Out-of-pocket Costs of Disabilities and Their Association with Household Socioeconomic Status Among School-aged Children in Vietnam

Hong-Luu Pham1,2, Masashi Kizuki1, Takehito Takano1, Kaoruko Seino3 and Masafumi Watanabe1

1 Department of Health Promotion, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, Japan
2 National Institute of Labor Protection, Vietnam
3 Department of International Health and Medicine, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, Japan

Abstract

Objective: The aim of this study was to assess the economic burden of disability of school-aged children and to evaluate the association between disabilities and household socioeconomic status, as well as the economic burden of disability and household socioeconomic status in Vietnam.

Materials and Methods: Nationally representative data for 9,882 children aged 6 to 17 years from the Vietnam Household Living Standard Survey 2006 were used. Disabilities were measured in six basic functional domains, including vision, hearing, remembering or concentrating, mobility, self-care, and communication. We evaluated the association between area, household income, educational attainment, or occupation of household head, and each difficulty. The ratio of health-care expenditure to per capita household income was compared by presence of a disability as well as household socioeconomic status.

Results: The prevalence of difficulty was 1.9% for vision and 2.3% for at least one of the other five domains. Difficulty in vision was more prevalent in the richer households (p=0.001), whereas difficulty in the other five domains was more prevalent in the poorer households (p=0.002). The ratio of health-care expenditure to per capita household income was greater than 0.05 in 4.6% of children. The adjusted odds ratio of children with difficulty in vision having a health-care expenditure share greater than 0.05 compared with children without difficulty was 4.78 (95% CI: 2.95, 7.73; p<0.001), and that for difficulty in the other five domains was 3.13 (95% CI: 2.04, 4.80; p<0.001). Among children with difficulty in at least one of the five domains other than vision, the proportion of children with a health-care expenditure share greater than 0.05 was higher among children from the poorer households (p=0.033).

Conclusions: Children with a disability spent more on health care relative to their income than those without. Visual disability was more prevalent among children from the richer households, whereas other disabilities were more prevalent among children from the poorer households.

Key words: disability, economic cost, socioeconomic status, children, Vietnam

Introduction

The Global Burden of Disease 2004 data estimated that 186 million (2.9%) of the world’s population were severely disabled and another 797 million (12.4%) had moderate long-term disability6). Disability is not found in the elderly exclusively; children are also affected. The average global prevalence of moderate and severe disability in children is 93 million (5.1%)6). However, the situation with regard to children with disabilities has often been neglected7). The proportion of children among all age groups suffering both moderate and severe disability is higher in low- and middle-income countries than in high-income countries6). Previous research on childhood disability in low- and middle-income countries focused on intellectual and hearing disabilities, and little is known about other types of disabilities6).

Presence of disability is considered as a key component of quality-of-life evaluation6). Children with disabilities continue to face discrimination and restricted access to social services up to adulthood6). The impacts depend on the social and environmental situations of a country. For example, vision problems correctable by glasses accounted for 40
percent of disabled children not attending school in Brazil\textsuperscript{9}.

Development of principles and standard scales for disabilities that are sensitive to cultural and resource differences has long been desired. After the United Nations International Seminar on Measurement of Disability in 2001, the Washington Group on Disability Statistics (Washington Group) was formed under United Nations sponsorship and developed a set of general disability measures that have been used by several countries in censuses and surveys. The questions use the World Health Organization’s International Classification of Functioning, Disability, and Health as a conceptual framework and focus on functioning in basic actions\textsuperscript{7}.

The disability status of the population has been a concern in Vietnam due to prolonged periods of war\textsuperscript{8}. In 2006, the Washington Group disability measures were translated into Vietnamese and included in the questionnaire of the Vietnam Household Living Standard Survey.

