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Factors Associated with Geriatric Syndromes in Older Homeless Adults

Rebecca T. Brown, M.D.[1,2], **Dan K. Kiely, M.P.H., M.A.**[3], **Monica Bharel, M.D.**[4,5,6], and **Susan L. Mitchell, M.D., M.P.H.**[3,7]

[1]Division of Geriatrics, University of California, San Francisco, San Francisco, CA

[2]San Francisco Veterans Affairs Medical Center, San Francisco, CA

[3]Hebrew SeniorLife Institute for Aging Research, Boston, MA

[4]Boston Healthcare for the Homeless Program, Boston, MA

[5]Department of Medicine of Boston Medical Center, Boston, MA

[6]Department of Medicine of Massachusetts General Hospital, Boston, MA

[7]Division of Gerontology of Beth Israel Deaconess Medical Center, Boston, MA

Abstract

Although older homeless adults have high rates of geriatric syndromes, risk factors for these syndromes are not known. We used multivariable regression to estimate the association of subject characteristics with the total number of geriatric syndromes in 250 homeless adults aged 50 years and older. Geriatric syndromes included falls, cognitive impairment, frailty, major depression, sensory impairment, and urinary incontinence. A higher total number of geriatric syndromes was associated with having less than a high school education, medical comorbidities (diabetes and arthritis), alcohol and drug use problems, and difficulty performing one or more ADLs. Clinicians who care for older homeless patients with these characteristics should consider screening them for geriatric syndromes. Moreover, this study identifies potentially modifiable risk factors associated with the total number of geriatric syndromes in older homeless adults. This knowledge may provide targets for clinical interventions to improve the health of older homeless patients.

Keywords

Homeless persons; aged; middle aged; geriatric syndromes

The U.S. homeless population is aging. One-third of homeless adults were at least 50 years old in 2003, compared with only 11% in 1990.[1] This proportion appears to have continued to rise over the past decade.[2] The aging homeless population is in poor health, with high rates of chronic illnesses[3] and geriatric syndromes, such as cognitive impairment, falls, and depression.[4] Geriatric syndromes are defined as conditions that occur in older adults and cross discrete disease categories,[5] and these syndromes have been found to be associated with high rates of acute health services use,[6] disability,[7] and mortality.[8,9] Researchers have identified multiple risk factors for these syndromes in the general population, and geriatric syndromes are thought to be defined in part by this multifactorial etiology.[5] Knowledge

Correspondences: Rebecca T. Brown, M.D., San Francisco Veterans Affairs Medical Center, 4150 Clement Street, 181G, San Francisco, CA 94122, USA (rebecca.brown@ucsf.edu).

about multiple risk factors has allowed researchers to develop multi-component interventions to prevent or treat geriatric syndromes.[10–12]

We previously found that older homeless adults have higher rates of geriatric syndromes at a relatively younger age compared to the general population.[4] The reasons for this finding are not clear. While risk factors associated with these syndromes in homeless adults may be similar to those known in the general population, it is conceivable that homeless adults have distinct risk factors. For example, high rates of mental illness[13] and substance use problems[14] may account for the premature development of geriatric syndromes in older homeless adults.

The objective of this study was to extend our prior work describing the prevalence of geriatric syndromes in an established cohort of 250 homeless adults aged 50 and older[4] by identifying factors associated with the presence of these syndromes. Understanding the unique factors associated with geriatric syndromes in older homeless adults is an important step to improve the care of this vulnerable population. This knowledge would allow health care providers to identify and assess homeless patients who may have these syndromes, and may provide targets for interventions to improve the health of older homeless adults.

Methods

The study design is described in detail elsewhere.[4] The Institutional Review Boards of Hebrew SeniorLife and Beth Israel Deaconess Medical Center in Boston approved the study's conduct. Subjects provided written informed consent for study participation.

Sample

We contacted 16 shelters (six emergency, five transitional, and five day) in Boston serving 50 or more single adults daily, and received permission to recruit subjects from eight shelters (three emergency, three transitional, and two day). Systematic random sampling was used to select shelter clients from bed lists or meal lines. Selected clients were invited to participate if they met the following criteria: age ≥50 years, current homelessness, ability to communicate in English, and ability to provide written informed consent. Individuals with delirium[15] or visible intoxication were excluded. Subjects received a $5 gift certificate to a pharmacy chain.

