Assessment of the age-specific disability weight of chronic schistosomiasis japonica

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Objective To estimate the age-specific disability weight of chronic schistosomiasis japonica in China.
Methods Between October 2004 and January 2005, residents from two schistosome-endemic counties were screened for *Schistosoma japonicum* infection using an enzyme-linked immunosorbent assay. Disability and morbidity were assessed in seropositive individuals using the European quality of life questionnaire with an additional cognitive dimension (known as the "EQ-5D plus") and ultrasonography. The age-specific disability weight of chronic schistosomiasis was estimated based on participants' self-rated health scores on the visual analogue scale of the questionnaire; the relationships between health status, morbidity and disability weight were explored using multilevel regression models.
Findings Of 2843 seropositive individuals, 1419 (49.9%) were classified as having chronic schistosomiasis. Hepatomegaly was found in 76.3% (1082/1419); hepatic fibrosis was found in 73.3% (1040/1419); and splenomegaly was found in 18.6% (264/1419). Diarrhoea was the most common self-reported symptom (46.0%; 653/1419), followed by abdominal pain (32.6%; 463/1419), impaired capacity to work or study (30.7%; 436/1419), and blood in the stool (11.1%; 157/1419). More than half of the respondents reported impairments in at least one dimension of the EQ-5D plus questionnaire, particularly pain or discomfort (47.9%; 675/1410) and anxiety or depression (39.4%; 555/1410). The overall disability weight was 0.191, and age-specific weights ranged from 0.095 among those aged 5–14 years to 0.246 among those aged ⩾ 60 years. Multilevel regression models indicated that the disability weight was significantly associated with the participant's sex, grade of hepatic fibrosis, the presence of hepatomegaly, abdominal pain, blood in the stool, impaired capacity to work or study, and cognition.
Conclusion The disability weight attributable to chronic schistosomiasis japonica is high and increases with age. Our findings call for a reappraisal of the disability weights due to chronic schistosomiasis mansoni and schistosomiasis haematobia as well as a re-estimation of the global burden of schistosomiasis.

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Une traduction en français de ce résumé figure à la fin de l'article. Al final del artículo se facilita una traducción al español. الترجمة العربية لهذه الخلاصة في نهاية النص الكامل لهذه المقالة.

Introduction

Schistosomiasis japonica is caused by the trematode *Schistosoma japonicum*, which is the only human blood fluke that occurs in China. Although significant progress has been made in controlling schistosomiasis in China, the disease remains of considerable public health significance, particularly in lake and marshland regions.[1–3] The other two main human schistosome species are *S. haematobium* and *S. mansoni*.[4] An infection with schistosomes is often followed by acute Katayama fever or nonspecific symptoms. If left untreated, an infection develops into a chronic condition characterized by hepatosplenic disease and impaired physical and cognitive development.[1] The Global Burden of Disease study estimated the burden of schistosomiasis at 1.7 million disability-adjusted life years lost in 2002, mainly as a result of morbidity.[5,6] However, recent reports and a meta-analysis suggest that the global burden of schistosomiasis might be several times higher.[7–9] This discrepancy might be explained by the paucity of community-based data on the distribution and severity of nonfatal health outcomes caused by schistosomiasis and the challenges of estimating schistosome disability weights that are species-specific.

The following observations prompted us to reassess the disability weight of chronic schistosomiasis japonica. First, the age-specific disability weights used in the Global Burden of Disease study were very low, namely 0.005 among those aged < 15 years and 0.006 among those aged ⩾ 15 years. Similar estimates have been attached to, for example, facial vitiligo.[5,9] Second, the same disability weights were assigned for chronic schistosomiasis regardless of the causative agent. However, an infection with *S. japonicum* causes distinct and more severe morbidity than that associated with other species, which is partially explained by the significantly higher egg production capacity of female *S. japonicum* worms.[10] Third, while schistosome infection is the only sequelae of schistosomiasis considered in the Global Burden of Disease study, morbidity may persist long after parasitological cure. Finally, the Global Burden of Disease study did not consider other effects associated with schistosomiasis, such as anaemia, malnutrition, cognitive impairment and growth retardation.

The consequences of chronic schistosomiasis are many and various but are mainly governed by two aspects. First, there is direct morbidity resulting

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from pathological changes and clinical manifestations induced by the deposition of schistosome eggs in tissues and the subsequent inflammatory immune reactions and calcification of dead eggs. This may cause hepatomegaly, splenomegaly, hepatic fibrosis and various other symptoms, including abdominal pain, diarrhoea and blood in the stool. Second, additional morbidity also associated with schistosomiasis (for example, anaemia, growth retardation and cognitive impairment) is nonspecific and thus it may be difficult to tease apart from morbid sequelae caused by other diseases.[9,11] Moreover, it may be difficult to identify chronic cases and to assess people's health status in endemic settings where multiparasitism is the norm rather than the exception.[1,12]

