Received: 4 April 2022 | Accepted: 12 July 2022

DOI: 10.1111/ene.15503

european journal of neurology
the official journal of the european academy of neurology

ORIGINAL ARTICLE

Influence of educational status and migration background on the long-term health-related quality of life after stroke

Lino Braadt[1] | Christa Meisinger[2] | Jakob Linseisen[2] | Inge Kirchberger[2,3] | Philipp Zickler[1] | Markus Naumann[1] | Michael Ertl[1]

[1]Department of Neurology and Clinical Neurophysiology, University Hospital Augsburg, Augsburg, Germany

[2]Epidemiology, Faculty of Medicine, University of Augsburg, Augsburg, Germany

[3]Institute for Medical Information Processing, Biometry and Epidemiology—IBE, Ludwig-Maximilians-Universität München, Munich, Germany

Correspondence
Michael Ertl, Department of Neurology and Clinical Neurophysiology, University Hospital Augsburg, Augsburg, Germany.
Email: michael.ertl@uk-augsburg.de

Funding information
Augsburg University, Faculty of Medicine

Abstract

Background and purpose: Acute stroke treatment and secondary prevention have tremendously improved functional outcomes after stroke. However, this does not always imply a likewise improvement in health-related quality of life (HRQoL). Knowledge on factors influencing HRQoL after stroke is still scarce, especially regarding social aspects like the level of education and the presence of migration background.

Methods: In the present stroke cohort study, participants were interviewed during their hospital stay and completed a postal questionnaire at 3 and 12 months post stroke. Functional outcomes were assessed by the modified Rankin Scale and HRQoL by evaluating the detailed Stroke Impact Scale (SIS). Logistic regression models were used to determine associations between education, migration background and quality of life end-points.

Results: A total of 945 (mean age 69 years; 56% male) stroke patients were enrolled. After adjusting for confounders, a lower educational level was associated with worse functional outcomes in the SIS domain 'strength' (odds ratio 2.67, 95% confidence interval 1.6–4.4, $p < 0.001$). Migration background was associated with worse outcomes in the SIS domain 'emotion' ($p = 0.007$, odds ratio 1.71, 95% confidence interval 1.2–2.5). Additionally, for female patients worse HRQoL outcomes were found in multiple other SIS domains.

Conclusions: Migration background and a lower educational level were significantly associated with lower long-term HRQoL after stroke. These aspects should be considered in targeted rehabilitation programmes and follow-up support of stroke patients.

KEYWORDS
education, health-related quality of life, migration background, patient-reported outcome measures, stroke

INTRODUCTION

Stroke is a major cause of disability worldwide and accounted for 143 million disability-adjusted life years in 2019 [1]. Over the years, acute stroke treatments, especially intravenous thrombolysis and endovascular therapy, have significantly improved functional outcomes. Stroke outcomes are usually evaluated by the National Institutes of Health Stroke Scale (NIHSS) and modified Rankin Scale (mRS). However, functional outcome measures mainly relate to activities of daily life and provide only limited information about the health status from the patient's perspective. Increasing evidence shows that the degree of disability does not necessarily correlate

with the health-related quality of life (HRQoL) [2]. Thus, stroke outcome research has advanced to additionally include patient-reported outcome measures (PROMs), which also comprise the patient's cognitive and social functions and domains such as symptom burden (e.g., fatigue) or emotional health (e.g., depression) in order to more appropriately reflect HRQoL.

Recently published results from our stroke cohort showed a discrepancy between good functional outcomes and nevertheless significantly reduced HRQoL in the short- and long-term outcome [3]. Factors associated with reduced HRQoL after stroke include depression and fatigue [4], unemployment and an unmarried or unengaged status [5]. Furthermore, a lower educational level showed an association with reduced HRQoL but to date has only been investigated in low- to middle-income countries [6]. It remains unknown whether the educational level is also relevant in high-income countries with different social and occupational situations.

In times of globalization migration is increasing, especially in Western societies. In 2020, 26.7% of the German population had a migration background [7]; in the city of our study (Augsburg) the share of the population with a migration background was even higher at 46.8% in the same year [8]. Different cultural or religious backgrounds influence disease concepts and coping strategies. Nevertheless, the relevance of these factors and their potential impact on HRQoL after stroke is unknown. Therefore, the influence of the education level and migration background on medium- (3 months) and long-term (12 months) outcomes including HRQoL was investigated in a large prospective stroke cohort study.