Disability affects economic well-being. Economic burden had been expressed as a percentage of health-care expenditure relative to household income, with the rationale that a high percentage means that “it is likely to force households to cut their consumption of other minimum needs, trigger productive asset sales or high levels of debt, and lead to impoverishment\textsuperscript{9}”. A study on data from the World Health Survey in 2002–2004 in 14 developing countries showed that households with disabilities experienced higher ratios of health-care to total household expenditure than households without disabilities in two-thirds of countries\textsuperscript{10}. Although the Vietnamese government is developing a universal health insurance system, households with members suffering disabilities have to pay extra expenses for examination, treatment, rehabilitation, and other costs related to health-care use\textsuperscript{11}. The economic burden on households with children with disabilities has become a concern\textsuperscript{8}.

Further, the disability statuses of children differ according to the socioeconomic statuses of their families. Data from the World Health Surveys in 14 countries showed that persons with disabilities are significantly worse off in two or more dimensions of economic well-being (education, employment, assets/living conditions, household expenditures, and household expenditures on health care)\textsuperscript{10}. On the other hand, study of the Multiple Indicator Cluster Survey data in 20 countries did not indicate a consistent relationship\textsuperscript{9}. Pattern of associations differ by countries and type of disabilities; there are still controversial issues that need to be resolved based on evidence.

The objectives of this study were to assess the economic burden of disability in different functional domains among school-aged children in Vietnam and to evaluate the association between presence of disability and demographic and household characteristics of children, as well as between economic burden of disability and demographic and household characteristics of children, using a large national representative sample.

**Materials and methods**

**Data source**

We used data from the Vietnam Household Living Standard Survey 2006. The Vietnam Household Living Standard Survey has been conducted nationwide by the General Statistics Office, Ministry of Planning and Investment, Vietnam in 1993, 1998 and every 2 years since 2002. Survey households were chosen using a multistage stratified cluster sampling process in which representative clusters were selected from all 64 provinces in Vietnam, and a random sample of households was selected within each cluster. Information collected regularly in every survey included basic demographic characteristics, educational attainment, health care use, and employment for all household members; household income and expenditure; and housing condition. Information was collected through face-to-face interviews with household heads, and key commune officials. The survey employed intensive interviewer training, standardized measurement tools and techniques, and instrument pretesting.

The reason for selecting the survey conducted in 2006 was that it was the latest survey that had collected information about disability. The survey was conducted among a total of 9,189 households in May and September 2006.

Use of the Vietnam Household Living Standard Survey data for this study was approved by the General Statistics Office, Ministry of Planning and Investment, Vietnam. The data set used in this study was provided by the General Statistics Office and did not contain personally identifiable information.

**Variables**

Two types of main outcome variable were presence of difficulties that were result of some physical or mental health problems, and health-care expenditure in the past 12 months.

Presence of difficulties was assessed according to the standard set of questions recommended by the Washington Group. The validity of this scale in the surveys in Asian and Pacific countries confirmed previously\textsuperscript{12}. The questions aimed to identify difficulties in six functional domains: vision (vision difficulties or problems), hearing (hearing limitation or problems), remembering or concentrating (problems with remembering or thinking that contribute to difficulty in doing daily activities), mobility (limitation or
problems getting around on foot), self-care (problems with taking care of yourself independently), and communication (problems with talking, listening, or understanding speech such that it contributes to difficulty in doing daily activities). Furthermore, the response categories captured the degree or severity of the difficulty; the response options were no, at least some difficulty, at least a lot of difficulty, and unable to do it at all. In this study, we dichotomized the response into no and yes (at least some difficulty or more).

Information regarding expenses related to use of medical services was collected for each household member who had used health-care services in the past 12 months. The expenses included out-of-pocket payment for medical service, treatment, and other related costs, such as bonuses for medical staff, and transportation fees. The unit of measurement was 1000 Vietnamese Dong (VND) (equivalent to 0.063-0.066 United States Dollars during the survey periods). We did not include payment for non-prescribed medicine, medical tools, health insurance, and aid, because information about them was not collected at the individual level.

