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JAMDA 24 (2023) 1798–1805

JAMDA

journal homepage: www.jamda.com

Original Study

# Prevalence, Severity and Impact of Visuospatial Neglect in Geriatric Stroke Rehabilitation, a Cross-Sectional Study

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*Keywords:*
Geriatric rehabilitation
stroke
neglect
assessment
prevalence
functional outcome
measurement
severity

A B S T R A C T

*Objectives:* Visuospatial neglect (VSN) is a common cognitive deficit of lateralized attention after stroke and can have a negative influence on patients' daily activities, community participation, and caregiver burden. VSN prevalence has been investigated in several mixed-age populations, but rarely in only an older population. As the population in geriatric rehabilitation (GR) is understudied and VSN may influence rehabilitation goals in GR (return home), we examined the prevalence of VSN as well as associations between VSN (severity) and population characteristics and the impact of VSN on functioning, length of stay, and discharge destination after GR.
*Design:* Multicenter cross-sectional study.
*Setting and Participants:* Stroke patients admitted to GR.
*Methods:* Three VSN tests (Star cancelation task, Line bisection task, and Catherine Bergego Scale) were administered in the first 2 weeks of GR admission. To examine VSN severity, a composite score was calculated based on scores of the 3 tests.
*Results:* A total of 114 stroke patients were included [55.3% female; mean age 80.2 (SD 8.0) years]. VSN prevalence was 47.4%, in which allocentric and egocentric neglect were more prevalent than VSN during activities of daily living. Participants with VSN spent more days in GR compared to participants without VSN (median 68.5 vs 35.5 days) and had fewer home returns. In addition, VSN participants showed less mobility, lower cognitive functioning, and less independence during self-care compared to participants without VSN. Mobility, self-care, cognition, duration of rehabilitation, and home return were negatively associated with VSN severity.
*Conclusions and Implications:* VSN is very prevalent in the GR stroke population. VSN severely hampers older people during daily activities and their rehabilitation process and, therefore, has a major personal and societal impact. Accordingly, systematic assessment of VSN in the early phase of geriatric rehabilitation with multiple VSN screening tests is recommended.


Visuospatial neglect (VSN) is a common cognitive deficit of lateralized attention after stroke. Estimates of prevalence differ, ranging from 20% to 82%, largely depending on patient sample, phase and time poststroke, number and types of tests used, and hemisphere of lesion.[1-3] Patients with VSN have a slower as well as a worse recovery in activities of daily living (ADL) (eg, reading, self-care, risk of falls) compared with non-VSN patients.[4-10] Likewise, VSN has negative impact on patients' participation in community (eg, way finding, pursuing hobbies) and seems to increase caregiver burden.[9,11]

Despite these reported associations, there is a lack of insight in VSN prevalence in the older stroke population,[3,12] and this may cause an important bias in current knowledge. Even though severity of VSN

All authors declare no conflicts of interest.

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https://doi.org/10.1016/j.jamda.2023.06.038

seems to be positively associated with increasing age,[13,14] there are no specific studies in the subacute phase dedicated to older patients on the prevalence of VSN.[3] However, an older population, and specifically with indications for geriatric rehabilitation (GR), can differ in prevalence and impact of VSN compared with mixed-age populations. Older people admitted to GR (with a temporary duration with about 4-8 weeks) are focused on the main goal to return to their own homes after rehabilitation, subgoals are made with the patient and multidisciplinary team (physically and cognitively) to achieve this goal. Older people are more often frail and have a higher comorbidity.[15] In addition, older people have another social context during rehabilitation (to support) but also after they returned home (eg, older caregiver). Considering on the one hand the negative influence of VSN on daily activities, community participation, and caregiver burden and on the other hand the main goal of GR (return home with successful integration), it is important, if not required, to gain more insight into the prevalence, severity, and impact of VSN in GR.[9-11]