MATERIALS AND METHODS

Study population, data collection and follow-up

The screening for the enrolment of patients included all adult patients who had been admitted with ischaemic or haemorrhagic strokes as well as transient ischaemic attacks between September 2018 and November 2019 to the University Hospital of Augsburg, Germany. A detailed description of enrolment, methods and conduction of interviews and follow-up data has been published elsewhere [9]. In summary, trained study nurses prospectively recorded all cases with a stroke. After having received written informed consent, a baseline interview and chart review were conducted to assess data on general biographic information, the diagnosis and its details, laboratory findings, treatment and comorbidities. Postal or telephone follow-up examinations were performed after 3 and 12 months, with questions regarding various aspects such as lifestyle, the current level of disability and PROMs using the Stroke Impact Scale (SIS) (see Figure 1).

Outcomes

The patients' functional outcomes were measured using the NIHSS (ranging from 0 to 42) [10] and the mRS [11], which were recorded at admission and at discharge from hospital. Additionally, the mRS was examined by postal follow-up questionnaires. The patient-reported

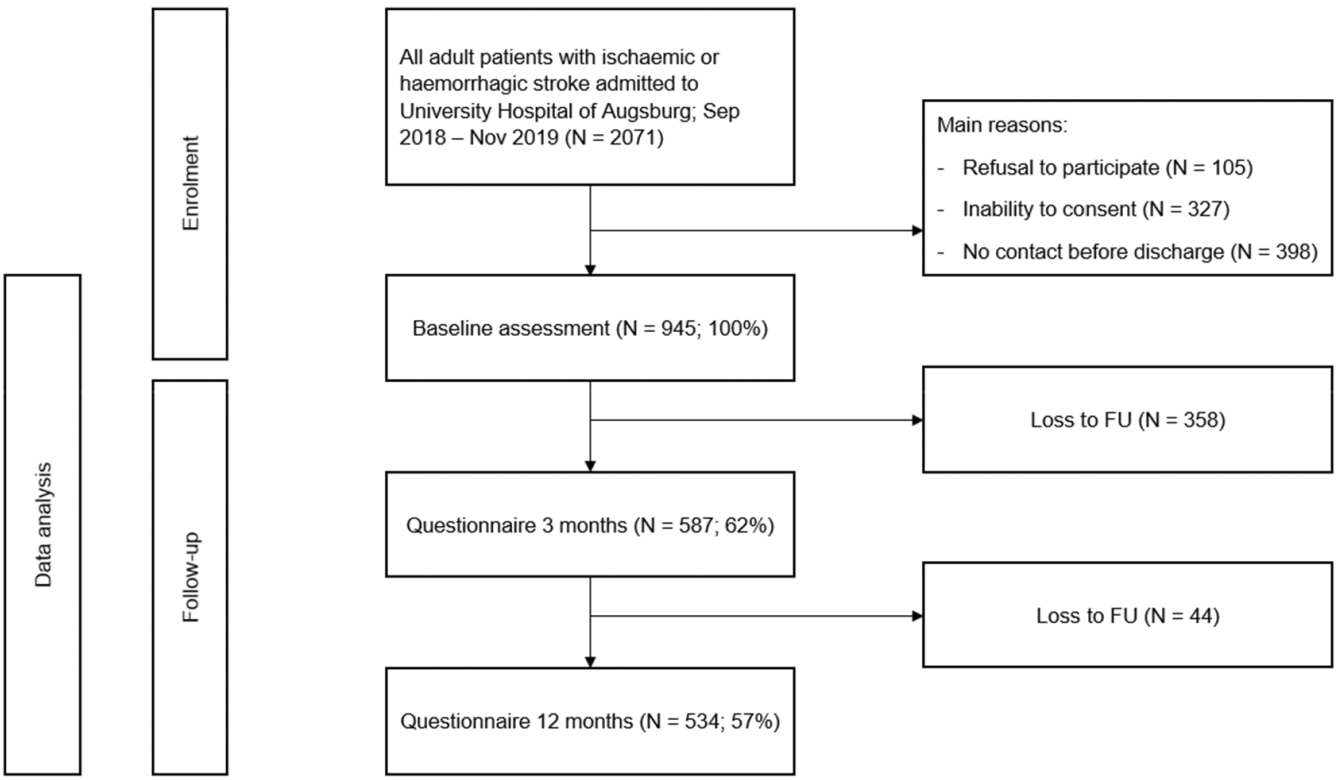

FIGURE 1 Consort chart of patient enrolment and follow-up

outcome measures were recorded using the SIS [12, 13], which includes 64 items assessed in eight domains and one combined ninth domain. Each domain has a score ranging from 0 to 100 (i.e., from no to full recovery). Namely, the domains refer to strength, hand function, activities of daily life, mobility, a physical domain, memory/thinking, communication, emotion and participation. As an example, the domain emotion evaluates predominant emotions within the past week, whilst the domain strength enquires about the subjective strength of arm, hand, leg and foot. The SIS was assessed after 3 months and again after 12 months.

The validity and reliability of the used scores have been published for the original and the German versions. The interrater reliability (mean kappa) for the NIHSS was 0.80 and for the mRS 0.76 [14]. The instrument reliability of the SIS (Cronbach alpha coefficients) ranged from 0.83 to 0.90 [13].