Data collection

Data were obtained from baseline in-person interviews and physical examinations (RTB), and included the following categories: demographic characteristics, health status, health services, homelessness, and geriatric syndromes. Demographic characteristics included self-reported age, gender, race/ethnicity, marital status, education, and primary language. Health status data included self-reported general health, comorbid conditions, number of medications taken daily, history of traumatic brain injury, and alcohol and drug problems in the past 30 days. To assess lifetime history of traumatic brain injury, subjects were asked, "Have you ever had an injury to the head which knocked you out or at least left you dazed, confused, or disoriented?"[16,17] Alcohol and drug problems in the past 30 days were measured using the Addiction Severity Index (ASI) composite score (range 0–1, higher scores indicate worse problems).[18] Using cut-off scores developed for homeless adults, alcohol problems were defined as an ASI score of 0.17 or higher and drug problems as an ASI score of 0.10 or higher.[19] Binge-drinking was defined as consumption of five or more alcoholic beverages on one or more days in the past 30 days.

Health services items were assessed by self-report, including health insurance (yes/no). Subjects who reported that they had a place where they usually obtained medical care were

asked to specify usual source of care (outpatient clinic vs. emergency department (ED)). Use of health care during the past year was assessed, including number of clinic visits. To characterize history of homelessness, subjects reported total years of homelessness during their lifetime, and number of months of homelessness during the past year.

Geriatric syndromes were assessed, including: functional impairment, cognitive impairment, frailty, depression, hearing impairment, visual impairment, and urinary incontinence. Assessment of functional status included measures of Activities of Daily Living (ADLs), Instrumental Activities of Daily Living (IADLs), falls, and mobility. The modified Katz ADL Scale was used to rate ability to bathe, dress, transfer, toilet, and eat using three categories: no difficulty, a little or some difficulty, or a lot of difficulty or inability to perform.[20] The Brief Instrumental Functioning Scale (BIFS) was used to assess ability to perform six IADLs on a similar three category scale.[21] Ability to perform ADLs or IADLs was dichotomized: i. no difficulty performing any ADL (or IADL) and ii. difficulty performing one or more ADL (or IADL) independently. History of falls during the past year was assessed with a yes/no question, "Did you fall to the ground in the past year?"[22] Problems with walking were assessed by asking subjects if they had difficulty walking without help from another person.[23]

Cognition was measured using the Mini-Mental State Examination (MMSE)[24] and the Trail Making Test Part B (TMT-B).[25] Impairment on the MMSE was defined as a score below 24 (range 0–30; lower scores indicate more impairment).[26] The TMT-B measures executive function, with longer time required to complete the task indicating worse function. Durations longer than five minutes on the TMT-B task were truncated at 300 seconds. Impaired executive function was defined as TMT-B duration more than 1.5 standard deviations above population-based norms, or as stopping the task early.[27]

To define frailty, we used the Fried criteria, in which three or more of five characteristics were present: unintentional weight loss, exhaustion, low physical activity, slow walking speed, and weak handgrip.[28] The Patient Health Questionnaire 9 (PHQ-9) score was used to assess depression, with major depression defined as a score of 10 or higher (range 0–27, higher scores indicate more symptoms).[29] Hearing impairment was defined as self-reported difficulty hearing despite using a hearing aid. Visual impairment was defined as best-corrected vision worse than 20/40 on Snellen chart.[30] The International Consultation on Incontinence Questionnaire (ICIQ) was used to assess urinary incontinence (range 0–21; higher values indicate worse symptoms and urinary incontinence is defined as a score of 1 or more).[31]

To provide a measure of the total burden of geriatric syndromes,[32] total number of geriatric syndromes was determined, with one point assigned for each of the following syndromes: i. fall in the past year; ii. cognitive impairment (defined as MMSE score below 24 and/or TMT-B duration more than 1.5 standard deviations above population-based norms); iii. frailty (defined as the presence of three or more of five characteristics); iv. major depression (defined as a PHQ-9 score of 10 or higher); v. sensory impairment (defined as self-reported hearing difficulty and/or visual acuity worse than 20/40); and vi. urinary incontinence (defined as an ICIQ score of 1 or more) (range, 0–6 total syndromes).