Subsequently, to not underdiagnose the prevalence of VSN and to take into account the heterogeneity of this syndrome,[6,16,17] it is important to assess VSN with more than 1 test.[9,18] Various VSN assessments are available specific to the different subtypes of VSN. For example, patients with egocentric neglect (viewer-centered) are slow or unable to attend to contralesional stimuli.[19,20] A shape cancelation task,[21,22] like the star cancellation, is known to be sensitive to capture egocentric neglect.[23-25] By contrast, patients with allocentric neglect (object-centered) fail to process one side of an object, regardless of its position in space.[26,27] A line bisection task[21,22] is more focused on assessing allocentric neglect.[20,26] It is important to stress that the sensitivity to allocentric neglect depends on how the test is administered; when the location(s) of the line(s) are all aligned to the patient's body center, egocentric neglect can also be detected. Next to this static pen-and-paper tests, VSN can occur in a more dynamic situation. An assessment during activities like the Catherine Bergego Scale (CBS[28-31]) can detect this specific group of VSN patients.[32] The European Academy of Neurology (EAN) recommended the use of these 3 tests.[18] It is important to use this test combination and to specify the subtypes of VSN, to prevent underrecognition of VSN, and for clear recommendations for VSN assessments.

The aim of this study was to examine the prevalence of VSN and VSN subtypes in a stroke population admitted to GR and to analyze the associations between VSN severity and population (demographic and stroke) characteristics as well as the impact on functioning (eg, mobility), length of stay, and discharge destination (home/no return home). With more insight regarding VSN in older persons, it is possible to work toward better VSN assessment, tailored treatment in GR, and better guidance of patient and caregiver to prepare for returning home.

## Methods

### *Protocol and Registration*

This NeAR (Neglect Assessment in geriatric Rehabilitation) study, a multicenter cross-sectional study, was approved by the Medical Ethics Committee of the Leiden University Medical Center (No. N20.094) and preregistered in the International Clinical Trials Registery Platform (No. NL9076). The research procedure was performed in accordance with the standards of the Declaration of Helsinki.

### *Setting and Study Population*

Stroke inpatients admitted to 6 care organizations with GR wards, affiliated to the University Network of the Care sector South Holland, were included from October 2020 until August 2021. GR is defined as a multidimensional approach of diagnostic and therapeutic interventions with the purpose of optimizing functional capacity, promote activity, and preserve functional reserve and social participation in older persons with disabling impairments.[33] Participants were eligible to participate in this study according to the following inclusion criteria: (1) clinically diagnosed stroke (hospital transfer-documentation) and (2) admitted to GR for stroke rehabilitation. Participants were excluded from this study based on the following criteria: (1) not English or Dutch speaking; (2) abnormal or uncorrected visual acuity; (3) not competent to give informed consent (physician); (4) not able to participate because of severe cognitive impairment (physician), and (5) not able to participate because of severe motor impairment (physician).

### *Study Procedure*

GR stroke inpatients were consecutively recruited by a health care professional or a trained employee of the affiliated ward. After obtaining written informed consent, population characteristics and clinical measures were collected by health care professionals from the ward. VSN assessments were administered by occupational therapists, nursing staff, or psychologists within 2 weeks after admission. Assessment consisted of 2 pen-and-paper tests (Star Cancelation[21,22] and Line Bisection,[21,22]) and 1 observation scale (Catherine Bergego Scale[28-31]). VSN was considered present when 1 or more tests were positive for VSN. In case of uncertainty, the last author was consulted.

### *Population Characteristics and Clinical Measures*

Population characteristics and clinical measures were collected from patient files: age, sex, stroke onset, type of stroke (ischemic/hemorrhagic), hemisphere of stroke (left/right/both), recurrent stroke, length of stay (LOS) in hospital and GR, presence of caregiver at home, mortality during inpatient rehabilitation, and discharge destination (return home/no return home). Additionally, we collected information on functional mobility, self-care, fatigue, pain and mood using the Utrecht Scale for Evaluation and Rehabilitation (USER); independence of gait using the Functional Ambulation Categories (FAC), and balance using the Berg Balance Scale (BBS).

The USER includes 30 items in 6 domains. Higher scores for mobility (0-35), self-care (0-35) and cognitive functioning (0-50) reflect better performance. The USER is a reliable, valid and responsive measure.[34] The pain, fatigue, and mood scores need additional validation.[34,35]

The FAC has an ordinal 6-point scale, with zero indicating not capable to walk, up to 5 indicating independent walking.[35,36] Last, the Berg Balance Scale (BBS) was included to estimate balance on an ordinal 14-item scale (0-56 points)[37] and has shown to be reliable and valid in stroke patients.[38,39]

