Socioeconomic Inequality in Disability Among Adults: A Multicountry Study Using the World Health Survey

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The World Health Organization (WHO) estimates that there are more than 1 billion people in the world living with some form of disability, of whom nearly 200 million have considerable difficulties in functioning.[1] Almost everyone will experience disability at some time in their lives. Those who live longer will endure increasing difficulties in everyday physical and mental functioning.[1] The United Nations Convention on the Rights of Persons with Disabilities[2] identified disability as an international priority area for concerted action.

Reported disability prevalence rates are lower in low- and lower middle-income countries than in upper middle- and high-income countries.[1] However, this may reflect different approaches to measuring and defining disability within and between individual countries and also different age distributions in the countries.[3-5] Surveys conducted in developing countries tend to focus on impairments. In developed countries, the focus is often on broader areas of participation and the need for services.[1] There is clearly a need to improve comparability between countries and studies, but in order to do this it is necessary to achieve consistency in definition and measurement.

The term disability is often used to refer to difficulties undertaking everyday tasks. Specific functional characterizations related to the activities of daily living are beneficial for many purposes (e.g., assessing eligibility for specific benefits or interventions). However, as a construct, disability spans many health conditions encompassing capacity limitations in physical, mental, and social functioning.[6] Disability is increasingly becoming a major public health issue, but before effective policy responses can be formulated, it is necessary to achieve clarification and agreement on definition and measurement.[7]

Consistent with the WHO and World Bank World Report on Disability,[1] we applied the International Classification of Functioning,

Objectives. We compared national prevalence and wealth-related inequality in disability across a large number of countries from all income groups.

Methods. Data on 218 737 respondents participating in the World Health Survey 2002–2004 were analyzed. A composite disability score (0–100) identified respondents who experienced significant disability in physical, mental, and social functioning irrespective of their underlying health condition. Disabled persons had disability composite scores above 40. Wealth was evaluated using an index of economic status in households based on ownership of selected assets. Socioeconomic inequalities were measured using the slope index of inequality and the relative index of inequality.

Results. Median age-standardized disability prevalence was higher in the low- and lower middle-income countries. In all the study countries, disability was more prevalent in the poorest than in the richest wealth quintiles. Pro-rich inequality was statistically significant in 43 of 49 countries, with disability prevalence higher among populations with lower wealth. Median relative inequality was higher in the high- and upper middle-income countries.

Conclusions. Integrating equity components into the monitoring of disability trends would help ensure that interventions reach and benefit populations with greatest need. (*Am J Public Health.* 2013;103:1278–1286. doi:10.2105/AJPH.2012.301115)

Disability and Health (ICF)[8] framework. Disability included limitations in functioning that result from interactions between the individual's health condition (e.g., diseases, injuries, and disorders) and environmental factors. We focused on measuring decrements in functioning that could be experienced by individuals in their body functions or capacities to carry out a set of activities not necessarily linked to their underlying health condition.[9]

Many authors have referred to specific domains of disability, aspects of functional status (e.g., mobility, blindness, or deafness), or specific population subgroups (e.g., institutionalized populations or older age groups) in the disability literature. In this study, disability refers to any decrement in functioning in a chosen set of domains, irrespective of health condition. Individuals with arthritis, heart disease, diabetes, or depression could experience decrements in functioning, as well as those who are deaf, blind, or paralyzed.

Persons with disability experience worse socioeconomic outcomes than persons without disability. Disability correlates with disadvantage, but causation is multidirectional.[1] Disability can lead to socioeconomic disadvantage and vice versa. There is country-level evidence of correlation between disability and various indicators of socioeconomic status (SES) such as education, income, and housing.[10-12] Given the rapid aging of the world's populations, extending knowledge of the social and economic determinants of disability is timely. Developing policies and interventions to target the determinants of these inequalities requires urgent policy attention at national and international levels. Building upon the World Report on Disability,[1] we examined how disability prevalence is distributed within country-specific adult populations in accordance with a standardized wealth index of SES.

Most previous studies were conducted in higher income countries.[13-16] This work

advances international understanding of socioeconomic inequality in disability because the analysis covered household survey data collected from a large number of countries at varying income levels.

Although the World Report on Disability[1] used the ICF definition, the Report did not detail how disability prevalence was distributed within country-specific adult populations in accordance with SES. We aimed to measure and compare national prevalence and wealth-related inequality in disability among adults, aged 18 years and older, across a large number of countries from all income groups using a comparable data set and measurement method.

METHODS

The World Health Survey (WHS) was conducted by the WHO in 2002–2004 to provide comparable population data on the health status and its determinants of adults, aged 18 years and older, in 70 countries from all regions of the world.[17] All samples were probabilistically selected with every individual being assigned a known nonzero probability of being selected. The samples were nationally representative, except in China, Comoros, Congo, Côte d'Ivoire, India, and the Russian Federation, where the WHS was carried out in geographically limited regions. To adjust for the population distribution represented by the United Nations Statistical Division (http://unstats.un.org/unsd/default.htm) and also nonresponse, post-stratification corrections were made to sampling weights.[18]

Data

Of the 70 countries in the WHS, 13 were initially excluded. Of these, 11 did not have data on sampling weights, and 2 had insufficient data to create the household wealth index that was the principle independent variable and measure of SES. Another 8 countries were excluded because data for the variables used in the analyses were missing for more than 25% of respondents in those countries. The data included in these analyses referred to 218 737 male and female respondents (aged 18 years and older) from the 49 included countries.

Thirty-three low- and lower middle-income countries and 16 upper middle- and high-income countries were further combined into lower income and higher income country groups, respectively. "Country income group" referred to the World Bank's development categories for 2003, the year most of the surveys were conducted.[19] Appendix Table A (available as a supplement to the online version of this article at http://www.ajph.org) shows the sample size by country.

Response rates at the household level were more than 70% in all 49 countries, except for Congo (64%), Spain (52%), and Czech Republic (24%). Individual-level response rates were more than 82% (http://www.who.int/healthinfo/survey/en/index.html).

