N=2091). Participants were divided into 2 groups: those who used and did not use wheelchairs.

Interventions: Not applicable.

Main Outcomes Measures: Physical characteristics, including pain, strength limitation, balance problems, mobility disability, as well as the frequency of going outside.

Results: The number of older adults who use wheelchairs had increased significantly from 4.7 per 100 people in 2011 to 7.1 in 2019 (*P*<.001). The logistic regression analysis indicated that participants who reported less frequently going out were at least 4.27 times more likely to be wheelchair users than non-wheelchair users (*P*<.01). Participants who reported health and physical problems were at least 2.48 times more likely to be wheelchair users than non-wheelchair users from 2011 to 2017 (*P*<.0001). Balance or coordination problems increased (24%-38%) significantly among non-wheelchair users from 2011 to 2019 (all *P*<.05).

Conclusions: Current wheelchair users reported more physical difficulties and were much less likely to go outside. This lower outdoor mobility could be due to physical difficulties or potential barriers in physical and socio-cultural environments. In addition, older adults who do not use wheelchairs showed increasing physical problems over time (including balance or coordination problems). Clinicians should consider older wheelchair users' health and physical limitations when prescribing wheelchairs.

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There are approximately 3.3 million Americans who use wheelchairs.[1] Mobility disability is a primary cause of wheelchair use. A wheelchair can be the primary means of mobility for someone with a permanent or progressive disability such as cerebral palsy, spinal cord injury, or multiple sclerosis.[2] Older adults are the largest group of consumers of assistive technology such as wheelchairs. In the US, there are an estimated 1 million wheeled mobility device users aged 65 and older, most of whom use manual wheelchairs.[3] According to the data published decades ago, the use of wheelchairs among older adults had been increasing over time.[4,5] However, there is a dearth of recent national-level data estimating the prevalence and trends of wheelchair use among the older population.

Mobility in late life is an important factor for maintaining social connectedness and overall health and quality of life.[6] Using a wheelchair allows users to move in their environment[7] to

accomplish lifestyle-related activities.[8] Health and physical characteristics (eg, pain, physical disability) of end users are significant determinants of the extent to which they use their wheelchairs, which can negatively affect daily activities and social participation.[9] Pain is common in the older population. The prevalence of chronic pain in older populations varies from 27% to 86%.[10] Individuals who use a wheelchair were more likely to experience shoulder pain due to activities of daily living, such as transferring and weight relief tasks.[11] Other physical challenges such as impaired balance, strength limitations, and mobility disabilities are more likely experienced by wheelchair users[9] and are the most common risk factors for falls, which may lead to severe consequences.[12] Yet, national-level descriptive data are lacking regarding the health and physical characteristics of older adult wheelchair users and whether these characteristics differ between older adults who use wheelchairs and those who do not. The estimations could be beneficial to evaluate users' needs at a population level regarding wheelchair use.

Besides the individual factors, physical and social environmental factors could influence out-of-home mobility and thus the health and well-being of older wheelchair users. For instance, the physical environment such as natural elements, architecture, and landscaping can influence wheelchair mobility. Social environment factors such as people and groups with whom a person interacts and resources available to the user (financial, emotional, etc) are all important elements in wheelchair mobility.[13]

In this research, we analyzed data from a national sample of American Medicare beneficiaries aged 65 and over to identify the trends of wheelchair use, physical characteristics, and out-of-home mobility of wheelchair users relative to non-wheelchair users. We hypothesized that the use of wheelchairs among older adults has significantly increased from 2011 to 2019. In addition, we hypothesized that pain was experienced by most older adults. Older adults who used a wheelchair were expected to be more likely to experience physical challenges, including pain, balance problems, strength limitation, and mobility incapability, and less likely to go outside compared with those who did not.

Methods

Data

We conducted secondary analyses of data from 5 waves of the National Health and Aging Trends Study (NHATS), which is a nationally representative longitudinal study of Medicare beneficiaries aged 65 and older in the United States. The NHATS data are collected annually by conducting in-person interviews with either a sample person (self-report) or a proxy to the sample person if they were unable to participate in the interview because of illness, and so on. Data collection began in 2011 (N=8245) and the repeated observations of the original cohort decreased over time: 2011 (N=8245), 2012 (N=6572), 2013 (N=5276), 2014 (N=4333), 2015 (N=3856), 2016 (N=3395), 2017 (N=2953), 2018 (N=2614), and 2019 (N=2333). Besides the deceased sample, the weighted

List of abbreviations:
NHATS   National Health and Aging Trends Study

response rate for each round ranged between 73.2% and 94.0% for living sample persons.[14] The NHATS data were replenished to account for the attrition in 2015. For this study, we only selected the 2011 self-report cohort and evaluated trends for repeated observations across 5 time points: 2011 (N=7206), 2013 (N=4454), 2015 (N=3327), 2017 (N=2623), and 2019 (N=2091).