### *VSN Assessments*

To assess VSN, 3 VSN tests were used. The Star cancellation test (SCT), more sensitive to capture egocentric neglect, includes 56 small stars with distractors.[22] Patients need to cancel all small stars. The maximum score is 54 points. A cutoff of $\leq$51 and an asymmetry of $\geq$2 indicates the presence of VSN.[21,40] The SCT has excellent test-retest reliability and good validity.[41-43] The Line bisection test (LBT), more focused on allocentric neglect, encompasses 3 horizontal lines, presented in a staircase, that patients need to bisect at the (subjective) center.[22] The total score is 9 points, with a cut-off score of $\leq$7 indicating the presence of VSN. A greater deviation of the selected point from the midline (in cm) indicates more severe VSN. The LBT has adequate to excellent test-retest reliability and validity.[41,43,44] The CBS is an observational checklist to detect VSN during everyday life

situations. The total score is 30.[28-31] The CBS has adequate to excellent reliability and good validity.[29,31,45]

*VSN Severity*

To determine the overall severity of VSN, a composite score was calculated based on the scores of the 3 VSN tests.[40] Therefore, only participants who performed all 3 tests were included. Our composite score consists of the sum of (1) number of omission differences of SCT (between contralesional and ipsilesional, range 0-27), (2) total deviation in centimeters from the midline on the LBT (range 0-30.6 cm), and (3) the total CBS score (range 0-30).[40] The interpretation of all scores are comparable; higher the score, the more severe is the VSN.

*Statistical Analyses*

Descriptive statistics were used to describe the population characteristics and clinical outcomes. Data were expressed as means (SDs), medians [interquartile ranges (IQRs)], or percentages, as appropriate. For the comparison between 2 groups, participants with and without VSN (VSN+ vs VSN−) regarding to population characteristics and clinical measures, Mann-Whitney *U* test and $\chi^2$ test were conducted.

To analyze the distribution of VSN prevalence in subtypes (by specific test), we used percentages of the VSN+ population (n = 54).

For analyzing the specific tests and test characteristics, we used number, percentages, and median (IQR) of the population who performed the specific test. Mann-Whitney *U* test and $\chi^2$ test were applied to compare VSN test characteristics between groups (VSN+ vs VSN− and left- vs right-sided VSN). Spearman rank coefficient was calculated to determine the association between VSN composite severity scores and ratio data regarding demographic (age) and stroke characteristics (time poststroke), clinical measures on functioning (FAC, BBS, USER), and LOS in hospital and GR. Mann-Whitney *U* test for 2 groups and Kruskal-Wallis for 3 groups comparison were used to investigate the association between VSN composite severity scores and nominal data (sex, lesion site, stroke type, recurrent stroke, and discharge destination). Statistical significance was set at $P < .05$.

## Results

Of the 206 inpatients eligible for this study, 11 were not approached, for example, due to the workload of health care professionals related to the COVID-19 pandemic. Of the remaining 195 patients, 47 did not meet 1 or more of the inclusion criteria, with comorbid cognitive impairment as the main reason for exclusion. In total, 148 patients were approached, of whom 34 patients refused to participate. Eventually, 114 patients were included in the study (Figure 1).

*Study Population*

The mean age of the study population (N = 114) was 80.2 (SD 8.0) years, with a median time poststroke of 18 (IQR 7-14) days. A slight majority was female (55.3%). Ischemic stroke was most common, and