Variables

A disability score was derived using the 16 WHS questions given in Appendix Table B (available as a supplement to the online version of this article at http://www.ajph.org). These questions were grouped into 8 health and functioning domains: vision, mobility, self-care, cognition, interpersonal activities, pain and discomfort, sleep and energy, and affect.[20,21] Participants were asked to rate the amount of difficulty they had experienced in each of the 8 domains in the previous 30 days. The response categories were: no difficulty, mild difficulty, moderate difficulty, severe difficulty, and extreme difficulty. The disability score ranged from 0 to 100, where 100 represented complete disability.

The disability composite score was calculated using item response theory (IRT) based on a partial credit model that is documented elsewhere.[22] The IRT method was developed for the World Report on Disability[1] and allows a parsimonious measurement of the disability construct using a constellation of items covering the 8 health and functioning domains. Technical Appendix C in the Word Report on Disability[1] gives a detailed explanation of how IRT was used to evaluate the composite disability score.

The average of scores from respondents who reported extreme difficulties or total inability in functioning in any of the 8 domains and who reported having been diagnosed with a chronic disease—such as arthritis, angina, asthma, diabetes, or depression—was around 40.[1] Scores at this threshold were typically associated with moderate to severe health for which people sought treatment or received

disability benefits.[1,22,23] Persons defined here as disabled (i.e., with disability composite scores > 40) would be considered to have at least moderate levels of disability equivalent to that identified in other studies, such as the Global Burden of Disease.[1]

A dichotomous hierarchical ordered probit model was used to develop an index of household economic status based on owning selected assets. The premise was that wealthier households were more likely to own a given set of assets. This is documented in other studies.[24–26] Asset-based approaches avoid some of the reporting biases that arise from using self-reported income. The effects of asset ownership and household characteristics on household wealth were simultaneously estimated with the hierarchical error term at the household level. The model produced asset cut-points representing the threshold on the wealth scale above which a household was more likely to own a particular asset. This "asset ladder" was then applied to every household in each survey to produce adjusted estimates of household wealth.

The index of economic status was divided into quintiles of household wealth within each country. Quintile 1 represented the poorest wealth quintile and quintile 5 the richest wealth quintile. An individual's economic status was measured in accordance with these wealth quintiles.

The following variables were included in the analysis as possible confounders: individual's age (measured categorically as 18–29, 30–39, 40–49, 50–59, 60–69, and ≥ 70 years), sex, marital status (married or cohabiting vs never married vs divorced, separated, or widowed), educational level (no education vs incomplete primary vs primary completed vs secondary vs high school completed or above); employment status (not employed vs employed), and area of residence (rural vs urban).

Methods of Analysis

Overall disability prevalence, prevalence by household wealth quintile, and crude and age- and sex-standardized[27] prevalence estimates were calculated for each country. Absolute and relative socioeconomic inequalities in disability were measured using the Slope Index of Inequality (SII) and the Relative Index of Inequality (RII).

The SII is defined as the absolute difference in the disability prevalence between the poorest and the richest, taking into account all other individuals in the regression. The SII can be either positive or negative. If, for example, the SII is +20, this means that disability is 20% points higher among the poorest compared with the richest, taking into account all other individuals in the regression.[28] The RII is defined as the ratio of the estimated prevalence of disability between the poorest and the richest, taking into account all other individuals in the regression. If, for example, the RII is 1.60, the estimated prevalence of disability in the poorest individuals is 1.6 times that in the richest.[28]

An SII value greater than zero and an RII value greater than 1 indicated that disability prevalence was higher among populations with lower wealth. We referred to this situation as pro-rich inequality, meaning that the inequalities favored the rich (i.e., in this case, the rich experienced less disability than the poor). Conversely, pro-poor inequality in disability meant that the inequality favored the poor (i.e., disability prevalence was lower among populations with lower wealth).[29] In addition to reporting crude SII and RII, adjustments are reported here in 2 stages: first, only for the individual's age, and second, for age, sex, marital status, education, employment, and place of residence.

A Poisson regression model with a robust variance was used to assess the association between disability and wealth and to generate the SII and RII values and 95% confidence intervals (CIs). We used the robust variance option to give an unbiased standard error because it provides more accurate estimates compared with a logit model, when the outcome has a high prevalence. One disadvantage of binary regression is it does not always provide convergent iterations, and manual setting up of the starting value may be time consuming and inefficient.[30–32]

All analyses were weighted to account for the individual country survey sample designs, and allowances were made for nonindependence within country clusters. Sampling weights were applied using the "survey" command in Stata version 11 (StataCorp, College Station, TX). A Taylor series linearization

method was used to provide robust standard errors. Detailed information on WHS sampling methods and weights is given at http://www.who.int/healthinfo/survey/en/index.html. Stata version 11 was used in all analyses.

RESULTS

Median age-standardized disability prevalence was higher in the low- and lower middle-income countries. In all the study countries, disability was more prevalent in the poorest than in the richest wealth quintiles. Pro-rich inequality was statistically significant in most of the countries. Relative inequalities, on average, were higher in the higher income country group.

Disability Prevalence by Country

Table 1 shows the overall crude prevalence of disability among adults (aged 18 years and older), as well as by household wealth quintile for each of the 49 countries. Persons were identified as having disability if their disability composite score was 40 or above. The age- and sex-standardized prevalence rates are included in Appendix Table C (available as a supplement to the online version of this article at http://www.ajph.org).

The prevalence of disability varied widely across countries (median of 13.3% and interquartile range of 9.7%). The lowest prevalence was in Malaysia, followed by Ireland, Vietnam, and Myanmar (in ascending order), where fewer than 5% of adults were disabled. The highest disability prevalence was in the Russian Federation, followed by Bangladesh, Morocco, and the Philippines (in ascending order), where greater than 25% of adults were disabled. The median of disability prevalence was higher in the lower income country group (15.1%; 95% CI = 13.7%, 18.8%) than in the higher income country group (10.8%; 95% CI = 6.5%, 13.4%) after standardizing for age and sex (Appendix Table C).

