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ABSTRACT

Background: Poststroke health-related quality of life (HRQOL) is an important outcome that may be influenced by ethnicity.
Objective: To compare long-term HRQOL, mental health and healthcare utilization between stroke survivors with a European (EUB) and non-European background (NEUB) in a hospital population.
Methods: In this retrospective cohort study patients completed questionnaires 2–5 years after stroke. Assessments included the EuroQol-5D-3L (EQ-5D), Short Form (SF-36, with physical and mental component summary scales, PCS and MCS), Hospital Anxiety and Depression Scale (HADS; scores $\geq$8 indicate clinically relevant complaints) and a questionnaire on the usage of services from physicians and/or healthcare professionals (HCP) in the past 6 months. Linear and logistic regression analysis was used, adjusted for age, sex, level of education and functional outcome.
Results: We included 207 patients (169 EUB, 38 NEUB); mean age 63.8 years (SD 14.4); 60.4 % male; mean follow up 36.3 months (SD 9.9). The EQ-5D and the PCS were higher in EUB versus NEUB patients (42.9 vs 35.4, $p < 0.01$; 0.76 vs 0.60, $p < 0.01$). The MCS showed a comparable, non-significant trend. The percentage of patients with HADS depression $\geq$8 was higher in NEUB patients versus EUB patients (54.3 % vs 29.8 %; $p > 0.01$). Significantly more NEUB patients had visited two or more physicians in the past six months compared to EUB patients (52.0 % vs 26.0 %; $p = 0.01$) whereas the use of services from HCP was similar.
Conclusions: NEUB stroke patients had worse outcomes regarding HRQOL and depressive symptoms compared to EUB patients. NEUB patients visited more physicians.

Introduction

Globally, in 2019, stroke is the second-leading cause of death and the third-leading cause of death and disability combined.[1] An increase of the number of stroke survivors is expected because ageing of the population results in an increased number of strokes and improvement in stroke care drives a decline in mortality.[2,3] In many stroke survivors, stroke is causing long-term disabilities within several domains of health, with a significant negative impact on the long-term health-related quality of life (HRQOL) including physical, mental and cognitive functioning and social participation.[4–7] However, the long-term outcomes of stroke may vary largely among patients.[8] Better insight into patient characteristics and other factors related to the long-term outcomes of stroke is important for the improvement of poststroke health care services in primary, secondary and/or tertiary care.

Factors that were previously found to have an impact on the long-term outcomes of stroke, apart from age, sex, stroke severity, comorbidity and education level, include race and/or ethnicity.[9,10] Whereas race relates to physical traits, ethnicity is a socio-political construction and is defined as belonging to a group of people that has a common

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national or cultural tradition.[11] Its impact on many diseases, including on the acute treatment of stroke, has been described before.[12]

A review specifically addressing the association between racial and ethnic differences in poststroke rehabilitation functional outcomes, published in 2014, included 17 studies.[10] Most of the addressed studies examined differences between Black and White stroke survivors, and found worse motor and cognitive outcomes at three months and twelve months follow up for Black stroke patients.[10]

Only a limited number of studies described ethnic disparities in poststroke HRQOL. With respect to the impact of ethnicity on HRQOL after stroke, a study published in 2015 showed a lower quality of life on physical domain (using the 12-item short-form stroke-specific quality of life scale) in Mexican Americans compared to non-Hispanic Whites three months after stroke.[13] A second study published in 2006 also concluded a lower HRQOL, analyzed with the EQ-5D, in Black American stroke survivors compared to White American stroke survivors, as well as in Hispanic stroke survivors compared to non-Hispanic stroke survivors.[14] An international, multicenter study published in 2020 found that non-Asian ethnicity was an independent predictor of a poor HRQOL three months after stroke, using the EQ-5D.[15]

Depression and anxiety are described as factors that lower the HRQOL in poststroke patients.[16] Concerning the impact of ethnicity on poststroke mental health, ethnic differences in prevalence of poststroke depression has been described before in the American population. Two studies had conflicting results in early poststroke depression (one month after stroke), one reported a higher prevalence in Hispanics compared to non-Hispanic whites,[17] while the other demonstrated the opposite trend.[18] One study showed a higher prevalence in Hispanics compared to non-Hispanics two years after stroke.[19] There are no European studies regarding the relationship between ethnicity and HRQOL, depression or anxiety after stroke.

