UNIVERSITÄTSKLINIKUM HAMBURG-EPPENDORF

Department of Health Economics and Health Services Research
Prof. Dr. Hans-Helmut König

Determinants of health-related quality of life among homeless individuals during
the COVID-19 pandemic

Dissertation

zur Erlangung des Grades eines Doktors der Medizin an der Medizinischen
Fakultät der Universität Hamburg

vorgelegt von:

Victoria van Rüth
aus Duisburg

Hamburg 2024

Angenommen von der Medizinischen Fakultät am: 09.10.2024

Veröffentlicht mit Genehmigung der Medizinischen Fakultät der Universität Hamburg

Prüfungsausschuss, der/die Vorsitzende: **PD Dr. Ghazal Aarabi**

Prüfungsausschuss, 2. Gutachter/in: **Prof. Dr. André Hajek**

Table of contents

Original Research

Determinants of health-related quality of life among homeless individuals during the COVID-19 pandemic

V. van Rüth [a, b, *], H.-H. König [b], F. Bertram [a], P. Schmiedel [a], B. Ondruschka [a], K. Püschel [a], F. Heinrich [a, #], A. Hajek [b, #]

[a] Institute of Legal Medicine, University Medical Center Hamburg-Eppendorf, Hamburg, Germany
[b] Department of Health Economics and Health Services Research, University Medical Center Hamburg-Eppendorf, Hamburg, Germany

ARTICLE INFO

ABSTRACT

Objective: To clarify which variables are associated with the health-related quality of life (HRQoL) among homeless individuals during the COVID-19 pandemic.
Study design: Cross-sectional research.
Methods: Data were taken from the Hamburg survey of homeless individuals (n = 151). HRQoL was assessed using the EQ-5D tool. More precisely, the EQ-5D-5L questionnaire was used to quantify problems in five health dimensions (i.e. mobility, self-care, usually activities, pain/discomfort, anxiety/depression), and its visual analog scale (EQ-VAS) was used to record the according self-rated health status. Explanatory variables include sex, age, education, marital status, country of origin, health insurance, and chronic alcohol consumption.
Results: With regard to HRQoL, most frequently, problems were reported as pain/discomfort (47.3%), followed by anxiety/depression (32.4%), mobility (29.7%), usual activities (20.7%) and self-care (4.6%). The mean EQ-VAS score was 75.34 (SD 22.23; range 1−100), and the mean EQ-5D-5L index was 0.84 (SD 0.23; range 0.32−1). Regressions showed increasing problems in mobility and self-care with higher age, whereas EQ-VAS was positively associated with younger age. Furthermore, EQ-5D-5L index was positively associated with younger age and higher education. Summarized, among this cohort, a higher age is associated with a lower HRQoL.
Conclusion: Remarkably high EQ-VAS values and rather few problems in the five dimensions investigated here were reported among the homeless individuals during the COVID-19 pandemic particularly compared with the general population. Moreover, study findings particularly stress the link between higher age and lower HRQoL among homeless individuals. This knowledge is important to address homeless individuals at risk of poor HRQoL. Longitudinal studies are required to confirm the given findings.

Introduction

In recent years, homelessness has increased substantially in most countries. In 2018, there were around 678,000 homeless individuals in Germany,[1] about 6600 of them in Hamburg (home city of the working group and city with the second largest general population in Germany).[2] The increase in homeless people demonstrates the relevance of understanding and monitoring this population, as they are known to show higher rates of premature mortality than the general population, particularly driven by suicide, unintentional injuries and proneness to violence, and an increased prevalence of a range of infectious diseases, mental disorders, and substance misuse.[3,4] Moreover, mortality is substantially increased in these homeless people; the standardized mortality ratios are typically 2−5 times higher than in the age-standardized general population.[3,5,6]

Therefore, it is important to understand this traditionally 'unseen', but growing population to reduce morbidity and mortality among homeless individuals and to come up with suitable offers for

improvement of their quality of life and possible reintegration in society.

Particular consideration should be given to homeless populations during the recent spread of the novel SARS-CoV-2 virus, which affects health and social systems globally.[7] Homeless populations are questioned as possible 'super spreaders'—they are more transient and geographically mobile than individuals in the general population and often lack safe housing and access to sanitary care with potentially less access to news and information reducing the awareness to socio-economic regulations, making tracking and prevention of transmission difficult to impossible.[8,9] Moreover, homeless people might be at higher risks of severe courses of COVID-19 (as they show higher mortality ratios and prevalence of chronic and infectious diseases) and also lack places to isolate and recover from the illness. However, little is known about infection rates among homeless people in Germany. Lindner et al. examined one homeless shelter in Berlin.[10] Out of 51 tested persons, no one was tested positive. A study from Aarhus, Denmark, tested 295 homeless individuals with no one being tested positive and only 11 persons carrying antibodies.[11] On the contrary, studies from other highly developed countries registered high prevalence of COVID-19 among homeless: 12% tested positive in Rhode island,[12] and 10.5% in King County, Washington.[13] Due to these varying data, it is difficult to estimate the rate of infection among homeless individuals in the Hamburg region.

To assign the findings of this study to the respective cutbacks in the daily life, one must consider the current regulations in Germany at the time of data collection. First nationwide measures were taken in March 2020, e.g. at a time interval with shutdown of schools. Only 1 week later, travel and contact regulations were intensified. In the following weeks, these measures were even prolonged. First eases became active by the end of April 2020 under the condition to wear facial masks at public places where distance of 1.5 m to one another could not be kept safely.[14]

Until today, many studies have analyzed the health-related quality of life (HRQoL) among different populations. However, to the best of the author's knowledge, little is known about the factors associated with the HRQoL among homeless individuals in general and particularly in times of the COVID-19 pandemic, even though it has been shown in several studies that HRQoL is inversely associated with mortality. This has been shown in middle-aged and older adults.[15–17] Therefore, the aim of this study is to identify factors associated with HRQoL among homeless people in times of the COVID-19 pandemic exemplified on a representative sample from Hamburg, Germany. This knowledge is important to address homeless individuals at risk of poor HRQoL, as single factors known to be associated with a lower HRQoL can be targeted more effectively.

Methods

Sample collection

Cross-sectional data were taken from the Hamburg survey of homeless individuals. In this study, two interviewer visited homeless persons in specialized medical practices or lodging houses, shelters for the night and asked potential participants. Out of 154 persons who were asked, three refused to participate (response rate 98.1%). Consequently, n = 151 individuals were included in the Hamburg survey of homeless individuals. In this given study, a total analytical sample of n = 111 individuals were included due to missing values in the rest.

The survey was performed with homeless individuals in a separate room within the institution/shelter/practice between May 25th and June 03rd 2020. We started by questioning about basic

demographic information followed by a physical examination, a blood withdrawal, a nasopharyngeal swab, and a questionnaire-based interview. If the participants were able to read and understand the questions on their own, they were asked to fill out the questionnaire. However, most participants had difficulties with at least one of the requirements. Therefore, most questionnaires were filled out via face-to-face interviews.

Written informed consent was provided by all participants prior to the investigations. We received a positive ethics vote from the ethics committee of Hamburg Medical Association (application number: PV7333).

Dependent variables

In our study, the EQ-5D-5L measurement was used to assess HRQoL.[18] It is a widely used, well-validated tool for assessing generic HRQoL consisting of five items (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) with five different levels (no problems, slight problems, moderate problems, severe problems, extreme problems).[19] An individual health status for each individual can be garnered by drawing the vector across each declared level of the five dimensions. For example, the state '11122' indicates no problems in mobility, self-care, and usual activities but slight problems in pain/discomfort and anxiety/depression. Based on value sets derived from country-specific societal preferences one index (EQ-5D index) for each of the $5^5 = 3125$ EQ-5D health states can be calculated. Such a value set has been developed for Germany ranging from −0.661 (extreme problems in all five dimensions) to 1 (no problems in any dimension).[20] Also, allowing negative values, the German value set is possible to describe HRQoL conditions worse than death. To analyze the factors associated with HRQoL, the answers of the participants were dichotomized for regression analysis (0 = no problem; 1 = problems including slight problems, moderate problems, severe problems, and extreme problems) in this study.

The questionnaire also contains a visual analog scale (EQ-VAS), which quantifies self-evaluated health based on the participants' preferences and ranges from 0 = worst imaginable health to 100 = best imaginable health (EQ-VAS score).

Independent variables

The following sociodemographic variables were considered: age (years), sex (female; male), marital status (single; divorced; married; widowed), country of origin (grouped into Germany, neighboring European country, and other), and education (grouped into 'primary', 'secondary', and 'tertiary' according to the Comparative Analysis of Social Mobility in Industrial Nations [CASMIN] classification). The division of the country of origin is based on the fact that immigrants from neighboring countries would only have to cross one border to reach Germany and the assumption that people from directly neighboring countries might share more alike cultures. However, another possible variable is dichotomizing the country of origin into: Germany, other.

Furthermore, health-insurance coverage (grouped into existent/non-existent) and chronic alcohol consumption (carbohydrate-deficient transferrin [CDT] blood value < 2.5% defined as normal, CDT > 2.5% defined as elevated)[21] were included.

Statistical analysis

First, basic characteristics of the analyzed sample were described. Thereafter, the factors probably associated with problems in EQ-5D dimensions were analyzed using multiple logistic regressions (no problems vs problems). Subsequently, multiple

4

Table 1
Sample characteristics stratified by problems.