Independent variables included sex, age, area (urban, and rural), household income in the past 12 months, educational attainment, and occupation of household head. Age was categorized into three groups: 6–10, 11–14, and 15–17 years, each corresponding to modal age for a primary school, a lower secondary school, and an upper secondary school, respectively. Household income was calculated as total household revenue minus total expenditure for the revenue-generating activities and divided into quintiles.

Statistical analysis

Data were collected from all chosen households (100% response rate). We analyzed all children (n=9,882) between 6 and 17 years of age in survey households. The analysis did not account for the intra-household correlation because a small proportion of households (7.6%) had more than one child with disabilities. The data set included the household sampling weight for each household, which had been calculated as the inverse of its household selection probability. We used the weight to take into account the multistage sampling design for all analyses.

The prevalence of difficulty in six functional domains was calculated by sex, age, area, household income, educational attainment, and occupation of household head. The difference in prevalence by these characteristics was assessed with a logistic regression analysis.

The multivariable logistic regression analysis required ten cases per independent indicator variable in the model[19]. In the subsequent analysis, a combined variable for difficulty in hearing, remembering or concentrating, mobility, self-care, or communication was used instead of using separate variables for difficulty in each domain. The frequency of having difficulty in vision was high enough for a multivariable analysis, and this domain was not combined.

The per capita household income was calculated by dividing household income by the number of household members. Then the ratio of the mean health-care expenditure to the mean per capita household income in the past 12 months was computed for each difficulty status. To compare the ratio by difficulty status, a dichotomous variable to indicate whether the ratio was greater than 0.05 or not was created and used as a dependent variable in the logistic regression models. The choice of 0.05 was based on the lower threshold value for catastrophic impact of health-care expenditure share used by van Doorslaer[4].

The ratio of the mean health-care expenditure to the mean per capita household income was also compared by characteristics of subjects among all children, among children with difficulty in vision, and among children with difficulty in hearing, remembering or concentrating, mobility, self-care, or communication. The odds ratio was adjusted for sex, age, area, household income in the past 12 months, educational attainment, and occupation of household head.

Results

Among 9,882 children, 397 (4.0%) children had at least one type of disability.

Table 1 shows the prevalence of difficulty in six functional domains marginally and by demographic and household characteristics of the 9,882 children. The overall prevalence of difficulty was 1.9% for vision, 0.5% for hearing, 1.0% for remembering or concentrating, 0.6% for mobility, 0.8% for self-care, and 0.9% for communication.

Table 2 shows the adjusted odds ratios of difficulties in vision as well as those in hearing, remembering or concentrating, mobility, self-care, or communication for each characteristic of subjects. Difficulties in vision were more prevalent among girls than boys, among children who were 11–17 years of age than those who were 6–10 years of age, and in urban areas than rural areas. With regard to the association between difficulty and household income, the direction of association differed between difficulty in vision and difficulty in the other domains: household income of a child with difficulty in vision was higher than that of a child without difficulty in vision, whereas household income of a child with difficulty in domains other than vision was lower than that of a child without difficulty in domains other than vision.

With regard to all subjects, the average per capita household income was 7441.2 thousand Vietnamese dong, or 469–491 United States dollars; per capita total household
Table 1  Prevalence of difficulty in six functional domains by demographic and household characteristics of children