The educational level was determined using the International Standard Classification of Education (ISCED-97) using six categories. To simplify analysis, the original six ISCED groups were reduced and dichotomized into 'basic education' for those with ISCED levels 1 to 3 and 'higher education' for levels 4 to 6. The approach of grouping ISCED was adapted from other publications [15].

According to the definition of the Federal Statistical Office of Germany a migration background was assumed when either the patient himself/herself or at least one parent was born without German citizenship [16]. For inferential statistical analysis only migration background versus no migration background were differentiated. Respective nationalities were only taken into account for descriptive statistical analysis, and grouping was done whenever complete information on the patient background was available. The groups consist of EU 15 (countries before 2004, including Great Britain), EU 13 (those joined in 2004 and after), the remainder of the European countries but not members of the EU (including Russia), Turkey, the USA and other countries. Those with multiple family antecedents were grouped into 'other'.

Statistical analysis

Baseline characteristics are presented as mean ± standard deviation for normal distributed or median and 25th and 75th quartiles (Q25–Q75) for non-normally distributed continuous variables. Categorized variables are given as numbers (*n*) and percentages (%).

Data were checked for normal distribution using QQ plots, Shapiro–Wilk and Kolmogorov–Smirnoff tests. Medians were compared by Mann–Whitney *U* test, means by *t* test. Categorical data were compared by chi-squared test or Fisher's exact test. For matched-pairs analysis of non-normally distributed variables, Wilcoxon matched-pairs test was used.

Logistic regression analyses were conducted with the domains of SIS as outcome. For this analysis the SIS outcomes were dichotomized into groups above and below the respective median. Independent variables of interest were migration background and basic education.

The models were adjusted for age, sex, body mass index (BMI) and family status. Furthermore, in the models with educational level migration background was also adjusted for, but not vice versa. A p value <0.05 was considered as statistically significant. Statistical analysis was conducted using SPSS software, version 28.0.1.0.

RESULTS

Study population at baseline

Our study included 945 consecutive patients. Their baseline characteristics are shown in Table 1. Women had a worse mRS at admission (2.45 ± 1.52 vs. 2.20 ± 1.48; $p = 0.012$), which did not persist at discharge (1.38 ± 1.46 vs. 1.34 ± 1.41; $p = 0.662$). The NIHSS was not associated with sex, either at admission or at discharge. Regarding basic and higher educational levels there was also a statistically significant difference between mRS at admission (2.34 ± 1.5 vs. 2.08 ± 1.45; $p = 0.045$), which was no longer the case at discharge. Again, the NIHSS in these subgroups did not differ, either at admission or at discharge. Patients with or without migration background did not differ significantly in their mRS at discharge, or NIHSS at both timepoints. For subgroup analyses of grouped migration backgrounds, only one group of patients from EU 13 countries had sufficient statistical power for comparison but showed no differences in functional outcomes such as mRS and NIHSS either at admission or discharge compared to patients without migration background (see Table S1). The educational level was not significantly associated with migration background.

Follow-up after 3 and 12 months

Considering baseline parameters only sex had a significant impact. Women had a worse mRS at admission, but this finding did not persist at all other timepoints including discharge from hospital and the follow-ups at 3 ($p = 0.73$) and 12 months ($p = 0.697$).

Regarding functional outcomes, patients reported a median mRS outcome of 1 both after 3 and after 12 months (median 1 (0–2) vs. 1 (0–2), $p = 0.83$). Almost no changes were observed for all SIS domains between 3 and 12 months (see Table S2). Therefore, further analysis focused on the long-term outcome after 12 months.

A migration background was not associated with significant differences of functional outcomes, either after 3 months ($p = 0.138$) or after 12 months ($p = 0.489$). Patients with a lower educational level had no different functional outcomes after 3 months ($p = 0.509$) but worse outcomes after 12 months ($p = 0.013$).

Men had a significantly better outcome in the domains 'activities of daily life' ($p = 0.001$), 'hand function' ($p < 0.001$), 'mobility' ($p = 0.027$) and in the combined 'physical' domain ($p = 0.025$; see Table S3). Patients without a migration background had a significantly better outcome in the domain 'emotion' compared to those with migrant background ($p = 0.017$; see Table 2). Furthermore,

TABLE 1 Baseline characteristics given as numbers, mean (±SD) or median (IQR) and numbers (%)