We hypothesized that ethnicity, being related to HRQOL and outcomes regarding mood after stroke, may also correlate with healthcare use of stroke patients. Ethnicity may have an impact on health status and thereby on health care usage, as well as on the accessibility and use of health care services. However, studies on this subject in stroke care are not available.

The primary aim of this study is to determine long-term outcomes of HRQOL in stroke survivors in a Dutch hospital population in relation to their ethnicity. In this respect, ethnicity is defined by country of birth (European background or Non-European background; EUB or NEUB resp.). The secondary aim is to explore the association between ethnicity and anxiety and depressive symptoms due to their known influence on HRQOL, as well as the association between ethnicity and healthcare utilization.

Patients and methods

Study design

In this retrospective cohort study, data were collected in 2012 at the Haaglanden Medical Center (HMC) in The Hague, The Netherlands. All data were collected using questionnaires and extraction from the patient hospital files. Patients were invited by letter with the study information, an informed consent letter and the questionnaires. Patients and, if applicable, their spouse or other caregiver, completed questionnaires about their current health condition. In case of no response after two weeks, a research nurse contacted the patients by telephone to encourage them to complete the forms. Patients had the choice to withdraw from the study at any moment without reason. A written exemption from ethical approval was acquired from the Medical Ethics Review Committee South West Netherlands.

Study population

We included adult patients with a first ever stroke who were hospitalized at the HMC between 2008 and 2010. Stroke was defined as an acute ischemic stroke, intracerebral hemorrhage or subarachnoid hemorrhage. Exclusion criteria were a diagnosis other than stroke (e.g. transient ischemic attack), a medical condition that does not allow participation in a study (e.g. patients in a vegetative state) and an insufficiently fluent grasp of Dutch.

Measurements

Stroke characteristics: The stroke characteristics were extracted from the hospital file; the type of stroke (ischemic/hemorrhagic), location of the lesion (right hemisphere/left hemisphere/vertebrobasilar/bilateral), thrombolysis (Y/N), degree of independence at admission and at discharge (Barthel Index, score ranging from 0 to 20, the higher the score, the higher the level of independence), length of hospitalization (in days) and the destination after discharge (home/other institute).

Patient characteristics: The socio-demographic determinants with variables: smoking (Y/N), alcohol utilization (Y/N), educational level as a proxy for socioeconomic status (Low: up to and including lower technical and vocational training; Medium: up to and including secondary technical and vocational training; High: up to and including higher technical and vocational training and university), patient living with any other individual (Y/N) and country of birth (divided into EUB and NEUB) were self-reported and obtained via the questionnaires. The follow-up in months was defined as the time since the date of stroke and the date of the administration of the survey.

Health-related quality of life: The primary outcome in this study, the HRQOL, was collected and measured with the Short Form-36 (SF-36) and the EuroQol-5D 3L (EQ-5D) questionnaires (both included in the supplementary). The SF-36 contains 36 items distributed over 9 domains: physical functioning (10 items), role limitations due to physical problems (4 items), impairments due to emotional problems (3 items), vitality (4 items), mental health (5 items), social functioning (2 items), pain (2 items), general health experience (5 items) and health change (1 item). The item scores are summed domain scale scores and transformed to a hundred-point scale, where a higher score indicates a better HRQOL.[20] In this study the physical and mental component summary scores were used (PCS and MCS respectively, scores 0–100, higher scores indicating better HRQOL). The SF-36 is available in a Dutch validated version.[21]

The EQ-5D descriptive system comprises the following five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension has 3 levels: no problems, some problems, and extreme problems. The patient is asked to indicate his/her health state by ticking the box next to the most appropriate statement in each of the five dimensions. Concerning the minimal important difference (MID), there is an observational longitudinal survey published about the MID of EQ-5D index of stroke patients.[22] They found a MID ranging from 0.08 to 0.12 by using anchor-based approaches. In our study, we held 0.12 points as clinically relevant.

Ethnicity: In this study, we compared patients who were born within Europe (EUB) to patients who were born outside Europe (NEUB). We made this distinction based on the patients' self-reported country of birth. Other definitions used to define ethnicity were not available, such as the parents' country of birth, or self-reported population group.