Mean (SD)/n (%)	Mobility		Self-care		Activities		Pain		Anxiety	
	No problems (n = 78)	Problems (n = 33)	No problems (n = 102)	Problems (n = 5)	No problems (n = 88)	Problems (n = 23)	No problems (n = 58)	Problems (n = 53)	No problems (n = 75)	Problems (n = 36)
Sociodemographic data										
Sex:										
- Male	66 (74.2%)	23 (25.8%)	81 (95.3%)	4 (4.7%)	72 (80.9%)	17 (19.1%)	47 (52.8%)	42 (47.2%)	65 (73.0%)	24 (27.0%)
- Female	12 (54.5%)	10 (45.5%)	21 (95.5%)	1 (4.5%)	16 (72.7%)	6 (27.3%)	11 (50.0%)	11 (50.0%)	10 (45.5%)	12 (54.5%)
Age	43.0 (12.5)	47.4 (12.3)	43.3 (12.0)	55.6 (13.3)	44.0 (12.4)	45.5 (13.4)	43.3 (11.4)	45.4 (13.8)	44.7 (12.0)	43.5 (13.8)
Education[a]:										
- Primary	22 (62.9%)	13 (37.1%)	30 (90.9%)	3 (9.1%)	27 (77.1%)	8 (22.9%)	17 (48.6%)	18 (51.4%)	21 (60.0%)	14 (14%)
- Secondary	52 (74.3%)	18 (25.7%)	67 (97.1%)	2 (2.9%)	56 (80.0%)	14 (20.0%)	36 (51.4%)	34 (48.6%)	50 (71.4%)	20 (28.6%)
- Tertiary	4 (66.7%)	2 (33.3%)	5 (100.0%)	0 (0.0%)	5 (83.3%)	1 (16.7%)	5 (83.3%)	1 (16.7%)	4 (66.7%)	2 (33.3%)
Marital status										
- Married, living together with spouse	0 (0%)	0 (0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0%)	0 (0%)
- Married, living separately from spouse	5 (55.6%)	4 (44.4%)	7 (87.5%)	1 (12.5%)	8 (88.9%)	1 (11.1%)	6 (66.7%)	3 (33.3%)	7 (77.8%)	2 (22.2%)
- Single	53 (68.8%)	24 (31.2%)	75 (97.4%)	2 (2.6%)	57 (74.0%)	20 (26.0%)	37 (48.1%)	40 (51.9%)	50 (64.9%)	27 (35.1%)
- Widowed	5 (83.3%)	1 (16.8%)	5 (100.0%)	0 (0.0%)	6 (100.0%)	0 (0.0%)	4 (66.7%)	2 (33.3%)	5 (83.3%)	1 (16.7%)
- Divorced	15 (78.9%)	4 (21.1%)	15 (88.2%)	2 (11.8%)	17 (89.5%)	2 (10.5%)	11 (57.9%)	8 (42.1%)	13 (68.4%)	6 (31.6%)
Country of origin:										
- Germany	35 (62.5%)	21 (37.5%)	53 (96.4%)	2 (3.6%)	40 (71.4%)	16 (28.6%)	26 (46.4%)	30 (53.6%)	33 (58.9%)	23 (41.4%)
- Neighboring Country	22 (73.3%)	8 (26.7%)	27 (93.1%)	2 (6.9%)	27 (90.0%)	3 (10.0%)	20 (66.7%)	10 (33.3%)	27 (90.0%)	3 (10.0%)
- Other	21 (84.0%)	4 (16.0%)	22 (95.7%)	1 (4.3%)	21 (84.0%)	4 (16.0%)	12 (48.0%)	13 (52.0%)	15 (60.0%)	10 (40.0%)
Lifestyle factors										
Health insurance:										
- Yes	51 (67.1%)	25 (32.9%)	70 (95.9%)	3 (4.1%)	56 (73.7%)	20 (26.3%)	38 (50.0%)	38 (50.0%)	45 (59.2%)	31 (40.0%)
- No	27 (77.1%)	8 (22.9%)	32 (94.1%)	2 (5.9%)	32 (91.4%)	3 (8.6%)	20 (57.1%)	15 (42.9%)	30 (85.7%)	5 (14.3%)
Chronic alcohol consumption:										
- Yes	48 (70.6%)	20 (29.4%)	39 (95.1%)	2 (4.9%)	35 (81.4%)	8 (18.6%)	24 (55.8%)	19 (44.2%)	40 (58.8%)	28 (41.2%)
- No	30 (69.8%)	13 (30.2%)	63 (95.5%)	3 (4.5%)	56 (73.7%)	15 (22.1%)	34 (50.0%)	34 (50.0%)	35 (81.4%)	8 (16.6%)
Quality of life										
Mobility										
- No problems	–	–	74 (98.7%)	1 (1.3%)	66 (84.6%)	12 (15.4%)	50 (64.1%)	28 (35.9%)	45 (59.2%)	31 (40.8%)
- Problems	–	–	28 (87.5%)	4 (12.5%)	22 (66.7%)	11 (33.3%)	8 (24.2%)	25 (75.8%)	30 (85.7%)	12 (36.4%)
Self-care										
- No problems	74 (72.5%)	28 (27.5%)	–	–	82 (80.4%)	20 (19.6%)	55 (53.9%)	47 (46.1%)	70 (68.6%)	32 (31.4%)
- Problems	1 (20.0%)	4 (80.0%)	–	–	3 (60.0%)	2 (40.0%)	1 (20.0%)	4 (80.0%)	2 (40.0%)	3 (60.0%)
Usual activities										
- No problems	66 (75.0%)	22 (25.0%)	82 (96.5%)	3 (3.5%)	–	–	52 (59.1%)	36 (40.9%)	66 (75.0%)	22 (25.0%)
- Problems	12 (52.8%)	11 (47.8%)	20 (90.9%)	2 (9.1%)	–	–	6 (26.1%)	17 (73.9%)	9 (39.1%)	14 (60.9%)
Pain/discomfort										
- No problems	50 (86.2%)	8 (13.8%)	55 (98.2%)	1 (1.8%)	52 (89.7%)	6 (10.3%)	–	–	49 (84.5%)	9 (15.5%)
- Problems	28 (52.8%)	25 (47.2%)	47 (92.2%)	4 (7.8%)	36 (67.9%)	17 (32.1%)	–	–	26 (49.%)	27 (50.9%)
Anxiety/depression										
- No problems	54 (72.0%)	21 (28.%)	70 (97.2%)	2 (2.8%)	66 (88.0%)	9 (12.0%)	49 (65.3%)	26 (34.7%)	–	–
- Problems	24 (66.7%)	12 (33.3%)	32 (91.4%)	3 (8.6%)	22 (61.1%)	14 (38.9%)	9 (25.0%)	27 (75.0%)	–	–

[a] Education according to Comparative Analysis of Social Mobility in Industrial Nations classification.

Table 2
Determinants of problems in EQ-5D dimensions. Findings of multiple logistic regressions.

	Problems in dimension mobility	Problems in dimension self-care	Problems in dimension usual activities	Problems in dimension pain/discomfort	Problems in anxiety/depression
Sociodemographic data					
Age	1.04 (1.00—1.08)*	1.14 (1.01—1.30)*	1.03 (0.99—1.08)	1.03 (0.99—1.06)	1.01 (0.97—1.04)
Gender: male (ref: female)	2.79 (0.90—8.59)	0.84 (0.06—11.53)	1.54 (0.44—5.41)	1.19 (0.42—3.40)	2.60 (0.88—7.72)
Marital status: single (ref: other[a])	1.98 (0.69—5.69)	0.44 (0.05—4.02)	5.71 (1.32—24.69)*	2.16 (0.84—5.56)	1.80 (0.59—5.47)
Country of origin:					
– Neighboring country (ref: Germany)	0.67 (0.18—2.55)	2.88 (0.16—53.39)	0.48 (0.09—2.39)	0.43 (0.12—1.45)	0.43 (0.09—1.97)
– Other	0.42 (0.11—1.65)	2.44 (0.13—46.07)	0.94 (0.23—3.88)	1.17 (0.39—3.52)	2.07 (0.63—6.86)
Education[b]:					
– Secondary (ref: primary)	0.49 (0.18—1.28)	0.14 (0.01—1.55)	0.94 (0.32—2.78)	0.80 (0.34—1.88)	0.63 (0.24—1.62)
– Tertiary	0.71 (0.09—5.62)	1 empty	0.40 (0.03—4.91)	0.12 (0.01—1.24)	0.36 (0.04—3.18)
Lifestyle factors					
Health insurance: yes (ref: no)	1.05 (0.32—3.38)	2.11 (0.20—21.86)	0.27 (0.06—1.26)	0.84 (0.31—2.29)	0.27 (0.07—0.99)*
Chronic alcohol consumption: yes (ref: no)	1.44 (0.49—4.29)	0.76 (0.05—11.86)	1.33 (0.41—4.31)	1.25 (0.47—3.31)	0.61 (0.21—1.78)
Constant	0.02 (0.01—0.40)**	0.0002 (0.00—0.52)*	0.01 (0.0005—0.41)*	0.20 (0.02—2.38)	0.16 (0.01—2.7)
Pseudo R^2	0.09	0.26	0.12	0.07	0.15
Observations	111	103	113	113	112

Odds ratios are reported; 95% CI in parentheses; ***P < 0001, **P < 0.01, *P < 0.05.
[a] Marital status: other (married, living separately from spouse; widowed; divorced).
[b] Education according to Comparative Analysis of Social Mobility in Industrial Nations classification.

linear regressions were used to investigate the determinants of EQ VAS and EQ-5D index. The significance level was set at $P < 0.05$ in all statistical tests. Stata 16.0 (Stata Corp., College Station, Texas) was used to perform statistical analyses.

Results

In the total analytical sample (n = 111), average age was 44.3 years (SD 12.6 years, ranging from 19 to 86 years), and 20% of the individuals were female. While 50.4% of the individuals were born in Germany, 27% of the individuals were born in direct neighboring countries. In sum, 63% of the individuals had secondary education. Moreover, 69.3% of the individuals were single, whereas none was married and still living together. In total, 68.5% of the individuals reported to have health insurance. The CDT value, which is indicative of chronic alcohol consumption, was elevated above the threshold defined in 38.7% of the individuals.

Average EQ-VAS score was 75.34 (SD 22.23, ranging from 1 to 100), and the mean EQ-5D index was 0.84 (SD 0.23, ranging from 0.32 to 1) in times of the COVID-19 pandemic.

Sample characteristics for our total analytical sample (with mobility as outcome measure) are described in Table 1. Of the total sample, 66.7% of the individuals reported problems in at least one of the EQ-5D dimensions, with only 1.6% of the individuals reporting 'extreme' problems and the majority describing their problems as slightly or moderately. Most frequent were problems with pain/discomfort (47.3%), followed by anxiety/depression (32.4%), mobility (29.7%), usual activities (20.7%), and self-care (4.6%). Extreme problems were most frequent with pain/discomfort (4.5%) and anxiety/depression (1.8%) and not reported with self-care and usual activities (both 0%).

Regression analysis

Findings of multiple logistic regressions (with problems in the dimensions mobility, self-care, activities, pain/discomfort, and anxiety/depression as outcome measures) are described in Table 2. Regressions showed that the likelihood of mobility problems or self-care problems was positively associated with higher age (with problems in mobility as outcome measure, odds ratio (OR): 1.04 [95%-CI: 1.00—1.08]; with problems in self-care, OR: 1.14 [95% confidence interval {CI}: 1.01—1.30]). Moreover, the likelihood of problems with usual activities was positively associated with being single (odds ratio (OR): 5.71 (95% confidence interval {CI}: 1.32—24.69). The likelihood of problems with anxiety/depression was negatively associated with an existing health insurance (OR: 0.27 [95%-CI: 0.07—0.99]).