Characteristics	Total study population	Migration background	Basic education
Age (valid)	929	274	602
M; SD	69.3; 13.1	66; 12.8	68.8; 13.3
>80	188 (20)	37 (14)	111 (18)
40–80	719 (77)	228 (83)	475 (79)
<40	22 (2)	9 (3)	16 (3)
Sex (valid)	945	274	602
Female	414 (44)	130 (47)	284 (47)
Male	531 (56)	144 (53)	318 (53)
Stroke type (valid)	945	274	602
Ischaemic stroke	908 (96)	257 (94)	576 (96)
Intracerebral haemorrhage	34 (4)	15 (5)	24 (4)
Subarachnoid haemorrhage	3 (<1)	2 (<1)	2 (<1)
Stroke aetiology (valid)	873	245	552
Macroangiopathy	223 (26)	60 (24)	153 (28)
Microangiopathy	163 (19)	52 (21)	105 (19)
Cardiogenic	219 (25)	50 (20)	140 (25)
Cryptogenic	247 (28)	78 (32)	144 (26)
Other	21 (2)	5 (2)	10 (2)
NIHSS (valid)			
At admission	928; 2 (0–3)	265; 2 (0–3)	590; 2 (0–4)
At discharge	834; 0 (0–4)	245; 0 (0–2)	530; 0 (0–2)
mRS (valid)			
At admission	931; M 2.31 (1.5)	266; M 2.28 (1.47)	591; M 2.34 (1.5)
At discharge	930; M 1.36 (1.43)	269; M 1.25 (1.37)	592; M 1.34 (1.4)
ISCED (valid)	785	274	602
Primary	5 (<1)	4 (1)	5 (<1)
Lower secondary	87 (11)	43 (16)	87 (14)
Upper secondary	510 (65)	164 (60)	510 (85)
Post-secondary, non-tertiary	47 (6)	22 (8)	0
First stage of tertiary	136 (17)	41 (15)	0
Second stage of tertiary	0	0	0
Migration background (valid)	783		600
No migration background	509 (65)		389 (65)
Migration background	274 (35)		211 (35)
Migration background grouped (valid)		255	
EU (before 2004, including Great Britain)		33 (13)	
Remainder EU (after 2004)		79 (31)	
Europe (non-EU, including Russia)		22 (9)	
Turkey		12 (5)	
USA		3 (1)	
Other		106 (42)	

Abbreviations: IQR, interquartile range; ISCED, International Standard Classification of Education; M, mean; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale.

higher educated patients had better outcomes in the domains 'hand function' ($p = 0.041$), 'participation' ($p = 0.036$), 'strength' ($p < 0.001$), 'mobility' ($p = 0.02$) and in the combined 'physical' domain ($p = 0.003$; see Table 3) compared to less educated patients. The further subgroup analysis of patients with migration background from EU 13 countries did not show significant differences in any domain.

TABLE 2 Patient-reported outcomes with and without migration background

	Migration background		No migration background		
SIS domain	*n* (valid)	M (Q1–Q3)	*n* (valid)	M (Q1–Q3)	*p*
ADL	166	93.75 (80.73–100)	329	93.75 (83.33–100)	0.77
Emotion	167	72.22 (61.11–86.11)	332	80.56 (66.67–88.89)	0.017
Memory	164	90.63 (75.78–100)	330	90.63 (81.25–100)	0.32
Hand function	152	90.00 (70.00–100)	291	95.00 (75.00–100)	0.23
Communication	165	96.43 (85.71–100)	329	92.86 (85.71–100)	0.84
Participation	156	83.85 (58.59–100)	321	88.89 (66.67–100)	0.09
Strength	147	75.00 (56.25–87.50)	274	75 (62.50–93.75)	0.20
Mobility	164	92.50 (75.00–100)	332	92.50 (77.50–100)	0.64
Physical	166	89.52 (74.14–96.77)	330	90.91 (78.88–96.77)	0.26

Abbreviations: ADL, activities of daily life; M, mean; Q, quartile; SIS, Stroke Impact Scale.

TABLE 3 SIS outcomes with basic and higher education

	Basic education		Higher education		
SIS domain	*n* (valid)	M (Q1–Q3)	*n* (valid)	M (Q1–Q3)	*p*
ADL	378	93.75 (79.17–100)	118	95.83 (85.42–100)	0.06
Emotion	378	77.78 (63.89–88.89)	122	80.56 (65.97–88.89)	0.62
Memory	378	90.63 (78.13–100)	117	93.75 (81.25–100)	0.10
Hand function	340	90.00 (70.00–100)	104	100 (75.00–100)	0.041
Communication	377	96.43 (85.71–100)	118	96.43 (85.71–100)	0.54
Participation	361	87.50 (61.11–100)	117	94.44 (69.44–100)	0.036
Strength	320	75.00 (56.25–81.25)	101	75.00 (68.75–100)	<0.001
Mobility	377	92.50 (75.00–100)	120	95.00 (84.53–100)	0.02
Physical	379	90.32 (75.00–96.77)	118	93.93 (80.74–99.19)	0.003

Abbreviations: ADL, activities of daily life; M, mean; Q, quartile; SIS, Stroke Impact Scale.