Disability Prevalence by Within-Country Wealth Status

Table 1 shows a large variation in disability within countries with respect to wealth. Disability was more prevalent in the poorest wealth quintile than in the richest in all the study countries, and for most countries, there

was a descending gradient of disability prevalence, moving from the poorest to the richest wealth quintile.

At least 1 of 5 adults belonging to the poorest wealth quintile was disabled in half of the countries. In the Russian Federation, Croatia, Portugal, Latvia, Congo, Spain, Morocco, Philippines, Georgia, and South Africa, at least 1 of 3 adults in the poorest wealth quintile was disabled.

Within-Country Absolute Inequality

Table 2 shows a positive SII in all countries indicating pro-rich inequality (i.e., a higher prevalence of disability in the poor). The SII was statistically significant in 43 countries. Almost half of these countries, most of which were higher-income, showed an SII of 20 percentage points or more, meaning that the absolute difference in disability across the entire distribution of wealth in each of these countries was at least 20 percentage points.

The inequality seen in Ireland, Burkina Faso, Pakistan, Dominican Republic, United Arab Emirates, and Lao People's Democratic Republic was not statistically significant but showed the same direction in the gradient. Although adjusting for age and other confounders attenuated the magnitude of inequality, the SII remained statistically significant in 26 countries.

Within-Country Relative Inequality

The RII was greater than 1 in all the countries, 43 of which showed a statistically significant pro-rich inequality (Figure 1 and Table 2). Disability prevalence was more than twice as high among the poorest compared with the richest adults in 36 countries in which there was also statistically significant inequality. Spain, Portugal, Estonia, and Malaysia showed the highest relative inequality.

The relative inequalities, on average, were higher in the higher income country group as shown in Figure 1. This is reflected in the fact that the median RII in the higher income group was 5.76, and the median RII in the lower income group was 2.44. Although the inequality attenuated after adjusting for age and other confounders, it remained statistically significant in 26 countries.

TABLE 1—Crude Prevalence of Disability Among Adults Aged 18 Years or Older, by Household Wealth Quintile: World Health Survey, 2002–2004

Country	Overall, Prevalence (SE)	Q1, Prevalence (SE)	Q2, Prevalence (SE)	Q3, Prevalence (SE)	Q4, Prevalence (SE)	Q5, Prevalence (SE)
Low-income countries						
Bangladesh	25.8 (1.2)	33.4 (2.2)	29.9 (2.2)	27.8 (1.9)	22.8 (1.9)	16.0 (1.5)
Burkina Faso	9.7 (0.9)	9.7 (1.7)	11.1 (1.7)	8.4 (1.1)	10.5 (1.7)	8.2 (1.2)
Chad	16.7 (1.1)	26.5 (2.6)	19.1 (1.7)	15.4 (1.9)	15.2 (1.7)	11.2 (1.4)
Congo	24.2 (3.7)	37.5 (10.3)	32.4 (4.8)	28.8 (5.6)	18.7 (4.5)	14.4 (4.1)
Cote d'Ivoire	13.3 (1.1)	13.4 (1.9)	17.1 (2.0)	16.5 (2.1)	12.5 (1.5)	9.6 (2.0)
Ethiopia	14.3 (0.9)	17.8 (1.7)	17.7 (1.6)	18.2 (1.5)	11.8 (1.3)	7.5 (1.3)
Ghana	8.8 (0.6)	11.3 (1.2)	10.9 (1.3)	10.0 (1.3)	8.1 (1.2)	6.0 (1.0)
India	22.1 (1.1)	28.4 (1.8)	24.2 (2.0)	20.8 (1.5)	20.5 (1.4)	16.3 (1.6)
Kenya	8.5 (0.8)	13.4 (1.9)	13.7 (2.0)	8.3 (1.3)	5.1 (1.1)	6.9 (1.9)
Lao People's Democratic Republic	5.3 (0.5)	6.1 (1.6)	6.1 (1.1)	5.8 (1.0)	4.0 (0.8)	4.6 (1.0)
Malawi	10.9 (1.1)	13.8 (1.7)	12.7 (1.8)	10.8 (1.3)	7.8 (1.2)	9.1 (1.7)
Mauritania	20.0 (1.4)	24.4 (2.9)	27.3 (3.6)	23.2 (2.8)	20.9 (2.1)	13.6 (1.7)
Myanmar	4.8 (0.5)	6.2 (1.1)	6.1 (0.9)	4.7 (0.8)	3.1 (0.6)	4.3 (0.7)
Nepal	17.1 (0.8)	23.2 (2.1)	18.1 (1.4)	17.6 (1.3)	16.6 (1.3)	12.3 (1.0)
Pakistan	10.4 (0.8)	10.4 (1.5)	10.7 (1.3)	10.8 (1.4)	11.5 (1.6)	8.1 (1.2)
Vietnam	4.6 (0.7)	8.5 (1.9)	5.4 (1.1)	6.1 (1.4)	2.0 (0.7)	2.6 (0.8)
Zambia	11.1 (1.0)	17.5 (2.0)	12.4 (1.7)	12.2 (1.9)	9.0 (1.6)	4.7 (1.0)
Zimbabwe	12.0 (0.9)	13.8 (1.8)	16.5 (1.9)	13.8 (1.7)	10.5 (1.4)	7.8 (1.2)
Lower middle-income countries						
Bosnia and Herzegovina	16.2 (1.9)	29.0 (4.4)	18.5 (3.6)	16.9 (4.2)	13.3 (3.1)	9.4 (2.9)
China	6.8 (1.1)	13.1 (2.9)	7.9 (1.0)	7.5 (1.8)	5.6 (1.5)	1.6 (0.6)
Dominican Republic	9.2 (0.7)	9.6 (1.6)	10.2 (1.5)	8.1 (1.4)	9.5 (1.6)	9.1 (1.3)
Ecuador	11.0 (0.8)	16.4 (2.0)	9.9 (1.4)	11.0 (1.9)	9.2 (1.4)	8.0 (1.1)
Georgia	18.8 (1.3)	33.5 (2.9)	21.7 (2.6)	17.5 (2.4)	16.8 (2.3)	11.4 (1.3)
Kazakhstan	13.3 (1.4)	16.5 (2.2)	13.5 (2.1)	16.6 (4.1)	14.9 (2.5)	5.9 (1.4)
Morocco	25.7 (1.2)	36.3 (2.4)	23.4 (2.9)	23.1 (2.2)	26.7 (2.8)	22.0 (2.1)
Namibia	18.4 (1.6)	30.5 (2.8)	18.4 (2.2)	19.5 (2.5)	11.8 (1.8)	9.1 (1.8)
Paraguay	8.1 (0.4)	10.9 (1.1)	8.1 (0.9)	8.6 (1.0)	8.9 (1.0)	5.7 (0.8)
Philippines	25.4 (1.4)	33.6 (2.0)	31.3 (2.2)	27.9 (1.9)	21.6 (1.6)	16.6 (1.6)
Russian Federation	28.1 (1.6)	49.0 (2.9)	32.4 (3.0)	27.8 (3.2)	14.7 (1.9)	14.4 (4.1)
South Africa	20.0 (1.8)	33.5 (4.4)	21.2 (2.9)	17.8 (2.7)	15.5 (2.3)	7.4 (2.1)
Sri Lanka	10.4 (0.9)	17.5 (1.9)	14.2 (1.5)	10.6 (1.4)	10.1 (1.3)	6.8 (1.0)
Tunisia	13.5 (0.8)	21.3 (2.1)	15.8 (1.6)	12.8 (1.3)	12.5 (1.3)	7.2 (1.1)
Ukraine	19.0 (1.4)	31.5 (3.4)	21.4 (2.8)	17.2 (2.2)	16.7 (2.5)	11.0 (1.6)
Upper middle-income countries						
Brazil	17.2 (0.7)	21.6 (1.7)	20.6 (1.4)	19.1 (1.5)	14.9 (1.3)	11.5 (1.3)
Croatia	20.4 (1.7)	47.4 (4.7)	27.5 (4.0)	19.4 (3.4)	14.3 (3.0)	8.7 (2.2)
Czech Republic	15.2 (1.7)	29.0 (4.7)	16.6 (4.6)	17.8 (3.6)	7.5 (2.4)	5.2 (2.4)
Estonia	14.5 (1.3)	28.4 (3.4)	22.0 (2.6)	16.2 (2.6)	5.6 (1.5)	1.6 (1.0)
Latvia	22.5 (1.7)	40.7 (4.6)	26.2 (3.8)	25.6 (3.9)	13.5 (2.9)	9.1 (2.1)
Malaysia	3.3 (0.4)	8.4 (1.4)	4.0 (1.0)	2.6 (0.6)	1.7 (0.4)	1.1 (0.4)
Mauritius	11.7 (0.8)	21.5 (2.0)	15.5 (1.6)	10.4 (1.3)	9.4 (1.2)	4.8 (1.0)
Mexico	6.1 (0.2)	6.6 (0.4)	7.0 (0.4)	6.5 (0.4)	6.3 (0.4)	4.4 (0.4)
Uruguay	5.4 (0.5)	10.2 (1.7)	7.3 (1.4)	5.4 (1.1)	4.2 (0.8)	2.4 (0.4)
High-income countries						
Finland	6.4 (0.8)	11.3 (2.3)	6.8 (1.8)	8.7 (2.1)	3.4 (1.3)	2.9 (1.2)