Measures

Wheelchair use was assessed in all waves of the NHATS survey. Respondents were asked, "In the last month, have you used a cane, walker, wheelchair, or scooter?", and the answers were coded dichotomously as "yes/no." If respondents answered "yes", they were asked a follow-up question "In the last month, did you use a wheelchair?" the answers were also coded dichotomously as "yes/no." We identified wheelchair use as those who answered "yes" to both questions and identified non-wheelchair use as those who answered "no" to either question.

We report baseline characteristics of both wheelchair user and non-wheelchair user groups, including sociodemographic characteristics and self-rated health status. Respondents were also asked "yes" or "no" questions about the occurrence of physical problems, including pain, strength limitation (upper & lower body), balance problems, mobility disability (unable to walk 3 blocks or 10 stairs), as well as a 5-point Likert scale question about the frequency of going outside (1-every day; 5-never). We examined the prevalence and trends of these physical characteristics and mobility, stratifying by those who used and did not use wheelchairs (see appendix 1 for NHATS questions).

Table 1   Demographic characteristics of the NHATS 2011

	2011 (N=7026)	
	Wheelchair (n=421) Number (%)	No Wheelchair (n=6605) Number (%)
Sex		
Men	129 (30.7)	2815 (42.7)
Women	291 (69.1)	3779 (57.3)
Age, y		
65-74	90 (21.4)	2802 (42.5)
75-84	159 (37.9)	2647 (40.1)
85+	171 (40.7)	1145 (17.4)
Race		
White	263 (62.6)	4609 (69.9)
Black, non-Hispanic	113 (26.9)	1377 (20.9)
Other, non-Hispanic	6 (1.4)	170 (2.6)
Hispanic	26 (6.2)	373 (5.7)
Marital status		
Married/ partner	134 (31.9)	3458 (52.4)
Separated/divorced	51 (12.1)	823 (12.5)
Widowed	218 (51.9)	2076 (31.5)
Never married	17 (4.0)	237 (3.6)
Health status		
Poor	97 (23.0)	378 (5.7)
Fair	151 (35.9)	1287 (19.5)
Good	99 (23.6)	2155 (32.7)
Very good	61 (14.5)	1876 (28.5)
Excellent	12 (2.9)	892 (13.5)
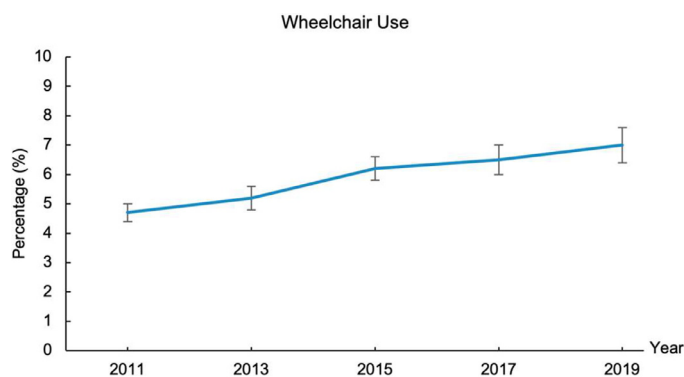
Wheelchair Use

Note: the error bars in the graph represented standard errors of the mean values

Fig 1   The prevalence rate of wheelchair use.