| Functional domains                  | Vision | Hearing, remembering or concentrating, mobility, self-care, or communication |
|-------------------------------------|--------|--------------------------------------------------------------------------------|
|                                     | N      | Total | Hearing | Remembering or concentrating | Mobility | Self-care | Communication |
| Overall                             | 9882   | 186   | 223     | 49 (0.5%)                      | 98 (1.0%) | 58 (0.6%) | 82 (0.8%)     | 93 (0.9%)     |
| Sex                                 |        |       |         |                                 |          |          |                |                |
| Boy                                 | 5032   | 71    | 119     | 27 (0.5%)                      | 53 (1.1%) | 29 (0.6%) | 51 (1.0%)     | 52 (1.0%)     |
| Girl                                | 4850   | 114   | 104     | 22 (0.5%)                      | 45 (0.9%) | 29 (0.6%) | 31 (0.6%)     | 41 (0.8%)     |
|                                     | p=0.002| p=0.459| p=0.614| p=0.539                      | p=0.849 | p=0.047 | p=0.328       |
| Age                                 |        |       |         |                                 |          |          |                |                |
| 6-10                                | 3132   | 33    | 89      | 16 (0.5%)                      | 33 (1.1%) | 12 (0.4%) | 44 (1.4%)     | 31 (1.0%)     |
| 11-14                               | 3641   | 81    | 63      | 17 (0.5%)                      | 32 (0.9%) | 19 (0.5%) | 19 (0.5%)     | 30 (0.8%)     |
| 15-17                               | 3109   | 72    | 71      | 16 (0.5%)                      | 33 (1.1%) | 27 (0.9%) | 20 (0.6%)     | 31 (1.0%)     |
|                                     | Trend p| Trend p| Trend p| Trend p                      | Trend p | Trend p | Trend p       | Trend p       |
|                                     | <0.001 | =0.197| =0.909  | =0.979                       | =0.017  | =0.003  | =0.971        |               |
| Area                                |        |       |         |                                 |          |          |                |                |
| Urban                               | 2198   | 104   | 39      | 8 (0.4%)                       | 14 (0.6%) | 12 (0.6%) | 21 (1.0%)     | 13 (0.6%)     |
| Rural                               | 7684   | 82    | 184     | 41 (0.5%)                      | 84 (1.1%) | 46 (0.6%) | 61 (0.8%)     | 80 (1.0%)     |
|                                     | p<0.001| p=0.090| p=0.271| p=0.066                      | p=0.814 | p=0.484 | p=0.044       |               |
| Household income                    |        |       |         |                                 |          |          |                |                |
| 1st quintile (lowest)               | 2542   | 18    | 82      | 20 (0.8%)                      | 35 (1.4%) | 18 (0.7%) | 26 (1.0%)     | 37 (1.5%)     |
| 2nd quintile                        | 2341   | 28    | 60      | 15 (0.6%)                      | 30 (1.3%) | 19 (0.8%) | 19 (0.8%)     | 26 (1.1%)     |
| 3rd quintile                        | 1948   | 32    | 35      | 8 (0.4%)                       | 17 (0.9%) | 5 (0.2%)  | 12 (0.6%)     | 15 (0.8%)     |
| 4th quintile                        | 1575   | 42    | 21      | 4 (0.3%)                       | 11 (0.7%) | 5 (0.3%)  | 11 (0.7%)     | 7 (4.0%)      |
| 5th quintile (highest)              | 1474   | 65    | 24      | 2 (0.1%)                       | 5 (0.3%)  | 12 (0.8%) | 13 (0.9%)     | 9 (0.6%)      |
|                                     | Trend p| Trend p| Trend p| Trend p                      | Trend p | Trend p | Trend p       | Trend p       |
|                                     | <0.001 | <0.001| <0.001  | <0.001                       | <0.001  | <0.001  | <0.001        |               |
| Educational attainment of household head|    |       |         |                                 |          |          |                |                |
| Primary school graduate or none     | 2779   | 38    | 49      | 16 (0.6%)                      | 20 (0.7%) | 10 (0.4%) | 19 (0.7%)     | 16 (0.6%)     |
| Lower secondary school graduate     | 3122   | 65    | 79      | 22 (0.7%)                      | 43 (1.4%) | 22 (0.7%) | 24 (0.8%)     | 39 (1.3%)     |
| Upper secondary school graduate     | 1219   | 44    | 19      | 2 (0.2%)                       | 6 (0.5%)  | 7 (0.6%)  | 11 (0.9%)     | 2 (0.2%)      |
| Junior college degree, bachelor’s degree, or higher | 2761   | 39    | 76      | 9 (0.3%)                       | 29 (1.0%) | 20 (0.7%) | 28 (1.0%)     | 36 (1.3%)     |
|                                     | Trend p| Trend p| Trend p| Trend p                      | Trend p | Trend p | Trend p       | Trend p       |
|                                     | =0.523 | =0.064| =0.054  | =0.789                       | =0.151  | =0.116  | =0.079        |               |
| Occupation of household head        |        |       |         |                                 |          |          |                |                |
| Leaders, professionals, or staffs in any fields | 725 | 35     | 11      | 2 (0.3%)                       | 3 (0.4%)  | 7 (1.0%)  | 8 (1.1%)      | 3 (0.4%)      |
| Skilled workers in personal services and sales | 245 | 10     | 5       | 2 (0.2%)                       | 3 (1.2%)  | 0       | 2 (0.2%)      | 2 (0.8%)      |
| Skilled workers in agriculture and fisheries | 406 | 5      | 8       | 2 (0.2%)                       | 5 (1.2%)  | 0 (0.1%)  | 2 (0.4%)      | 4 (1.0%)      |
| Skilled handicraftsman and other skilled manual workers | 1092 | 38     | 18      | 3 (1.6%)                       | 3 (0.3%)  | 10 (0.9%) | 5 (0.5%)      | 6 (0.5%)      |
| Assemblers and machine operators    | 269    | 5     | 3       | 2 (0.7%)                       | 2 (0.7%)  | 1 (0.4%)  | 1 (0.4%)      | 1 (0.4%)      |
| Unskilled workers                   | 6360   | 76    | 157     | 35 (0.6%)                      | 64 (1.0%) | 43 (0.7%) | 57 (0.9%)     | 66 (1.0%)     |
| Armed forces                        | 18     | 0     | 1       | 1 (4.4%)                       | 1 (4.4%)  | 1        | 1 (4.4%)      | 1 (4.4%)      |
| Not working                         | 767    | 18    | 20      | 3 (0.4%)                       | 10 (1.3%) | 1 (0.2%)  | 7 (1.0%)      | 10 (1.3%)     |
|                                     | p=0.001| p=0.402| p=0.719| p=0.582                      | p=0.104 | p=0.442 | p=0.226       |               |