After adjusting for the confounders age, BMI, sex, marital status and migration background by logistic regression analyses a significant association between a lower educational level and the outcome 'strength' in the SIS domain persisted (odds ratio 2.67, 95% confidence interval 1.6–4.4, $p < 0.001$). Migration background was significantly related to the domain 'emotion' (odds ratio 1.71, 95% confidence interval 1.2–2.5, $p = 0.007$; see Figure 2).

DISCUSSION

In the present study a significant correlation between the patients' educational status, migration background and HRQoL after stroke was found.

The educational level of patients in the present study was an independent predictive factor for functional outcome and quality of life. It was associated with a worse mRS at admission and after 12 months, an observation that was also found in another stroke patient collective [17]. A low socioeconomic status, which is associated with a low educational level [18], is known to increase the cardiovascular risk and incidence of cardiovascular diseases [19]. In the present study a lower educational level had a significant impact on multiple SIS domains and a negative impact on HRQoL. Similar results have been described in heart failure patients where HRQoL was diminished with lower educational levels. These patients had increased needs of care but less social support [20]. Nevertheless, after consideration of confounding variables like sex, age, BMI, marital status and migration background only the SIS domain 'strength' remained significantly reduced. Since this domain captures the subjective function of the extremities it needs to be considered that a correlation with more severe functional deficits is possible. This assumption is further supported by a worse mRS score at admission in this subgroup. As it is known that stroke severity does not necessarily define HRQoL [3], it can be hypothesized that physical inabilities might impact quality of life even more in patients with a lower educational level.

In the present cohort, a migration background was present in 35% of patients. Of those, a background out of EU 13 was the largest group (31%). Although a link between migration background and lower educational levels is reported [21], this connection was found to be non-significant in our study. Correspondingly, patients with a migration background showed different results from those with lower educational levels. There was no association of migration background with different functional outcomes, either at baseline or at follow-up. Nevertheless, it had a significant impact on HRQoL with negative effects on the SIS domain 'emotion'. This domain

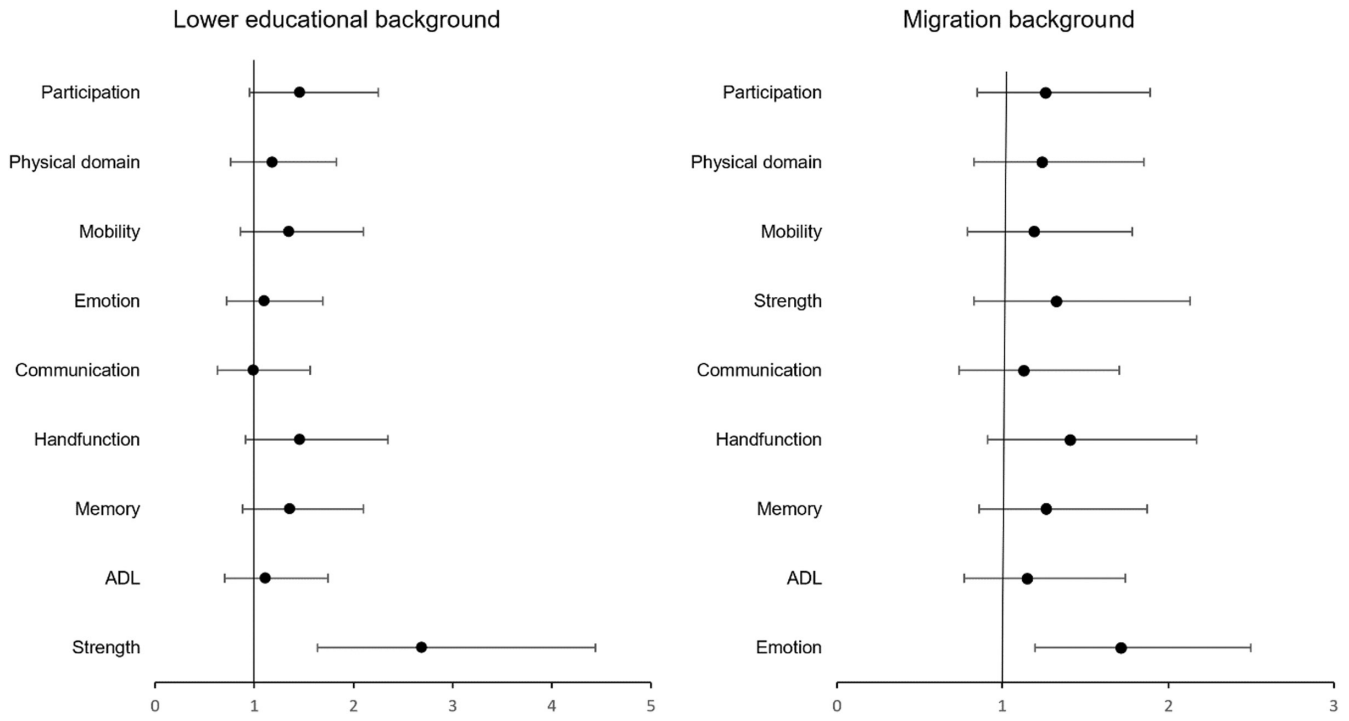

FIGURE 2 Odds ratio, SIS domains in their relation to the educational and migration background. SIS, Stroke Impact Scale