Continued

TABLE 1—Continued

Ireland	4.1 (1.0)	9.1 (2.6)	3.2 (2.0)	2.4 (1.3)	3.5 (1.5)	3.8 (2.6)
Luxembourg	11.1 (1.3)	19.6 (3.6)	16.1 (3.2)	9.2 (2.5)	5.3 (2.0)	4.7 (1.9)
Portugal	14.3 (1.4)	44.6 (4.2)	18.3 (3.3)	10.5 (2.3)	10.0 (2.5)	4.7 (1.5)
Spain	12.8 (0.6)	36.4 (1.8)	19.1 (1.6)	13.3 (1.2)	6.9 (0.9)	3.6 (0.7)
Sweden	17.8 (2.5)	23.6 (4.8)	31.7 (3.8)	20.1 (4.9)	11.6 (3.3)	11.0 (3.2)
United Arab Emirates	5.6 (1.0)	7.9 (3.2)	7.9 (2.2)	6.0 (1.8)	4.3 (1.8)	3.5 (1.2)

Note. Countries were grouped into income groups according to the World Development Report, 2005.[19]

DISCUSSION

This was the first study of its kind to assess wealth-based inequality using a broad, consistent, and rigorous measure of disability, among adults aged 18 years and older, within and between 49 countries from different geographical regions and at varying income levels. The results confirmed that disability was common among both poor and rich countries. The findings showed that age-adjusted disability prevalence was, on average, higher in low- and lower middle-income countries than in upper middle- and high-income countries.

Importantly, we standardized the way in which disability was measured at a multi-country level. Developing countries tended to measure disability through censuses and used tools that focused on a limited set of impairments, thus yielding lower prevalence rates. By contrast, developed countries had better resources with which to conduct population-based surveys. As a consequence, developed countries have mostly used broader measures of disability, which include a range of activity limitations, participation restrictions, and impairments.[1]

The results showed that disability was more common among the poor, and that this pro-rich inequality was present in both lower and higher income countries. This held true for both absolute and relative inequalities in many countries, even after adjusting for age, sex, marital status, educational level, employment status, and area of residence. Relative inequalities were, on average, higher in the higher income country group than the lower income country group. Recent evidence showed a widening of health inequalities in some European countries with generous welfare arrangements.[33,34]

In some high-income countries like Portugal and Spain, although the national disability prevalence (14.3% and 12.8%, respectively) was similar to the median prevalence in all study countries (13.3%), the disability prevalence in the poorest quintile was very high (44.6% for Portugal and 36.4% for Spain). Portugal and Spain were among the countries with the highest prevalence in the poorest quintile. Although Malaysia (an upper middle-income country) had the lowest crude disability prevalence (3.3%), it presented one of highest relative inequalities; disability was nearly 12 times higher among the poorest compared with the richest. Findings such as these were important because they showed how national averages could mask inequalities in the distribution of a health measure within populations. Only upon closer examination it was possible to see patterns within countries. Policymakers need to have disaggregated evidence of this type to develop targeted interventions that address unequal distributions of health and disability.