The advent of portable ultrasound devices[13] and progress made with questionnaires for self-reported health (for example, the EuroQol Group's quality of life questionnaire known as EQ-5D)[14,15] offer new avenues for obtaining community-based estimates of the disability weight caused by chronic schistosomiasis. Abdominal ultrasonography allows the direct visualization of pathology in the liver and spleen and facilitates the quantification of disease progression and resolution following treatment.[13,16–18] The EQ-5D questionnaire is a standardized instrument that measures people's health status and their quality of life. In March 2000, a version of the EQ-5D questionnaire authorized by the EuroQol Group was validated in health-related quality of life studies in Beijing.[19] The original questionnaire has been expanded to include a cognitive dimension; this version is known as EQ-5D plus.[20,21] WHO has initiated a data collection strategy for health valuation that pays more attention to the individual notion of health in assessments of the burden of disease.[22,23]

The objective of our study was to estimate the age-specific disability weight of chronic schistosomiasis japonica by measuring health outcomes and overall quality of life among communities in schistosome-endemic settings in China.

Methods

Study area and population

This study was embedded in the third nationwide sampling survey on schistosomiasis, carried out in 2004.[24] All tests and examinations adhered to standardized, quality-controlled procedures that are widely used in China. The sensitivity of the enzyme-linked immunosorbent assay (ELISA) used (Shenzhen Combined Biotech) was 97%.[25] Technical and medical staff (for example, laboratory technicians and ultrasonographers) were well-acquainted with the procedures.

Our study was carried out between October 2004 and January 2005 in two schistosome-endemic counties. Dangtu county is located on the south bank of the Yangtze River in the eastern part of Anhui province. Hanshou county is economically less developed, and is situated in the marshlands of Hunan province's western Dongting Lake region. A 3-km grid sampling technique was used to select villages for inclusion.[26] Within each randomly selected grid cell, a single administrative village was chosen, based on its accessibility and representativeness in terms of schistosomiasis endemicity. Residents aged $\geq$ 5 years were eligible for inclusion.

Questionnaire and diagnostic procedures

Participants who gave written informed consent were tested for schistosome-specific antibodies using an ELISA test.[25] A positive test result indicates that a participant is infected with *S. japonicum* or has a recent history of infection (within the past 2 years).

All seropositive individuals were first interviewed using a standardized and pre-tested questionnaire to obtain information on sociodemographic variables (age, sex, educational attainment and occupation), treatment history, potential contacts with cercariae-infested water during the previous year and self-reported symptoms, using a recall period of 2 weeks. Next, functional outcomes were assessed using the EQ-5D plus questionnaire.[14,15,20,21] This questionnaire obtains data on six dimensions: mobility, self-care, usual activities, pain or discomfort, anxiety or depression, and cognition. The attribute "usual activities" was clarified by mentioning specific areas of interest such as work, study and family or leisure activities. Attributes associated with "cognition" included memory, concentration, coherence and intelligence quotient (IQ). For each dimension, three possible outcomes were considered: no problems, moderate problems and extreme problems. The questionnaire also included a 20-cm visual analogue scale used for self-assessment of general health status. Participants are asked to rate their health on a scale from the best imaginable (100) to the worst imaginable (0).

Subsequently, an abdominal ultrasonographic examination was performed to assess the level and extent of hepatic morbidity and spleen-related morbidity. The ultrasonographic examination was performed on fasting participants (who had had no food 4 hours prior to the examination) positioned horizontally during relaxed inhalation. Pathology was graded according to standardized criteria.[27,28] Hepatic fibrosis was graded from 0 (normal) to grade III (severe damage). Hepatomegaly was defined as a protrusion of the liver of > 3 cm under the xiphoid process or > 0 cm under the right costal margin at the midclavicular line. Splenomegaly was defined as a protrusion of the spleen of > 0 cm under the right subcostal margin at the midclavicular line.

Finally, the diagnosis of chronic schistosomiasis japonica was based on the following criteria: (i) positive serological result, (ii) self-reported contact with potentially schistosome-infested water, and (iii) either schistosomiasis-like hepatic fibrosis of grade II–III as detected by ultrasonography, or no or light hepatic fibrosis (grade 0 or I) with the presence of hepatomegaly or splenomegaly.[27,29] Participants who met these inclusion criteria but had signs of portal hypertension due to hepatic fibrosis such as ascites, megalosplenia or dwarfism (advanced or late-stage schistosomiasis) were excluded. Although participants were not specifically examined for other diseases, those with clinical signs and symptoms clearly attributable to conditions other than schistosomiasis were excluded from further analysis.

Statistical analysis

All data were double-entered and validated using EpiData version 3.0 software. Statistical analyses were performed using SAS software version 8.1. The χ^2 test was used to examine differences between categories, and the Cochran–Mantel–Haenszel χ^2 test was used to explore linear associations between outcome variables and age. The disability weight for each individual was computed based on the self-rated health score on the linear visual analogue scale using the following formula: disability weight = 1 – (score/100); age-specific

mean disability weights were also calculated. Analysis of variance (ANOVA) was used to test the differences in mean disability weights between age groups; the Bonferroni *t*-test was used for comparisons between groups.