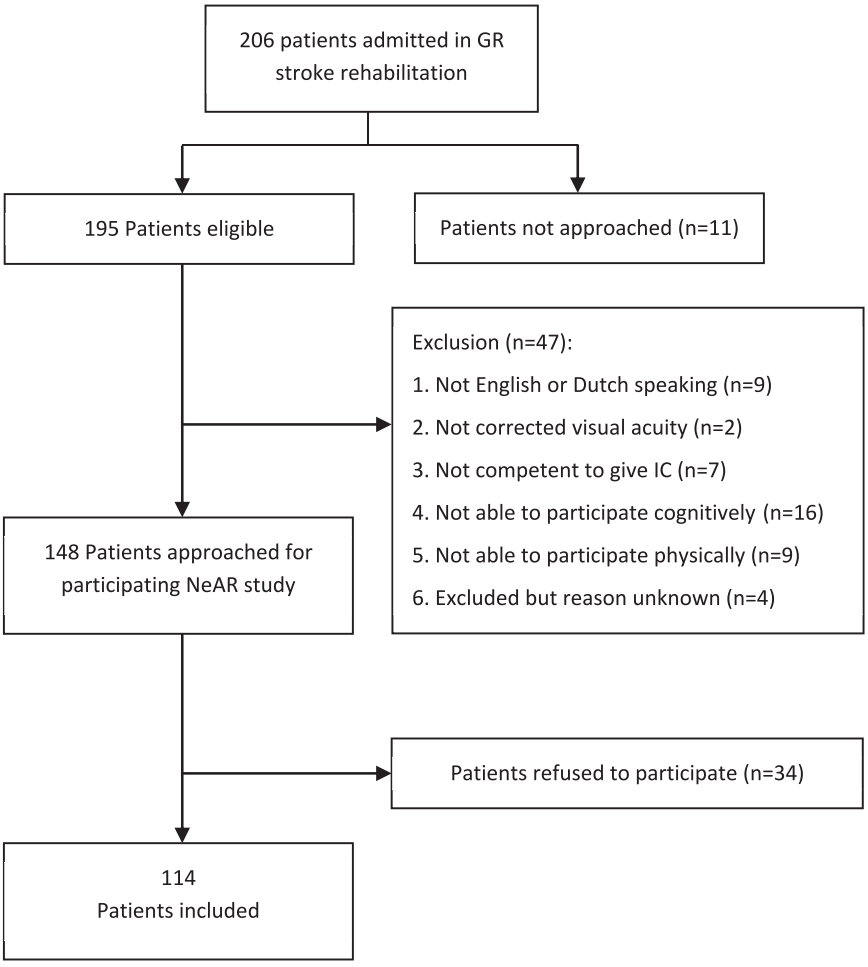


**Fig. 1.** Flowchart of inclusion procedure NeAR study.

50% of the population had left hemisphere lesions. The median LOS in hospital was 10 (IQR 7-14) days, and the median LOS in GR was 44 (IQR 26.8-75) days. Of the 114 participants, 33.3% had a caregiver at home, and 78.4% returned home after discharge. Overall mortality during inpatient rehabilitation was 2.6%.

Table 1 shows the characteristics of the study population per group (VSN− and VSN+). Both groups were comparable with respect to age, sex, lesion site, first ever vs recurrent stroke, pain, fatigue, mood, caregiver at home, and mortality during GR. The VSN+ group, however, showed significantly less mobility (FAC, $P = .006$; BBS, $P = .045$; USER mobility, $P = .003$), was less independent during self-care (USER self-care, $P = .005$), and had lower estimated cognitive functions (USER cognitive functioning, $P = .003$) compared to the VSN− group. Furthermore, the VSN+ group showed a significantly longer LOS in hospital of 1.5 days ($P = .005$) and longer LOS in GR of 33 days ($P < .001$). Time poststroke onset to the VSN assessment was longer compared to the VSN− group, probably because of the longer LOS in hospital. After GR, the VSN+ group was less likely to be discharged home compared to the VSN− group ($P < .001$).

### *Prevalence of VSN and VSN Subtypes*

The overall prevalence of VSN was 47.4% (n = 54) (Table 1). The distribution of the prevalence of VSN subtypes in this VSN+ population is presented in Figure 2. Regardless of the performances in other tests, allocentric neglect by LBT was most frequently registered within the VSN+ population (53.8%, n = 31). Egocentric neglect diagnosed by SCT was prevalent in 57.5% (n = 29) and neglect during ADL in 40.9% (n = 22) of the VSN+ population. Most VSN+ participants (61.2%) showed VSN for only 1 subtype. Egocentric or allocentric neglect (both 24.1%) were most frequently diagnosed, and only VSN during ADL was less common (13%). The percentages of overlap of 2 subtypes were small, and 13% of the VSN+ population scored above the cutoff on all 3 tests.

