Socioeconomic Status, the Countries' Socioeconomic Development and Mental Health: Observational Evidence for Persons with Spinal Cord Injury from 22 Countries

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Objectives: Evidence on social inequalities in mental health of persons with physical impairments is limited. We therefore investigate associations of individual-level socioeconomic status (SES) and the country-level socioeconomic development (SED) with mental health in persons with spinal cord injury (SCI).

Methods: We analyzed data from 12,588 participants of the International SCI Community Survey from 22 countries. To investigate individual-level inequalities, SES indicators (education, income, financial hardship, subjective status) were regressed on the SF-36 mental health index (MHI-5), stratified by countries. Country-level inequalities were analyzed with empirical Bayes estimates of random intercepts derived from linear mixed-models adjusting for individual-level SES.

Results: Financial hardship and subjective status consistently predicted individual-level mental health inequalities. Country-level SED was inconsistently related to mental health when adjusting for individual-level SES. It however appeared that higher SED was associated with better mental health within higher-resourced countries.

Conclusion: Reducing impoverishment and marginalization may present valuable strategies to reduce mental health inequalities in SCI populations. Investigations of country-level determinants of mental health in persons with SCI should consider influences beyond country-level SED, such as cultural factors.

Keywords: mental health, spinal cord injury, InSCI community survey, socioeconomic status, socioeconomic development, social inequalities, physical impairments

INTRODUCTION

With a prevalence of 10.7% in all world regions, mental disorders importantly contribute to the global burden of disease [1]. Mental disorders are even more frequent in individuals with physical impairments, exacerbating their individual burden of disease [2, 3]. As demonstrated in recent meta-analyses, the prevalence of depression and anxiety disorders in people with spinal cord injury (SCI) is, with 22.2% for depression [(95% confidence interval (CI) 18.7%–26.3%; total number of studies included (k) = 19, total number of participants (n) = 35,676)] and 27% for anxiety (95% CI 24%–30%; k = 18, n = 2,772), alarmingly high [4, 5]. Mental health status is largely shaped by social, economic, and environmental conditions as well as the availability of psychosocial resources. Persons with SCI might be particularly vulnerable to poor mental health due to an increased risk of experiencing stressors, such as discrimination, social exclusion, unemployment, and reduced availability of psychosocial resources [6–8]. It is therefore important to advance evidence on risk factors of poor mental health in persons with SCI to adequately tailor rehabilitative and public health interventions.

Several systematic reviews drawing on global evidence convincingly documented that low socioeconomic status (SES) presents a risk factor for poor mental health [3, 9–11]. It is assumed that socioeconomic disadvantage is linked to greater exposure to unfavorable psychosocial, behavioral and environmental conditions throughout the life course, ultimately negatively affecting people's mental health [9]. Similar social inequalities in mental health were observed in SCI populations for depression [12–15], anxiety [12], and perceived mental health [16]. As various SES indicators reflect different sets of relevant resources for mental health, the distinction between distinct SES dimensions is pivotal to identify main drivers of poor mental health [3, 17]. The relative importance of different SES indicators with regard to mental health of persons with physical impairments is yet to be clarified as available evidence mainly relies on the traditional SES indicators education [13–16] and income [12–16], while studies on subjective dimensions of SES, such as perceived financial hardship [15, 16] and subjective status are rare.

Mental health may also depend on larger societal and structural conditions, such as a countries' socioeconomic development (SED) as reflected by indicators such as gross domestic product or average life expectancy. These macro-level conditions possibly influence individual-level living conditions and social determinants which may ultimately affect mental health. For example, countries with greater income inequality and poorer developed welfare arrangements may provide less favorable environments for maintaining good mental health [18]. However, no cross-country comparative study on mental health in persons with physical impairments has been performed to date.

The present study investigates social inequalities in mental health of persons with SCI from 22 countries considering four distinct individual-level SES indicators (education, household income, financial hardship and subjective status) as well as country-level SED. More specifically, we aim to analyze 1) individual-level associations between different SES indicators and mental health within countries, and 2) between-country differences in average mental health that remain when individual-level SES is considered. In both cases, relationships with country-level SED are explored.