Statistical analyses

Subject characteristics were described using means and standard deviations for continuous variables and frequencies and proportions for categorical variables.

Ordinal logistic multivariable models were used to estimate the association of each subject characteristic (independent variable) with the total number of geriatric syndromes (ordinal

score). Effect measures included odds ratios and 95% confidence intervals. Baseline characteristics that we felt 'a priori' could be related to the total number of geriatric syndromes based on the literature[5] were entered into bivariate analyses. Covariates associated with the outcomes in bivariate analyses at the p<.20 level were entered into multivariable models.

To construct the final multivariable model, we used backwards selection, sequentially removing the covariate with the largest p value ≥05 (with the exception of age and sex, which were retained in the final model). If removing a covariate caused the regression coefficient for any of the other variables to change ≥20% when compared to the previous model, that covariate was defined as a confounder and retained in the model. Collinearity was defined as a ≥20% increase in the standard error of the regression coefficient on multivariable analysis compared to bivariate analysis. Covariates causing collinearity problems were removed from the model if they did not confound other variables.

All analyses were conducted using SAS version 9.3 (SAS Institute, Cary, North Carolina). All reported p values were two-sided and $P<.05$ was considered significant.

Results

Sample

Of the 472 shelter clients screened for eligibility, 387 (82.0%) met eligibility criteria. Clients were ineligible for the following reasons: not homeless (N=44/85, 51.8%); unable to communicate in English (N=27/85, 31.8%); unable to provide informed consent (N=5/85, 5.9%); and visible intoxication (N=9/85, 10.6%). Among the 387 eligible individuals, 250 (64.6%) subjects were recruited. Eligible clients who declined to participate did not differ significantly from those enrolled by observed race/ethnicity, but were older (mean age 59.5 years, p=.002) and likelier to be men (89.8%, p=.02).

Subject characteristics and geriatric syndromes

Characteristics of the cohort are presented in Table 1 and are also described in detail elsewhere.[4] Briefly, the mean age of the subjects was 56.2 (standard deviation (SD) 5.3, range, 50–85) years, 19.2% were female, 40.0% were White, 26.2% had not completed high school, and 86.8% identified English as their primary language. Nearly 60% of subjects reported a lifetime history of traumatic brain injury. Most subjects had been homeless for a year or more (61.6%), with a mean duration of lifetime homelessness of 7.7 (SD, 8.4) years.

The total number of geriatric syndromes was distributed as follows: 0, N=21 (8.4%); 1, N=51 (20.4%); 2, N=67 (26.8%); 3, N=54 (21.6%); 4, N=33 (12.2%); 5, N=19 (7.6%); 6, N=5 (2.0%) (Table 2). More than half of the subjects fell in the past year (53.4%). Mean MMSE score was 26.3 (SD, 3.1), and 24.5% of subjects had cognitive impairment defined by MMSE score <24. Mean TMT-B duration was 130.3 (SD, 67.4) seconds, and 28.0% of subjects had cognitive impairment defined by TMT-B duration more than 1.5 standard deviations above population-based norms. More than 40% of subjects had cognitive impairment defined as MMSE and/or TMT-B impairment. Of the subjects, 16.2% met frailty criteria, and 39.8% had major depression defined by PHQ-9 score. One third of subjects reported hearing difficulty, and 21.1% had best-corrected vision worse than 20/40. Nearly half of subjects had sensory impairment defined as hearing and/or vision impairment, and 49.6% reported urinary incontinence.

Subjects with a single geriatric syndrome had a high probability of having at least one other geriatric syndrome (Table 3). If a subject had one of six geriatric syndromes (fall, cognitive impairment, frailty, depression, sensory impairment, or urinary incontinence), the

probability of having at least one additional geriatric syndrome among those six exceeded 85%. Among the six syndromes, hearing impairment and urinary incontinence were the least likely to be associated with one or more additional syndromes, while MMSE impairment, TMT-B impairment, depression, and frailty were most likely to be associated with one or more additional syndromes.