Data for per capita household income and educational attainment of the household head were missing in 2 cases and 1 case, respectively. The p-values were calculated with logistic regression analyses.

expenditure was 5350.6 thousand dong, or 337–353 dollars; and health-care expenditure was 95.0 thousand dong, or 6 dollars.

Table 3 compares the ratio of health-care expenditure to per capita household income between children with a specific disability and those without. The overall ratio was 0.0128. The proportion of children with a ratio greater than 0.05 was 4.6% and was higher among children with difficulty in vision, remembering or concentrating, mobility, self-care, and communication than those without these respective difficulties. Among children with difficulty in vision, both household income and health-care expenditure were higher
among children without difficulty in vision, respectively. On the other hand, among children with difficulty in hearing, remembering or concentrating, mobility, self-care, or communication, household income was lower and health-care expenditure was higher than among children without difficulty, respectively.

Table 4 compares the ratio of health-care expenditure to per capita household income among all children who were 6–17 years of age by their characteristics. The proportion of children with a ratio being greater than 0.05 was higher among children from the poorer households.

Table 5 compares the ratio of health-care expenditure to per capita household income among children with difficulties in hearing, remembering or concentrating, mobility, self-care, or communication by their characteristics. The proportion of children with a ratio greater than 0.05 was higher among children from the poorer households.

The goodness-of-fit of the multivariable logistic regression model was higher for analysis in children with difficulties in vision by their characteristics. In rural areas, household income was lower and health-care expenditure was higher compared with urban areas, among children with a difficulty in vision. The proportion of children with a ratio greater than 0.05 was higher in rural areas than urban areas.