For this study, the threshold for disability was set at 40, using the WHO composite disability measure, which ranged from 0 to 100. However, WHO also defined a threshold of 50 to estimate the prevalence of persons experiencing very significant difficulties. Severe disability refers to conditions such as quadriplegia, severe depression, or blindness, which represents 2% of the world's population. Education- and wealth-related inequalities were as prominent in those with severe disabilities and in the pooled data set across countries.

Our conceptualization of disability was etiology independent, as derived from the model based on the ICF.[8] We were not looking at diseases as such, but at decrements in functioning independent of causation.

Because chronic diseases (that required treatment by a health professional) were likely to be associated with disability, it was justifiable to use them as indicator conditions to set a meaningful threshold for significant disability. The average scores of respondents diagnosed with a chronic disease and currently receiving treatment– such as arthritis, angina, asthma, diabetes, and depression—were also computed. It was found that the average score for those reporting extreme difficulties in functioning and those reporting chronic diseases, such as arthritis, angina, asthma, diabetes, and depression, was around 40, with a range from 0 (no functioning difficulty) to 100 (complete difficulty). Therefore, 40 was chosen as the threshold point between "disabled" and "not disabled" for all survey respondents. These methods are fully described elsewhere.[1]

For all countries, the prevalence of those reporting "extreme" difficulty as well as "severe" or "extreme" difficulty on 1 or more health domain was calculated. Correlations between these measures and crude disability prevalence were 0.66 and 0.73, respectively, indicating high face validity in the disability measure (Appendix Table D; available as a supplement to the online version of this article at http://www.ajph.org).

There are a number of valuable messages here for policymakers. This definition of disability encompassed a spectrum ranging from moderate to severe disability. This is important because there are many ways of preventing and alleviating moderate (and milder) levels of disability through legislation, policy, capacity building, and technological developments.[1] People with mild and moderate disabilities are often neglected, yet their needs may be met efficiently with relatively low-cost interventions.

TABLE 2—Wealth-Related Inequality in Disability Among Adults Aged 18 Years or Older: World Health Survey, 2002–2004