In view of the hierarchical nature of the data, two multilevel regression models were developed with individuals assigned to level 1 and villages assigned to level 2.[30,31] Model 1 explored the relationships between the questionnaire results and the disability weight, and model 2 assessed the correlation between schistosome-related morbidity and disability weight. In model 1, predictors included the sociodemographic data and the six dimensions of the questionnaire. In model 2, the independent variables included sociodemographic data, the number of previous antischistosomal treatments, reported symptoms, grade of hepatic fibrosis, and presence of hepatomegaly and splenomegaly. In both models, the county was considered to be a fixed effect. Independent variables showing no statistical significance ($P > 0.05$) were removed by a stepwise backward elimination procedure. Age, occupation, educational attainment and hepatic fibrosis were specified as categorical variables, with a reference category and a set of contrasted dummy variables. The two-level models had the following structure: $y_{ij} = \beta_0 + \sum \beta_k x_{kij} + u_i + e_{ij}$, where y_{ij} is the dependent variable for subject j in village i, β_0 is the intercept, x_{kij} are the fixed variables (predictors), β_k is the regression coefficient of the corresponding x_k, u_i is a random effect representing the variability between villages, e_{ij} is the residual or error resulting in assumed normal distribution with mean 0 and variance 1.[30,31]

Ethical approval and informed consent

The study protocol was approved by the institutional review board of the National Institute of Parasitic Diseases (Shanghai, China), and the WHO Research Ethics Review Committee. The objectives, procedures and potential risks were explained to county and village authorities, who subsequently informed the local population about the procedures. Written informed consent was sought from all participants. Seropositive individuals were treated with praziquantel, free of charge, according to Chinese national guidelines.[27]

Findings

Altogether, 91 villages were randomly selected; 40 in Dangtu county (including 15 villages that are non-endemic for *S. japonicum*) and 51 in Hanshou county (20 non-endemic villages). The estimated population of these villages was 134 385, of whom two-thirds had lived in their home village for at least 6 months in 2004. There were 77 387 people eligible for inclusion (aged ⩾ 5 years), and 59 765 were screened by ELISA; of these, 3405 (5.7%) tested positive. Complete questionnaire and ultrasound data were obtained from 2843 seropositive individuals.

Among those who were seropositive, the most common self-reported signs and symptoms were diarrhoea (30.0%; 853/2843), abdominal pain (23.0%; 655/2843) and blood in the stool (6.9%; 196/2843). Impaired capacity to work or study was mentioned by 18.7% (533/2843). Hepatic fibrosis was found in 57.9% (1646/2843; grade I: 36.7%, 1042/2843; grade II: 20.2%, 574/2843; grade III: 1.1%, 30/2843). The prevalence of hepatomegaly was 38.2% (1085/2843) and splenomegaly was 9.5% (269/2843).

In total, 1419 of the 2843 seropositive individuals (49.9%) met the criteria for chronic schistosomiasis japonica. Table 1 (available at: http://www.who.int/bulletin) shows the number and percentage of self-reported signs and symptoms as well as schistosome-related pathology, stratified by age, among all people with chronic schistosomiasis japonica. The highest proportion of chronic cases was observed among those aged 45 to 59 years, accounting for 43.2% (613/1419) of all chronic cases, whereas the proportion in the youngest age group – those aged 5 to 14 years – was 2.2% (31/1419). There were no statistically significant differences in the prevalence of splenomegaly, reported abdominal pain and reported diarrhoea among the different age groups. The prevalence of impaired capacity to work or study showed a strong increase with age: rising from 6.5% (2/31) among those aged 5 to 14 years to 39.7% (85/214) among those aged ⩾ 60 years. Likewise, the overall prevalence of hepatic fibrosis increased with age: rising from 16.1% (5/31) among those aged 5 to 14 years to 90.2% (193/214) among those aged ⩾ 60 years. While the prevalence of grades II–III fibrosis increased with age, the rate of grade I fibrosis reached its peak among participants aged 15 to 44 years. Grade III lesions were found only in participants aged ⩾ 15 years. An inverse association with age was found for hepatomegaly; the prevalence declined from 90.3% (28/31) among those aged 5 to 14 years to 63.6% (136/214) among those aged ⩾ 60 years.

The results obtained through the EQ-5D plus questionnaire are summarized in Tables 2 and 3. More than half of all participants with chronic schistosomiasis japonica reported impairments (moderate impairment was reported by 50.0%, 705/1410; extreme impairment by 5.8%, 82/1410), with the highest prevalence in the pain or discomfort dimension (47.9%, 675/1410) and the anxiety or depression dimension (39.4%, 555/1410). Impaired cognition and usual activities are typical sequelae of chronic schistosomiasis; impairments in cognition were articulated by 20.2% (285/1410) of the participants and

Table 2. **Number (%) of participants (n = 1410) with chronic schistosomiasis japonica who reported no, moderate or extreme problems on the EuroQol EQ-5D questionnaire with an additional cognitive dimension, stratified by the six dimensions, in two counties in China, October 2004–January 2005**[a]

Dimension	Degree of health problem			Any problem
	None	Moderate	Extreme	
Mobility	1374 (97.5)	35 (2.5)	1 (0.1)	36 (2.6)
Self-care	1360 (96.5)	47 (3.3)	3 (0.2)	50 (3.6)
Usual activities	1203 (85.3)	203 (14.4)	4 (0.3)	207 (14.7)
Pain or discomfort	735 (52.1)	655 (46.5)	20 (1.4)	675 (47.9)
Anxiety or depression	855 (60.6)	505 (35.8)	50 (3.6)	555 (39.4)
Cognition	1125 (79.8)	243 (17.2)	42 (3.0)	285 (20.2)
Any dimension	623 (44.2)	705 (50.0)	82 (5.8)	787 (55.8)

[a] Questionnaire data were missing for 9 participants.