Table 6 compares the ratio of health-care expenditure to per capita household income among children with difficulties in vision, hearing, remembering or concentrating, mobility, self-care, or communication by their characteristics. The proportion of children with a ratio being greater than 0.05 was higher among children from the poorer households.
ties than in all children: the pseudo $R^2$ of the multivariable logistic regression model was 0.013 among all children, 0.163 among children with difficulty in vision, and 0.231 among children with difficulty in hearing, remembering or concentrating, mobility, self-care, or communication.

### Discussion

We used a large national representative sample to present the economic burden of disabilities by different functional domains among school-aged children and its association with demographic and household characteristics of children in Vietnam. We also showed the association between socioeconomic status and disabilities. The ratio of health-care expenditure to per capita household income was higher among children who had a difficulty in vision, remembering or concentrating, mobility, self-care, or communication compared with those who did not have the respective difficulty. There was a relation between household income and the presence of difficulty in vision, as well as between household income and the presence of difficulty in hearing, remembering or concentrating, mobility, self-care, or communication: difficulty in vision was more prevalent in richer households; on the other hand, difficulty in hearing, remembering or concentratel

---

**Table 3** Per capita household income and health-care expenditure in the past 12 months

| Per capita household income (1000 VND) [A] | Health-care expenditure (1000 VND) [B] | [B]/[A] | [B]/[A]>0.05 |
|------------------------------------------|----------------------------------------|---------|---------------|
| Mean (SD)                                | Mean (SD)                              | Share of inpatient care expenditure | %   | OR | (95%CI) |
| Overall 7441.2 (9043.1)                  | 95.0 (887.9)                           | 54.9%   | 0.0128        | 4.6% | –     |
| Children with difficulties in specific domains |

#### Vision

| No 7382.2 (9052.6) | 81.3 (709.5) | 53.4% | 0.0110 | 4.4% | Reference |
| Yes 10521.5 (7969.7) | 807.4 (3901.1) | 62.9% | 0.0767 | 14.6% | 4.78 (2.95, 7.73) p<0.001 |

#### Hearing, remembering or concentrating, mobility, self-care, or communication

| No 7467.9 (9059.6) | 83.3 (792.7) | 50.2% | 0.0112 | 4.4% | Reference |
| Yes 6284.0 (8234.2) | 601.0 (2735.9) | 83.1% | 0.0956 | 13.3% | 3.13 (2.04, 4.80) p<0.001 |

#### Hearing

| No 7454.2 (9061.6) | 94.8 (888.4) | 54.9% | 0.0127 | 4.6% | Reference |
| Yes 4827.1 (2777.5) | 133.6 (783.7) | 54.2% | 0.0277 | 6.8% | 1.33 (0.49, 3.62) p=0.578 |

#### Remembering or concentrating

| No 7461.8 (9073.7) | 91.6 (845.4) | 53.6% | 0.0123 | 4.5% | Reference |
| Yes 5391.7 (4743.5) | 430.1 (2845.4) | 82.3% | 0.0798 | 14.3% | 3.22 (1.78, 5.81) p<0.001 |

#### Mobility

| No 7441.8 (9055.9) | 85.7 (810) | 51.2% | 0.0115 | 4.5% | Reference |
| Yes 7341.7 (6615.2) | 1656.5 (4567.1) | 87.0% | 0.2256 | 24.8% | 7.49 (3.90, 14.38) p<0.001 |

#### Self-care

| No 7438.1 (9014.6) | 86.7 (807.7) | 51.3% | 0.0117 | 4.5% | Reference |
| Yes 7809.8 (12029.1) | 1079.7 (4023.4) | 89.7% | 0.1382 | 16.2% | 3.99 (2.06, 7.74) p<0.001 |

#### Communication

| No 7460.0 (9069.7) | 89.7 (825.3) | 52.8% | 0.0120 | 4.5% | Reference |
| Yes 5456.8 (5231.6) | 649.4 (3447.4) | 84.8% | 0.1190 | 14.9% | 3.46 (1.91, 6.28) p<0.001 |