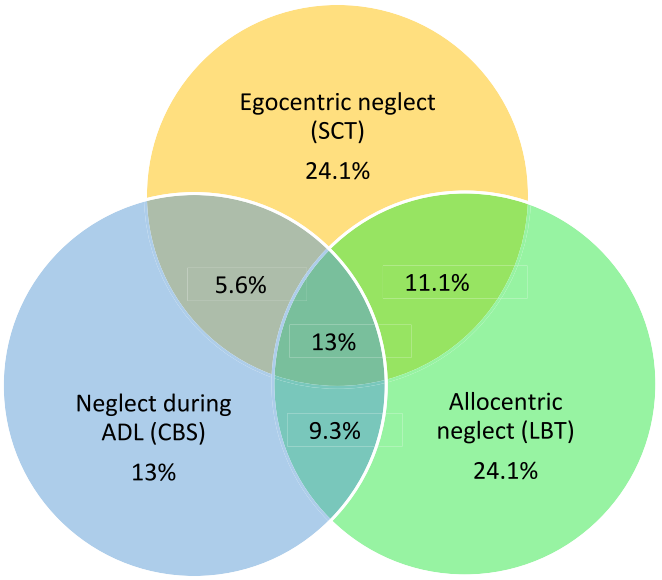


**Fig. 2.** Venn diagram indicating the prevalence of neglect subtypes (egocentric, allocentric, during ADL) in VSN+ population (n = 54) by specific test (SCT, LBT, and CBS). Overlapping areas indicate the percentages of participants with combinations of subtypes.

More details of the characteristics of the specific VSN tests (by specific subtypes) are presented in Table 2. The number of completed

**Table 1**
Demographics, Stroke-Related Characteristics, and Clinical Outcome Measures of Participants Without (VSN−) and With Visuospatial Neglect (VSN+)

| Characteristics | VSN− (n = 60) | VSN+ (n = 54) | VSN− vs VSN+ |
|---|---|---|---|
| Age, y, mean (SD) | 81 (8.6) | 79.3 (7.1) | $U = 1402.5$, $z = -1.236$, $P = .216$ |
| Sex male, n (%) | 23 (38.3) | 26 (50) | $\chi^2 = 2.101$, df = 1, $P = .147$ |
| Time poststroke, d, median (IQR) | 16 (10.8-20.3) | 21 (16-31)* | $U = 829$, $z = -3.953$, **$P < .001$** |
| LOS at hospital, d, median (IQR) | 8.5 (7 12) | 10 (8-18.5)† | $U = 1109$, $z = -2.777$, **$P = .005$** |
| Lesion site, n (%) | | | |
| Unilateral left | 31 (51.7) | 26 (48.1) | $\chi^2 = 2.296$, df = 2, $P = .317$ |
| Unilateral right | 26 (43.3) | 28 (51.9) | |
| Bilateral | 2 (3.3) | 0 | |
| Not applicable | 1 (10.9) | 0 | |
| Stroke type, n (%) | | | |
| Ischemic | 57 (95) | 44 (81.5) | $\chi^2 = 6.799$, df = 1, **$P = .009$** |
| Hemorrhage | 2 (3.3) | 10 (18.5) | |
| Unknown | 1 (1.7) | 0 | |
| Recurrent stroke n (%) | 16 (26.7) | 16 (29.6) | $\chi^2 = .088$, df = 1, $P = .77$ |
| FAC (0-5), median (IQR)† | 3 (2-4) | 2 (0-4) | $U = 1078$, $z = -2.774$, **$P = .006$** |
| Berg Balance Scale score (0-56), median (IQR)† | 31 (11-43) | 23 (3.3-39.8) | $U = 1195.5$, $z = -2.001$, **$P = .045$** |
| USER score†, median (IQR) | | | |
| Mobility (0-35) | 17 (9-24.8) | 9 (4-20) | $U = 977$, $z = -2.948$, **$P = .003$** |
| Self-care (0-35) | 23 (13-30) | 15 (8-23) | $U = 978$, $z = -2.820$, **$P = .005$** |
| CF (0-50) | 48 (35-50) | 40 (27.5-46) | $U = 1018.5$, $z = -2.957$, **$P = .003$** |
| Pain (0-100) | 20 (0-50) | 10 (0-40) | $U = 1235$, $z = -.452$, $P = .65$ |
| Fatigue (0-100) | 40 (20-60) | 40 (7.5-62.5) | $U = 1249$, $z = -.344$, $P = .73$ |
| Mood (0-400) | 40 (20-60) | 70 (7.5-70) | $U = 1184.5$, $z = -.622$, $P = .53$ |
| LOS at GR, median (IQR) | 35.5 (21-52.3) | 68.5 (39-103) | $U = 894.5$, $z = -4.118$, **$P < .001$** |
| Caregiver at home, n (%) | 21 (35.0) | 17 (31.5) | $\chi^2 = 0.103$, df = 1, $P = .75$ |
| Discharge destination home, n (%) | 55 (93.2) | 32 (61.5) | $\chi^2 = 0.16.371$, df = 1, **$P < .001$** |
| Mortality, n (%) | 1 (1.7) | 2 (3.7) | $\chi^2 = 0.460$, df = 1, $P = .50$ |

CF, cognitive functioning.
Scale numbers appearing in bold indicate statistical significance ($P \leq .05$).
*Data were also analyzed without 2 outliers. Removal of these 2 participants did not alter the results ($P < .000$; $P > .767$).
†Group ranges: VSN− = 51-60, VSN+ = 50-54.