Table 3. **Number (%) of participants with chronic schistosomiasis japonica reporting moderate or extreme problems on the EuroQol EQ-5D questionnaire with an additional cognitive dimension, stratified by age, in two counties in China, October 2004–January 2005**

Age group (years)	No. of cases	Dimension						
		Mobility[a]	Self-care[a]	Usual activities[a]	Pain or discomfort[a]	Anxiety or depression[a]	Cognition[a]	Any dimension[b]
5–14	31	0 (0.0)	0 (0.0)	0 (0.0)	5 (16.1)	2 (6.5)	2 (6.5)	6 (19.4)
15–44	558	3 (0.5)	6 (1.1)	46 (8.2)	237 (42.5)	182 (32.6)	64 (11.5)	300 (53.8)
45–59	611	20 (3.3)	25 (4.1)	99 (16.2)	324 (53.0)	271 (44.4)	150 (24.6)	363 (59.4)
⩾ 60	210	13 (6.2)	19 (9.1)	62 (29.5)	109 (51.9)	100 (47.6)	69 (32.9)	118 (56.2)
Total	1410	36 (2.6)	50 (3.6)	207 (14.7)	675 (47.9)	555 (39.4)	285 (20.2)	787 (55.8)

[a] Significant difference between age groups for general association ($P < 0.001$) and a linear association between health outcome and age ($P < 0.001$).
[b] Significant difference between age groups for general association ($P < 0.001$) and a linear association between health outcome and age ($P < 0.05$).

impairments in ability to perform usual activities were acknowledged by 14.7% (207/1410). Impaired mobility was reported by only 2.6% (36/1410) of the population sample. Stratification of the questionnaire results by age and probing with the Cochran–Mantel–Haenszel χ^2 test revealed a significant linear association between age and each of the six dimensions ($P < 0.001$). Usually, the highest level of impairment was found in participants aged ⩾ 60 years. The youngest participants reported no impairment with regard to mobility, self-care and usual activities.

The mean disability weight of chronic schistosomiasis japonica was computed after 43 participants were excluded because they had been diagnosed with additional conditions. The overall disability weight was 0.191, and the age-specific values were 0.095 for those aged 5 to 14 years, 0.159 for those aged 15 to 44 years, 0.207 for those aged 45 to 59 years and 0.246 for those aged ⩾ 60 years. The difference between the age-specific disability weights was highly significant (ANOVA $F = 61.1$, $P < 0.001$). All pair-wise comparisons among age groups showed statistical significance at a level of 5% (Table 4).

Results obtained from the two multilevel models revealed highly significant covariation for disability weights across villages ($P < 0.001$); this implies clustering and variation in the degree of disability at the community level. The fixed effect of the county had no statistical significance ($P > 0.05$). At the individual level, the disability weight for males was significantly lower than that for females ($P < 0.01$). There was no significant difference with regard to educational attainment, except among the oldest age group in model 2.

The fixed and random parameter estimates are summarized in Tables 5 and 6 (available at: http://www.who.int/bulletin). In model 1, the dimensions of mobility and self-care were removed ($P > 0.05$). The remaining four dimensions of the questionnaire were all positively associated with the disability weight ($P < 0.001$). The highest disability weights were found among farmers, fishermen and boatmen. In model 2, splenomegaly and the number of previous antischistosomal treatments failed to predict the disability weight, and hence were removed from the analysis. The disability weight was significantly associated with abdominal pain, diarrhoea, blood in the stool, impaired capacity for work or study, hepatomegaly and hepatic fibrosis ($P < 0.05$). Grades II–III hepatic fibrosis, impaired capacity for work or study, hepatomegaly and blood in the stool accounted for most of the variation in the disability weight.

Discussion

The national schistosomiasis control programme in China, launched in the mid-1950s, is considered one of the greatest public health achievements in the country.[1–3] However, the distribution and severity of schistosome-related morbidity at the community level remain to be fully understood. We attempted to assess the age-specific disability weight of chronic schistosomiasis japonica using a combination of tools, both objective (pathology assessed by ultrasonography) and subjective (self-reported signs and symptoms and quality of life assessed by questionnaire), in a community-based study.