Findings of mulitple linear regressions (with EQ-VAS and EQ5D Index as outcome measures) are described in Table 3. Regressions revealed that EQ-VAS was positively associated ($\beta = -0.30$, $P < 0.05$) with younger age. Furthermore, regressions showed that EQ-5D-5L index was positively associated with younger age ($\beta = -0.004$, $P < 0.05$) and higher education (i.e. tertiary education; $\beta = -0.14$, $P < 0.05$).

In Supplementary Tables 2 and 3, regressions with dichotomized country of origin can be found. Supplementary Table 1 shows bivariate test results along with descriptive statistics. Moreover, in Supplementary Tables 2 and 3, regressions were displayed (with 'months of being homeless' added to the main model).

Discussion

The aim of this study was to determine factors associated with HRQoL of homeless individuals during the COVID-19 pandemic.

6

Table 3
Determinants of EQ-VAS and EQ-5D-5L Index (GER). Findings of multiple linear regressions.

	EQ-VAS	EQ-5D-5L index (GER)
Sociodemographic data		
Age (years)	−0.30 (0.15)*	−0.004 (0.002)*
Gender: male (ref: female)	−5.17 (4.93)	−0.04 (0.05)
Marital status: single (ref: other[a])	−3.45 (4.72)	−0.05 (0.05)
Country of origin:		
- Neighboring country (ref: Germany)	−1.47 (8.06)	−0.05 (0.07)
- Other	−5.83 (6.16)	−0.07 (0.08)
Education[b]:		
- Secondary (ref: primary)	−0.80 (4.27)	0.02 (0.05)
- Tertiary	1.45 (8.43)	0.14 (0.06)*
Lifestyle factors		
Health insurance: yes (ref: no)	9.57 (6.21)	0.08 (0.07)
Chronic alcohol consumption: yes (ref: no)	1.71 (5.47)	0.05 (0.04)
Constant	96.41 (10.78)***	1.07 (0.11)***
R^2	0.08	0.09
Observations	112	107

Beta-coefficients (unstandardized) are reported; robust standard errors in parentheses; ***$P < 0001$, **$P < 0.01$, *$P < 0.05$.
[a] Marital status: other (married, living separately from spouse; widowed; divorced).
[b] Education according to Comparative Analysis of Social Mobility in Industrial Nations classification.

Analyzing scarce data of homeless individuals, this study adds first knowledge to the factors associated with HRQoL in this cohort during the COVID-19 pandemic exemplarily for Hamburg, Germany. While the majority of sociodemographic and lifestyle factors were not associated with the outcome measures, higher age was associated with several outcome measures in this given study as it was reported also in previous research.[5,22] The age association seems reasonable, as with higher age mobility, and the ability to take care of oneself most commonly becomes more difficult, and the incidence of age-related conditions such as cognitive or functional impairment increases.[3] However, one might have expected this association to be even more pronounced. A possible explanation for the non-significant association between age and problems with usual activities, pain/discomfort, and anxiety/depression might be that with higher age, homeless individuals who experience health deteriorations simultaneously lower their own expectations regarding HRQoL (in terms of problems with pain, anxiety/depression, and usual activities). However, given the vulnerability (e.g. in terms of multimorbidity, chronic alcohol, and drug abuse) of homeless individuals, the non-significant association between problems in the dimension pain/discomfort and higher age is notable and requires further research, particularly longitudinal studies to tackle the issue of selection bias ('survival of the fittest'). However, the high response rate for this study forms the rationale for a relatively realistic and representative cohort at least for the Metropolitan region Hamburg, Germany.

Thus far, only a few studies exist identifying problems in the five dimensions among homeless individuals.[5,22–24] For example, in a study from 2012, performed by Sun et al.[5] examining HRQoL among homeless individuals in Stockholm (Sweden), the participants reported most problems in the dimension pain/discomfort. Other studies revealed comparable findings (in terms of chronic pain conditions,[25,26] reporting most problems in dimension pain/discomfort[5,22]). In sum, in terms of problems within the five dimensions of EQ-5D, our findings are in good accordance with previous research, and the special pandemic situation in 2020 seems not to shift the pre-existing problems of homeless individuals regarding their life quality fundamentally.

Moreover, the authors expected the HRQoL (particularly in terms of EQ-VAS and EQ-5D index) to be lower in women as they more often suffer from anxiety/depression disorders[27,28] and more often face chronic pain conditions.[29] However, regressions did not show any association between sex and HRQoL here. This may be

caused by the fact that many women live in 'hidden homelessness',[30] and as a result, the study team was able to reach only a small share resulting in only 20% female participants. It may be the case that the women accessible are facing similar environmental influences as homeless men. Therefore, they may not differ in terms of HRQoL. However, future research is required to clarify this issue.

Compared with the general adult population in Germany,[31] homeless individuals rated their HRQoL as quite high, particularly when considering their living conditions and the recent cutbacks in daily life owed to the pandemic spread of the SARS-CoV-2 virus. In Germany, the general population under regular conditions has a mean EQ-VAS of 71.59 (SD 21.36) and EQ-5D index of 0.88 (SD 0.18) in the year 2014 (March to April).[31] More precisely, in the age category 45–54 years, the average EQ-5D Index was 0.87, SD 0.17 (men: 0.89, SD 0.15; women: 0.86, SD 0.19). Slightly higher (35–44 years) or comparable (55–64 years) average EQ-5D Indices have been reported in adjacent age groups.

Initially, we expected HRQoL of homeless individuals to be very low, as previous research has reported for other homeless cohorts[23,32] and against the backdrop of the COVID-19 pandemic (e.g. fear of COVID-19 and its consequences). However, mean EQ-5D index in this study was also higher than that in previous research among homeless people: 0.84 in this study vs 0.65 in a study by Kozloff et al., which was performed between 2009 and 2011 in Toronto, Canada.[23] This discrepancy may be due to the fact that homeless people adapt to the circumstances of living without a permanent home. Another explanation may be that they optimistically rate—or, negatively interpreted, idealize—their HRQoL. Moreover, publication bias may explain that rather low HRQoL values and not identifying significant correlates of HRQoL are not published in peer-reviewed journals. It might be possible that the given results reflect the actual subjective perception.

Some strengths and limitations are worth noting. To best of our knowledge, there are only a few studies reporting on EQ-5D in homeless people, and this is the very first study reporting on HRQoL of homeless people during the SARS-CoV-2 pandemic. One strength of the present study is that the EQ-5D-5L questionnaire is a common and valid measure to assess the HRQoL. Most interviews were conducted by only two interviewers. However, even though most data were collected by interviews, some participants who were able to read and write also conducted the study by filling out the questionnaire themselves. This is to be regarded as a limitation in terms of consistency. Recruiting samples of homeless individuals

7

for surveys is difficult because reaching them is hard when being transient and a substantial proportion of eligible persons might be reluctant to participate due to distrust of official institutions or due to cognitive problems and illnesses. Nevertheless, despite the mentioned difficulties about reaching this special and vulnerable population, we were able to include 151 persons. In addition, the response rate of 98.1% was remarkably high.

However, due to the cross-sectional character of the study, the exposure and outcome are assessed contemporary, and it is therefore not possible to constitute a true cause and effect relationship. Due to possible participation bias and exclusion criteria, individuals in bad mental and physical conditions are likely to have been underrepresented at the time of recruitment. Furthermore, resting on the fact that we were only able to visit homeless shelters, some selection bias is likely to be present, excluding homeless people who avoid any institutional accommodations. Moreover, some covariates may be missing: future research including covariates such as income, hygienic practices and knowledge of COVID-19, and preexisting health status before COVID-19 is important among homeless individuals.

Conclusion

Remarkably high EQ-VAS values were reported among the homeless individuals during the COVID-19 pandemic in Hamburg, Germany. Moreover, study findings particularly stress the link between higher age and lower HRQoL. This knowledge is important to address homeless individuals at risk of poor HRQoL. Longitudinal studies are required to confirm the findings presented.

Author statements

Ethical approval

We received a positive ethics vote from the ethics committee of Hamburg Ethics committee (application number: PV7333).

Funding

The study was made financially possible by uncommitted private donations to the University Medical Centre Hamburg-Eppendorf. Financial support in ongoing research among this topic is granted by the Volkswagen Foundation. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests

The authors declare that they have no conflict of interest.

Consent to participate

Written informed consent was provided by all participants prior to the investigations.

Consent for publication

Not applicable.

Availability of data and material (data transparency)

The data sets analyzed during the current study are not publicly available due to ethical restrictions involving patient data but are available from the corresponding author on reasonable request.

Code availability (software application or custom code)

Not applicable.

CRediT authorship contribution statement

V. van Rüth: Conceptualization, Methodology, Formal analysis, Writing — original draft, Writing — review & editing, Funding acquisition. **H.-H. König:** Conceptualization, Writing — review & editing, Supervision. **F. Bertram:** Conceptualization, Writing — review & editing. **P. Schmiedel:** Writing — review & editing. **B. Ondruschka:** Writing — review & editing. **K. Püschel:** Conceptualization, Writing — review & editing. **F. Heinrich:** Conceptualization, Writing — review & editing, Funding acquisition. **A. Hajek:** Conceptualization, Methodology, Formal analysis, Writing — review & editing, Supervision.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2021.02.026.