METHODS

Design

This cross-sectional study uses data from the International SCI community survey (InSCI) performed in 22 countries between January 2017 and May 2019 covering all continents. In total, 12,588 community-dwelling persons with traumatic or non-traumatic SCI aged over 18 years participated in this survey. An injury to the spinal cord causes complete or partial loss of motor function and sensation below the lesion level, often severely affecting functioning and health [19]. Persons with neuro-degenerative disorders, congenital SCI etiologies, or Guillain Barré syndrome were excluded [20], as people with these health conditions usually follow different rehabilitation paths and disease progressions than those with acquired SCI and would thus present a non-comparable sub-population within the sample. National Study Centers were responsible for recruitment and data collection and sampling strategies varied according to local conditions, including random and convenience sampling. Countries offered paper-pencil or online questionnaires, telephone or personal interviews. Compliance with national laws and regulatory approvals by Institutional Review Boards or Ethical Committees was mandatory and the study conformed to the Helsinki Declaration. Informed consent was required from all participants according to national regulations. Details on methodological features, recruitment results, and participants characteristics are reported elsewhere [20, 21].

Measures

Mental health was assessed with the SF-36 five-item Mental Health Index (MHI-5) [22] showing satisfactory reliability and validity as a screening instrument for general mental health in individuals with SCI [23]. The MHI-5 measures the frequency of experiencing five emotional states during the last month (0 = all of the time, 4 = none of the time). The raw sum score was transformed to a 0–100 score with higher scores indicating better mental health [22].

Individual-Level Socioeconomic Status

Education, income, financial hardship and subjective status were used as indicators for individual-level SES. Education was assessed as highest level of formal education obtained. For analysis this information was classified into three categories: no schooling/primary/lower secondary; upper/post-secondary; tertiary education. Given the high proportion of persons with no schooling or only primary education in China, Indonesia, Morocco and Thailand (28%–40% of samples), a classification differentiating no schooling/primary; lower/higher/post-secondary; and tertiary education was used for those countries. Net-equivalent household income in the countries' currency was calculated by including

information on household income, weighted by number of adults and children in the household according to criteria from the Organisation for Economic Co-Operation and Development (OECD) [24]. Given differences in the assessment of household income between countries (e.g., some before, some after taxes), we were unable to derive a measure that permitted cross-country comparison based on a common standard such as purchasing power parity. To nevertheless assess income inequalities within countries, income quartiles for each country were derived from income distributions within country samples. Financial hardship was evaluated with an item on the impact of people's financial situation on their life during the past month (not applicable/ no influence, made my life a little harder, made my life a lot harder) from the Nottwil Environmental Factors Inventory Short Form [25]. The MacArthur Scale of Subjective Social Status was used to assess subjective status on a 10-rung ladder [26], with higher values indicating higher subjective status.

Country-Level Socioeconomic Development

The Human Development Index (HDI) was used to operationalize country-level SED [27]. Developed by the United Nations, the HDI provides a summary measure of a country's achievements along three dimensions: life expectancy at birth, access to knowledge represented as mean years of schooling for adults aged over 25 years and expected years of schooling for children of school-entering age, and standard of living represented as gross national income per capita in USD purchasing power parity. The HDI ranges from 0 to 1, with higher values indicating greater development. We used the HDI of 2017 (multiplied with 100 to receive legible effect sizes), the first year of the InSCI data collection [27].

Covariates

Gender, age, SCI severity (complete/incomplete paraplegia, complete/incomplete tetraplegia), etiology of SCI (traumatic, non-traumatic), years since injury, and mobility classes were considered as potential confounders. Mobility classes were derived from an item of the Spinal Cord Injury Independence Scale for self-report [28] with four categories: independent walking, walking with aids, manual wheelchair, power wheelchair/total assistance.