Table 2   Means and standard errors of prevalence rate

			2011	2013	2015	2017	2019
Wheelchair use		Mean	.05	.05	.06	.06	.07
		SE	.00	.00	.00	.00	.01
Pain	Wheelchair use	Mean	.74	.74	.76	.73	.68
		SE	.03	.03	.03	.04	.04
	Non-wheelchair use	Mean	.52	.53	.54	.54	.57
		SE	.01	.01	.01	.01	.01
Balance or coordination problem	Wheelchair use	Mean	.68	.66	.72	.76	.67
		SE	.03	.03	.03	.03	.04
	Non-wheelchair use	Mean	.24	.28	.32	.35	.38
		SE	.01	.01	.01	.01	.01
Upper body strength limitation	Wheelchair use	Mean	.62	.61	.57	.53	.57
		SE	.03	.03	.04	.04	.04
	Non-wheelchair use	Mean	.25	.27	.29	.30	.31
		SE	.01	.01	.01	.01	.01
Lower body strength limitation	Wheelchair use	Mean	.78	.80	.75	.75	.70
		SE	.02	.03	.03	.03	.04
	Non-wheelchair use	Mean	.32	.33	.33	.33	.36
		SE	.01	.01	.01	.01	.01
Unable to walk 3 blocks	Wheelchair use	Mean	.95	.95	.91	.94	.96
		SE	.01	.01	.02	.02	.02
	Non-wheelchair use	Mean	.21	.22	.24	.26	.28
		SE	.01	.01	.01	.01	.01
Unable to climb 10 stairs	Wheelchair use	Mean	.80	.84	.83	.86	.80
		SE	.02	.03	.03	.03	.04
	Non-wheelchair use	Mean	.14	.14	.15	.16	.17
		SE	.00	.01	.01	.01	.01
Going out every day or most days	Wheelchair use	Mean	.43	.43	.33	.42	.37
		SE	.03	.03	.04	.04	.04
	Non-wheelchair use	Mean	.89	.88	.87	.84	.85
		SE	.00	.01	.01	.01	.01
Going out some days	Wheelchair use	Mean	.33	.28	.38	.29	.34
		SE	.03	.03	.04	.04	.04
	Non-wheelchair use	Mean	.08	.09	.10	.13	.12
		SE	.00	.00	.01	.01	.01
Going out rarely or never	Wheelchair use	Mean	.24	.29	.28	.28	.29
		SE	.02	.03	.03	.03	.04
	Non-wheelchair use	Mean	.03	.03	.03	.03	.03
		SE	.00	.00	.00	.00	.00

Table 3 *P* Values for the comparison across years

	Wheelchair Use				
	2011	2013	2015	2017	2019
2011		.16	.00[†]	.00[†]	<.001[†]
2013			<.05*	<.05*	<.01[†]
2015				.57	.17
2017					.33

	Pain (Wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.97	.53	.78	.21
2013			.52	.81	.24
2015				.40	.10
2017					.34

	Pain (Non-wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.29	<.05*	<.05*	<.0001[†]
2013			.22	.19	<.001[†]
2015				.83	<.01[†]
2017					.01*

	Balance or Coordination Problem (Wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.59	.29	.05	.86
2013			.12	<.05*	.82
2015				.35	.31
2017					.07

	Balance or Coordination Problem (Non-wheelchair Use)				
	2011	2013	2015	2017	2019
2011		<.0001[†]	<.0001[†]	<.0001[†]	<.0001[†]
2013			<.001[†]	<.0001[†]	<.0001[†]
2015				<.001[†]	<.0001[†]
2017					<.05*

	Upper Body Strength Limitation (Wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.85	.30	.08	.29
2013			.41	.13	.42
2015				.48	.93
2017					.56

	Upper Body Strength Limitation (Non-wheelchair Use)				
	2011	2013	2015	2017	2019
2011		<.05*	<.0001[†]	<.0001[†]	<.0001[†]
2013			<.05*	<.01[†]	<.01[†]
2015				.32	.18
2017					.66

	Lower Body Strength Limitation (Wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.56	.47	.37	.06
2013			.21	.18	<.05*
2015				.86	.27
2017					.31

Lower Body Strength Limitation (Non-wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.53	.23	.29	<.01[†]
2013			.51	.58	<.05*
2015				.99	.08
2017					.07

Unable to Walk 3 Blocks (Wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.70	.11	.88	.51
2013			.07	.66	.74
2015				.28	.07
2017					.45

Unable to Walk 3 Blocks (Non-wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.07	<.001[†]	<.0001[†]	<.0001[†]
2013			<.05*	<.0001[†]	<.0001[†]
2015				<.01[†]	.0001[†]
2017					.09

Unable to Climb 10 Stairs (Wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.27	.39	.13	.97
2013			.87	.62	.35
2015				.50	.46
2017					.19

Unable to Climb 10 Stairs (Non-wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.69	.05	<.05*	<.01[†]
2013			<.05*	<.05*	<.001[†]
2015				.57	.10
2017					.21

Going Out Every Day or Most Days (Wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.48	.06	.59	.15
2013			.25	.94	.42
2015				.24	.81
2017					.39

Going Out Every Day or Most Days (Non-wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.20	<.05*	<.0001[†]	<.0001[†]
2013			.14	<.0001[†]	<.001[†]
2015				<.0001[†]	<.05*
2017					.22