Depression and anxiety: The HADS questionnaire was used to collect data about depression and anxiety symptoms.[23] It focuses on symptoms in the past four weeks and consists of a depression and anxiety scale, both with 7 items. Each item is scored with a 4-points scale (0–3) with a maximum score of 21 per subscale. The higher the score, the more symptoms the patient experiences. A possible anxiety disorder or depression is indicated by a score from 8 to 10 and a suspected anxiety disorder or depression by a score of 11 or higher.[24] In this study we used the cut-off point of 8 or higher to indicate relevant anxiety or depression symptoms.

Healthcare utilization: To determine the extent of healthcare

utilization, the patients were asked which physician (general practitioner (GP), neurologist, rehabilitation physician, psychiatrist or other physician) they had seen in the past 6 months (Y/N). Utilization of other healthcare professionals (HCPs; physical therapist, occupational therapist, speech therapist, psychologist, social worker, dietician, nurse, household professional and other healthcare professional) was collected the same way. We summed up the amount of different physician and HCP visits and used a cut-off point of 2 or more different physicians and 1 or more HCPs.[5] Furthermore, the outcomes of physician visits were also analyzed separately by splitting the visits into GP visits (Y/N) and medical specialist visits (Y/N).

Data analyses

The distribution of the continuous data was examined using the Kolmogorov-Smirnov test and accordingly the data were expressed as means with standard deviation (SD) or medians with interquartile ranges (IQR). Categorical data were expressed as numbers and percentages. The HADS Anxiety and Depressions scores were dichotomized according to the abovementioned cut-off points of ≥ 8 or <8.

We analyzed and compared the characteristics and/or long-term outcomes of patients who responded and patients who did not respond, and patients with a EUB and a NEUB background using unpaired t-tests or Mann-Whitney U tests, where appropriate, for continuous variables and Chi-Square tests for categorical variables. Due to their likely influence on the HRQOL described in earlier studies, we adjusted for possible known confounders including age, sex, level of education and the Barthel index on admission (as proxy for functional outcome).[16,25,26] Multivariable regression analyses were performed. Continuous outcome data were analyzed by comparing means of a multivariable linear regression analysis, whereas for categorical data (dichotomous variables) multivariable logistic regression was performed. The independent variable in these analyses was having a European or Non-European background, based on the region of birth. Multicollinearity was checked using variance inflation factor (VIF) values. A VIF value above 4 or tolerance below 0.25 indicates that multicollinearity might exist and would be excluded from the multivariate linear or logistic regression. The results of the linear regression analyses were expressed as the estimated mean differences with the 95 % confidence interval (CI), and of the logistic regression analyses as odds ratios (OR) with the 95 % CI. A p-value of 0.05 or less (2-tailed) was considered statistically significant.

All analyses were done using SPSS Statistics, version 27 (Armonk, NY: IBM Corp). A missing or incomplete answer on one or more questions of the EQ-5D was considered a missing value and in such a case the question was not included in the analysis. More than one missing or incomplete answer on the HADS was considered a missing value and in this case it was not included in the analysis.

Results

A total of 576 patients were considered eligible for participation and received an invitation. 207 provided informed consent and completed the questionnaires (35.9 % response rate). In the group of patients who responded, the proportion of patients from NEUB origin was lower compared to the group of patients who did not respond (n = 38, 18.4 % versus n = 118, 34.6 %, $p < 0.05$) indicating underrepresentation of NEUB patients in the study population. In addition, the median Barthel index at discharge was significantly higher in the group of patients who responded compared to the group of patients who did not respond (19 versus 17; $p = 0.05$), whereas the Barthel on admission, age and sex did not differ.

Table 1 presents the patient characteristics of the group of patients who responded. The mean age of these patients was 63.8 years (SD 14.4), and 125 (60.4 %) were male. In total, there were 14 different documented countries of birth. The majority of the patients was born in the Netherlands (78.7 %), followed by 6.8 % in Indonesia and 4.3 % in Suriname. Patients in the EUB group were predominantly born in the Netherlands (96.4 %). Apart from alcohol utilization no differences were observed on patient and stroke characteristics.

Table 1
Patient and stroke characteristics; differences between patients with a European background (EUB) and non-European background (NEUB) patients.