Statistical Analysis

Analyses were conducted using STATA 16.0 for Windows (College Station, TX, United States). Associations of individual-level SES with mental health within countries were analyzed with linear regressions of mental health scores on SES predictors stratified by country. Two subsequent types of models were estimated: 1) unadjusted models in which mental health was regressed separately on each SES indicator; 2) adjusted models in which mental health was regressed simultaneously on all SES indicators and covariates. We report coefficients, 95% CI and p-values from global Wald-tests. Models were estimated both with individual-level SES predictors entered as factor variables (apart from subjective status) and as continuous variables. The latter served the investigation of linear trends. Coefficients
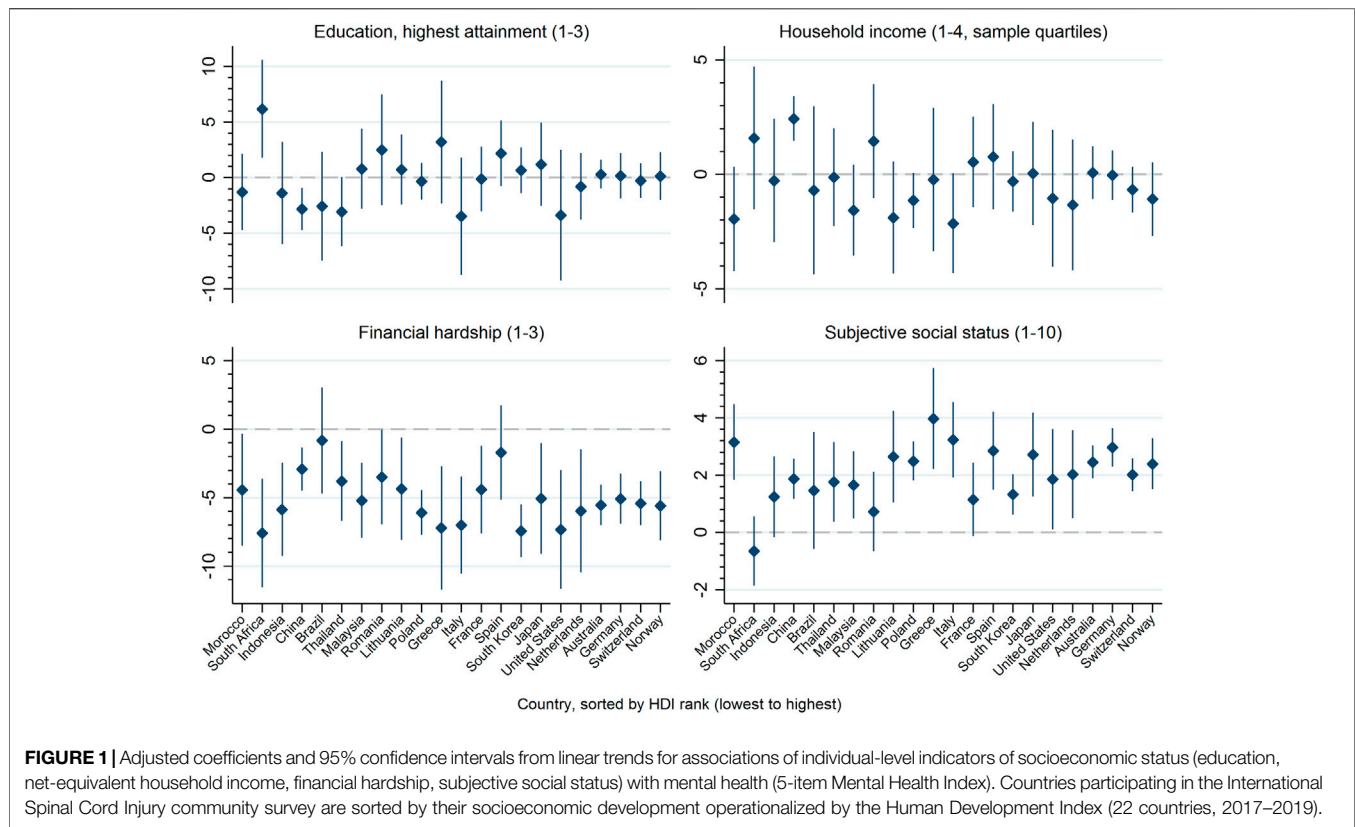
TABLE 1 | Description of study variables in the 12,588 participants of the International Spinal Cord Injury community survey (22 countries, 2017–2019).