Going Out Some Days (Wheelchair Use)				
	2011	2013	2015	2017	2019
2011		<.05*	.65	.19	.57
2013			<.05*	.65	.27
2015				.10	.38
2017					.53

Going Out Some Days (Non-wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.54	.16	<.0001[†]	<.01[†]
2013			.41	<.0001[†]	<.05*
2015				<.001[†]	.08
2017					.23

Going Out Rarely or Never (Wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.48	.06	.59	.15
2013			.25	.94	.42
2015				.24	.81
2017					.39

Going Out Rarely or Never (Non-wheelchair Use)				
	2011	2013	2015	2017	2019
2011		.20	<.05*	<.0001[†]	<.0001[†]
2013			.14	<.0001[†]	<.001[†]
2015				<.0001[†]	<.05*
2017					.22

* $P < 0.05$
[†] $P < 0.01$

Statistical analyses

Considering the independent variable (wheelchair use vs non-wheelchair use) was binary and the dependent variables were either in binary (pain, balance problems, strength limitation, and mobility disability) or ordinal scale (going outside), we conducted logistic regression analyses to evaluate the effect of wheelchair use on physical characteristics, and frequency of going outside in participants who used and did not use wheelchairs at each round. In each model, we included cluster, strata, and weight variables as suggested by the guidance of NHATS analysis accounting for sample design.[15] We specified the individual Sample Person (SP) ID as the cluster variable to account for within-person differences over time. We used analytical weights at each round to adjust for the differential probabilities of selection and nonresponse as well as for the missing SP interviews for those in residential care settings beyond 2011. The proportion difference between the 2 groups was compared at each round. To estimate the difference across rounds, we included the interaction of round and group in the model. Post hoc pairwise analysis was further conducted to compare the percentage between rounds and groups. All statistical analyses were performed using the Statistical Analysis System (SAS) Version 9.4 (SAS Institute Inc, 2013). The survey analysis procedures in SAS software properly analyze complex survey data by considering the complex sampling design.

Results

The descriptive characteristics of the study sample are summarized in table 1 for the 7026 older adult survey respondents. Around 6% of them (n=421) reported that they used wheelchairs in the last month. Most of those who used wheelchairs were 75 years and older, women, and white. More than half of them were widowed and reported poor or fair health status. Compared with older adults who used wheelchairs, those who did not use wheelchairs in the last month (N=6605) were more likely to be men, younger, married or had a partner, or had better health status.

Trends in wheelchair use

To assess changes in wheelchair use over time, we analyzed the percentage of wheelchair use and standard error in each year and compared the differences across the years. As shown in figure 1, the prevalence rate of wheelchair use among participants significantly increased from 4.7 per 100 people in 2011 to 7.1 in 2019 (see tables 2 and 3). The prevalence of wheelchair uses since 2015 significantly increased, compared with the years 2011 and 2013 ($P<.05$). However, a significant difference was not observed between 2011 and 2013, nor were there differences across the later years (2015, 2017, and 2019). We further investigated the trends of health and physical characteristics and frequency of going outside among the participants who used wheelchairs and the comparison with those who did not in the following sections.