**Table 2**
Overview of Specific Test (SCT, LBT, and CBS) and Test Characteristics (by Subtype) Categorized per Group Without (VSN−) and With VSN (VSN+)

| VSN-Specific Test and Test Characteristics (by Subtype) | VSN− | VSN+ | VSN− vs VSN+ | Left-Sided VSN+ | Right-Sided VSN+ | Left vs Right VSN+ |
|---|---|---|---|---|---|---|
| Star cancelation task (Egocentric) (n = 107) | | | | | | |
| Number of patients diagnosed (%) | 78 (72.9) | 29 (27.1) | | 14 (48.3) | 15 (51.7) | |
| Number of star omissions, median (IQR) | 1 (0-2) | 6 (4-20.5) | $U = 132.0$, $z = -7.14$, **$P < .001$**, $r = -0.69$ | 12.5 (5.5-25.5) | 5 (4-6) | $U = 58.50$, $z = -2.05$, **$P = .040$**, $r = -0.198$ |
| Stars asymmetry score, median (IQR) | 1 (0-1) | 4 (2.5-6.5) | $U = 10.50$, $z = -0.824$, **$P = < .001$**, $r = -0.080$ | 4 (2-15.8) | 4 (3-5) | $U = 91.00$, $z = -0.621$, $P = .54$, $r = -0.060$ |
| Line bisection task (allocentric) (n = 108) | | | | | | |
| Number of patients diagnosed (%) | 77 (71.3) | 31 (28.7) | | 22 (71.0) | 9 (29.0) | |
| Total score (0-9), median (IQR) | 9 (9-9) | 5 (3-6) | $U = 0.00$, $z = -9.18$, **$P = < .001$**, $r = -0.883$ | 6 (3-6.3) | 5 (2.5-5.5) | $U = 81.00$, $z = -0.797$, $P = .43$, $r = -0.076$ |
| Deviation, cm, median (IQR) | 1.6 (1.2-2.2) | 5.3 (4.2-8.3) | $U = 11.50$, $z = -8.03$, **$P = < .001$**, $r = -0.773$ | 5.1 (4.0-8.6) | 6.8 (4.9-8.1) | $U = 80.00$, $z = -0.827$, $P = .41$, $r = -0.080$ |
| CBS (VSN during ADL) (n = 109) | | | | | | |
| Number of patients diagnosed (%) | 87 (76.3) | 22 (19.3) | | 12 (54.4) | 10 (45.5) | |
| Total score (0-30), median (IQR) | 0 (0-1.7) | 13 (8.7-18.9) | $U = 0.00$, $z = -7.66$, **$P < .001$**, $r = -0.734$ | 14.6 (11.3-19) | 10 (7.6-19.6) | $U = 43.5$, $z = -1.09$, $P = .28$, $r = -0.104$ |

Subsequently, the VSN+ group was further categorized as left- vs right-sided VSN. Scale numbers appearing in bold indicate statistical significance ($P \leq .05$).

tests per specific VSN test were comparable (107-109 tests completed). The median (IQR) of all VSN tests indicated that VSN extended from mild to severe VSN, implying a highly representative population. Left- and right-sided neglect were common on all tests. Only the SCT star omission had a significant difference in severity between left- (more severe) vs right-sided VSN.

### *Associations Between VSN Severity and Population Characteristics and the Impact on Functioning, LOS, and Discharge Destination*

For 99 participants (86.8%), composite scores for VSN severity were calculated that ranged from 0.7 to 58.6 (median 4.5, IQR 2.8-8.8). No associations were found between VSN composite severity score and age, sex, stroke lesion site, recurrent stroke, pain, fatigue, and mood (Figure 3). However, participants with hemorrhagic stroke had higher VSN composite severity scores than participants with ischemic stroke ($P = .015$). Higher VSN composite severity scores were associated with less mobility and more dependency during self-care (FAC score, $P < .001$; BBS score, $P < .005$; and USER scores: mobility, $P < .001$; self-care, $P < .001$; and lower cognitive functioning, $P < .001$). Furthermore, higher VSN composite scores were associated with longer LOS in GR ($P < .001$) and less discharge home ($P < .001$).