	PATIENTS WHO RESPONDED (N = 207)	EUB (N = 169)	NEUB (N = 38)	P-VALUE
PATIENT CHARACTERISTICS				
MEAN AGE, YEARS (SD)	63.8 (14.4)	64.3 (14.0)	61.3 (16.2)	.20*
SEX, MALE - N (%)	125 (60.4)	101 (59.8)	24 (63.2)	.70**
SOCIAL SITUATION, MARRIED/PATIENT LIVING WITH ANY OTHER INDIVIDUAL - N (%)	135 (66.2)	110 (65.9)	25 (67.6)	.84**
EDUCATIONAL LEVEL - N (%)				.89**
- **LOW**	72 (36.2)	59 (36.2)	13 (36.1)	
-MIDDLE	72 (36.2)	60 (36.8)	12 (33.3)	
-HIGH	55 (27.6)	44 (27.0)	11 (30.6)	
-MISSING DATA	8	6	2	
FOLLOW UP – N	205	168	37	
MONTHS, MEAN (SD)	36.3 (9.9)	35.9 (9.8)	37.8 (10.6)	.31*
SMOKERS BEFORE ADMISSION - N (%)	29 (14.1)	24 (14.3)	5 (13.5)	.90**
ALCOHOL USER BEFORE ADMISSION - N (%)	90 (43.9)	84 (50.0)	6 (16.2)	<.01**
STROKE CHARACTERISTICS				
TYPE OF STROKE - N (%)				.51**
-ISCHEMIC	181 (87.4)	149 (88.2)	32 (84.2)	
-HEMORRHAGIC	26 (12.6)	20 (11.8)	6 (15.8)	
LESION - N (%)	o			.77**
-LEFT HEMIPHERE	97 (46.9)	79 (46.7)	18 (47.4)	
-RIGHT HEMIPHERE	66 (31.9)	52 (30.8)	13 (36.8)	
-VERTEBROBASILAR	43 (20.8)	37 (21.9)	6 (15.8)	
-BILATERAL	1 (0.5)	1 (0.6)	0 (0)	
IV THROMBOLYSIS - N (%)	49 (23.7)	45 (26.6)	4 (10.5)	.08**
BARTHEL SCORE AT ADMISSION - N	174	143	31	.83***
MEDIAN (25–75 IQR)	14[9–20]	14[9–20]	14[9–20]	
BARTHEL SCORE AT DISCHARGE -N	174	143	31	.78*
MEDIAN (25–75 IQR)	19 (12.3–20)	19[13–20]	19 (11.3–20)	
HOSPITAL STAY – N	206o	168	38	.08*
MEAN DAYS HOSPITAL STAY (SD)	8.7 (8.0)	8.3 (7.1)	10.8 (11.2)	
DISCHARGE TO HOME -N (%)	98 (53.6)	83 (55.0)	15 (46.9)	.40**

N = number; SD = standard deviation; IQR = interquartile range; * = unpaired T-test; ** = Chi-square test, *** = Mann-Whitney *U* test.

Long-term HRQOL

Table 2 shows that the mean physical component score (PCS) of the SF-36 was 42.9 (SD 13.3) in the EUB group and 35.4 (SD 13.1) in the NEUB group, a statistically significant crude difference of 7.5 points (p

Table 2
Differences between patients with a European background (EUB) and non-European background (NEUB) in quality of life, anxiety- and depressive symptoms and healthcare utilization in the past 6 months; crude results and adjusted for potential confounders (age, sex, Barthel Index and educational level).

	EUB	N	NEUB	N	MEAN DIFFERENCE (95 % CI)**	OR (95 % CI) CRUDE	P VALUE	OR (95 % CI) ADJUSTED*	P VALUE*
HRQOL - SF36; PCS; MEAN (SD)	42.9 (13.3)	151	35.4 (13.1)	35	7.5 (2.6–12.4)	–	<.01	–	<.01
HRQOL - SF36; MCS; MEAN (SD)	47.1 (12.4)	151	43.7 (12.8)	35	3.4 (−1.2–8.0)	–	.15	–	.35
HRQOL - EQ-5D; MEAN (SD)	.76 (.221)	159	.60 (.336)	36	.16 (.07–0.25)	–	<.01	–	<.01
HADS-D ≥8; N (%)	48 (29.8)	161	19 (54.3)	35	–	2.80 (1.33–5.90)	.01	2.55 (1.08–6.05)	.03
HADS-A ≥8; N (%)	38 (23.8)	160	14 (40.0)	35	–	2.14 (.99–4.61)	.05	1.51 (0.61–3.75)	.37
HEALTH CARE USAGE - PHYSICIANS, ≥ 2 VISITS; N (%)	32 (26.0)	111	13 (52.0)	21	–	3.08 (1.28–7.44)	.01	4.14 (1.45–11.79)	.01
HEALTH CARE USAGE – VISIT GP; N (%)	86 (55.8)	154	29 (80.6)	36		3.27 (1.35–7.90)	.01	4.29 (1.52–12.09)	.01
HEALTH CARE USAGE – VISIT SPECIALIST; N (%)	52 (38.5)	141	21 (63.6)	33		2.66 (1.21–5.83)	.01	3.73 (1.44–9.65)	.01
HEALTH CARE USAGE - HCP, ≥ 1 VISITS; N (%)	68 (51.5)	107	12 (44.4)	24	–	0.75 (0.33–1.73)	.50	0.84 (0.30–2.29)	.73