Trends and comparison in pain

Pain is a significant physical characteristic that could influence wheelchair mobility. We described the trends of pain among people who used wheelchairs and the comparison with those who did not. Figure 2 indicates that the prevalence rate of pain among older people who used wheelchairs varied from 68.2 per 100 people the lowest in 2019 to 76.3 the highest in 2015. The difference across years was not significant ($P>.05$). The prevalence rate of pain among participants who did not use wheelchairs increased from 51.5 per 100 people in 2011 to 57.4 in 2019. The prevalence rate in 2019 increased significantly, compared with previous years ($P<.05$). The prevalence in 2015 and 2017 also showed significant increases, compared with 2011 ($P<.05$). In addition, those participants who reported pain were at least 2.48 times more likely to be wheelchair users than non-wheelchair users in all the years ($P<.0001$), except 2019 with 1.59 times ($P<.05$; see table 4).
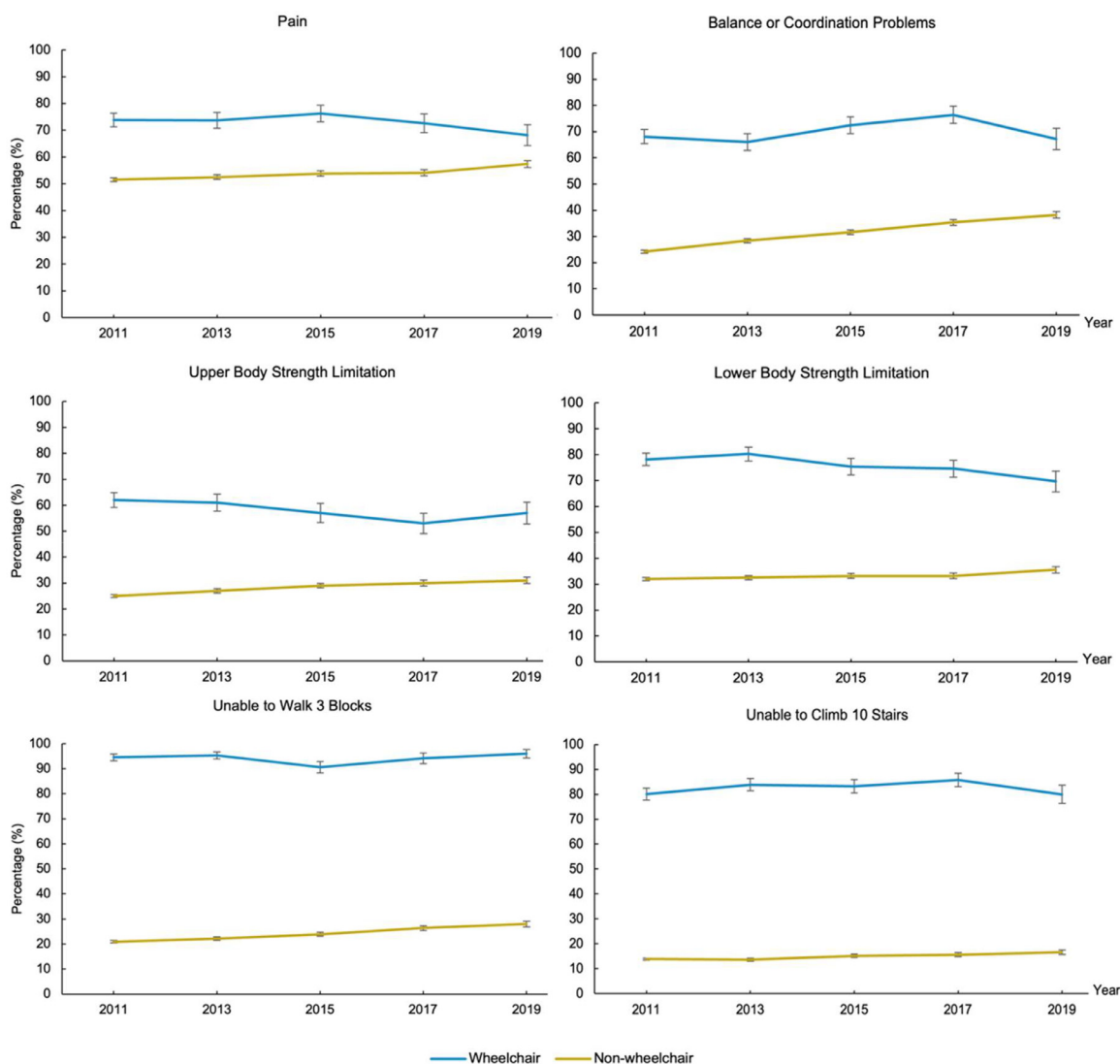
Note: the error bars in the graph represented standard errors of the mean values

Fig 2 The prevalence rate of physical problems.

Trends and comparison in balance or coordination problem

We investigated the trends of balance or coordination problems among people who used wheelchairs and those who did not, as well as the comparison between both groups. Figure 2 indicates that the prevalence rate of balance or coordination problems among older people who used wheelchairs varied from 66.0 per 100 people as the lowest in 2013 to 76.4 as the highest in 2017. The difference between these 2 years was significant ($P<.05$). The prevalence rate among participants who did not use wheelchairs increased from 24.2 per 100 people in 2011 to 38.2 in 2019. The differences across all the years were significant ($P<.05$). In addition, those who reported balance or coordination problems were at least 4.27 times more likely to be wheelchair users than non-wheelchair users in all the years, except year 2019 with 3.31 times ($P<.0001$).