References

1. Wohnungslosenhilfe Bf. *Wohnungslosigkeit: Kein Ende in Sicht.* 2018.
2. Entscheidung GfOu.. *Befragung obdachloser, auf der Straße lebender Menschen und wohnungsloser, öffentlich-rechtlich untergebrachter Haushalte.* 2018. Hamburg.
3. Fazel S, Geddes JR, Kushel M. The health of homeless people in high-income countries: descriptive epidemiology, health consequences, and clinical and policy recommendations. *Lancet* 2014;**384**(9953):1529—40.
4. Nilsson SF, Nordentoft M, Fazel S, Laursen TM. Homelessness and police-recorded crime victimisation: a nationwide, register-based cohort study. *Lancet Publ Health* 2020;**5**(6):e333—41.
5. Sun S, Irestig R, Burström B, Beijer U, Burström K. Health-related quality of life (EQ-5D) among homeless persons compared to a general population sample in Stockholm County, 2006. *Scand J Publ Health* 2012;**40**(2):115—25.
6. Hwang SW, Aubry T, Palepu A, Farrell S, Nisenbaum R, Hubley AM, et al. The health and housing in transition study: a longitudinal study of the health of homeless and vulnerably housed adults in three Canadian cities. *Int J Publ Health* 2011;**56**(6):609—23.
7. Lewer D, Braithwaite I, Bullock M, Eyre MT, White PJ, Aldridge RW, et al. COVID-19 among people experiencing homelessness in England: a modelling study. *Lancet Respir Med* 2011;**8**(12):1181—91.
8. Tsai J, Wilson M. COVID-19: a potential public health problem for homeless populations. *Lancet Publ Health* 2020;**5**(4):e186—7.
9. Perri M, Dosani N, Hwang SW. COVID-19 and people experiencing homelessness: challenges and mitigation strategies. *CMAJ* 2020;**192**(26). E716-e9.
10. Lindner AK, Sarma N, Rust LM, Hellmund T, Krasovski-Nikiforovs S, Wintel M, et al. Monitoring for COVID-19 by universal testing in a homeless shelter in Germany: a prospective feasibility cohort study. *medRxiv* 2020. 10.04.20205401.
11. Storgaard SF, Eiset AH, Abdullahi F, Wejse C. First wave of COVID-19 did not reach the homeless population in Aarhus. *Dan Med J* 2020;**67**(12).
12. Karb R, Samuels E, Vanjani R, Trimbur C, Napoli A. Homeless shelter characteristics and prevalence of SARS-CoV-2. *West J Emerg Med* 2020;**21**(5): 1048—53.
13. Tobolowsky FA, Gonzales E, Self JL, Rao CY, Keating R, Marx GE, et al. COVID-19 outbreak among three affiliated homeless service sites - king county, Washington, 2020. *MMWR Morb Mortal Wkly Rep* 2020;**69**(17):523—6.
14. Matuschek C, Moll F, Fangerau H, Fischer JC, Zänker K, van Griensven M, et al. Face masks: benefits and risks during the COVID-19 crisis. *Eur J Med Res* 2020;**25**(1):32.
15. Hao W, Li J, Fu P, Zhao D, Jing Z, Wang Y, et al. Physical frailty and health-related quality of life among Chinese rural older adults: a moderated mediation analysis of physical disability and physical activity. *BMJ Open* 2021;**11**(1): e042496.
16. Phyo AZZ, Ryan J, Gonzalez-Chica DA, Woods RL, Reid CM, Nelson MR, et al. Health-related quality of life and all-cause mortality among older healthy individuals in Australia and the United States: a prospective cohort study. *Qual Life Res* 2021;**30**:1037—48.
17. Kroenke CH, Kubzansky LD, Adler N, Kawachi I. Prospective change in health-related quality of life and subsequent mortality among middle-aged and older women. *Am J Publ Health* 2008;**98**(11):2085—91.
18. EuroQol–a new facility for the measurement of health-related quality of life. *Health Pol* 1990;**16**(3):199—208.

8

19. Devlin NJ, Krabbe PF. The development of new research methods for the valuation of EQ-5D-5L. *Eur J Health Econ* 2013;**14**(Suppl 1):S1–3.

20. Ludwig K, Graf von der Schulenburg JM, Greiner W. German value set for the EQ-5D-5L. *Pharmacoeconomics* 2018;**36**(6):663–74.

21. Bortolotti F, Sorio D, Bertaso A, Tagliaro F. Analytical and diagnostic aspects of carbohydrate deficient transferrin (CDT): a critical review over years 2007-2017. *J Pharmaceut Biomed Anal* 2018;**147**:2–12.

22. Levorato S, Bocci G, Troiano G, Messina G, Nante N. Health status of homeless persons: a pilot study in the Padua municipal dorm. *Ann Ig* 2017;**29**(1):54–62.

23. Kozloff N, Pinto AD, Stergiopoulos V, Hwang SW, O'Campo P, Bayoumi AM. Convergent validity of the EQ-5D-3L in a randomized-controlled trial of the Housing First model. *BMC Health Serv Res* 2019;**19**(1):482.

24. Gentil L, Grenier G, Bamvita JM, Dorvil H, Fleury MJ. Profiles of quality of life in a homeless population. *Front Psychiatr* 2019;**10**:10.

25. Hwang SW, Wilkins E, Chambers C, Estrabillo E, Berends J, MacDonald A. Chronic pain among homeless persons: characteristics, treatment, and barriers to management. *BMC Fam Pract* 2011;**12**(1):73.

26. Fisher R, Ewing J, Garrett A, Harrison EK, Lwin KK, Wheeler DW. The nature and prevalence of chronic pain in homeless persons: an observational study. *F1000Res* 2013;**2**:164.

27. Roy T, Lloyd CE. Epidemiology of depression and diabetes: a systematic review. *J Affect Disord* 2012;**142**(Suppl):S8–21.

28. Baxter AJ, Scott KM, Vos T, Whiteford HA. Global prevalence of anxiety disorders: a systematic review and meta-regression. *Psychol Med* 2013;**43**(5):897–910.

29. Geneen LJ, Moore RA, Clarke C, Martin D, Colvin LA, Smith BH. Physical activity and exercise for chronic pain in adults: an overview of Cochrane Reviews. *Cochrane Database Syst Rev* 2017;**4**(4):Cd011279.

30. Watson J, Crawley J, Kane D. Social exclusion, health and hidden homelessness. *Publ Health* 2016;**139**:96–102.

31. Grochtdreis T, Dams J, König H-H, Konnopka A. Health-related quality of life measured with the EQ-5D-5L: estimation of normative index values based on a representative German population sample and value set. *Eur J Health Econ* 2019;**20**(6):933–44.

32. Wolf J, Burnam A, Koegel P, Sullivan G, Morton S. Changes in subjective quality of life among homeless adults who obtain housing: a prospective examination. *Soc Psychiatr Psychiatr Epidemiol* 2001;**36**(8):391–8.

9

2. Exposition of the publication

2.1 Introduction
The World Health Organization (WHO) defines health not only as the absence of disease but as "a state of complete physical, mental and social well-being" (Callahan, 1973). Among these three pillars of health, the multidimensional health-related quality of life (HRQoL) can also be found as an important parameter influencing individual well-being.

HRQoL instruments usually are questionnaires covering different dimensions or domains of well-being. Most instruments were developed by experts based on surveys in the general population, literature, or as a further development of already existing questionnaires. Those questionnaires can either be self-administered or completed by interviewers. The latter has the advantage that it decreases missing answers and errors but needs extensive resources. The first method is simple to perform but has the risk of high percentages of missing values or misunderstandings (Guyatt et al., 1993). Generic instruments are designed to cover dimensions that are relevant to everyone. Among the most common used HRQoL measuring generic tools are the Short Form 36 (SF-36) and the EuroQol 5-dimensions (EQ-5D). Less frequently used options include the Finnish 15D and the Assessment of Quality of Life (AQoL) (Fayers et al., 2005, Hawthorne et al., 2001).

Previous data from population studies show a lower HRQoL to be significantly associated with a higher number of physician visits, a higher risk of hospitalization, and even higher mortality (Dominick et al., 2002, Chen and Li, 2009). Among others, common risk factors for a lower HRQoL are female gender, higher age, and mental or chronic somatic disease (Grochtdreis et al., 2019, Cook and Harman, 2008).

One population group for which HRQoL is only poorly described is that of homeless persons. Several studies examine HRQoL after a special intervention, e.g. housing programs (Spector et al., 2020, Baxter et al., 2019), but data considering the daily situation of the homeless population remain scarce.

This cohort is hard to reach for data acquisition because it is more transient, often there is mistrust towards official institutions, and one third of the homeless population in Germany originates from foreign countries, therefore there might be language barriers (Bundesministerium für Arbeit und Soziales, 2022). However, international research indicates an increased prevalence of somatic as well as mental illnesses among the approximately 700,000 homeless people in Europe compared to the general population (Fazel et al., 2014, European Parliament, 2020). Thus it can be hypothesized that the HRQoL among homeless people is also lower than among the general population.

These circumstances have been hypothesized to be further exacerbated by the outbreak of the Coronavirus Disease 2019 (COVID-19) pandemic, because at the very beginning of the pandemic in spring 2020, many care-providing facilities in Germany were closed, from overnight shelters to low-threshold outpatient clinics and social counseling services (Bundesarbeitsgemeinschaft Wohnungslosenhilfe e.V., 2020, Gesellschaft für innovative Sozialplanung und Sozialforschung e.V. Bonn, 2020). In the wake of these curtailments, the homeless population received international attention, such as by the authors Tsai and Wilson, who proclaimed an increased vulnerability of homeless people in the COVID-19 pandemic due to their pre-existing conditions, limited care situation, and polysubstance dependence (Tsai and Wilson, 2020). Various research

projects followed their article; among others, the 'Hamburg survey of Homeless Individuals' at the Hamburg Institute of Forensic Medicine started to investigate the somatic and mental health as well as the care situation of homeless people in Hamburg.

2.2 Methods

From May 25th to June 3rd, 2020, 151 homeless individuals were included in the 'Hamburg survey of Homeless Individuals'. Prior to the period of data acquisition, lasting two weeks, a positive ethics vote from the ethics committee of the Hamburg Medical Association (application number: PV7333) had been awaited. Afterwards, all institutions offering any kind of care for homeless people in Hamburg were contacted, informed about the study, and asked for their participation. Nine facilities participated. In each case, a quiet room was required for data collection in order to acquire potentially confidential data from the study participant. During data collection, the vital signs of blood pressure, heart rate, peripheral oxygen saturation, as well as body height and weight were measured. In addition, a blood sample and a nasopharyngeal swap were taken.

Furthermore, there was a comprehensive questionnaire component which, as far as possible, was completed independently by the participants of the survey. For those participants who could not read nor write, the questionnaire was completed as a face-to-face interview. The questionnaire had been translated in advance into the most common languages among homeless people in Germany. The questionnaire included demographic questions (date of birth, gender, highest level of education, marital status, country of origin, duration of homelessness), the 4-item patient health questionnaire (PHQ-4), the 5-level EuroQol 5-dimensions (EQ-5D-5L), the EuroQol visual analogue scale (EQ-VAS), and the University of California (UCLA) Loneliness Scale. The study participants were also asked for their address in order to inform them about potentially conspicuous findings in the blood tests. After study participation, an expense allowance of five euros, pursuant to the Ethics Commission's recommendation was provided.

In the 'Hamburg survey of Homeless Individuals', the EQ-5D-5L generic instrument was used, because the questions are easy to understand, and it has only five dimensions; it is therefore simple to fill out compared to the SF-36. Previous data show that the two questionnaires cannot be used interchangeably (Ye et al., 2019), although they have similar predictions across inpatient and outpatient setting and medical conditions (Rowen et al., 2009). Additionally, throughout European countries the EQ-5D is the most frequently recommended questionnaire (Grochtdreis et al., 2019). The EQ-5D also is a generic instrument that has been validated internationally in many settings (Wille et al., 2010).