Country	Absolute Inequality (SII)			Relative Inequality (RII)		
	Crude, Prevalence Difference (95% CI)	Age-Adjusted, Prevalence Difference (95% CI)	Multiple Factors-Adjusted,[a] Prevalence Difference (95% CI)	Crude, Prevalence Ratio (95% CI)	Age-Adjusted, Prevalence Ratio (95% CI)	Multiple Factors-Adjusted,[a] Prevalence Ratio (95% CI)
Low-income countries						
Bangladesh*	21.0 (15.9, 26.0)	17.7 (12.8, 22.6)	12.8 (7.8, 17.9)	2.26 (1.87, 2.72)	2.00 (1.67, 2.39)	1.66 (1.35, 2.03)
Burkina Faso	0.9 (–3.5, 5.3)	–0.8 (–4.8, 3.2)	0.0 (–4.5, 4.6)	1.10 (0.70, 1.72)	0.92 (0.61, 1.40)	1.00 (0.63, 1.61)
Chad	16.8 (10.6, 22.9)	9.9 (3.9, 15.8)	46.7 (–0.2, 13.6)	2.73 (1.89, 3.93)	1.82 (1.27, 2.62)	1.51 (0.99, 2.30)
Congo	28.6 (6.4, 50.8)	27.0 (5.5, 48.4)	18.1 (–1.7, 38.0)	3.26 (1.41, 7.50)	3.06 (1.39, 6.70)	2.16 (0.95, 4.88)
Cote d'Ivoire	7.9 (1.5, 14.2)	3.4 (–2.9, 9.8)	2.8 (–4.2, 9.8)	1.80 (1.09, 2.97)	1.30 (0.79, 2.13)	1.24 (0.72, 2.12)
Ethiopia*	13.6 (8.8, 18.5)	12.2 (7.3, 17.2)	11.7 (5.9, 17.5)	2.59 (1.85, 3.62)	2.37 (1.68, 3.34)	2.28 (1.56, 3.34)
Ghana	6.9 (3.2, 10.6)	4.8 (1.5, 8.0)	3.8 (–0.2, 7.7)	2.19 (1.43, 3.34)	1.73 (1.18, 2.53)	1.54 (0.97, 2.45)
India*	12.6 (6.9, 18.4)	14.2 (9.0, 19.4)	10.4 (5.1, 15.7)	1.77 (1.39, 2.25)	1.89 (1.52, 2.35)	1.60 (1.27, 2.03)
Kenya*	10.5 (5.1, 15.9)	7.3 (2.8, 11.8)	4.7 (0.6, 8.8)	3.45 (1.79, 6.63)	2.41 (1.35, 4.32)	1.77 (1.06, 2.97)
Lao People's Democratic Republic	2.3 (–1.8, 6.3)	4.5 (0.1, 9.1)	4.4 (–0.4, 9.3)	1.53 (0.73, 3.21)	2.29 (1.06, 4.96)	2.26 (1.00, 5.08)
Malawi	7.4 (1.9, 12.8)	5.8 (0.5, 11.2)	3.0 (–3.5, 9.5)	1.96 (1.23, 3.14)	1.72 (1.06, 2.77)	1.32 (0.73, 2.40)
Mauritania*	17.9 (9.6, 26.1)	13.4 (5.1, 21.6)	9.5 (0.0, 19.0)	2.44 (1.63, 3.66)	1.97 (1.31, 2.97)	1.62 (1.01, 2.61)
Myanmar*	3.1 (0.4, 5.9)	3.6 (1.0, 6.3)	3.6 (0.6, 6.5)	1.93 (1.09, 3.42)	2.14 (1.24, 3.69)	2.12 (1.20, 3.74)
Nepal*	12.2 (7.2, 17.2)	10.1 (5.5, 14.7)	7.5 (2.9, 12.0)	2.04 (1.56, 2.68)	1.81 (1.40, 2.34)	1.55 (1.20, 2.01)
Pakistan	1.0 (3.4, 5.5)	1.2 (–3.2, 5.7)	0.1 (–5.9, 6.1)	1.10 (0.72, 1.69)	1.13 (0.73, 1.73)	1.01 (0.57, 1.79)
Vietnam*	7.5 (2.8, 12.2)	8.5 (3.4, 13.6)	6.9 (2.2, 11.5)	5.05 (2.07, 12.33)	6.08 (2.44, 15.19)	4.52 (1.79, 11.45)
Zambia	15.9 (10.6, 21.3)	10.8 (5.8, 15.8)	–0.8 (–7.7, 6.1)	4.20 (2.69, 6.57)	2.73 (1.74, 4.29)	0.93 (0.51, 1.71)
Zimbabwe*	10.6 (5.8, 15.4)	9.5 (4.5, 14.4)	8.9 (3.8, 14.0)	2.42 (1.63, 3.59)	2.22 (1.47, 3.34)	2.12 (1.38, 3.25)
Lower middle-income countries						
Bosnia and Herzegovina	22.9 (13.6, 32.2)	10.5 (0.9, 20.0)	9.8 (–1.5, 21.0)	4.10 (2.31, 7.27)	1.96 (1.03, 3.74)	1.88 (0.88, 4.02)
China*	11.7 (5.6, 17.8)	8.6 (3.5, 13.6)	10.4 (4.7, 16.1)	5.65 (2.31, 13.84)	3.77 (1.80, 7.89)	4.87 (2.20, 10.79)
Dominican Republic	1.6 (–2.8, 6.0)	0.5 (–3.7, 4.6)	3.3 (–1.8, 8.5)	1.19 (0.74, 1.92)	1.05 (0.67, 1.65)	1.43 (0.83, 2.48)
Ecuador*	10.4 (5.5, 15.3)	10.7 (6.4, 14.9)	8.1 (3.0, 13.1)	2.59 (1.71, 3.92)	2.63 (1.84, 3.77)	2.10 (1.34, 3.29)
Georgia*	24.2 (16.2, 32.2)	14.1 (8.3, 20.0)	22.1 (15.3, 28.8)	3.62 (2.44, 5.36)	2.17 (1.57, 3.01)	3.26 (2.41, 4.42)
Kazakhstan	11.7 (5.6, 17.7)	9.7 (3.7, 15.6)	7.1 (–0.1, 14.3)	2.41 (1.53, 3.77)	2.09 (1.29, 3.36)	1.72 (0.98, 3.03)
Morocco*	11.1 (3.9, 18.3)	8.7 (2.5, 14.8)	29.3 (14.9, 43.6)	1.54 (1.17, 2.03)	1.40 (1.10, 1.78)	2.94 (1.84, 4.68)
Namibia*	25.4 (18.2, 32.7)	21.0 (14.2, 27.9)	13.5 (6.2, 20.9)	3.97 (2.75, 5.71)	3.20 (2.26, 4.53)	2.14 (1.39, 3.30)
Paraguay	5.2 (2.4, 8.1)	5.5 (2.7, 8.3)	3.0 (–1.0, 7.0)	1.91 (1.33, 2.75)	1.96 (1.37, 2.80)	1.45 (0.88, 2.40)
Philippines*	21.7 (15.8, 27.5)	22.3 (16.5, 28.0)	15.6 (9.1, 22.1)	2.35 (1.86, 2.97)	2.40 (1.91, 3.01)	1.86 (1.45, 2.39)
Russian Federation	47.6 (35.0, 60.3)	12.7 (1.5, 23.9)	4.7 (–6.4, 15.8)	5.44 (3.27, 9.06)	1.60 (1.02, 2.52)	1.19 (0.78, 1.80)
South Africa*	30.3 (18.4, 42.2)	28.6 (17.6, 39.6)	16.6 (5.7, 27.4)	4.53 (2.68, 7.67)	4.20 (2.56, 6.90)	2.38 (1.38, 4.09)
Sri Lanka	11.3 (7.5, 15.2)	10.5 (7.0, 14.0)	4.1 (–0.6, 8.7)	2.96 (2.07, 4.22)	2.75 (1.97, 3.84)	1.49 (0.93, 2.41)
Tunisia*	15.2 (9.9, 20.6)	12.6 (7.8, 17.4)	14.3 (8.1, 20.6)	3.10 (2.12, 4.53)	2.58 (1.82, 3.66)	2.92 (1.88, 4.53)
Ukraine	23.7 (15.5, 31.9)	6.2 (–1.0, 13.3)	2.2 (–4.7, 9.1)	3.48 (2.35, 5.15)	1.40 (0.95, 2.06)	1.13 (0.78, 1.63)
Upper middle-income countries						
Brazil*	13.2 (8.4, 18.0)	14.3 (9.5, 19.0)	8.2 (2.4, 14.0)	2.16 (1.62, 2.86)	2.29 (1.74, 3.01)	1.62 (1.14, 2.31)
Croatia	39.9 (28.3, 51.5)	21.2 (11.5, 30.8)	8.6 (–3.0, 20.3)	7.06 (3.98, 12.55)	3.05 (1.75, .33)	1.56 (0.83, 2.96)
Czech Republic	32.8 (18.3, 47.3)	8.9 (–1.9, 19.7)	–2.1 (–13.4, 9.1)	8.64 (3.76, 19.85)	1.88 (0.84, 4.21)	0.87 (0.43, 1.77)
Estonia*	38.8 (29.5, 48.0)	26.9 (20.9, 32.9)	20.1 (13.7, 26.6)	14.32 (8.02, 25.56)	7.60 (4.90, 1.80)	4.80 (2.75, 8.39)
Latvia*	38.3 (26.1, 50.5)	21.2 (10.4, 32.1)	12.6 (1.6, 23.7)	5.49 (3.38, 8.90)	2.72 (1.64, 4.50)	1.81 (1.06, 3.08)
Malaysia*	8.2 (4.9, 11.4)	7.8 (4.6, 11.0)	7.1 (2.9, 11.3)	11.77 (5.61, 24.68)	10.63 (5.14, 21.99)	9.12 (3.56, 23.42)
Mauritius*	20.2 (15.2, 25.2)	16.5 (12.5, 20.5)	8.7 (5.1, 12.4)	5.60 (3.84, 8.19)	4.25 (3.07, 5.89)	2.21 (1.56, 3.13)
Mexico*	2.9 (1.6, 4.2)	3.6 (2.5, 4.7)	2.7 (1.3, 4.2)	1.61 (1.30, 1.99)	1.80 (1.50, 2.17)	1.57 (1.23, 1.99)