Trends and comparison in body strength limitation

Similar to the analysis of the above 2 factors, we investigated the prevalence of both upper and lower body strength limitations among people who used wheelchairs and those who did not. As shown in figure 2, the prevalence rate of upper body limitation among older people who used wheelchairs varied from 53.4 per 100 people as the lowest in 2017 to 61.7 as the highest in 2011. The difference across years was not significant ($P>.05$). The prevalence rate among participants who did not use wheelchairs increased from 25.3 per 100 people in 2011 to 31.0 in 2019. The differences across all the years were significant ($P<.05$), except for the difference between 2015, 2017, and 2019. In addition, those participants who reported upper body limitation were at least 2.48 times more likely to be wheelchair users than non-wheelchair users in all the years ($P<.01$).

Table 4 Logistic regression models of the predictor of wheelchair use for physical problems and mobility

Variable	2011 OR (95% CI)	P	2013 OR (95% CI)	P	2015 OR (95% CI)	P	2017 OR (95% CI)	P	2019 OR (95% CI)	P
Pain	2.65 (2.04, 3.45)	<.01	2.53 (1.87, 3.43)	<.01	2.76 (1.95, 3.90)	<.01	2.5 (1.58, 3.22)	<.01	1.59 (1.10, 2.29)	<.05
Balance	6.67 (5.19, 8.56)	<.01	4.91 (3.68, 6.54)	<.01	5.67 (4.11, 7.84)	<.01	5.94 (4.12, 8.55)	<.01	3.31 (2.28, 4.82)	<.01
Upper body strength	4.76 (3.74, 6.04)	<.01	4.18 (3.15, 5.53)	<.01	3.21 (2.36, 4.37)	<.01	2.63 (1.90, 3.62)	<.01	2.9 (2.04, 4.12)	<.01
Lower body strength	7.62 (5.77, 10.07)	<.01	8.42 (6.04, 11.75)	<.01	6.15 (4.33, 8.74)	<.01	5.91 (4.51, 8.41)	<.01	4.15 (2.84, 6.09)	<.01
Unable to walk 3 blocks	65.13 (39.10, 108.49)	<.01	70.69 (38.21, 130.81)	<.01	30.56 (17.88, 52.24)	<.01	45.01 (20.67, 98.03)	<.01	61.54 (26.28, 144.12)	<.01
Unable to walk 10 stairs	24.99 (18.42, 33.91)	<.01	32.86 (22.62, 47.74)	<.01	27.78 (18.83, 40.98)	<.01	32.37 (20.72, 50.55)	<.01	19.9 (12.47, 31.75)	<.01
Frequency of going out										
Rarely or never vs everyday & most days	16.93 (12.26, 23.74)	<.01	19.51 (13.50, 28.20)	<.01	22.43 (14.55, 34.57)	<.01	16.41 (10.65, 25.28)	<.01	19.7 (12.08, 32.12)	<.01
Rarely or never vs some days	2.05 (1.46, 2.89)	.78	2.99 (2.01, 4.46)	.17	2.14 (1.38, 3.31)	.16	3.72 (2.32, 5.96)	.12	2.91 (1.74, 4.84)	.16
Some days vs everyday & most days	8.24 (6.24, 10.88)	<.01	6.53 (4.62, 9.23)	<.01	10.48 (7.24, 15.16)	<.01	9.41 (2.97, 6.55)	<.01	6.68 (4.41, 10.43)	<.01

NOTE. Effect size OR<1.44 very small; 1.44≤OR<2.48 small; 2.48≤OR<4.27 medium; OR≥4.27 large.[16]

For the lower body strength limitation (see fig 2), the prevalence rate among older people who used wheelchairs increased significantly from 69.7 per 100 people as the lowest in 2019 to 80.2 as the highest in 2013 (*P*<.05). The prevalence rate among participants who did not use wheelchairs increased over the years, from 32.0 per 100 people in 2011 to 35.6 in 2019. The difference between both years was significant, as well as the years between 2013 and 2019 (*P*<.05). In addition, those who reported lower body limitation were at least 4.27 times more likely to be wheelchair users than non-wheelchair users in all the years, except the year 2019 with 4.15 times (*P*<.01).

Trends and comparison in mobility disability

Mobility disabilities were investigated by self-reported incapability of walking and climbing stairs. Figure 2 indicates that the prevalence rate of walking disability among participants who did not use wheelchairs increased from 20.9 per 100 people in 2011 to 28.0 in 2019. The difference was significant (*P*<.0001). However, the changes in the earlier years (2011 and 2013) and the recent years (2017 and 2019) were not significant (*P*>.05). We also found that the prevalence rate of difficulty with climbing stairs among participants who did not use wheelchairs increased significantly from 13.9 per 100 people in 2011 to 16.7 in 2019. A significant difference was also found between the years 2011 and 2017, and the differences between 2013 and the later years (*P*<.05).