Variables [% missing values]	Total
Categorical variables	**N (%)**
Male gender [0.3]	9,165 (73.0)
SCI severity [4.3]	
Incomplete paraplegia	4,155 (34.5)
Complete paraplegia	3,381 (28.1)
Incomplete tetraplegia	3,284 (27.3)
Complete tetraplegia	1,225 (10.2)
Traumatic etiology [1.6]	9,990 (80.6)
Mobility classes [2.9]	
Walking without aids	2,036 (16.7)
Walking with aids	2,006 (16.4)
Manual wheelchair	5,392 (44.1)
Electric wheelchair/complete dependence	2,784 (22.8)
Highest level of education [2.3]	
No schooling or primary	1,183 (9.6)
Lower secondary	2,282 (18.6)
Upper or post-secondary	5,272 (42.9)
Tertiary	3,628 (29.3)
Net-equivalent household income [8.5]	
Lowest quartile	2,942 (25.6)
2nd lowest quartile	2,865 (24.9)
2nd highest quartile	2,903 (25.2)
Highest quartile	2,803 (24.4)
Financial hardship [4.0]	
Massive	2,156 (17.8)
Some	3,414 (28.2)
None	6,523 (53.9)
Continuous variables	**Mean (SD)**
Age in years [0.6]	51.3 (15.3)
Time since injury in years [2.7]	13.1 (11.9)
Subjective social status, 1–10 score [4.2]	4.8 (2.1)
Mental health MHI-5, 0–100 score [4.0]	66.3 (20.6)

Abbreviations: MHI-5, 5-item Mental Health Index; SCI, spinal cord injury; SD, standard deviation.

representing linear trends for individual-level SES indicators within the different countries are plotted across countries sorted by HDI rank to identify obvious patterns.

To examine how far the cross-country differences in mental health were accounted for by between sample variation in average individual-level SES, sociodemographic, and SCI characteristics (covariates), we fitted a linear mixed-effects model with a random intercept for country and regressed mental health scores simultaneously on all individual-level SES indicators and covariates. We then preceded in two steps: First, covariate-adjusted marginal means and 95% CIs of the country-specific mental health scores as estimated from the mixed-effects model were plotted against HDI-rank of the countries. This shows the pattern of mental health by country HDI that we would expect to see if only differences in individual-level predictors (within and between countries) as estimated with the model's fixed part mattered. Second, we used empirical Bayes estimation to derive best linear unbiased predictors (BLUPs) for random intercepts and their standard errors for each country [29]. These BLUPs represent the error in prediction due to unobserved

FIGURE 1 | Adjusted coefficients and 95% confidence intervals from linear trends for associations of individual-level indicators of socioeconomic status (education, net-equivalent household income, financial hardship, subjective social status) with mental health (5-item Mental Health Index). Countries participating in the International Spinal Cord Injury community survey are sorted by their socioeconomic development operationalized by the Human Development Index (22 countries, 2017–2019).

between-country heterogeneity, i.e., residual variation in the data that is neither explained by the modeled individual factors nor accounted for by measurement error. These BLUPs can be interpreted as country-sample effects on the mental health of people with SCI, given covariates. BLUPs >0 indicate underestimation of the average mental health status with the fixed effects part of the model or over-performance of a country sample with regard to the mental health of people with SCI as compared to our expectation given cross-country variation in individual-level SES and covariates. BLUPs <0 indicate overestimation or underperformance of country samples with regard to expected country-level mental health. Estimated BLUPs of random intercepts with 95% CIs were plotted against country HDI. Restricted cubic-spline smoothening with 4 knots was used for exploration of patterns in the relationship of BLUPs and HDI [30]. R-squared and Root Mean-Squared Error of Approximation (RMSEA) are provided as indicators for goodness of fit of the restricted cubic-spline model to the data.

To assess potential bias due to missing values, analyses were repeated with complete and imputed data in sensitivity analysis. Missing values were imputed with multiple imputation (MI) by chained equations on 25 imputed datasets [31], assuming that data were missing at random. Results from both analyses were compared and no relevant differences between the two strategies were detected. Results shown are based on imputed data.