## Discussion

This study examined the prevalence of VSN and VSN subtypes during GR and analyzed the associations between VSN severity and population characteristics as well as the impact on functioning, length of stay, and discharge destination.

In this multicenter cross-sectional study, we found a prevalence of VSN of 47.4% in our stroke population admitted for inpatient GR, which is comparable with the prevalence in more commonly studied mixed-age or acute-phase stroke populations.[1-3] This emphasizes the urgency of more attention for VSN during inpatient GR.

We observed that a single VSN test diagnosed only a part of the complete VSN+ population; at least 42.5% of the VSN+ population would be missed in our cohort without a set of tests. This stresses the importance of using multiple tests during VSN screening and supports the recommendations of the EAN.[18] The feasibility of a more comprehensive set of tests after this VSN screening in GR should be investigated in future research. With respect to the side of VSN and in line with other studies, left- and right-sided VSN were largely comparable.[2,46,47]

Both presence and severity of VSN were strongly negatively associated with functioning, LOS in hospital and GR, and discharge home. This indicates that the presence and severity of VSN have a large negative impact on older stroke patients and are in line with or even more severe according to findings of more common studied mixed-age or acute-phase populations and makes them even more vulnerable.[4-11] These associations may help care professionals in daily care. Future research should determine what the most important moderators and mediators are.

Longer LOS in GR and less discharge home are important indicators for clinical care. Previous studies also indicated longer LOS in more commonly studied populations, yet with increasing age the LOS for VSN patients seems to increase even more.[48,49]

Given these study results, health care organizations should be better equipped for patients with VSN, especially because the main goal for GR patients is to return home. Therefore, health care systems and health insurance companies should consider the impact of VSN in regard to GR programs, expectations, costs, and goal setting.

In many GR wards, no program for VSN treatment has been implemented yet. Further research regarding usability and user experiences of VSN tests in specific GR setting could help provide more insight and tips for implementation in future. Implementation could, however, start immediately and is highly recommended. The first step is to assess all stroke patients with multiple screening tests (SCT, LBT, and CBS) in the early phase of admission. The second step is to use the knowledge of these study results in a more tailormade treatment plan. The last step is to unroll multidisciplinary VSN treatment and guidance, in which the results of this study (subtype, impact, and expectations) are essential to help patients and caregivers understand the nature of their difficulties and coach them during GR.

Strengths of this study were the multicenter design, population size, and inclusion of VSN subtypes, which made the study population very representative and the results potentially generalizable to different clinical GR settings. To our knowledge, this is the first VSN prevalence study in a GR population. Another strength was the multidisciplinary character of assessments, which contributes to the