HRQOL = health-related quality of life; SF36=Short form 36; PCS = physical component scale; MCS = mental component scale; EQ-5D = EuroQol-5D; HADS-D = hospital anxiety and depression scale – depression subscale; HADS-A = hospital anxiety and depression scale – anxiety subscale; GP = general practitioner; HCP = healthcare professional; N = number; SD = standard deviation; SE = standard error; OR = odds ratio; CI = confidence interval; * = adjusted for age, sex, educational level and Barthel Index on admission. ** no differences between crude and adjusted data.

< 0.01). After adjusting for potential confounders sex, age, level of education and functional outcome, the significant difference in PCS persisted (p < 0.01; Table 2). There was no collinearity in the aforementioned potential confounders.

The mean difference regarding the mental component score (MCS) was 3.4 points (p = 0.15; Table 2). These scores indicate that patients of the EUB group experienced a better physical quality of life compared to patients in the NEUB group after stroke, while the crude difference as well as the adjusted difference in mental quality of life was not statistically significant.

The mean EQ-5D poststroke quality of life was 0.762 (SD 0.221) for the EUB group and 0.599 (SD 0.336) for the NEUB group. The crude difference remained significant after multivariable adjustment (p < 0.01). This difference can be considered as clinically relevant (MID of 0.12).

Anxiety and depression

A HADS-depression score ≥8 was significantly more often observed in the NEUB group than the EUB group (54.3 % vs 29.8 % respectively; p = 0.01; Table 2). The difference remained significant after adjusting for possible confounders (p = 0.03). There was a non-significant difference in patients with NEUB background compared to patients of the EUB group regarding anxiety scores (40.0 % vs 23.8 % respectively; p = 0.052; Table 2).

Healthcare utilization

The percentage of patients who visited two or more physicians for the past six months was significantly higher in the NEUB group compared to the EUB group (52.0 % vs 26.0 %; p = 0.01) as represented in Table 2. The significant difference persisted after adjusting for confounders (p = 0.01). Focusing on the percentage of patients visiting the general practitioner (GP) or medical specialists, a significantly higher percentage can be found in the NEUB group compared to the EUB group. These results persisted after adjusting for confounders (p = 0.01). Regarding the other healthcare professionals, the EUB and the NEUB group were comparable in healthcare utilization.

Discussion

Stroke survivors in the Dutch population who were born outside Europe had a lower long-term quality of life than stroke survivors who were born in Europe. This difference is mainly due to a lower physical quality of life, rather than a lower mental quality of life. We found a higher percentage of depressive symptoms and a higher healthcare utilization in patients born outside Europe compared to patients who were born in Europe.

Our results are in line with earlier studies concluding a worse poststroke HRQOL in minority groups, however, these studies were based on populations of American or Asian origin. The follow up was three months in two studies and was unknown in the third study.[13–15] Therefore, the results cannot be extrapolated directly to the present study.

One study analyzed differences in HRQOL among elderly immigrants of different ethnic groups in general society in the Netherlands, including Moroccans, Turks and Moluccans (Indonesia).[27] Differences in HRQOL were found in this study population, but these differences were affected by other factors (multimorbidity and loneliness), not ethnicity. One study suggested a different interpretation of the concept of HRQOL between ethnic groups which could possibly be explained by variation in cultural conceptualization.[28] However, this study analyzed patients with traumatic brain injury. Whether this difference in interpretation of HRQOL is a factor in poststroke patients is unknown. Another explanation of ethnical inequalities in HRQOL consists of differences in socioeconomic factors. A lower income can be an independent negative predictor for HRQOL in poststroke patients.[29] Data regarding educational level may serve as a proxy variable in this respect and was included in our study to correct for confounding.