2.3 Results

In the 'Hamburg survey of Homeless Individuals', 151 individuals could be involved, with 80% being male. Mean age was 44.6 years (standard deviation, SD: 12.5; range 19 to 86 years) and 68.5% of all participants were single. The cohort characteristics for the analyzed study population in which 111 individuals were included are described in the original publication.

In the sample, 66.7% of the participants reported problems in at least one of the five dimensions, most frequently pain/discomfort (47.3%), and anxiety/depression (32.4%) were named. The mean EQ-5D index was 0.84 (SD 0.23, range 0.32-1) and average EQ-VAS score was 75.34 (SD 22.23, range 1-100). Logistic regressions showed that problems with mobility and self-care

increased with higher age, while a higher EQ-VAS score was positively associated with younger age. In addition, a higher EQ-5D-5L index was positively associated with younger age and higher education. Our study revealed no further associations between HRQoL and the surveyed variables. In summary, older age was associated with lower HRQoL in this cohort of homeless people during the COVID-19 pandemic.

2.4 Discussion

The aim of this cross-sectional study was to describe the HRQoL and determine factors associated with HRQoL of homeless individuals in an early stage of the COVID-19 pandemic.

2.4.1 Integration into the current literature

Data from previous studies present a mixed record in this regard. Gentil et al. identified elderly women with few episodes of homelessness and low functional disability to have the highest quality of life; while criminal records, personality disorders, or substance use disorders were negatively associated with HRQoL (Gentil et al., 2019). When these risk factors are considered and compared to the risk factors for a lower HRQoL among the general population, the homeless population and the general population are analogous. Yet, in a study conducted in England on patients with one of six chronic diseases, the patients were divided into two different groups: housed people and homeless people. The results showed, that individuals in the homeless subgroup more often suffered from long-term conditions of their diseases and the overall HRQoL was significantly lower than in housed individuals (Lewer et al., 2019). In line with this, data from Scandinavian countries show a lower HRQoL in the homeless population compared to the general population (Sun et al., 2012).

However, our study revealed an almost comparable HRQoL among homeless individuals early in the COVID-19 pandemic in Hamburg, Germany (average EQ-5D-5L index: 0.84, SD: 0.23, average EQ-VAS score: 75.34, SD 22.23) compared to the general adult population nationally during the COVID-19 pandemic (average EQ-5D-5L index: 0.85, SD 0.21, average EQ-VAS score: 70.8, SD 24.0) (König et al., 2023). In the general population, most problems were reported in the dimension pain/discomfort (55.8%), too. These results are in marked contrast to the author's hypothesis that the HRQoL of homeless people is significantly reduced compared to the general population, particularly under pandemic conditions.

In addition to that, also the few existing data on the quality of life of homeless people show a different picture: among Swedish homeless people, the mean EQ-VAS score and mean EQ-5D index were distinctly lower in both 2006 and 2018 compared to the data available here (EQ-VAS 2006: 56.5, SD: 23.4, EQ-5D index 2006: 0.80, SD: 0.15, EQ-VAS 2018: 53.4, SD: 26.7, EQ-5D index 2018: 0.73, SD 0.16) (Sun et al., 2012, Burström et al., 2021).

However, the negative association between age and HRQoL that was found in the published work, is in line with the results among the general population (König et al., 2023) and previous research on HRQoL among other homeless cohorts (Burström et al., 2021).

2.4.2 Explanatory possibilities for a high HRQoL in homeless people

Some possible explanations for these astonishing results such as adaption of homeless people to their living circumstances or selection bias were discussed

in the published work. In social psychology, "adaptation" refers to a person's ability to adjust to new life circumstances. For the endpoints measuring HRQoL, it is generally assumed that the study participants' report is the best source of information about the current condition (Reeve et al., 2013). This results in a limitation as to how objectifiable HRQoL actually is. Furthermore, people rate their own quality of life differently in various life situations and not every functional impairment has a negative impact on a person's quality of life (Singer et al., 2020). Therefore, results of HRQoL measurements help to gather the true subjective well-being of the study participant and thus contribute to a better understanding of the person's health situation, but it is not always possible to guess the true well-being on the basis of questionnaires. Summarized, the assessment of HRQoL can change over the course of a person's life, and since people are able to adapt to given life circumstances, homeless people may rate their HRQoL higher after sufficient time of adaption.

One further possible explanation for a false-high HRQoL among homeless people might be that an elevated blood alcohol concentration could be measured in 39 blood samples (35%) among the study cohort (Aboutara et al., 2022), indicating alcohol consumption among 39 individuals just shortly before the participation in the study. Furthermore, on the basis of the laboratory findings chronic excessive alcohol consumption can be assumed in 46 % (51 individuals) of the study participants, which can lead to a reduced memory and abstraction capacity (Oscar-Berman et al., 1997). There may have been a false-high assessment of HRQoL due to short-term impaired judgment as a result of acute consumption or long-term impaired judgment in chronic excessive alcoholics. In future research, one could avoid influencing the results through these factors by not including persons above certain cut-off values for alcohol consumption in the analyzed population.

One further reason for false-high values of HRQoL among homeless people during the COVID-19 pandemic could be the selection bias. As stated previously, homeless people are a cohort that is hard to reach (Booth, 1999). On the one hand there often is reluctance from homeless people against official institutions, even low-threshold ones, such as medical practices or homeless shelters. People deliberately avoiding contacting social assistance could not be included in this study. In order to be able to reach homeless people more comprehensively in future research projects, the data collection could, for example, be adapted in such a way that fixed rooms in shelters are no longer necessary. If survey teams are more mobile and have a flexible space, such as on a bus or with a tent, they can visit homeless people in their locations and include those they would not have met in permanent shelters. This strategy could also be useful from a preventive point of view in future pandemic events. Previous data during the COVID-19 pandemic show that the willingness to be vaccinated against COVID-19 among homeless people is influenced not only by trust in the vaccine but also by that in the political and health care system (Grune et al., 2023). Reaching out directly or via low threshold facilities to homeless people who mistrust official institutions might be helpful in order to achieve a high vaccination coverage rate.

On the other hand, especially women often live in 'hidden homelessness', which means that they temporarily live with others but lack immediate housing (Watson et al., 2016). The number of people affected is therefore difficult to estimate, and they could not be included in the study either because they hardly make use of the social assistance system. Close collaboration with social workers could help to locate and include affected individuals in future studies.

2.4.3 Possible improvement strategies for research on homeless people

Another approach to improve research on homeless people in the future is conducting questionnaires with interpreters. In the 'Hamburg survey of Homeless Individuals' the questionnaires were translated to other languages such as Polish, Bulgarian, Russian, or English prior to the conduction of the study. However, several study participants were not able to read or write. In those cases, the questionnaires were either filled out with the help of translator apps as face-to-face interviews or with the support of acquaintances of the same language. Especially with people who cannot read or write, interpreters could lead to more precise results. But also for the rest of the cohort interpreters might enable more exact answers because it could induce greater trust if one could talk in his/her native language with the interviewer. Many homeless people of different mother languages can be reached by just a few translators, so that the additional effort would be kept within limits. In the study described above for example, 50% of all study participants were German, 27% originated from German-neighboring countries and only 23% originated from countries further away. From the 27% of people from directly neighboring countries, most individuals came from Poland.

2.4.4. About foreign homeless people in Germany

The origin from another country could have a special influence on the health of homeless people. Study data show that the origin of homeless people can be an important factor influencing health (Bertram et al., 2022, Heinrich et al., 2022). In the publication from Bertram et al., homeless people originating from Germany were shown to be health insured more likely and be housed in homeless assistance facilities more likely. As part of the study, questions were also asked about prior somatic and mental illnesses diagnosed by physicians and, at the same time, potential illnesses were assessed via screening examinations and questionnaires. It has become apparent that homeless people originating from Germany would more often suffer from mental health conditions while more of the diseases suspected in screening during the study were diagnosed. In contrast, originating from a country outside of Germany was associated with a lack of health insurance and fewer mental illnesses, but many possibly undiagnosed somatic illnesses. When forming a sum score of mental, somatic and potentially unknown determinants, an existing migration history was a significant contributor/contributing factor for an increased score, i.e. a reduced health status (Bertram et al., 2022). The reduced health status could be reflected in a reduced quality of life and therefore especially homeless people with a migration history should be further investigated and surveyed in the future.

In addition, in a multicultural study population, such as the homeless, it is important to consider that questionnaires validated in Westernized nations could be misinterpreted in the cultural context of other countries. Interpreters who grew up bilingually and know both cultures, the Western and the national culture of the study participant, could yield more accurate results by adapting the questions to the respective cultural background (Presser et al., 2004).

2.4.5. Limitations of the study

In the published data, regression analysis showed a positive correlation for problems in mobility and self-care with higher age. In line with that, a higher EQ-VAS score was inversely associated with age. A higher EQ-5D-5L index was associated with higher education and too, with younger age. Possibly, due to a limited number of questions in the questionnaire, this study did not examine

important influencing variables such as income, a criminal history, or the presence of a distinctive social network for example. By further collecting diverse covariates, additional factors influencing the HRQoL of homeless people during the COVID-19 pandemic could be investigated. Further research could also include larger study population groups. 151 individuals participated in the 'Hamburg survey of Homeless Individuals', which represents a comparatively large number of participants in research on homeless people; however, the number remains rather small compared to population-based cross-sectional studies. Data acquisition took place in the city of Hamburg only and just homeless people visiting facilities, whose management agreed to participate in the study, could be included. Those factors may have led to selection bias. Moreover, most of the questionnaires were translated independently. In future research, standardized translations could lead to more reproducible results.

HRQoL in homeless populations is probably associated with multiple variables involving sociodemographic data, health status, and health care use. Especially longitudinal data would be valuable for research on different determinants of HRQoL among homeless people. Regional differences could have a decisive influence on HRQoL among the homeless (Lewer et al., 2019). By using longitudinal data, further analyses of HRQoL among homeless people under individual regional, temporal, and legal circumstances could be conducted. However, those are difficult to gather because of the high mobility among homeless and hard to follow-up circumstances.