RESULTS

Table 1 provides details on basic sample characteristics. The majority of participants was male (73%), mean age was around 51 years (SD 15.3), incomplete paraplegia was the most (35%) and complete tetraplegia the least frequent SCI type (10%). In 80% of participants, SCI was caused by trauma. Average time since SCI was about 13 years (SD 11.9). Roughly two thirds of participants were wheelchair dependent. Around 18% indicated experiencing massive financial hardship and around 10% reported primary, 61% secondary, and 29% tertiary education as highest educational level. Average subjective status was 4.8 (SD 2.1). With the exception of income (which was represented in terms of country-sample quartiles), there was a trend for higher average individual-level SES in countries with greater HDI (see **Supplementary Appendix S1** for country-specific SES distributions). For the 0–100 mental health scale overall average was 66.3 (SD 20.6). A detailed description of mental health scores in different countries can be found elsewhere (see **Supplementary Table S2**, [6]).

Individual-Level Socioeconomic Status and Mental Health

Figure 1 shows adjusted coefficients of country-specific associations between individual-level SES and mental health
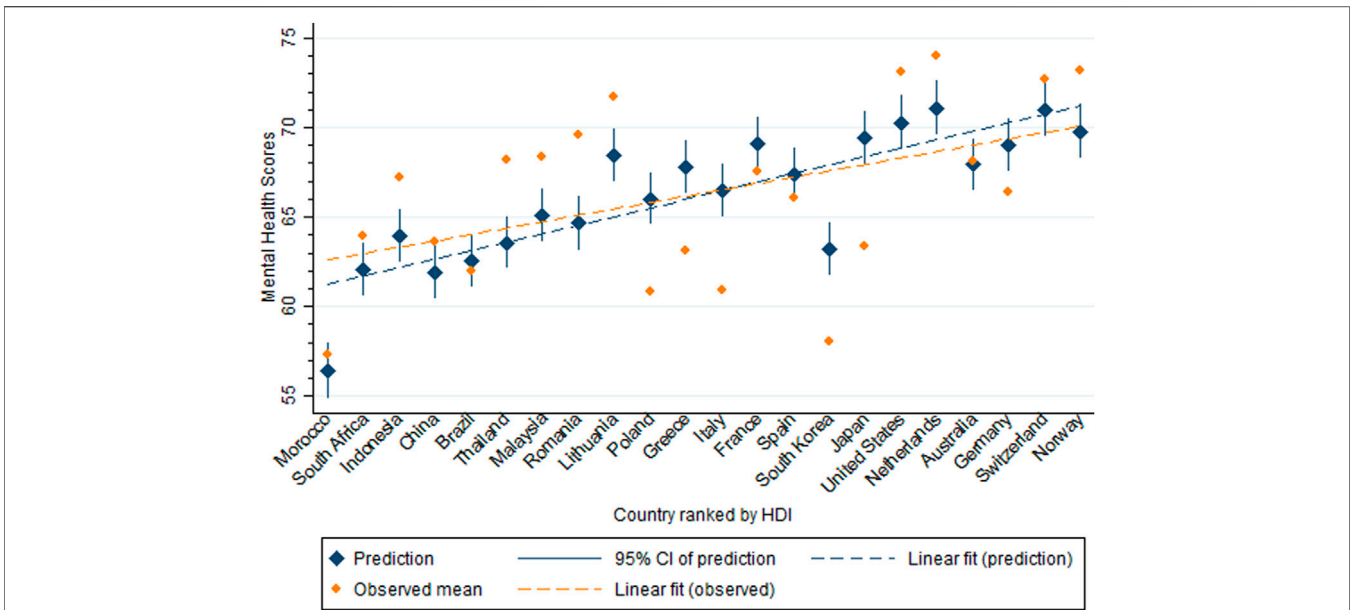
FIGURE 2 | Observed and predicted mental health scores (5-item Mental Health Index) by countries participating in the International Spinal Cord Injury community survey, ordered according to their socioeconomic development operationalized by the Human Development Index (22 countries, 2017–2019).
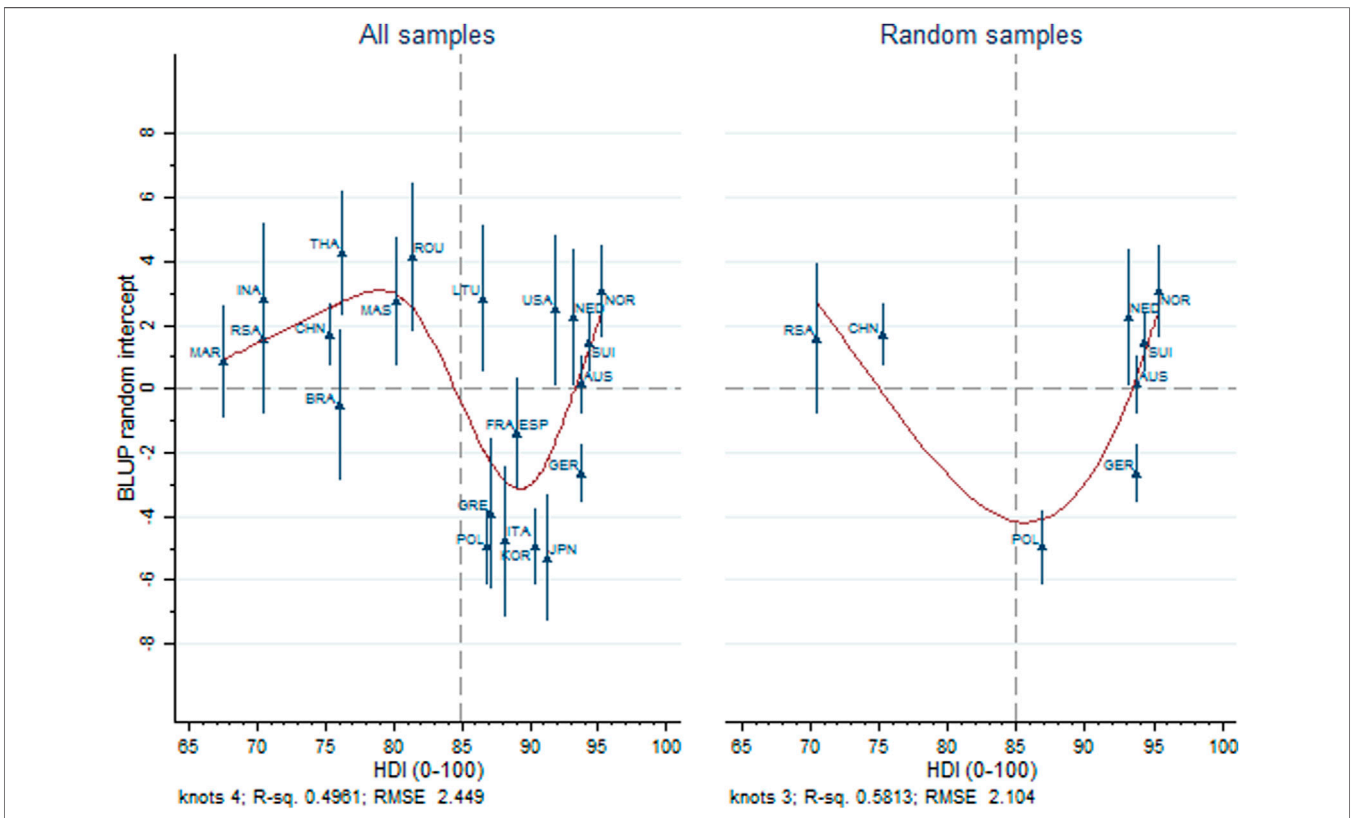