Factors associated with total number of geriatric syndromes

In bivariate ordinal logistic regression analyses, the following factors were significantly associated with a higher total number of geriatric syndromes: less than a high school education, one or more clinic visits in the past year, diabetes mellitus, hypertension, arthritis, alcohol use problems, drug use problems, and ADL impairment. After multivariable adjustment, all factors remained significantly associated with a higher total number of geriatric syndromes, with the exception of hypertension and clinic visit in the past year. Of the six characteristics significantly associated with a higher total number of geriatric syndromes, ADL impairment, arthritis, diabetes mellitus and drug use problem all had odds ratios of 2 or higher.

Discussion

Our findings demonstrate that while some factors associated with geriatric syndromes in older homeless adults are similar to those in community-dwelling adults, important differences exist. Unlike in the general population, older age in this homeless cohort was not associated with the total number of geriatric syndromes.[5] Furthermore, characteristics more commonly found in the homeless population than in the general population (i.e., alcohol and drug use problems) were strongly associated with a higher total number of geriatric syndromes. These findings have important clinical implications.

The characteristics of this cohort are similar to those of prior large cohorts of homeless adults, including gender, race/ethnicity, marital[33] and health status.[34] However, rates of health insurance were higher than in previous studies,[33] due to Massachusetts health reform, which provides subsidized health insurance to residents earning up to 300% of the federal poverty level. Compared to homeless adults age 50 and older in previous cohorts, subjects in this cohort had higher rates of self-reported comorbidity;[2] rates of functional impairment,[35] cognitive impairment,[36] depression,[37] hearing[36] and visual impairment[38] were generally similar to those reported previously.

This study confirms current knowledge about factors associated with geriatric syndromes in the general older population, while revealing how these syndromes present uniquely in older homeless adults. Like community-dwelling older adults, homeless subjects with a single geriatric syndrome were likely to have at least one additional syndrome.[7] However, while the proportion of subjects in the general population with one geriatric syndrome who had one or more additional syndromes ranged from 48.7% to 78.7%,[7] the proportion in homeless adults was much higher, ranging from 88.2% to 98.9%. This finding suggests that older homeless patients who are found to have a single geriatric syndrome should be screened for additional syndromes.

Several demographic and health status factors associated with geriatric syndromes in the older homeless cohort were similar to those in community-dwelling older adults. Lower educational level was associated with a higher total number of geriatric syndromes among the homeless subjects, and is known to be associated with cognitive impairment in the general population.[39,40] Similarly, diabetes and arthritis were associated with a higher total number of geriatric syndromes in the homeless cohort, consistent with studies of

community-dwelling older adults that show diabetes to be associated with a higher prevalence of geriatric syndromes[41] and arthritis to be associated with falls.[42]

In contrast to studies of the general older population,[5,28,43–44] older age was not associated with total number of geriatric syndromes in the homeless cohort. There may be several reasons for this finding. In the general older population, geriatric syndromes are thought to result from an accumulation of deficits that occurs with aging.[5] While a similar accumulation of deficits may occur in homeless adults, in this cohort total number of geriatric syndromes was related to factors that do not increase in prevalence with older age. For example, alcohol use problems are less prevalent in both older community-dwelling and older homeless adults compared to their younger counterparts.[45,14] Alternatively, it is possible that older age is associated with a higher total number of geriatric syndromes, but that this relationship is not evident due to death or institutionalization of the oldest, frailest homeless adults. Consistent with this hypothesis, adults age 65 and older account for only 5% of the total homeless population,[1,46] possibly due to death, institutionalization, and the availability of age-linked benefits such as Social Security.

Characteristics that are more common in homeless adults than community-dwelling older adults were significantly associated with the total number of geriatric syndromes, namely alcohol and drug use problems. Similar relationships between alcohol misuse and geriatric syndromes have been noted in community-dwelling older adults,[47–53] though the relationship of illicit drug use to geriatric syndromes has not been examined in the general population.

These findings have implications for clinical practice by identifying characteristics that may help clinicians target older homeless patients who would most benefit from screening for geriatric syndromes. Most of the syndromes included in this study have screening tests that require 5 minutes or less to administer. Though delivering standard treatments for geriatric syndromes to older homeless patients is challenging, patients who screen positive for geriatric syndromes may benefit from early treatment interventions.