Continued

TABLE 2—Continued

Uruguay*	8.9 (6.2, 11.6)	7.3 (4.4, 10.2)	7.1 (4.1, 10.1)	5.20 (3.84, 7.04)	4.06 (2.84, 5.82)	3.91 (2.53, 6.04)
High-income countries						
Finland	11.5 (5.2, 17.7)	8.0 (1.5, 14.6)	3.0 (−3.0, 9.1)	5.92 (2.45, 14.34)	3.69 (1.34, 10.14)	1.64 (0.59, 4.55)
Ireland	3.8 (−4.7, 12.4)	0.1 (−9.5, 9.8)	−4.2 (−20.2, 11.8)	2.55 (0.26, 4.96)	1.03 (0.10, 11.05)	0.41 (0.03, 6.27)
Luxembourg*	22.0 (11.8, 32.2)	23.2 (11.2, 35.2)	14.3 (4.1, 24.5)	7.19 (3.21, 16.09)	7.79 (3.08, 19.67)	3.91 (1.51, 10.11)
Portugal	39.8 (28.8, 50.9)	14.1 (5.2, 22.9)	8.4 (−5.2, 22.0)	16.02 (7.35, 34.92)	3.07 (1.40, 6.75)	1.91 (0.62, 5.93)
Spain*	35.9 (31.0, 40.8)	15.2 (11.0, 19.4)	9.5 (5.2, 13.9)	16.70 (11.40, 24.46)	3.93 (2.60, 5.94)	2.32 (1.52, 3.55)
Sweden	20.1 (10.7, 29.6)	15.8 (2.9, 28.8)	12.7 (−0.9, 26.2)	3.10 (1.69, 5.67)	2.47 (1.14, 5.33)	2.07 (0.96, 4.49)
United Arab Emirates	5.9 (−2.2, 14.0)	7.2 (−1.2, 15.6)	7.6 (−1.3, 16.5)	2.87 (0.77, 10.62)	3.50 (0.94, 13.07)	3.74 (0.98, 14.30)

Note. CI = confidence interval; RII = relative index of inequality; SII = slope index of inequality. Countries were grouped into income groups according to the World Development Report, 2005.[19]
[a]Adjusted for individual's age, sex, marital status, education, employment status, and place of residence.
*P < .05 after adjustment for multiple factors listed here.

The study showed that disability is an issue of public health policy importance in both rich and poor countries. Inequality in the distribution of disability with a disproportionate share in poorer sections of populations within countries calls for tailored policy responses. The study aligned with the Convention on the Rights of Persons with Disabilities' recommendation for the collection of disaggregated information to accurately conduct needs assessments and implement appropriate measures to improve disability outcomes.[2] Although individual countries would no doubt face different challenges, these results provide an impetus for policy attention and a focus on disability encompassing impairments as well as limitations in activity and participation.

Strengths and Limitations

The study had several strengths. The use of the large WHS data set of 49 countries, which was based on a consistent set of measures, ensured comparability of disability prevalence and inequalities by wealth quintiles. There are numerous databases (including Web sites) and studies of various international and national organizations that have compiled disability statistics, but disability prevalence differences are not easy to explain because these sources do not always provide data that can be compared across or within countries.[1] A major strength of the study was the analysis of comparable national and international disability data.

In much of the literature, disability was discussed in terms of limitations in basic and instrumental daily activities or locomotion function.[35] Our definition of disability was not contingent on having a long-term impairment but derived from difficulties in functioning measured in the last 30 days, irrespective of the underlying health condition or impairment. We measured disability across 8 health domains to give a comparable picture of disability in keeping with current international conceptualizations.[8]

Low- and lower middle-income countries had higher mortality among children, and especially children with severe disabilities, as well as higher adult mortality rates (Appendix Table E; available as a supplement to the online version of this article at http://www.ajph.org). Our findings showed higher disability prevalence in low- and lower middle-income countries in adults aged 18 years and older. We expected, therefore, that the prevalence of disability, as defined here, would be even higher in low- and lower middle-income countries should children and young adults survive to older ages than we estimated in our study.

The use of absolute and relative measures of inequality was a further strength of this work. This study highlighted the marked inequality that existed in the prevalence of disability globally and also showed higher disability prevalence in the poorest population groups in some higher income countries compared with lower-income countries.

The cross-sectional nature of the data meant that it was only possible to extrapolate associations between wealth status and disability. Because the aim was to describe the distribution of disability among populations, the analysis was not limited by the cross-sectional data. However, there is a need for longitudinal evidence to delineate causality between wealth status and disability.

In addition, the study was based on self-reported data, and so incurred the possibility of systematic reporting bias that might affect individual country estimates.[1] Nonetheless, the consistent pattern in the social gradient in disability across a wide range of countries showed the robustness of this association. Future studies should include physical assessment of functioning in multiple domains to minimize reporting bias and validate self-reports.