FIGURE 3 | Estimated best linear unbiased predictions for random intercepts and their standard errors from mixed effects models regressing mental health on individual-level socioeconomic status and covariates, from all samples and only for countries participating in the International Spinal Cord Injury community survey using random sampling. The dashed vertical line indicates overall average of the Human Development Index of included country samples (22 countries, 2017–2019).

(linear trends). Education and income were inconsistently associated with mental health and 95% CIs mostly included zero, indicating statistical non-significance. Exceptions are China (higher education related to worse mental health and higher income related to better mental health) and South Africa (higher education associated with better mental health). In contrast, mental health status decreased with the degree of perceived financial hardship in all countries, with statistically significant associations in 20 of 22 countries (adjusted models). Similarly, higher subjective status was linked to better mental health in all countries except South Africa, with statistically significant associations in 17 out of 22 countries (adjusted models). The results from models where education, income, and financial hardship were entered as factor variables largely corresponded to linear trends reported here (see **Supplementary Appendixes S2, S3**).

Country-Level Socioeconomic Development and Mental Health

Figure 2 shows observed and predicted marginal mental health scores plotted by countries HDI ranks. A clear trend towards better mental health in countries with higher HDI for mental health scores as predicted by the fixed effects part of the mixed model, stands in contrast to observed mental health scores in most countries. Against the predicted linear trend, Morocco and South Korea stand out for low and Lithuania for high predicted as well as observed mental health.

Figure 3 displays BLUPs for country-specific random intercepts, representing between-country variation unaccounted for individual-level SES and covariates. All countries with an HDI below overall average (84.9, vertical dashed line) apart from Brazil show better mental health than expected based on individual-level SES and covariates. In contrast, 8 out of 14 countries with above-average HDI perform worse than expected. The restricted cubic spline smoothening model explained 48.7% of the variance of random intercepts for all samples and 58.9% when only considering countries with random samples. We observed different patterns for below- vs. above-average HDI countries in both cases. When considering all countries, below-average HDI countries show a trend of increasingly positive residual country-level effects on mental health that corresponds to increasing HDI. The curve then sharply declines between Romania and Poland and increases sharply again afterwards in approximately linear fashion. This increase from countries with worse to those with better mental health than the expectation derived from estimated effects of individual-level predictors again corresponds to increased HDI. The one exception not fitting this pattern is Lithuania. The latter trend is equally obvious in the graph displaying countries with random samples only, while no such relation is observed for the two remaining countries with below-average HDI.

DISCUSSION

This study provides initial evidence for social inequalities of mental health within a population of people with physical impairments due to SCI. We observed that subjective indicators of SES (financial hardship and subjective status) were consistently related to poorer mental health whereas effects of the traditional SES indicators education and income on mental health were more volatile across countries and mostly statistically insignificant. These findings highlight the importance of including subjective SES indicators in research that aims to identify key drivers of poor mental health in people with SCI. While average individual-level SES of people with SCI was generally lower in countries with lower country-level SED as reflected by the HDI, cross-country differences in mental health were neither sufficiently explained by this variation in individual-level SES nor by differences in sample composition regarding sociodemographic and SCI-related characteristics. Residual between-country variation in average mental health also did not clearly follow differences in country-level SED. A group of countries with lower SED (below-average HDI) was clearly set apart from a group with higher SED. The observed mental health of people with SCI from countries with below-average HDI was generally better than predictions based on individual-level SES and covariates would suggest. Nonetheless, in both, countries with below- as well as above-average HDI, increasing HDI appeared to be related to better mental health. This trend was, however, only confirmed for countries with above-average HDI when only countries using random sampling frames for recruitment were considered.

In contrast to other studies in SCI populations [12–16], our country-specific results showed that education and income had limited predictive value for mental health in comparison to more subjective SES indicators. This is in line with previous findings from general population surveys showing that subjective status was more strongly linked to health outcomes than traditional SES indicators [32, 33]. Low subjective status may reflect feelings of marginalization and social exclusion better than objective SES indicators and thus more readily trigger negative emotions that ultimately obstruct mental health. Perceived financial hardship may more adequately capture conditions of poverty where ends cannot be met than nominal income. Perceived financial hardship may affect mental health through daily hassles and psychosocial distress [34, 35]. This may be of particular relevance in a population with increased healthcare needs and costs due to physical impairment. Perceived financial hardship might also be particularly harmful for the mental health of persons with physical impairments as it may lead to restricted social participation and social exclusion [16, 36]. Also, poorer access to health care services in general, and psychological support services in particular, might negatively affect mental health in persons experiencing financial hardship [9].