Table 4. **Calculated mean disability weights for chronic schistosomiasis japonica, stratified by age, in two counties in China, October 2004–January 2005**

Age group (years)	No. of cases ($n = 1369$)[a]	Mean disability weight score[b]	Standard deviation	95% confidence interval	Minimum score (No. of cases)	Maximum score (No. of cases)
5–14	31	0.095[c]	0.052	0.076–0.115	0.00 (1)	0.20 (3)
15–44	556	0.159[c]	0.089	0.152–0.167	0.00 (3)	0.50 (2)
45–59	587	0.207[c]	0.088	0.200–0.214	0.05 (17)	0.50 (1)
⩾ 60	195	0.246[c]	0.120	0.229–0.263	0.05 (4)	0.99 (1)
All	1369	0.191	0.099	0.185–0.196	0 (4)	0.99 (1)

[a] A total of 50 participants were excluded: they were diagnosed with other diseases ($n = 43$) or had incomplete questionnaire data ($n = 7$).
[b] Analysis of variance was performed for mean scores ($P < 0.0001$).
[c] Bonferroni *t*-test was performed for comparisons between age groups; a significant difference was found among different age groups at the 5% significance level.

A fundamental issue in the study of schistosomiasis is that infection and morbidity are not one and the same. The morbidity is the result of immunological reaction against parasite eggs that are trapped in the tissues of the human host. Detection of *S. japonicum* eggs in stool samples remains the gold standard for diagnosis, thus putting the emphasis on infection.[1,3] This approach, however, lacks sensitivity in areas where multiple rounds of mass drug administration have been implemented.[3,32,33] On the other hand, estimates of disease burden and also control programmes make reference to actual morbidity.[7,34,35] The development of inexpensive serological tests with a high sensitivity has facilitated large-scale screening for schistosomiasis,[33] and abdominal ultrasonography provides a convenient means for assessing hepatosplenic pathology and measuring disease progression. Hepatic fibrosis, especially grade II and grade III, is a sound marker for chronic schistosomiasis japonica.[36,37] In this study, seropositive individuals with a history of recent contact with cercariae-infested water were examined by ultrasonography, and those with typical pathological features were defined as cases with chronic schistosomiasis. Cases concurrently diagnosed with other diseases (for example, hepatitis B and C) were excluded to avoid confounding when estimating the disability weight attributable to chronic schistosomiasis japonica.

Self-reports of abdominal pain, diarrhoea and blood in the stool showed promise for use in rapid diagnosis of *S. japonicum* infection in preceding questionnaire-based surveys.[38,39] We found that the number of chronic cases and the prevalence of reported symptoms were low in the youngest age group (5 to 14 years). In general, the prevalence of self-reported signs and symptoms increased with age. Similarly, the level and extent of hepatic fibrosis increased with age, but it lagged behind that of self-reported signs and symptoms. These observations mirror the chronic nature of schistosomiasis and emphasize the importance of preventing reinfection and providing antifibrosis treatment after parasitological cure and the subsequent regression of other conditions, such as hepatomegaly.[40,41] Comparisons of questionnaire results between different age groups revealed that older people (aged ⩾ 45 years) rated their quality of life as considerably poorer than their younger counterparts (those aged < 45 years). This finding corroborates the notion that older people suffer disproportionately from chronic schistosomiasis but other psychosocial factors may also play a role.

The age-specific disability weight of chronic schistosomiasis japonica rose from 0.095 in children aged 5 to 14 years to 0.246 in the oldest age group. To our knowledge, this is the first attempt to estimate the age-specific disability weights of this disease within a community-based study. The resulting values are several times higher than the weights put forward in the Global Burden of Disease study for quantifying the global burden of schistosomiasis (that is, 0.005 to 0.006). However, the latter estimates are weighted averages of all possible nonfatal health outcomes associated with a schistosome infection regardless of the species and the duration and intensity of infection, and they are based on expert opinion. Our results are closer to findings from a meta-analysis that reported disability weights of 0.02 to 0.15.[9] In addition, our findings are in agreement with a report by Finkelstein and colleagues.[42] Using a decision-tree model they found an overall disability weight of 0.130 for chronic schistosomiasis japonica, with age-specific disability weights of 0.098 for those aged < 15 years and 0.198 for those aged ⩾ 15 years.

The multilevel regression models indicate that disability weights are significantly associated with schistosome-related morbidity, such as hepatic fibrosis and hepatomegaly, as well as self-reported abdominal pain, blood in the stool, impairments in the capacity to work or study and in cognition.[9] We found a strong heterogeneity across villages but no significant difference between the two counties. Therefore, it appears that ecological conditions govern the epidemiology of schistosomiasis at the village level and lead to clustering of disease and disability, annihilating the effects of socioeconomic conditions, which are generally thought to be an important determinant of health.[5,19,43] At the individual level, age showed a positive linear association with the estimated disability weight and with many of the self-reported signs and symptoms and pathology in the univariate analysis. However, age seemed to play a less important part in the multilevel models. Thus, age was rather a confounder since it was associated both with disability and several of the health outcomes.[44,45] Interestingly, the disability weight differed by sex. There is a need to study the root causes of this gender difference. We speculate that there are risk factors, adaptation mechanisms and coping strategies that are gender-specific.[22,23] Farmers tended to have an elevated disability weight, which is probably due to occupation-specific risk factors.

There are at least three shortcomings of this investigation. First, because our disability estimates excluded the effects of some morbid sequelae associated with schistosomiasis (for example, anaemia and malnutrition), our disability weights are likely to yield underestimates of the true burden posed by this disease. Second, it is conceivable that some participants suffered from co-morbidity that remained undiscovered by our diagnostic approach. Third, the general health condition of people is likely to deteriorate as they age. However, we are confident that the combined effects of these limitations are rather small and, hence, the methods and calculations used resulted in reliable estimates of the age-specific disability weight of chronic schistosomiasis japonica.