2.4.6 National Survey on Psychiatric and Somatic Health of Homeless Individuals
In order to meet some limitations of the 'Hamburg survey of Homeless Individuals' (2020) and because the claim rate was unexpectedly high at 98.1% and thus favorable for further research, in summer 2021 the 'National Survey on Psychiatric and Somatic Health of Homeless Individuals' (NAPSHI) was conducted as a multicentric cross-sectional study. The study included a higher sample number and homeless people in four big cities in Germany were surveyed. In order to counteract various regional influences in the best possible way, the study was again conducted in Hamburg (in the north of Germany), in Munich (south), in Leipzig (east), and Frankfurt/ Main (west).
In the NAPSHI study, the preexisting questionnaire from the 'Hamburg survey of Homeless Individuals' was adapted and expanded based on the experience of the interviewers and according to the results from 2020. The EQ-5D-5L questionnaire continued to be executed. 616 individuals were included in the analysis of the HRQoL of homeless individuals 2021. In this study, the mean EQ-5D-5L index was 0.85 (SD: 0.24, in 2020: 0.84, SD: 0.23) and mean EQ-VAS score was 68.97 (SD: 23.83, in 2020: 75.34, SD: 22.23) (Brennecke et al., 2023). The study from 2021 thus shows similarly high values for the HRQoL among homeless people as in 2020. Nevertheless, the high values of HRQoL remain surprising. Reproducing the 2020 findings from Hamburg on a national and multicentric level in 2021, makes the hypothesis of habituation and adaptation to poor health conditions or lower expectations as contributing factors to HRQoL more likely. However, the question remains as to why the data from the survey of homeless people in Germany stand in distinct contrast to those from international investigations.
Further data are still being evaluated at the current time. Certainly, an isolated evaluation of the homeless people studied in Hamburg between 2021 versus

2020 is also of interest here to be able to evaluate the development over a one-year period. Nevertheless, further longitudinal data will be needed, especially from non-German homeless people who may have a lower quality of life, to identify groups at risk within this population and to develop appropriate interventions.

2.4.7. Prospects for the development of the homeless population
The number of homeless people has more than doubled in most European Union (EU) member states over the last 15 years (European Economic and Social Committee, 2023) and further increase is to be expected due to refugee movements into Europe. In Germany, for example, there were over 84 million people at the end of 2022, more than ever before, partly due to a large number of Ukrainian refugees (Tagesschau, 2023). It is estimated that several million people in Europe experience homelessness each year. This makes it all the more important to take social policy measures in sufficient time to improve the living conditions of homeless people in the long term.

2.4.8. Health and social policy prevention of homelessness
Possible preventive measures could include improved education and job promotion in order to increase people's economic stability in the long term. In addition, early interventions such as debt burden and job placement could help to prevent homelessness from occurring in the first place. Furthermore, an expansion of social housing programs could help to provide affordable housing for people on low incomes.

In the case of homelessness, there is a need for better networking of social services and counseling centers with psychological support, drug counseling facilities and social workers. In addition, integration programs should be promoted to reduce stigmatization. The provision of emergency accommodations with medical care and sanitary facilities can offer short-term help and facilitate the transition to a permanent housing situation.

Summarized, tackling homelessness requires a holistic and coordinated approach at various levels, from government action to the expansion of charitable initiatives.

2.5 Questionnaire

- PHQ-4 questionnaire –

Over the last 2 weeks, how often have you been bothered by the following problems?
1. Feeling nervous, anxious or on edge
   - O not at all
   - O several days
   - O more than half of the days
   - O nearly every day
2. not being able to stop or control worrying
   - O not at all
   - O several days
   - O more than half of the days
   - O nearly every day
3. feeling down, depressed, or hopeless
   - O not at all
   - O several days
   - O more than half of the days
   - O nearly every day
4. little interest or pleasure in doing things
   - O not at all
   - O several days
   - O more than half of the days
   - O nearly every day

- UCLA-3 questionnaire –

1. How often do you feel isolated from others?
   - O hardly or never
   - O some of the time
   - O often
2. How often do you feel you lack companionship?
   - O hardly or never
   - O some of the time
   - O often
3. How often do you feel left out?
   - O hardly or never
   - O some of the time
   - O often

- EQ5D-5L questionnaire –

Questions about Quality of life TODAY
1. Mobility
    - O I have no problems in walking about
    - O I have slight problems in walking about
    - O I have moderate problems in walking about
    - O I have severe problems in walking about
    - O I am unable to walk about
2. Self-care
    - O I have no problems washing or dressing myself
    - O I have slight problems washing or dressing myself
    - O I have moderate problems washing or dressing myself
    - O I have severe problems washing or dressing myself
    - O I am unable to wash or dress myself
3. Usual activities
    - O I have no problems doing my usual activities
    - O I have slight problems doing my usual activities
    - O I have moderate problems doing my usual activities
    - O I have severe problems doing my usual activities
    - O I am unable to do my usual activities
4. Pain / discomfort
    - O I have no pain or discomfort
    - O I have slight pain or discomfort
    - O I have moderate pain or discomfort
    - O I have severe pain or discomfort
    - O I have extreme pain or discomfort
5. Anxiety / depression
    - O I am not anxious or depressed
    - O I am slightly anxious or depressed
    - O I am moderately anxious or depressed
    - O I am severely anxious or depressed
    - O I am extremely anxious or depressed

- EQ-VAS -

- WE WOULD LIKE TO KNOW HOW GOOD OR BAD YOUR HEALTH IS TODAY.

- THIS SCALE IS NUMBERED FROM 0 TO 100.

- 100 MEANS THE <u>BEST</u> HEALTH YOU CAN IMAGINE.
  0 MEANS THE <u>WORST</u> HEALTH YOU CAN IMAGINE.

- MARK AN X ON THE SCALE TO INDICATE HOW YOUR HEALTH IS TODAY.

- NOW, PLEASE WRITE THE NUMBER YOU MARKED ON THE SCALE IN THE BOX BELOW.

YOUR HEALTH TODAY =

100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
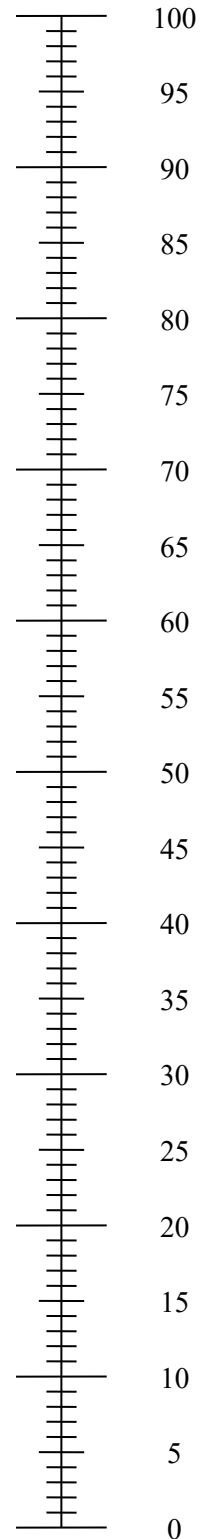
Questions concerning your person

1. Family status
   - O married, living together
   - O married, separated
   - O single
   - O widowed
   - O divorced

2. Which is your country of birth?

   _____

3. Which language do you speak most of the time?

   _____

4. Highest level of education

   - O no graduation (yet)
   - O graduation from main school
   - O graduation from middle school
   - O general qualification for university
   - O training qualification
   - O training for civil servants
   - O university of applied science degree
   - O university degree

5. Do you have a permanent abode?
   - O yes
   - O no
     - if no: Since _____ year(s)?

6. How tall are you and how much do you weigh?

   Weight: _____ O estimated value

   Height: _____ O estimated value

7. Last meal
   - O within the last 6 hours
   - O on an empty stomach for 6 hours
   - O on an empty stomach for 12 hours

8. Last drink (except water)
   - O within the last 6 hours
   - O on an empty stomach for 6 hours
   - O on an empty stomach for 12 hours

9. When and what was your last meal?

   _____

Questions concerning your health

1. How afraid are you of ever falling ill with Corona (COVID-19)?
   - O not at all
   - O a little
   - O moderate
   - O high

2. How high do you assess your personal risk of ever falling ill with Corona (COVID-19)?
   - O very low
   - O low
   - O average
   - O high
   - O very high

3. There is a lot that I can do to prevent falling ill with COVID-19)
   - O 1 (no consent at all)
   - O 2
   - O 3
   - O 4
   - O 5
   - O 6
   - O 7 (explicit consent)

4. The diagnosis "COVID-19" would ruin my life.
   - O 1 (no consent at all)
   - O 2
   - O 3
   - O 4
   - O 5
   - O 6
   - O 7 (explicit consent)

5. Do you have an electronic health card from a health insurance company?
   - O yes
   - O no
   - O do not know

6. Did you make use of medical service (i.e. mobile offers, visits to the doctor) within the last 12 months?
   - O yes
   - O no
   - O do not know

   If no: Why not (multiple choices possible)?
   - O no need
   - O I do not know about the different services
   - O none of the offers suits me
   - O services do not help me
   - O services are too expansive
   - O services are too far away
   - O I am not sure whether I may make use of those services
   - O language barriers
   - O could not pull myself up

   - O other _____

7. How often did you visit doctors in the last 3 months?

O Number of visits to the doctor in the last 3 months_____

        O How many of those were at a neurologist / psychiatrist /

psychotherapist? _____

        O no use of neurologists / psychiatrists / psychotherapists

O no visit to the doctor at all

8. How many nights did you spend at hospitals within the last 12 months?

_____

9. How often did you have to be in hospital within the last 12 months?

_____

10. Did you make use of one of the outpatient services within the last 12

months?

    O Krankenmobil (medical office in a bus)
    O Zahnmobil (dental office in a bus)
    O ArztMobil Hamburg (medical office in a bus on holidays or the
weekend)

11. How many different medications do you usually take?

_____ drugs are medically prescribed

12. Where do you get your medication? If there are several sources please

name the most important one.

_____

13. Are there difficulties when accessing medication?
    O yes
    O no
    If yes: what difficulties (multiple choices possible)?
        O medication is too expansive
        O I do not know, which medication I should take
        O language barriers (when talking to pharmacists)

        O other:

_____

2.6 References

ABOUTARA, N., MÜLLER, A., JUNGEN, H., SZEWCZYK, A., VAN RÜTH, V., BERTRAM, F., PÜSCHEL, K., HEINRICH, F. & IWERSEN-BERGMANN, S. 2022. Investigating the use of PEth, CDT and MCV to evaluate alcohol consumption in a cohort of homeless individuals- A comparison of different alcohol biomarkers. *Forensic Sci Int,* 331**,** 111147.