The study has several limitations. Limited power may account for our inability to detect a significant association between certain comorbidities (e.g., stroke) and total number of geriatric syndromes. Recruitment of subjects was limited to shelters, and therefore does not capture individuals who do not access these organizations. Recruiting from shelters could either overestimate geriatric syndromes (if more functional homeless adults do not access shelters), or could underestimate syndromes (if frailer individuals are unable to seek shelter). However, half of the subjects in this study were recruited during winter months, when only 6% of single homeless adults in Boston stay on the street.[54] Because we measured substance use during the previous 30 days, we were unable to measure the association of duration of substance use with the total number of geriatric syndromes. While unmeasured confounders may partially account for the observed associations, our results are consistent with those of studies conducted in the general population.[41–44,47–53] Because we only included Massachusetts shelters, the findings may not be generalizable to other areas. However, the subjects' demographic characteristics are similar to a nationally representative homeless cohort.[33] Finally, we report associations between subject characteristics and geriatric syndromes, but cannot infer causality due to the study's cross-sectional design.

Our study identifies factors associated with the total number of geriatric syndromes in older homeless adults. Several factors associated with geriatric syndromes are preventable or treatable, including diabetes, arthritis, substance use, and ADL impairment. Older homeless adults with these problems may benefit from intensive medical treatment and case management directed at treating these conditions. Moreover, these factors may represent

potential targets for interventions to improve health status and decrease use of health services in older homeless adults.

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Table 1

Baseline characteristics of homeless subjects

Characteristic	All subjects (N=250)
Demographics	
Age, years mean (SD)	56.2 (5.3)
Women, n (%)	48 (19.2)
Race/ethnicity, n (%)	
African-American	100 (40.0)
White	100 (40.0)
Multiracial/Other	24 (9.6)
Latino	26 (10.4)
Married or partnered, n (%)	15 (6.0)
less than a high school education, n (%)	65 (26.0)
Primary language English, n (%)	217 (86.8)
Military service	76 (30.4)
Health status	
Comorbid conditions, n (%)	
Stroke	17 (6.9)
Diabetes mellitus	40 (16.0)
Coronary artery disease	33 (13.2)
Hypertension	147 (58.8)
Arthritis	110 (44.0)
Number of daily medications ≥4	119 (47.6)
Alcohol problems, n (%)	
Addiction severity index ≥0.17	46 (18.4)
≥1 binge drinking episodes	74 (29.6)
Drug problems, n (%)	
Addiction severity index ≥0.10	42 (16.8)
Traumatic brain injury	147 (58.8)
Health services	
Insurance, n (%)	234 (93.6)
Lacks usual source of care or uses ED, n (%)	71 (28.4)
≥1 clinic visit, past year, n (%)	216 (86.4)
Homelessness	
Lifetime homelessness, years mean (SD)	7.7 (8.4)
Homeless ≥1 year, n (%)	154 (61.6)

Table 2

Prevalence or mean value of geriatric syndromes in the cohort

Geriatric syndrome	All subjects (N=250)
Total number of geriatric syndromes, n (%)	
0	21 (8.4)
1	51 (20.4)
2	67 (26.8)
3	54 (21.6)
4	33 (12.2)
5	19 (7.6)
6	5 (2.0)
Functional status, n (%)	
ADL impairment	74 (29.6)
IADL impairment	142 (57.3)
Fall in past year, n (%)	133 (53.4)
Mobility impairment, n (%)	
Difficulty walking, self-report	104 (41.6)
Cognition	
MMSE score, mean (SD)	26.3 (3.1)
MMSE impairment,[a] n (%)	61 (24.5)
TMT-B mean (SD)	130.3 (67.4)
TMT-B impairment,[b] n (%)	67 (28.0)
MMSE and/or TMT-B impaired (%)	99 (40.1)
Frailty, n (%)	40 (16.2)
Depression, PHQ-9 ≥10, n (%)	99 (39.8)
Sensory impairment,[c] n (%)	110 (49.1)
Hearing impairment, self-report, n (%)	76 (30.5)
Visual acuity <20/40, n (%)	45 (21.1)
Urinary incontinence, ICIQ ≥1, n (%)	123 (49.6)