The disability weight of chronic schistosomiasis japonica is considerably higher than previously estimated. Our results contribute to the further strengthening of the evidence-base of the true health impact of chronic schistosomiasis. There is a pressing need to recalculate the species-specific disability weight of chronic schistosome infections, which in turn will lead to a more accurate estimate of the global burden of this neglected tropical disease.[46] This knowledge may guide a more rational and cost-effective allocation of resources for controlling schistosomiasis.[3,8,9] ■

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Résumé

Evaluation du poids dans l'incapacité par âge de la schistosomiase sino-japonaise chronique

Objectif Estimer le poids dans l'incapacité par âge de la schistosomiase sino-japonaise chronique.

Méthodes Entre octobre 2004 et janvier 2005, des habitants de deux pays d'endémie de la schistosomiase ont été soumis à un dépistage de l'infection à *Schistosoma japonicum* à l'aide d'un test immunoenzymatique. L'incapacité et la morbidité ont été évaluées chez les individus séropositifs par l'application du questionnaire européen d'évaluation de la qualité de vie, avec détermination d'une dimension cognitive supplémentaire (connu sous l'appellation « EQ-5D plus »), suivie d'une échographie. Le poids dans l'incapacité par âge de la schistosomiase chronique a été estimé à partir des scores d'autoévaluation par les participants de leur état de santé sur l'échelle visuelle analogique du questionnaire. Les relations entre état de santé, morbidité et poids de l'incapacité ont été étudiées au moyen de modèles de régression multiniveaux.

Résultats Parmi 2843 individus séropositifs pour la schistosomiase sino-japonaise, 1419 (49,9 %) ont été classés comme atteints d'une schistosomiase chronique. On a relevé une hépatomégalie chez 76,3 % (1082/1419) de ces malades chroniques, une fibrose hépatique chez 73,3 % d'entre eux (1040/1419) et une splénomégalie chez 18,6 % (264/1419) d'entre eux. La diarrhée était le symptôme le plus couramment auto-rapporté (653cas /1419, soit 46,0 % des cas). Suivaient, par ordre de fréquence, des douleurs abdominales (463 cas/1419, soit 32,6 % des cas), une diminution de la capacité de travail ou d'étude (436 cas/1419, soit 30,7 % des cas) et la présence de sang dans les selles (157 cas/1419, soit 11,1 % des cas). Plus de la moitié des personnes interrogées ont signalé des troubles dans l'une au moins des dimensions du questionnaire EQ-5D plus, et notamment une douleur ou une gêne (675 cas/1410, soit 47,9 % des cas) et un état anxieux ou déprimé (555 cas/1410, soit 39,4 % des cas). Le poids global de la maladie dans l'incapacité était de 0,191 et la valeur du poids dans l'incapacité par âge allait de 0,095 pour la tranche d'âges 5-14 ans à 0,246 parmi les plus de 60 ans. En utilisant des modèles de régression multiniveaux, on a pu mettre en évidence des associations statistiquement significatives entre le poids de l'incapacité d'une part et le sexe du participant, le grade de son éventuelle fibrose hépatique et la présence éventuelle d'une hépatomégalie, de douleurs abdominales, de sang dans les selles ou d'une diminution de la capacité de travail ou d'étude et de la capacité cognitive.

Resumen

Evaluación del peso de la discapacidad por edades por esquistosomiasis japonica crónica

Objetivo Estimar el peso de la discapacidad por edades causada por la esquistosomiasis japonica crónica en China.

Métodos Entre octubre de 2004 y enero de 2005, se sometió a cribado mediante una prueba de inmunosorción enzimática a residentes de dos circunscripciones con esquistosoma endémico a fin de detectar los casos de infección por *Schistosoma japonicum*. En las personas seropositivas, se procedió a evaluar la discapacidad y la morbilidad utilizando el cuestionario sobre calidad de vida europeo con una dimensión cognitiva adicional (el llamado «EQ-5D plus») y técnicas de ultrasonografía. El peso de la discapacidad por edades correspondiente a la esquistosomiasis crónica se calculó a partir de las puntuaciones de salud autoasignadas por los participantes en la escala analógica visual del cuestionario; las relaciones entre el estado de salud, la morbilidad y el peso de la discapacidad se analizaron utilizando modelos de regresión multinivel.