P-values comparing per capita household income or healthcare expenditure by difficulty status were obtained with Mann-Whitney U tests. The odds ratios compared the odds of [B]/[A]>0.05 between children with a specific disability and those without. The odds ratios were adjusted for sex, age, area, household income, and educational attainment and occupation of household head.
Household income among children with difficulty in vision by substantially higher health-care expenditure. The higher cost of health care among children with disability was caused in regions of the world. The prevalence of intellectual disability between 0.09% and 18.3%\(^3\) was within the range of previous reports in low- and middle-income regions. The prevalence of visual impairment between 0.4% and 19.7%; and the prevalence of hearing impairment between 0.1% and 12.5%; the prevalence of hearing impairment between 0.4% and 19.7%; and the prevalence of intellectual disability between 0.09% and 18.3%\(^3\). The prevalence of difficulty in vision was not as high as that among children with disabilities in other domains. This low share of inpatient care is consistent with the fact that among the pediatric population in the UK, the proportion of children who received hospital eye services and required hospital admission was low (less than 10%) and with the fact that the total cost of ophthalmic surgery and inpatient eye services was less than that of ophthalmology outpatient eye services\(^{13}\).

In the Vietnam Household Living Standard Survey 2006, disability was measured by the international standard measurement tool. The estimated prevalence of difficulty in Vietnamese children ranged from 0.5% for hearing to 1.9% for vision. The prevalence of disability among children in low- and middle-income countries has varied across studies. For example, the prevalence of visual impairment varied between 0.1% and 12.5%; the prevalence of hearing impairment between 0.4% and 19.7%; and the prevalence of intellectual disability between 0.09% and 18.3%\(^3\). The prevalence of difficulty estimated in this study was within the range of previous reports in low- and middle-income countries.

Households with children with a disability spent more on health care than households without such children. Regarding difficulty in vision, the increase in the economic burden of health care among children with disability was caused by substantially higher health-care expenditure. The higher household income among children with difficulty in vision than children without this difficulty diluted the influence of the increase in the health-care expenditure for difficulty in vision. The share of inpatient care expenditure relative to total health-care expenditure among children with difficulty in vision was not as high as that among children with disabilities in other domains. This low share of inpatient care is consistent with the fact that among the pediatric population in the UK, the proportion of children who received hospital eye services and required hospital admission was low (less than 10%) and with the fact that the total cost of ophthalmic surgery and inpatient eye services was less than that of ophthalmology outpatient eye services\(^{13}\).

Regarding difficulties in other domains, the difference in the ratio was caused by both relatively lower income and substantially higher health-care expenditure among children with a disability than those without the respective disability. Households with children with difficulty in hearing, remembering or concentrating, mobility, self-care, or communication tended to be poorer than those without children with difficulties. With the exception of difficulty in hearing, more than 80% of high health-care expenditure were for in-

| Table 4 | Ratio of health-care expenditure to per capita household income among all children who were 6–17 years of age |
|---------|---------------------------------------------------------------------------------------------------|
| Per capita household income [A] (1000 VND) | Health-care expenditure [B] (1000 VND) | [B]/[A] | [B]/[A]>0.05 |
| Mean (SD) | Mean (SD) | % | OR (95%CI) |
| Overall | 7441.2 (9043.1) | 95.0 (887.8) | 0.0128 | 4.6% |
| Area | | | | |
| Urban | 12349.6 (13779.1) | 126.6 (945.6) | 0.0103 | 4.0% |
| Rural | 6036.5 (6480.7) | 86.0 (870.4) | 0.0142 | 4.8% |
| Household income | | | | |
| 1st quintile (lowest) | 2607.1 (642.9) | 44.8 (448.6) | 0.0172 | 5.3% |
| 2nd quintile | 4324.0 (465.6) | 91.3 (746.9) | 0.0211 | 6.0% |
| 3rd quintile | 6215.7 (642.9) | 130.5 (1500.5) | 0.0210 | 4.6% |
| 4th quintile | 9090.6 (1068.7) | 96.1 (685) | 0.0106 | 3.0% |
| 5th quintile (highest) | 20582.2 (17665.2) | 139.3 (754) | 0.0068 | 3.0% |