Another limitation was that the countries in WHS were not probabilistically selected and so were not representative of the world or of countries of similar economic development. Therefore, although the study included a large set of countries, the findings might not reflect the distribution of disability globally. Additionally, there were low response rates (< 70%) for some countries (e.g., Congo, Czech Republic, and Spain). This was attributable to inabilities in locating selected households or because households refused to participate in the WHS.

Conclusions

Using comparable measurement methods and an international data set, this study compared disability prevalence and socioeconomic inequalities in disability among adults, aged 18 years or older, in 49 countries. Age- and
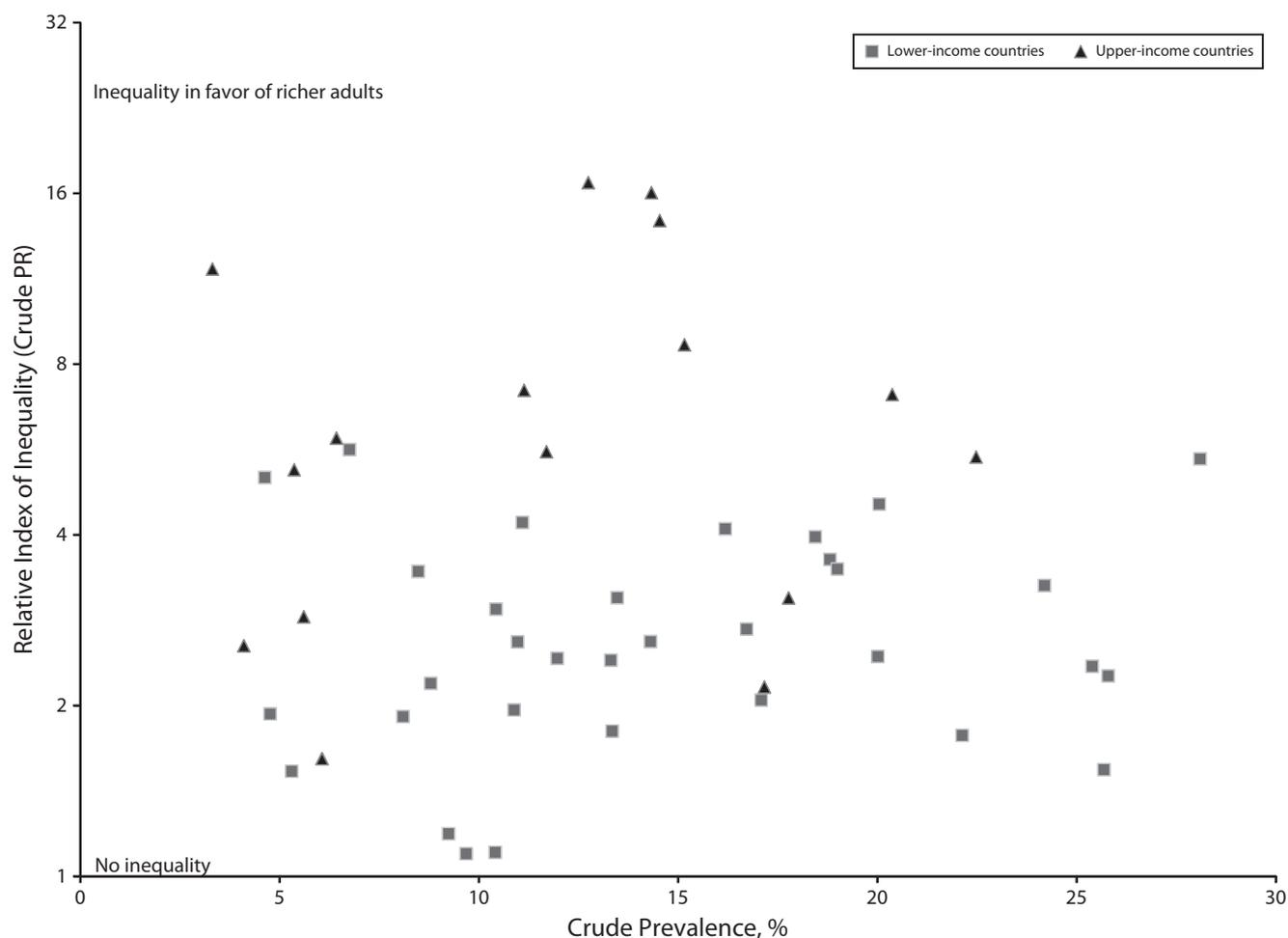
Note. PR = prevalence ratio.

FIGURE 1—Disability among adults aged 18 years or older, average vs wealth-related inequality: data from 49 countries, World Health Survey 2002–2004.

sex-standardized disability prevalence was, on average, higher in low- and lower middle-income countries than in upper middle- and high-income countries. Socioeconomic inequality in disability existed in most of the countries, favoring the richer populations. It is important that, in future, monitoring the extent of disability and related policies leads to improvements in the measurement of disability. It is also necessary to generate data disaggregated by socioeconomic factors so that the impact of policies on disadvantaged individuals can be assessed over time.[36] ∎

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Contributors

A. R. Hosseinpoor designed the study and performed the statistical analysis with input from E. Verdes. J. A. Stewart Williams and J. Gautam undertook the literature review. J. A. Stewart Williams wrote the first draft with input from A. R. Hosseinpoor and S. Chatterji. A. Posarac, A. Officer, and N. Kostanjsek read the draft and provided critical comments. All co-authors read and approved the final draft.

Human Participant Protection

Informed consent was obtained in all surveys. A standard consent form approved by the ethics review committee was read to the respondent in the respondent's language. Once the respondent agreed to participate in the survey, if the respondent was literate, the form was provided to the respondent to read over and sign and was countersigned by the interviewer. If the respondent was illiterate and gave consent to participate, the interviewer confirmed this consent and signed on the form that the respondent had been read the form, had understood the study, and agreed

to participate. This procedure was approved by institutional review boards in the participating countries.

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