Resultados De 2843 personas seropositivas, se diagnosticó esquistosomiasis crónica a 1419 (49,9%). Se halló hepatomegalia en un 76,3% de esos casos (1082/1419); fibrosis hepática en el 73,3% (1040/1419); y esplenomegalia en el 18,6% (264/1419). La diarrea fue el más común de los síntomas declarados espontáneamente (46,0%; 653/1419), seguido del dolor abdominal (32,6%; 463/1419), el deterioro de la capacidad para trabajar o estudiar (30,7%; 436/1419), y la presencia de sangre en las heces (11,1%; 157/1419). Más de la mitad de los encuestados notificaron trastornos al menos en una dimensión del cuestionario EQ-5D plus, en particular dolor o malestar (47,9%; 675/1410) y ansiedad o depresión (39,4%; 555/1410). El peso de discapacidad general fue del 0,191, y los pesos por edades se situaron entre 0,095 para los enfermos de 5 a 14 años y 0,246 para los de 60 años o más. Los modelos de regresión multinivel mostraron que el peso de la discapacidad estaba relacionado de forma significativa con el sexo del participante y con el grado de fibrosis hepática, la presencia de hepatomegalia, el dolor abdominal, la sangre en las heces, el deterioro de la capacidad para trabajar o estudiar y los problemas cognitivos.

Conclusión El peso de la discapacidad atribuible a la esquistosomiasis japonica crónica es alto y aumenta con la edad. Nuestros resultados sugieren que es necesario reevaluar los pesos de la discapacidad por esquistosomiasis mansoni y esquistosomiasis haematobia crónicas, así como la carga mundial de esquistosomiasis.

ملخص

تقيـيم ما لداء البلهارسيات اليابانية المزمن من أهمية في العجز الخاص بكل فئة عمرية

الهدف: تقدير ما لداء البلهارسيات اليابانية المزمن من أهمية في العجز الخاص بكل فئة عمرية في الصين.

الطريقة: استُخْدِمت مقايسة الممتز المناعي المرتبط بالإنزيم (إليزا) لتحري العدوى بالبلهارسيات اليابانية بين مواطني مقاطعتَيْن يتوطَّن فيهما المرض في الفتـرة بين تشرين الأول/أكتوبر 2004 وكانون الثاني/يناير 2005. واستُخْدِم كلٌّ من الاستبيان الأوروبي حول جودة الحياة مع بعدٍ إضافي معرفي يدعى (EQ-50 plus) والتصوير بالأمواج فوق الصوتية لتقيـيم العجز والمراضة في الأفراد الإيجابيـين مصلياً. وقد قدرت أهمية العجز الناجم عن داء البلهارسيات اليابانية المزمن والخاص بكل فئة عمرية بناءً على الأحراز الصحية التي قدَّرها المساهمون في التقيـيم لأنفسهم اعتماداً على سلم قياس بصري مضاهئ في الاستبيان، واستُكْشِفَت العلاقات بين الوضع الصحي وأهمية العجز والمراضة باستخدام نماذج التحوف المتعدد المستويات.

الموجودات: من بين 2843 من الأفراد الإيجابيِّين مصلياً، صُنِّف 1419 منهم (49.9%) بين المصابين بداء البلهارسيات المزمن. وقد كُشِفَ لدى 1082 من بين 1419 منهم (76.3%) ضخامة كبدية ولدى 1040 من بين 1419 منهم (73.3%) تَلَيُّف كبدي، ولدى 264 من بين 1419 منهم (18.6%) ضخامة طحال. أما الإسهال فقد كان أكثر الأعراض التي يبلِّغ عنها المرضى بأنفسهم، إذ لوحظ لدى 653 من بين 1419 (46%)، وتلاه الألم البطني لدى 463 من بين 1419 (32.6%)، وتأثُّر القدرة على العمل أو الدراسة لدى 436 من بين 1419 (30.7%) ووجود الدم في البراز لدى 157 من بين 1419 (11.1%). وقد أبلغ أكثر من نصف المستجيبين للدراسة عن تأثُّرهم في واحد على الأقل من عناصر الاستبيان EQ-50 plus، ولاسيما الألم وعدم الارتياح لدى 675 من بين 1410 (47.9%)، والقلق والاكتئاب لدى 555 من بين 1410 (39.4%). وقد كانت الأهمية الإجمالية للعجز 0.191، فيما تراوحت الأهمية في العجز الخاص بكل فئة عمرية بين 0.095 بين ممن تـتـراوح أعمارهم بين 5-14 عاماً و0.246 بين من تزيد أعمارهم عن 60 عاماً. وتشير نماذج التحوُّف المتعدِّد المستويات إلى أن أهمية العجز قد ترافق وبقدرٍ يُعْتَدُّ به إحصائياً مع جنس المشارِك في الدراسة، ودرجة التليف الكبدي، ووجود ضخامة الكبد، والألم البطني، ووجود الدم في البراز، ونقص القدرة على العمل والدراسة والمعرفة.

الاستنتاج: أهمية العجز الذي يُعْزَى إلى داء البلهارسيات المزمن بالغة ومتزايدة مع تقدُّم العمر. وتستدعي النتائج التي وصلت إليها دراستنا إعادة تقيـيم أهمية العجز الناجم عن داء البلهارسيات المانسونية المزمن وداء البلهارسيات الدموية إلى جانب إعادة تقيـيم العبء العالمي لداء البلهارسيات.