ADL = Activity of Daily Living

IADL = Instrumental Activity of Daily Living

MMSE = Mini-Mental State Examination

TMT-B = Trail Making Test Part B

PHQ-9 = Patient Health Questionnaire 9

ICIQ = International Consultation on Incontinence Questionnaire

[a] Impairment defined as MMSE score <24

[b] Impairment defined as TMT-B duration >1.5 standard deviations above population-based norms

[c] Impairment defined as self-reported hearing difficulty and/or best-corrected visual acuity >20/40

Table 3

Proportion of homeless subjects with one geriatric syndrome who have at least one additional geriatric syndrome

Geriatric syndrome	≥1 other geriatric syndromes (95% CI)	≥2 other geriatric syndromes (95% CI)	≥4 other geriatric syndromes (95% CI)
Fall in past year (n = 133)	91.7 (85.7,95.8)	66.9 (58.2,74.8)	17.3 (11.3,24.8)
Cognition			
MMSE impairment,[a] (n = 61)	96.7 (88.7,99.6)	73.8 (60.9,84.2)	24.6 (14.5,37.3)
TMT-B impairment,[b] (n = 67)	98.5 (92.0,100.0)	71.6 (59.3,82.0)	28.4 (18.0,40.7)
MMSE and/or TMT-B impairment (n = 99)	89.9 (82.2,95.1)	64.7 (54.4,74.0)	22.2 (14.5,31.7)
Frailty (n = 40)	95.0 (83.1,99.4)	87.5 (73.2,95.8)	37.5 (22.7,54.2)
Depression, PHQ-9 ≥10 (n = 99)	98.0 (92.9,99.8)	81.8 (72.8,88.9)	23.2 (15.3,32.8)
Sensory impairment[c] (n = 110)	88.2 (80.6,93.6)	65.5 (55.8,74.3)	18.2 (11.5,26.7)
Hearing impairment, self-report (n=76)	88.2 (78.7,94.4)	69.7 (58.1,79.8)	26.3 (16.9,37.7)
Visual acuity >20/40 (n = 45)	91.1 (78.8,97.5)	71.1 (55.7,83.6)	15.6 (6.5,29.5)
Urinary incontinence, ICIQ ≥1 (n = 123)	89.4 (82.6,94.3)	63.4 (54.3,71.9)	17.9 (11.6,25.8)

MMSE = Mini-Mental State Examination

TMT-B = Trail Making Test Part B

PHQ-9 = Patient Health Questionnaire 9

ICIQ = International Consultation on Incontinence Questionnaire

[a] Impairment defined as MMSE score <24

[b] Impairment defined as TMT-B duration >1.5 standard deviations above population-based norms

[c] Impairment defined as self-reported hearing difficulty and/or best-corrected visual acuity >20/40

Table 4

Association of subject characteristics with total number of geriatric syndromes

Characteristic	OR for total number of geriatric syndromes (95% CI)	
	Bivariate	Multivariable[a]
Agequartiles	0.98 (0.81,1.29)	1.04 (0.85,1.27)
Female	0.85 (0.48,1.47)	0.92 (0.51,1.67)
Non-White race	1.12 (0.72,1.75)	N/A
Less than a high school education	1.68 (1.01,2.78)	1.82 (1.08,3.06)
Primary language non-English	1.54 (0.80,2.94)	N/A
One or more clinic visits in the past year	2.56 (1.33,4.91)	N/A
Stroke	2.11 (0.88,5.05)	N/A
Diabetes mellitus	2.49 (1.36,4.57)	2.28 (1.22,4.26)
Coronary artery disease	1.34 (0.70,2.57)	N/A
Hypertension	1.81 (1.25,2.86)	N/A
Arthritis	2.95 (1.86,4.68)	2.35 (1.43,3.86)
Alcohol use problem	2.16 (1.22,3.84)	1.96 (1.07,3.57)
Drug use problem	2.38 (1.31,4.31)	2.27 (1.23,4.18)
Traumatic brain injury	0.99 (0.78,1.25)	N/A
ADL impairment	3.85 (2.32,6.39)	2.69 (1.56,4.64)

ADL = Activity of Daily Living

[a] Includes all covariates associated with total number of geriatric syndromes at the $P<.05$ level