Our study further demonstrated a statistical association between county-level SED and mental health at the population level. However, this association was less straightforward than it might be expected. Cross-country differences in mental health were neither explained by between-country variation in individual-level SES, nor was there an overall linear trend for the relation of country HDI with residual between-country differences in mental health scores. In contrast, we observed separate trends for countries with below- and above-average HDI. Only for countries with above-average HDI (higher SED countries), higher HDI was robustly associated with better mental health. For these countries, increased availability of mental health services and access to psychological support might drive inequalities in mental health at the country-level [9]. In turn, countries with below-average HDI showed a better country-level performance in mental health than a majority of higher HDI countries given variation in individual-level SES and covariates. Within all below-average HDI countries, increasing HDI then appeared to be related to better mental health as well. However, the latter finding was not robust when only countries with random samples were considered, possibly due to the low number of countries with lower SED that employed such sampling frame. These patterns in cross-country differences in mental health and their association with SED may reflect different distributions of self-reported mental health in different groups of countries, i.e. those with below- vs. above-average HDI. We subsequently discuss four potential explanations for the observed associations. First, problems in mental health might be underreported in countries where mental disorders have historically been a taboo and/or associated with stigmatization [37]. Second, recall bias and a stronger focus on current affect state is conceivable as receiving attention through the survey may have improved the affect state of people from countries where such surveys are uncommon. Third, the HDI does not consider dimensions relevant to people's mental health that are in the favor of lower resource countries, such as stronger family cohesion or collective value-orientation. Fourth, important (unobserved) individual-level variables that show strong variation between countries and have a strong effect on mental health have been omitted from the model, e.g. perceived family support or availability of informal caregivers.

Implications

Given that poor mental health, financial hardship and low subjective status interact bi-directionally, interventions may not exclusively target mental health outcomes through psychological interventions, but also consider acting on the reduction of financial hardship or poverty and the personal perception of one's standing in society [38]. Interventions may address barriers limiting individual and collective opportunities for economic integration and participation [39], e.g., labor market access and increased social participation for persons with physical impairments. Besides attempting to reduce

poverty and marginalization in persons with SCI, the removal of economic and socio-cultural barriers and systemic discrimination as well as strengthening specific psychosocial resources in lower SES groups may present promising strategies to support mental health equality in persons with SCI. On the country-level, it should be further scrutinized what factors beyond SED as measured with common indices like the HDI possibly contribute to mental health.

Limitations

The representativeness of the study samples to the total population of individuals with SCI in the participating countries and thus the generalizability of the results is limited as 14 of 22 countries relied on convenience sampling, while only eight countries applied random sampling strategies. It is also worthwhile mentioning that the results for specific countries cannot be generalized to respective continents, as the within-continent differences in SED is in some cases relevant (e.g., southern Asian countries vs. other Asian countries). Moreover, the operationalization of income as quartiles of the within country-sample distribution may is suboptimal as those quartiles only reflect the income situation in relation to other people with SCI in the same country-sample and not their income situation in relation to the total population. Moreover, cross-country differences in purchasing power cannot be captured in this way. The lack of information on mental health or SES for non-responders prevents us from assessing whether non-response was patterned according to those characteristics. We further cannot evaluate whether self-report on mental health or SES led to biased responses, as for example information on income and mental health are prone to social desirability bias, particularly if poverty and/or mental diseases are subject to stigmatization. Also, it remains unclear whether the different data collection methods introduced any bias in responses. Finally, reverse causation of associations cannot be excluded, especially for the indicator subjective status, as persons with poor mental health might be prone to evaluate their social status as low.

Conclusion

This study provides evidence for social inequalities in mental health in persons with SCI across different regions of the world, highlighting the importance of perceived financial hardship and low subjective status as predictors of decreased mental health. Conversely, the traditional SES indicators education and income poorly explained differences in mental health and showed inconsistent effects across countries. There was no clear overall association of country-level SED with average mental health of SCI populations. It appears, however, that higher levels of SED are associated with better mental health within the group of higher-resourced countries. Efforts to reduce financial hardship and to increase the subjective status of people with SCI present promising strategies to reduce mental health inequalities in this population within and across countries.

ETHICS STATEMENT

This is a study performed in 22 countries. A full list of Ethical Committees that approved the study in all 22 countries can be found at: https://figshare.com/articles/journal_contribution/Ethics_committees_or_review_boards_approvals_in_the_22_InSCI_countries_/15165006. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors conceptualized the study and were actively involved in recruitment and data collection in their countries; JR and CF analyzed the data and interpreted the results; CF and JR drafted the manuscript. All authors reviewed and approved the final version of the manuscript.

CONFLICT OF INTEREST

The authors declare that they do not have any conflicts of interest.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.ssph-journal.org/articles/10.3389/ijph.2022.1604673/full#supplementary-material

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