Trends and comparison in the frequency of going outside

We further investigated the frequency of going outside over the years and the difference between participants who used wheelchairs and those who did not. As figure 3 indicates, almost all participants (80%) who did not use wheelchairs went outside every day or most days. Only around one-third of participants who used wheelchairs went outside every day or most days, close to the percentage of them who went outside some days, or rarely or never. Participants who reported less frequently going out (rarely or never vs every day & most days; some days vs every day & most days) were at least 4.27 times more likely to be those who used wheelchairs than those who did not (*P*<.01; see table 4). The prevalence rate of going outside every day or most days among participants who did not use wheelchairs decreased significantly from 89 per 100 people in 2011 to 85 in 2019 (*P*<.0001; see tables 2 and 3).

Discussion

First, to summarize the key findings of our analyses: The rate of wheelchair use has increased significantly on a yearly basis. Moreover, participants who used wheelchairs went out much less frequently than those who did not use wheelchairs. Health and physical problems such as pain, balance problems, and body strength limitations were more common among older wheelchair users. However, out-of-home mobility decreased, and physical problems increased significantly over time for the older adults who did not use wheelchairs.

Wheelchair use has increased among older adults from 4.7 per 100 people in 2011 to 7.1 in 2019, which echoes previous studies but with a higher percentage rate. For example, Kirby[4] quoted US
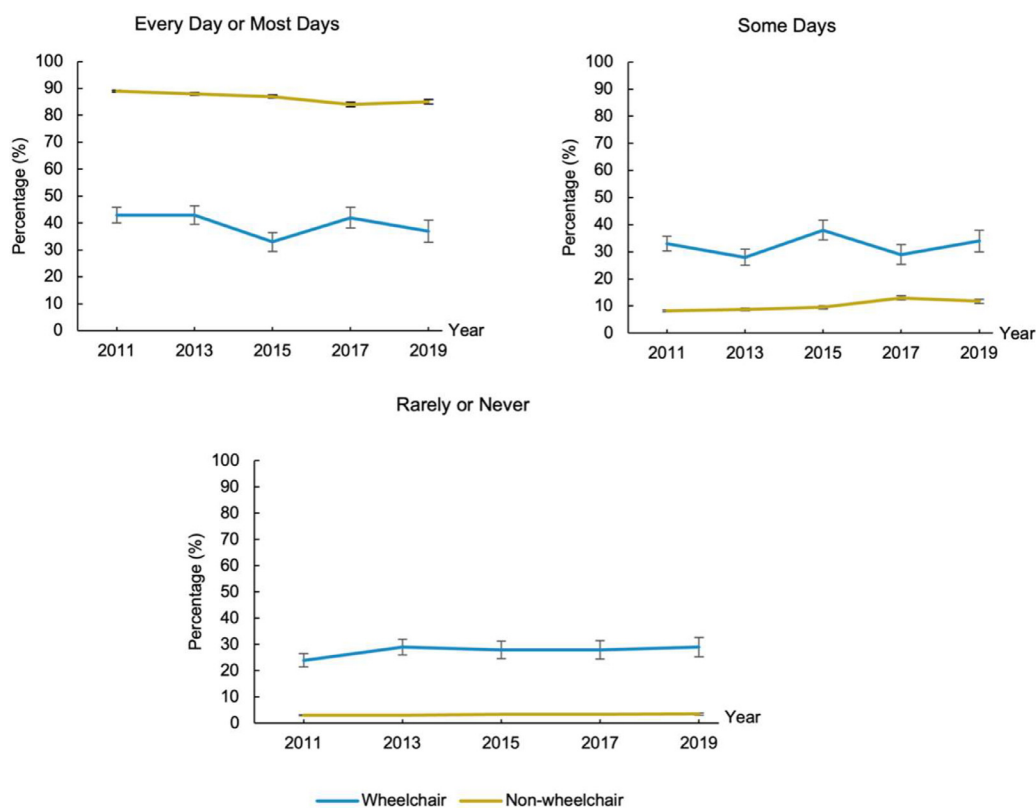
Note: the error bars in the graph represented standard errors of the mean values

Fig 3   The frequency of going outside.

statistics indicating that the prevalence rate of wheelchair use among people aged 65 years and over in the USA went from 3.3 per 1000 people in 1982 to 4.2 in 1992. LaPlante and Kaye[5] analyzed data on wheeled mobility equipment (WME, eg, wheelchair, scooter) use between 1990 and 2005. They found that the annualized rate of increase was 4.2% a year for older persons.