In two studies, a higher prevalence of depressive symptoms was described in Hispanics compared to White Americans and other non-Hispanics, with up to two years follow up.[18,19] In one study lower odds of poststroke depression one month after stroke were observed in the Hispanic group compared to non-Hispanic whites, but no significant differences were found 12 months after stroke.[17]

The present study also demonstrated a higher percentage of patients with depressive symptoms in the NEUB group. Differences between outcomes of aforementioned studies, might be explained by differences

in included patients (first ever stroke versus also recurrent strokes), timing of questionnaires (90 days versus two years) and definition of poststroke depression (self-reported versus validated depression scales).

Healthcare utilization is partly dependent on the level of reimbursement and since this is different in every country, caution is needed when comparing results from different countries. For example, contrary to our results, American studies show fewer physician visits among ethnic minority groups.[30,31] These disparities have been explained by differences in access to healthcare. One study found more impoverishment and uninsured patients within the Hispanic and Black population, which raises the threshold for using healthcare.[32] A basic health insurance package is legally required in the Netherlands; physician healthcare costs are reimbursed equally for every patient; the higher healthcare use regarding physician visits can be related to the lower outcomes after stroke. However, treatment of other HCPs (such as physical therapy) is only reimbursed completely for those who can afford a supplementary health insurance package. This may be the explanation for the paradoxical result of lower scores on physical quality of life of patients in the NEUB group without a reflection of this difference in higher use of HCPs (such as physical therapy).

A strength of this study is the multi-ethnic study population and the long follow-up time. Furthermore, it is the first study to describe the influence of ethnicity on outcomes after stroke regarding HRQOL, depression and anxiety and healthcare utilization in the EUB context. There were several baseline factors that differed between the EUB and NEUB group, which could be of influence on the outcome. A trend was observed regarding thrombolytic therapy; the NEUB group seem to have a lower chance of receiving this therapy. Also, the mean duration of hospital stay was longer in the NEUB group, although these differences were statistically not significant. When interpreting the results however, the following limitations should be taken into account. Firstly, to define ethnicity we used for practical reasons self-reported country of birth, while self-reported ethnicity would be more in line with international literature. However, the concept of identification to population groups is less customary in the Netherlands. Second, this study is prone to selection bias due to its design. NEUB patients were less likely to be included in the study. The most plausible explanation for this difference is the use of Dutch questionnaires, excluding patients that lack Dutch language skills. Also, stroke severity (for example measured by NIHSS) might be associated with a worse outcome in quality of life. Adjusting for this possible confounder would be justified, however due to the retrospective design of this study, this measurement was mostly not available, therefore correction for this factor was not possible. Therefore, we used the Barthel index, a functional outcome measurement. Finally, a pre-existing difference in HRQOL between diverse ethnic groups in society may attribute to differences in the outcomes after stroke, although this effect can be in both directions.

In conclusion, this study confirms that disparities can be expected in long-term outcome regarding quality of life, depressive symptoms and healthcare consumption in stroke survivors related to ethnical differences. Ethnicity, defined by country of birth, seems to be an independent determinant for HRQOL, mood disorders and healthcare utilization of stroke survivors. EUB stroke patients have better outcomes regarding HRQOL and depressive symptoms and need their GP and medical specialist less often compared to NEUBs. Poststroke care programs should take this into account.

Further research into the cause of the differences between the groups is needed. These results could be used to improve long-term outcomes and thereby narrow the differences in outcomes between stroke survivors with different ethnicities.

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CRediT authorship contribution statement

Y.X. Lee: Conceptualization, Investigation, Methodology, Writing – original draft, Writing – review & editing. **S.T. Auwerda:** Data curation, Formal analysis, Methodology. **K. Jellema:** Conceptualization, Supervision, Writing – review & editing. **T.P.M. Vliet Vlieland:** Validation, Writing – review & editing. **H.J. Arwert:** Conceptualization, Supervision, Validation, Writing – review & editing.

Declaration of competing interest

S.T. Auwerda reports no disclosures.

Y.X. Lee reports no disclosures.

K. Jellema reports no disclosures.

H.J. Arwert: Is member of advisory board for development of quality criteria in primary care of stroke patients; payments are made to Basalt Rehabilitation.

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