reflects the emotional stability and patient-inherent abilities to cope with a disease. A potential explanation could be that migrants less often use rehabilitation offers [22], which can be associated with lower information availability due to language barriers and with concerns that cultural differences might not be fully understood [23]. As language skills were not enquired about, this aspect could not be investigated in the present study population. In other healthcare issues cultural differences and ethnicity have already been shown to be associated with different disease coping strategies, perception of stress and the use of family support [24, 25]. The dichotomization into an existing or non-existing migration background oversimplifies a complex mixture of different countries and cultural backgrounds also in the present cohort. Our attempt to further subgroup migration backgrounds did not yield significant results due to small subgroup numbers or because the predominant background from EU 13 countries was not the subgroup that caused the significant results. Another important aspect are potential differences between the first or second migration generation relating to the degree of social integration and language competence.

Sex is a decisive factor influencing stroke severity, functional outcome and quality of life after stroke. This could also partly be reproduced in the present cohort, with women having lower mRS values at the timepoint of admission. This effect was restricted to the mRS with NIHSS values not being statistically different. Although the effect was statistically significant, the average difference of 2.45 versus 2.2 points was quite low and the question of clinical significance remains. Although women had more functional impairments and reported worse outcomes in multiple SIS domains both in the present study and in the literature [26, 27], this factor was not associated with the influence of education and migration background on HRQoL after stroke in the present analysis.

Disease-modifying programmes in stroke were the aim of intensive research during the last few years [28, 29]. These programmes are focused on intensive treatment of cardiovascular risk factors to prevent further strokes. The present results underline the need for early screening and identification of additional risk factors like educational level and migration background that have a negative impact on HRQoL. As a consequence, targeted interventions and tailored stroke rehabilitation programmes could be helpful to improve quality of life outcomes. For example, smoking cessation is known to be less successful in low socioeconomic status but can be improved by using an internet-based intervention programme especially directed at this subgroup [30].

Strengths and limitations

The combination of long-term follow-up data in a large prospective stroke cohort, examining PROMs alongside much other detailed information on the patients' biographical and medical data, is a major strength of the study. SIS is a stroke-specific questionnaire, examining various aspects of the individual outcome, allowing analysis of HRQoL in detail. On the other hand, its stroke specificity does not allow a direct comparison with HRQoL measures in other diseases. The overlap of the SIS domain 'strength' with functional outcome measures impedes interpretation. Despite our large cohort, 46% of patients were not included, for example due to refusal to participate (5%) or inability to consent (16%). Of the included patients, 38% were lost to follow-up before 3 months and

a further 7% of the remaining before 12 months. This represents a potential selection bias, but was partly addressed by checking for stroke severity differences, that is, associations between mRS and NIHSS with migration or educational backgrounds. Since 17% of patients did not provide information about their educational level and their nationality, some statistical effects might not have become significant.

Migration background is a very wide ranging concept with relevant differences in cultural and linguistic aspects. To address these peculiarities, whenever possible the migration backgrounds were grouped into subgroups. Here, backgrounds from EU 15 (EU countries before 2004 [including Great Britain]), EU 13 (those joining in 2004 and after), other European countries without EU membership (including Russia), Turkey, the USA and other countries were differentiated. Patients with multiple antecedents were grouped to 'other background'. By this distinction, the aim was for differentiation between the Western cultures, which would include the example of Austrian descent, eastern European cultures, Arabic countries and others. From these subgroups, only the eastern European group (EU 13) was large enough for statistical analysis. Therefore, more specific influences of particular backgrounds need to be investigated in future studies.

CONCLUSION

In the present study lower educational levels and the presence of a migration background were independent factors significantly associated with a lower long-term HRQoL after stroke. This underlines the importance of investigating quality of life measures in addition to functional outcomes. Our results imply that further improvement in HRQoL could potentially be achieved by tailored rehabilitation programmes and more intense or targeted supportive measures.