BAXTER, A. J., TWEED, E. J., KATIKIREDDI, S. V. & THOMSON, H. 2019. Effects of Housing First approaches on health and well-being of adults who are homeless or at risk of homelessness: systematic review and meta-analysis of randomised controlled trials. *J Epidemiol Community Health,* 73**,** 379-387.

BERTRAM, F., HAJEK, A., DOST, K., GRAF, W., BRENNECKE, A., KOWALSKI, V., RÜTH, V. V., KÖNIG, H. H., WULFF, B., ONDRUSCHKA, B., PÜSCHEL, K. & HEINRICH, F. 2022. The Mental and Physical Health of the Homeless. *Dtsch Arztebl Int,* 119**,** 861-868.

BOOTH, S. 1999. Researching Health and Homelessness: Methodological Challenges for Researchers Working with a Vulnerable, Hard to Reach, Transient Population. *Australian Journal of Primary Health,* 5**,** 76-81.

BRENNECKE, A., HEINRICH, F., VAN RÜTH, V., DOST, K., GRAF, W., KOWALSKI, V., RAUCH, A., LANGENWALDER, F., PÜSCHEL, K., ONDRUSCHKA, B., KÖNIG, H.-H., BERTRAM, F. & HAJEK, A. 2023. Determinants of health-related quality of life (HRQoL) among homeless individuals during the COVID-19 pandemic. *Quality of Life Research*.

BUNDESARBEITSGEMEINSCHAFT WOHNUNGSLOSENHILFE E.V. 2020. Umfrage (Mai 2020): Corona und Wohnungslosigkeit.

BUNDESMINISTERIUM FÜR ARBEIT UND SOZIALES 2022. Ausmaß und Struktur von Wohnungslosigkeit: Der Wohnungslosenbericht 2022 des Bundesministeriums für Arbeit und Soziales.

BURSTRÖM, B., IRESTIG, R. & BURSTRÖM, K. 2021. EQ-5D-3L Health Status Among Homeless People in Stockholm, Sweden, 2006 and 2018. *Front Public Health,* 9**,** 780753.

CALLAHAN, D. 1973. The WHO Definition of 'Health'. *The Hastings Center Studies,* 1**,** 77-87.

CHEN, T. & LI, L. 2009. Influence of health-related quality of life on health service utilization in addition to socio-demographic and morbidity variables among primary care patients in China. *Int J Public Health,* 54**,** 325-32.

COOK, E. L. & HARMAN, J. S. 2008. A Comparison of Health-Related Quality of Life for Individuals with Mental Health Disorders and Common Chronic Medical Conditions. *Public Health Reports,* 123**,** 45-51.

DOMINICK, K. L., AHERN, F. M., GOLD, C. H. & HELLER, D. A. 2002. Relationship of health-related quality of life to health care utilization and mortality among older adults. *Aging Clinical and Experimental Research,* 14**,** 499-508.

EUROPEAN ECONOMIC AND SOCIAL COMMITTEE. 2023. *For an EU framework for national homeless strategies based on the principle of Housing First* [Online]. Available: https://www.eesc.europa.eu/en/news-media/press-summaries/eu-framework-national-homeless-strategies-based-principle-housing-first [Accessed].

EUROPEAN PARLIAMENT. 2020. *How Parliament wants to end homelessness in the EU* [Online]. Available: https://www.europarl.europa.eu/news/en/headlines/society/20201119STO92006/how-parliament-wants-to-end-homelessness-in-the-eu [Accessed 13.06.2023 2023].

FAYERS, P. M., HAYS, R. & HAYS, R. D. 2005. *Assessing Quality of Life in Clinical Trials: Methods and Practice,* Oxford University Press.

FAZEL, S., GEDDES, J. R. & KUSHEL, M. 2014. The health of homeless people in high-income countries: descriptive epidemiology, health consequences, and clinical and policy recommendations. *Lancet,* 384**,** 1529-40.

GENTIL, L., GRENIER, G., BAMVITA, J. M., DORVIL, H. & FLEURY, M. J. 2019. Profiles of Quality of Life in a Homeless Population. *Front Psychiatry,* 10**,** 10.

GESELLSCHAFT FÜR INNOVATIVE SOZIALPLANUNG UND SOZIALFORSCHUNG E.V. BONN 2020. Auswirkungen der Covid-19-Pandemie auf die Wohnungsnotfallhilfen – Kurzexpertise als Ergänzung zum Forschungsbericht „Entstehung, Verlauf und Struktur von Wohnungslosigkeit und Strategien zu ihrer Vermeidung und Behebung". *BMAS-Forschungsbericht***,** 320.

GROCHTDREIS, T., DAMS, J., KÖNIG, H.-H. & KONNOPKA, A. 2019. Health-related quality of life measured with the EQ-5D-5L: estimation of normative index values based on a representative German population sample and value set. *The European Journal of Health Economics,* 20**,** 933-944.

GRUNE, J., SAVELSBERG, D., KOBUS, M., LINDNER, A. K., HERRMANN, W. J. & SCHUSTER, A. 2023. Determinants of COVID-19 vaccine acceptance and access among people experiencing homelessness in Germany: A qualitative interview study. *Front Public Health,* 11**,** 1148029.

GUYATT, G. H., FEENY, D. H. & PATRICK, D. L. 1993. Measuring health-related quality of life. *Annals of internal medicine,* 118**,** 622-629.

HAWTHORNE, G., RICHARDSON, J. & DAY, N. A. 2001. A comparison of the Assessment of Quality of Life (AQoL) with four other generic utility instruments. *Annals of Medicine,* 33**,** 358-370.

HEINRICH, F., BERTRAM, F., RÜTH, V. V., HOFFMANN, A., LÜTGEHETMANN, M. & PÜSCHEL, K. 2022. The Prevalence and Determinants of Viral Hepatitis Among Homeless Individuals in Hamburg. *Dtsch Arztebl Int,* 119**,** 8-9.

KÖNIG, H. H., NEUMANN-BÖHME, S., SABAT, I., SCHREYÖGG, J., TORBICA, A., VAN EXEL, J., BARROS, P. P., STARGARDT, T. & HAJEK, A. 2023. Health-related quality of life in seven European countries throughout the course of the COVID-19 pandemic: evidence from the European COvid Survey (ECOS). *Qual Life Res,* 32**,** 1631-1644.

LEWER, D., ALDRIDGE, R. W., MENEZES, D., SAWYER, C., ZANINOTTO, P., DEDICOAT, M., AHMED, I., LUCHENSKI, S., HAYWARD, A. & STORY, A. 2019. Health-related quality of life and prevalence of six chronic diseases in homeless and housed people: a cross-sectional study in London and Birmingham, England. *BMJ Open,* 9**,** e025192.

OSCAR-BERMAN, M., SHAGRIN, B., EVERT, D. L. & EPSTEIN, C. 1997. Impairments of brain and behavior: the neurological effects of alcohol. *Alcohol Health Res World,* 21**,** 65-75.

PRESSER, S., ROTHGEB, J. M., COUPER, M. P., LESSLER, J. T., MARTIN, E., MARTIN, J. & SINGER, E. 2004. *Methods for Testing and Evaluating Survey Questionnaires,* Hoboken, New Jersey, John Wiley & Sons, Inc.

REEVE, B. B., WYRWICH, K. W., WU, A. W., VELIKOVA, G., TERWEE, C. B., SNYDER, C. F., SCHWARTZ, C., REVICKI, D. A., MOINPOUR, C. M., MCLEOD, L. D., LYONS, J. C., LENDERKING, W. R., HINDS, P. S., HAYS, R. D., GREENHALGH, J., GERSHON, R., FEENY, D., FAYERS, P. M., CELLA, D., BRUNDAGE, M., AHMED, S., AARONSON, N. K. & BUTT, Z. 2013. ISOQOL recommends minimum standards for patient-reported outcome measures used in patient-centered outcomes and comparative effectiveness research. *Qual Life Res,* 22**,** 1889-905.

ROWEN, D., BRAZIER, J. & ROBERTS, J. 2009. Mapping SF-36 onto the EQ-5D index: how reliable is the relationship? *Health Qual Life Outcomes,* 7**,** 27.

SINGER, S., VORDERMARK, D. & QUIDDE, J. 2020. Bewertung von Allgemeinzustand und Quality of Life. *In:* SCHMOLL, H.-J. (ed.) *Kompendium Internistische Onkologie : Standards in Diagnostik und Therapie.* Berlin, Heidelberg: Springer Berlin Heidelberg.

SPECTOR, A. L., QUINN, K. G., MCAULIFFE, T. L., DIFRANCEISCO, W., BENDIXEN, A. & DICKSON-GOMEZ, J. 2020. Health-related quality of life and related factors among chronically homeless adults living in different permanent supportive housing models: a cross-sectional study. *Qual Life Res,* 29**,** 2051-2061.

SUN, S., IRESTIG, R., BURSTRÖM, B., BEIJER, U. & BURSTRÖM, K. 2012. Health-related quality of life (EQ-5D) among homeless persons compared to a general population sample in Stockholm County, 2006. *Scandinavian Journal of Public Health,* 40**,** 115-125.

TAGESSCHAU. 2023. *Zuwanderung führt zu Rekordbevölkerung* [Online]. Available: https://www.tagesschau.de/inland/gesellschaft/zuwanderung-deutschland-113.html#:~:text=84%2C3%20Millionen%20Menschen%20in%20Deutschland%20Zuwanderung%20führt%20zu%20Rekordbevölkerung&text=Noch%20nie%20lebten%20am%20Ende,auch%20die%20Ukraine%2DFlüchtlinge%20beigetragen. [Accessed 14.12.2023 2023].

TSAI, J. & WILSON, M. 2020. COVID-19: a potential public health problem for homeless populations. *Lancet Public Health,* 5**,** e186-e187.

WATSON, J., CRAWLEY, J. & KANE, D. 2016. Social exclusion, health and hidden homelessness. *Public Health,* 139**,** 96-102.

WILLE, N., BADIA, X., BONSEL, G., BURSTRÖM, K., CAVRINI, G., DEVLIN, N., EGMAR, A. C., GREINER, W., GUSI, N., HERDMAN, M., JELSMA, J., KIND, P., SCALONE, L. & RAVENS-SIEBERER, U. 2010. Development of the EQ-5D-Y: a child-friendly version of the EQ-5D. *Qual Life Res,* 19**,** 875-86.

YE, Z., SUN, L. & WANG, Q. 2019. A head-to-head comparison of EQ-5D-5 L and SF-6D in Chinese patients with low back pain. *Health and Quality of Life Outcomes,* 17**,** 57.