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Table 1. **Number (%) of participants with chronic schistosomiasis japonica with self-reported signs and symptoms, and pathology, stratified by age, in two counties in China, October 2004–January 2005**

Age group (years)	No. of cases	Self-reported signs and symptoms[a]				Pathology					
		Diarrhoea[b]	Abdominal pain[b]	Blood in the stool[c]	Impaired work or study capacity[d]	Hepatomegaly[d]	Splenomegaly[b]	Hepatic fibrosis			
								Grade I	Grade II	Grade III	Total[c]
5–14	31	7 (22.6)	6 (19.4)	3 (9.7)	2 (6.5)	28 (90.3)	7 (22.6)	4 (12.9)	1 (3.2)	0 (0.0)	5 (16.1)
15–44	561	261 (46.5)	171 (30.5)	44 (7.8)	136 (24.2)	468 (83.4)	96 (17.1)	200 (35.7)	141 (25.1)	7 (1.3)	348 (62.0)
45–59	613	287 (46.8)	217 (35.4)	81 (13.2)	213 (34.8)	450 (73.4)	115 (18.8)	182 (29.7)	301 (49.1)	11 (1.8)	494 (80.6)
⩾ 60	214	98 (45.8)	69 (32.2)	29 (13.6)	85 (39.7)	136 (63.6)	46 (21.5)	56 (26.2)	128 (59.8)	9 (4.2)	193 (90.2)
Total	1419	653 (46.0)	463 (32.6)	157 (11.1)	436 (30.7)	1082 (76.3)	264 (18.6)	442 (31.2)	571 (40.2)	27 (1.9)	1040 (73.3)

[a] Recall period for the questionnaire was 2 weeks.
[b] No significant difference between age groups ($P > 0.05$).
[c] Significant difference between age groups for general association ($P < 0.05$) and a linear association between health outcome and age ($P < 0.05$).
[d] Significant difference between age groups for general association ($P < 0.0001$) and a linear association between health outcome and age ($P < 0.0001$).

Table 5. **Results of multilevel regression model 1 exploring the relationship between the disability weight of chronic schistosomiasis japonica and the EuroQol EQ-5D questionnaire with an additional cognitive dimension, in two counties in China, October 2004–January 2005 (n = 1409)**[a]

Parameter	Coefficient	Standard error	*Z* or *t* value[b]	*P* value
Intercept	−0.02926	0.01625	−1.80	0.076
Fixed effects				
Age group (years)[c]				
15–44	−0.02139	0.01718	−1.25	0.216
45–59	0.00331	0.01745	0.19	0.850
⩾ 60	0.03471	0.01783	1.95	0.054
Sex[d]	−0.00991	0.00373	−2.65	0.008
Occupation[e]				
Civil servant, employee, business person	0.02670	0.02196	1.22	0.233
Farmer	0.03915	0.01434	2.73	0.010
Fisherman, boatman	0.05741	0.02358	2.44	0.020
Health status				
Usual activities	0.05024	0.00638	7.87	< 0.001
Pain or discomfort	0.03151	0.00500	6.30	< 0.001
Anxiety or depression	0.03376	0.00458	7.38	< 0.001
Cognition	0.03924	0.00523	7.51	< 0.001
Random effects				
Village	0.00337	0.00068	4.99	< 0.001
Residual	0.00354	0.00014	25.41	< 0.001

[a] 10 participants were excluded owing to missing values.
[b] *Z* value for random effects and *t* value for fixed effects.
[c] Reference group: 5–14-year-olds.
[d] Reference group: females.
[e] Reference group: schoolchildren and students.

Table 6. **Results of multilevel regression model 2 exploring the relationship between the disability weight of chronic schistosomiasis japonica and related morbidity, in two counties in China, October 2004–January 2005 (n = 1407)**[a]

Parameter	Coefficient	Standard error	Z or t value[b]	P value
Intercept	0.1068	0.01616	6.61	< 0.001
Fixed effects				
Age group (years)[c]				
15–44	−0.01621	0.01902	−0.85	0.396
45–59	0.01456	0.01934	0.75	0.453
⩾ 60	0.05380	0.01979	2.72	0.008
Sex[d]	−0.01698	0.00416	−4.08	< 0.001
Occupation[e]				
Civil servant, employee, business person	0.02165	0.02422	0.89	0.378
Farmer	0.03615	0.01589	2.28	0.029
Fisherman, boatman	0.05108	0.02610	1.96	0.059
Self-reported signs and symptoms				
Abdominal pain	0.01331	0.00505	2.64	0.008
Diarrhoea	0.01582	0.00548	2.89	0.004
Blood in the stool	0.02402	0.00655	3.67	< 0.001
Working capacity	0.03866	0.00636	6.08	< 0.001
Pathology				
Hepatic fibrosis[f]				
Grade I	0.01226	0.00575	2.13	0.036
Grade II	0.03515	0.00723	4.86	< 0.001
Grade III	0.04598	0.01489	3.09	0.003
Hepatomegaly	0.02782	0.00669	4.16	< 0.001
Random effects				
Village	0.00309	0.00064	4.84	< 0.001
Residual	0.00432	0.00017	25.45	< 0.001

[a] 12 participants were excluded owing to missing values.
[b] Z value for random effects and t value for fixed effects.
[c] Reference group: 5–14-year-olds.
[d] Reference group: females.
[e] Reference group: schoolchildren and students.
[f] Reference group: no hepatic fibrosis (grade 0).