AUTHOR CONTRIBUTIONS

Lino Braadt: Formal analysis (lead); investigation (lead); writing – original draft (lead). **Christa Meisinger:** Conceptualization (lead); data curation (equal); formal analysis (supporting); funding acquisition (equal); investigation (equal); methodology (lead); project administration (equal); supervision (equal); validation (equal); writing – review and editing (supporting). **Jakob Linseisen:** Conceptualization (supporting); data curation (equal); funding acquisition (supporting); methodology (lead); project administration (lead); resources (lead); software (lead); supervision (equal); validation (equal); writing – review and editing (equal). **Inge Kirchberger:** Formal analysis (supporting); investigation (equal); methodology (equal); validation (equal); writing – review and editing (equal). **Philipp Zickler:** Conceptualization (equal); methodology (equal); project administration (equal); supervision (equal); writing – review and editing (equal). **Markus Naumann:** Conceptualization (equal); funding acquisition (equal); methodology (equal); project administration (equal); resources (lead); supervision (equal); writing – review and editing (equal). **Michael Ertl:** Conceptualization (lead); formal analysis (equal); funding acquisition (lead); investigation (equal); methodology (equal); project administration (lead); supervision (lead); writing – original draft (lead); writing – review and editing (lead).

ACKNOWLEDGEMENTS

The authors are grateful for the general support from the Chair of Epidemiology and the Department of Neurology and Clinical Neurophysiology at the University Hospital Augsburg. Dennis Freuer and Holger Vogelhuber are thanked in particular for their active support. Open Access funding enabled and organized by Projekt DEAL.

FUNDING INFORMATION

The cohort study was funded by the Medical Faculty, University of Augsburg, Augsburg, Germany.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICAL STATEMENT

The study was approved by the ethics committee of the Ludwig-Maximilians University Munich (29.08.2018, reference number 18-196) in accordance with the ethical standards of the 1964 Declaration of Helsinki. All patients or their legal representatives gave their informed and written consent.

ORCID

Michael Ertl https://orcid.org/0000-0001-5271-4898

REFERENCES

1. Roth GA, Mensah GA, Johnson CO, et al. Global burden of cardiovascular diseases and risk factors, 1990–2019: update from the GBD 2019 study. *J Am Coll Cardiol*. 2020;76(25):2982-3021.
2. Ali M, Fulton R, Quinn T, Brady M. How well do standard stroke outcome measures reflect quality of life? A retrospective analysis of clinical trial data. *Stroke*. 2013;44(11):3161-3165.
3. Kainz A, Meisinger C, Linseisen J, et al. Changes of health-related quality of life within the 1st year after stroke—results from a prospective stroke cohort study. *Front Neurol*. 2021;12:715313.
4. de Bruijn MA, Synhaeve NE, van Rijsbergen MW, et al. Quality of life after young ischemic stroke of mild severity is mainly influenced by psychological factors. *J Stroke Cerebrovasc Dis*. 2015;24(10):2183-2188.
5. Rachpukdee S, Howteerakul N, Suwannapong N, Tang-Aroonsin S. Quality of life of stroke survivors: a 3-month follow-up study. *J Stroke Cerebrovasc Dis*. 2013;22(7):e70-e78.
6. Mahesh PKB, Gunathunga MW, Jayasinghe S, Arnold SM, Liyanage SN. Factors influencing pre-stroke and post-stroke quality of life among stroke survivors in a lower middle-income country. *Neurol Sci*. 2018;39(2):287-295.
7. Statistisches Bundesamt. Pressemitteilung Nr. 463 vom 1. Oktober 2021; 2021. Accessed January 10, 2022. https://www.destatis.de/DE/Presse/Pressemitteilungen/2021/10/PD21_463_125.