Our findings indicated a significant disparity in out-of-home mobility between older wheelchair users and older non-wheelchair users. While out-of-home mobility decreased among older non-wheelchair users, older adults who used wheelchairs were much less likely to go outside on a regular basis. This lower outdoor mobility could be due to their health and functional limitations (eg, pain) or potential barriers in physical and socio-cultural environments for outside wheelchair mobility.[17]

Physical problems such as pain, balance problem, and body strength limitation, were common among older wheelchair users, which echoes previous research.[7] Older wheelchair users could experience pain and physical problems due to medical conditions, neurologic conditions, or musculoskeletal problems.[12] In addition, older adults who used wheelchairs were more likely to experience health and physical problems than those who did not. This result may be due to wheelchair users' existing conditions or wheelchair use, for example, a prolonged period of sitting in the wheelchair.[18-20] Clinicians should consider older wheelchair users' health and physical limitations when prescribing wheelchairs. In addition, the disparities between the 2 groups emphasized the significance of exploring social determinants underlying the disparities in health and physical problem and out-of-home mobility.

The fundamental causes of these disparities can guide effective public health research and action.

Our findings also confirmed a frequently observed clinical observation that health and physical problems (eg, pain, balance problems) among older adults who did not use wheelchairs increased over the years. Physical challenges could affect the efficiency of wheelchair use and have been linked with a higher risk of falling,[21] which often results in functional impairment and mortality.[22] Addressing these physical problems is significant for fall prevention and better quality of life.[23,24]

Study limitations

The NHATS data set has some limitations that necessarily constrain the conclusions but provide insights and direction for future research. First, as with any survey, self-reports of wheelchair use, health and physical problems, and frequencies of going outside may have been subject to recall bias. Second, the percentages of those who used wheelchairs had health and physical problems, and rarely/never went outside were likely underestimations given that older adults who were proxy-interviewed were excluded. These older adults often had cognitive and/or other serious health issues and were more likely to be homebound. Third, we categorized participants who used other mobility devices, such as canes, walkers, and scooters into the non-wheelchair use group. Participants who used these mobility devices could have health and physical problems as well, which might affect the homogeneity of the physical characteristics of

the group. In addition, the subjective measure of wheelchair uses, and format of the NHATS wheelchair questions could affect the accuracy of the identification of wheelchair users and non-wheelchair users. The classification between groups needs to be improved to better understand the differences between the 2 groups in future research. However, we did find significant differences between the groups of people who use wheelchairs and do not, which can provide important insights to clinicians and guide future research on the topic. And fourth, although over 96% of U.S. older adults have Medicare coverage, those not covered by Medicare are least likely to have health care and social resources and are not represented in the study sample.

Conclusion

With increasing numbers of older adults in the population, a better understanding of the prevalence of wheelchair use and the personal characteristics of older wheelchair users will help to identify their unmet needs. We estimated the trends of wheelchair use and identified the characteristics of older adults who used a wheelchair by analyzing a nationally representative data sample. Our analysis focused on individual characteristics. Two clear patterns emerged that provide insights for potential interventions. First, older adults who do not use wheelchairs showed increasing physical problems over time (including balance or coordination problems). Addressing physical problems is significant for improving health and well-being. Second, compared with non-wheelchair users, older adults who used a wheelchair were more likely to experience physical and health problems and less likely to go outside. This field of inquiry would benefit from an examination of a more complete picture including extra-individual factors, such as the physical and socio-cultural environment that may influence wheelchair mobility.

Keywords

Aging; Physical problems; Rehabilitation; Trends; Wheelchair use

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Appendix 1 NHATS Questions Included in the Study

Pain	In the last month, have you been bothered by pain?
Balance or coordination problems	In the last month, did you have problems with balance or coordination?
Body strength limitation	In the last month, did you have limited strength or movement in your shoulders, arms, or hands?
	In the last month, did you have limited strength or movement in your hips, legs, knees, or feet?
Mobility disability	In the last month, were you able to walk 3 blocks by yourself and without your {cane/walker/cane or walker}?
	In the last month, were you able to walk up 10 stairs by yourself and without your cane?
Frequency of going outside	In the last month, how often did you leave your home to go outside? Would you say every day, most days, some days, rarely, or never? 1 every day (7 days a week), 2 most days (5-6 days a week), some days (2-4 days a week), rarely (once a week or less), 5 never

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