3. Abstract

3.1 Zusammenfassung – German

Hintergrund: Das Ziel der Hamburger Wohnungslosenbefragung war es, die gesundheitsbezogene Lebensqualität wohnungsloser Menschen in der Anfangsphase der COVID-19-Pandemie zu ermitteln.

Methoden: Die Daten stammen aus der Hamburger Wohnungslosenbefragung während der COVID-19-Pandemie (n = 151). Der etablierte EQ-5D-5L wurde verwendet, um Probleme in fünf Gesundheitsdimensionen zu quantifizieren, und seine visuelle Analogskala (EQ-VAS) wurde verwendet, um den selbst eingeschätzten Gesundheitszustand zu erfassen. Soziodemografische Faktoren wurden in die Regressionsanalyse einbezogen.

Ergebnisse & Diskussion: Überraschenderweise zeigten die Ergebnisse vergleichbare Werte der gesundheitsbezogenen Lebensqualität wie in der Allgemeinbevölkerung, trotz der zahlreichen Herausforderungen, mit denen wohnungslose Menschen konfrontiert sind. Mögliche Erklärungsansätze sind die Anpassung an die Lebensbedingungen, Selektionsverzerrungen und der Einfluss des Alkoholkonsums.

Schlussfolgerung: Die Ergebnisse unterstreichen die Notwendigkeit umfassenderer und langfristiger Studien, um die Faktoren zu verstehen, die sich auf die gesundheitsbezogene Lebensqualität wohnungsloser Menschen auswirken. Darüber hinaus sind wirksame Präventivmaßnahmen wie Bildung, Arbeitsförderung und soziale Wohnungsbauprogramme von entscheidender Bedeutung für den Umgang mit Obdachlosigkeit und die Verbesserung der Gesundheit wohnungsloser Menschen.

3.2 Abstract – English

Background: The 'Hamburg survey of Homeless Individuals' aimed to assess the health-related quality of life (HRQoL) of homeless individuals during the early stages of the COVID-19 pandemic.

Methods: Data were taken from the 'Hamburg survey of Homeless Individuals' during the COVID-19 pandemic (n = 151). The established EQ-5D-5L was used to quantify problems in five health dimensions, and its visual analogue scale (EQ-VAS) was used to record the self-rated health status. Sociodemographic factors were included in a regression analysis.

Results & Discussion: Surprisingly, the results showed comparable HRQoL scores to those of the general population, despite the numerous challenges faced by homeless individuals. Potential explanations include adaptation to living conditions, selection bias, and the influence of alcohol consumption.

Conclusion: The findings emphasize the need for more comprehensive and longitudinal studies to understand the factors affecting HRQoL in homeless populations. Additionally, effective preventive measures such as education, job promotion, and social housing programs are crucial in addressing homelessness and improving well-being of homeless people.

4. Declaration of own work share

The work listed below for this publication was carried out by me, Victoria van Rüth, independently or in collaboration:

- Conception of the study and writing of the study protocol (with F. Bertram, Prof. A. Hajek, F. Heinrich, Prof. H.-H. König, Prof. K. Püschel)
- Application for funding of the study (with F. Heinrich, Prof. K. Püschel)
- Application for approval by the Hamburg Ethics Committee (with F. Bertram, F. Heinrich, Prof. K. Püschel)
- Planning and organization of data collection (with F. Bertram, F. Heinrich)
- Collection of data (with scientific assistants)
- Digitalization of the collected data (with scientific assistants)
- Processing of the data
- Statistical analysis (with Prof. A. Hajek)
- Literature research
- Preparation of figures (with Prof. A. Hajek)
- Conception and writing of the manuscript (with Prof. A. Hajek)
- Publication of the thesis in the Public Health Journal (with Prof. A. Hajek)
- Writing of this publication doctoral thesis
- Presentation of the data at the following congress
  - Federal conference of the Bundesarbeitsgemeinschaft für Wohnungslosenhilfe e.V. (03/2021)

The work listed below for this publication was performed without my direct collaboration:
- Laboratory chemical processing and analysis of the collected blood samples in the Microbiology and Clinical Chemistry Department of the University Hospital Hamburg Eppendorf

5. Acknowledgements

6. Curriculum vitae

Lebenslauf aus datenschutzrechtlichen Gründen nicht enthalten

7. List of publications

van Rüth V, Hajek A, Heinrich F, Ondruschka B, Püschel K, Bertram F. Gesundheit wohnungsloser Menschen während der COVID-19-Pandemie [Health of homeless individuals during the COVID-19 pandemic]. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz. 2023 Aug;66(8):882-889. German. doi: 10.1007/s00103-023-03739-8. Epub 2023 Jul 19. PMID: 37466653; PMCID: PMC10372111

Bertram F, Hajek A, […], Rüth VV, König HH, Wulff B, Ondruschka B, Püschel K, Heinrich F. The Mental and Physical Health of the Homeless. Dtsch Arztebl Int. 2022 Feb 16;119(50):861-868. doi: 10.3238/arztebl.m2022.0357. PMID: 36382585; PMCID: PMC9989961.

Hajek A, Bertram F, van Rüth V, […], Ondruschka B, Heinrich F, König HH. Fear of COVID-19 among homeless individuals in Germany in mid-2021. Front Public Health. 2022 Aug 10;10:915965. doi: 10.3389/fpubh.2022.915965. PMID: 36033736; PMCID: PMC9400009.

Dost K, Heinrich F, […], van Rüth V, Ondruschka B, Püschel K, König HH, Bertram F, Hajek A. Predictors of Loneliness among Homeless Individuals in Germany during the COVID-19 Pandemic. Int J Environ Res Public Health. 2022 Oct 5;19(19):12718. doi: 10.3390/ijerph191912718. PMID: 36232018; PMCID: PMC9566392.

Gottschalk U, […], van Rüth V, Kozlik-Feldmann R, Singer D, Sachweh JS, Biermann D. Outcomes of extracorporeal membrane oxygenation and cardiopulmonary bypass in children after drowning-related resuscitation. Perfusion. 2023 Jan;38(1):109-114. doi: 10.1177/02676591211041229. Epub 2021 Sep 2. PMID: 34472993; PMCID: PMC9841817.

von Stumm M, […], van Rüth V, […], Sachweh JS, Biermann D. Impact of delayed sternal closure on wound infections following neonatal and infant cardiac surgery. PLoS One. 2022 May 23;17(5):e0267985. doi: 10.1371/journal.pone.0267985. PMID: 35604953; PMCID: PMC9126390.

Kehl T, van Rüth V, Weinrich JM, Hübler M. Using three-dimensional visualization as an optimal tool to plan and validate an aortopexy in a congenital heart disease patient with severe tracheal stenosis. Interact Cardiovasc Thorac Surg. 2022 Mar 31;34(4):708-710. doi: 10.1093/icvts/ivab315. PMID: 34738096; PMCID: PMC9026186

Hübler, S. & van Rüth, V., Kozlik-Feldmann, R., Hübler, M., Biermann, D., Sachweh, J.. (2023). Early Obstruction of Systemic to Pulmonary Artery Shunts in Neonates and Infants. The Thoracic and Cardiovascular Surgeon. 71. 10.1055/s-0043-1761707.

Hajek A, Heinrich F, van Rüth V, […], Püschel K, Bertram F, König HH. Prevalence and determinants of depression and anxiety measured by the PHQ-4 among homeless individuals during the COVID-19 pandemic. Evidence from the Hamburg survey of homeless individuals. Psychiatry Res. 2022

Feb;308:114350. doi: 10.1016/j.psychres.2021.114350. Epub 2021 Dec 21.
PMID: 34968806; PMCID: PMC8729330.

Hajek A, van Rüth V, Bertram F, […], Püschel K, König HH. Inanspruchnahme
von Gesundheitsleistungen bei Obdachlosen: Ergebnisse der Hamburger
Obdachlosenbefragung [Use of Health Care by Homeless Individuals: Results
of the Hamburg Survey of Homeless Individuals]. Gesundheitswesen. 2022
Aug;84(8-09):674-678. German. doi: 10.1055/a-1498-1581. Epub 2021 Jul 23.
PMID: 34298564.

Hajek A, Bertram F, Heinrich F, van Rüth V, Ondruschka B, […], Püschel K,
König HH. Determinants of health care use among homeless individuals:
evidence from the Hamburg survey of homeless individuals. BMC Health Serv
Res. 2021 Apr 7;21(1):317. doi: 10.1186/s12913-021-06314-6. PMID:
33827570; PMCID: PMC8026095.

Hajek A, Bertram F, van Rüth V, […], Püschel K, Heinrich F, König HH.
Prevalence and Factors Associated with Fear of COVID-19 Among Homeless
Individuals During the COVID-19 Pandemic: Evidence from the Hamburg
Survey of Homeless Individuals. Risk Manag Healthc Policy. 2021 Jun
24;14:2689-2695. doi: 10.2147/RMHP.S317039. PMID: 34194250; PMCID:
PMC8238066

Heinrich F, Bertram F, Rüth VV, […], Püschel K. The Prevalence and
Determinants of Viral Hepatitis Among Homeless Individuals in Hamburg. Dtsch
Arztebl Int. 2022 Jan 10;119(1-2):8-9. doi: 10.3238/arztebl.m2022.0003. PMID:
37255009; PMCID: PMC9002301.

Aboutara N, […], van Rüth V, Bertram F, Püschel K, Heinrich F, Iwersen-
Bergmann S. Investigating the use of PEth, CDT and MCV to evaluate alcohol
consumption in a cohort of homeless individuals- A comparison of different
alcohol biomarkers. Forensic Sci Int. 2022 Feb;331:111147. doi:
10.1016/j.forsciint.2021.111147. Epub 2021 Dec 10. PMID: 34920332

8. Declaration on oath

Ich versichere ausdrücklich, dass ich die Arbeit selbständig und ohne fremde Hilfe verfasst, andere als die von mir angegebenen Quellen und Hilfsmittel nicht benutzt und die aus den benutzten Werken wörtlich oder inhaltlich entnommenen Stellen einzeln nach Ausgabe (Auflage und Jahr des Erscheinens), Band und Seite des benutzten Werkes kenntlich gemacht habe.

Ferner versichere ich, dass ich die Dissertation bisher nicht einem Fachvertreter an einer anderen Hochschule zur Überprüfung vorgelegt oder mich anderweitig um Zulassung zur Promotion beworben habe.

Ich erkläre mich einverstanden, dass meine Dissertation vom Dekanat der Medizinischen Fakultät mit einer gängigen Software zur Erkennung von Plagiaten überprüft werden kann.

Unterschrift: ……………………………………………….