html;jsessionid=03FDED2AE0B0FBBBCB5D729401B28DFF.live712
8. Gleich A. Strukturatlas 2020. R. O. Stadt Augsburg, Amt für Statistik und Stadtforschung. 2020. https://digital.zlb.de/viewer/metadata/15610988_2020/1/
9. Ertl M, Meisinger C, Linseisen J, Baumeister S-E, Zickler P, Naumann M. Long-term outcomes in patients with stroke after in-hospital treatment—study protocol of the prospective stroke cohort Augsburg (SCHANA Study). *Medicina*. 2020;56(6):280.
10. Kwah LK, Diong J. National Institutes of Health Stroke Scale (NIHSS). *J Physiother*. 2014;60(1):61.
11. Banks JL, Marotta CA. Outcomes validity and reliability of the modified Rankin scale: implications for stroke clinical trials: a literature review and synthesis. *Stroke*. 2007;38(3):1091-1096.
12. Duncan PW, Bode RK, Min Lai S, Perera S. Rasch analysis of a new stroke-specific outcome scale: the Stroke Impact Scale. *Arch Phys Med Rehabil*. 2003;84(7):950-963.
13. Duncan PW, Wallace D, Lai SM, Johnson D, Embretson S, Laster LJ. The stroke impact scale version 2.0. Evaluation of reliability, validity, and sensitivity to change. *Stroke*. 1999;30(10):2131-2140.
14. Berger K, Weltermann B, Kolominsky-Rabas P, et al. The reliability of stroke scales. The German version of NIHSS, ESS and Rankin scales. *Fortschr Neurol Psychiatr*. 1999;67(2):81-93.
15. Chlapecka A, Kagstrom A, Cermakova P. Educational attainment inequalities in depressive symptoms in more than 100,000 individuals in Europe. *Eur Psychiatry*. 2020;63(1):e97.
16. Statistisches Bundesamt. Migrationshintergrund 2021. Accessed January 15, 2022. https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bevoelkerung/Migration-Integration/Glossar/migrationshintergrund.html
17. Olascoaga-Arrate A, Freijo-Guerrero MM, Fernandez-Maiztegi C, et al. Relationship between level of education and one-year survival after ischaemic stroke. *Rev Neurol*. 2019;68(4):147-154.
18. Association AP. Socioeconomic status 2022. Accessed January 15, 2022. https://www.apa.org/topics/socioeconomic-status
19. Schultz WM, Kelli HM, Lisko JC, et al. Socioeconomic status and cardiovascular outcomes: challenges and interventions. *Circulation*. 2018;137(20):2166-2178.
20. Barbareschi G, Sanderman R, Leegte IL, van Veldhuisen DJ, Jaarsma T. Educational level and the quality of life of heart failure patients: a longitudinal study. *J Card Fail*. 2011;17(1):47-53.
21. Autorengruppe Bildungsberichterstattung. Bildung in Deutschland 2016, Ein indikatorengestützter Bericht mit einer Analyse zu Bildung und Migration. B. W. Bertelsmann Verlag GmbH & Co. KG; 2016. https://www.bildungsbericht.de/de/bildungsberichte-seit-2006/bildungsbericht-2016/pdf-bildungsbericht-2016/bildungsbericht-2016
22. Kohls M. Morbidität und Mortalität von Migranten in Deutschland. (Forschungsbericht/Bundesamt für Migration und Flüchtlinge (BAMF) Forschungszentrum Migration, Integration und Asyl (FZ), 9). Nürnberg: Bundesamt für Migration und Flüchtlinge (BAMF) Forschungszentrum Migration, Integration und Asyl (FZ); 2011. https://nbnresolving.org/urn:nbn:de:0168-ssoar-259992
23. Klein J, von dem Knesebeck O. Inequalities in health care utilization among migrants and non-migrants in Germany: a systematic review. *Int J Equity Health*. 2018;17(1):160.
24. Aranda MP, Knight BG. The influence of ethnicity and culture on the caregiver stress and coping process: a sociocultural review and analysis. *Gerontologist*. 1997;37(3):342-354.
25. Ernst ME, Williams JR, McCabe BE. Racial/ethnic differences in stress, coping, and distress among mothers with a child in the ICU. *Am J Crit Care*. 2021;30(4):275-284.
26. Appelros P, Åsberg S. Sex differences in stroke. *Handb Clin Neurol*. 2020;175:299-312.
27. Gall S, Phan H, Madsen TE, et al. Focused update of sex differences in patient reported outcome measures after stroke. *Stroke*. 2018;49(3):531-535.
28. Ahmadi M, Laumeier I, Ihl T, et al. A support programme for secondary prevention in patients with transient ischaemic attack and minor stroke (INSPiRE-TMS): an open-label, randomised controlled trial. *Lancet Neurol*. 2020;19(1):49-60.
29. Eichner FA, Schwarzbach CJ, Keller M, et al. Trial design and pilot phase results of a cluster-randomised intervention trial to improve stroke care after hospital discharge—the structured ambulatory post-stroke care program (SANO). *Eur Stroke J*. 2021;6(2):213-221.
30. Brown J, Michie S, Geraghty AW, et al. Internet-based intervention for smoking cessation (StopAdvisor) in people with low and high socioeconomic status: a randomised controlled trial. *Lancet Respir Med*. 2014;2(12):997-1006.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Braadt L, Meisinger C, Linseisen J, et al. Influence of educational status and migration background on the long-term health-related quality of life after stroke. *Eur J Neurol*. 2022;29:3288-3295. doi: 10.1111/ene.15503

MANAGE-PD

Tool for Making Informed Decisions to **Aid Timely Management of Parkinson's Disease**

MANAGE-PD allows you to:

- Identify PD patients inadequately controlled on oral medications
- Determine which patients with PD may be adequately controlled on their current treatment regimen or may require changes to their treatment regimen

Scan the QR code to access to the web

Click here to access to the web

MANAGE-PD is an AbbVie Inc. registered Medical Device. It is a collaborative research and development effort between AbbVie Medical Affairs and Health Economics and Outcomes, the Parkinson's Foundation and an international panel of Movement Disorder Specialists.

PD: Parkinson´s Disease

Parkinson's Foundation

Veeva Code: ABBV-AA-00335-FM Approved: January 2022

abbvie