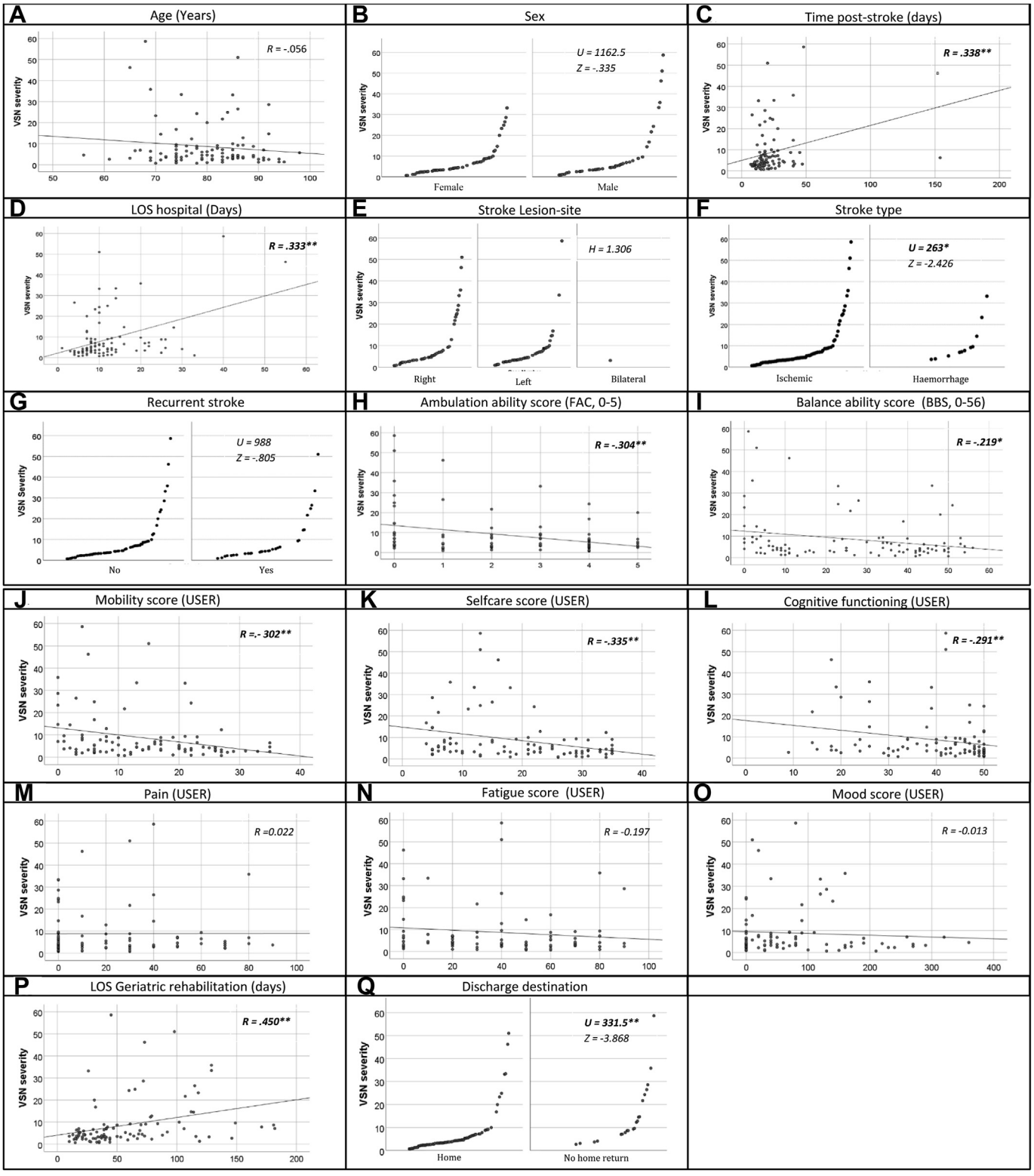


**Fig. 3.** Overview of associations between overall VSN severity, as indicated with the composite score (the higher the value, the higher the VSN severity) and (A) age, (B) sex, (C) time poststroke, (D) days in hospital, (E) lesion site, (F) stroke type, (G) recurrent stroke, several aspects of functional independence: (H) FAC, (I) BBS, (J) mobility, (K) self-care, and (L) cognitive functioning, (M) pain, (N) fatigue, (O) mood, (P) days in GR, and (Q) discharge destination. *Correlation is significant at the .05 level (2-tailed). **Correlation is significant at the .01 level (2-tailed). †Group sizes differ between n = 88 and n = 99.

multidisciplinary approach of VSN treatment and increases the likelihood of adapting the current screening protocol in clinical practice.

This study also has a few potential limitations. The CBS diagnosed less VSN than pen-and-paper tests. It is possible that CBS subscores were less applicable to the already vulnerable GR population (and could not be scored) or scored better because of the high level of patients' dependency. The CBS has not been tested yet in this specific older GR population. Future research of the CBS for this specific population is recommended. Notwithstanding this potential issue, the CBS still diagnosed 40.9% of the VSN+ population, and 13% were diagnosed by use of the CBS only. We therefore still recommend combining pen-and-paper tests with observations during activities.

Another subject for discussion could be our description of VSN subtypes (egocentric and allocentric), as there are other subtypes/names of VSN than the ones we used in our study. We chose these descriptions based on their frequent use in clinical practice and research.[50] The use of the different subtypes provided insight into why different tests should be used.

Last, the focus of this study was based on VSN and VSN subtypes. However, in research and clinical practice, one should keep in mind that neglect is not limited to this visual domain. Other fields could be involved, like region of space (peripersonal vs extrapersonal neglect) as well as sensory domains (auditory, tactile, motor).

## Conclusions and Implications

VSN is very prevalent in the GR stroke population and severely hampers older people during daily activities and their rehabilitation process, and therefore has a major personal and societal impact. Accordingly, systematic assessment of VSN in the early phase of geriatric rehabilitation with multiple VSN tests is recommended.

## Acknowledgments

This research was made possible in cooperation with Zorggroep Florence. We would like to thank the health care professionals and participants for participating in this study.

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