The odds ratios were adjusted for sex, age, and all other characteristics. The pseudo R\(^2\) of the multivariable logistic regression model was 0.013.
Table 5  Ratio of health-care expenditure to per capita household income among children with difficulty in vision

|                      | Per capita household income [A] (1000 VND) | Health-care expenditure [B] (1000 VND) | [B]/[A] | [B]/[A]>0.05 % | OR (95%CI) |
|----------------------|------------------------------------------|----------------------------------------|---------|----------------|------------|
| Overall              | 10521.5 (7969.7)                         | 807.4 (3901.1)                         | 0.0767  | 14.6%          | -          |
| Area                 |                                          |                                        |         |                |            |
| Urban                | 13450.2 (9074.0)                         | 308.2 (1432.3)                         | 0.0229  | 8.0%           | Reference  |
| Rural                | 6811.5 (3937.7)                          | 1439.8 (5603.3)                        | 0.2114  | 23.1%          | 5.19 (1.53, 17.60) p=0.008 |
| Household income     |                                          |                                        |         |                |            |
| 1st quintile (lowest)| 2941.3 (498.8)                           | 296.4 (1044.2)                         | 0.1008  | 16.6%          | Reference  |
| 2nd quintile         | 4319.3 (477.3)                           | 191.0 (365.9)                          | 0.0442  | 23.3%          | 2.29 (0.41, 12.59) p=0.342 |
| 3rd quintile         | 6293.8 (694.8)                           | 1665.8 (7964.4)                        | 0.2647  | 10.7%          | 0.83 (0.11, 6.03) p=0.853 |
| 4th quintile         | 8979.4 (900.8)                           | 705.1 (2693.2)                         | 0.0785  | 9.4%           | 0.87 (0.15, 5.21) p=0.880 |
| 5th quintile (highest)| 18369.0 (8705.7)                        | 853.5 (2665.9)                         | 0.0465  | 15.6%          | 3.24 (0.61, 17.27) p=0.168 |
| Educational attainment of household head |                                  |                                        |         |                | Trend p=0.383 |
| Primary school graduate | 9437.2 (9528.8)                      | 586.8 (2222.6)                         | 0.0622  | 17.4%          | Reference  |
| Lower secondary school graduate | 8397.7 (4406.0)                  | 1601.3 (6128.6)                        | 0.1907  | 20.0%          | 1.31 (0.47, 3.64) p=0.611 |
| Upper secondary school graduate | 14054.0 (10112.1)               | 197.9 (343.0)                          | 0.0141  | 9.9%           | 0.81 (0.16, 4.07) p=0.796 |
| Junior college degree, bachelor’s degree, or higher | 11153.5 (7011.5)              | 392.1 (2088.0)                         | 0.0352  | 8.4%           | 0.51 (0.11, 2.37) p=0.386 |
| Occupation of household head |                                  |                                        |         |                | Trend p=0.303 |
| Leaders, professionals, or staffs in any fields | 13808.2 (5597.7)              | 524.8 (1932.6)                         | 0.0380  | 8.6%           | Reference  |
| Skilled workers in personal services and sales | 12739.0 (7626.8)              | 1212.3 (4290.6)                        | 0.0952  | 7.9%           | 0.68 (0.04, 12.59) p=0.798 |
| Skilled workers in agriculture and fisheries | 7388.3 (1640.2)                | 1292.3 (2707.2)                        | 0.1749  | 20.2%          | 2.80 (0.14, 54.00) p=0.496 |
| Skilled handicraftsman and other skilled manual workers | 7424.0 (4390.7)                | 1068.1 (3417.2)                        | 0.1439  | 17.1%          | 1.08 (0.17, 6.79) p=0.935 |
| Assemblers and machine operators | 10534.1 (3370.4)              | 630.5 (860.6)                          | 0.0599  | 41.9%          | 9.18 (0.95, 88.46) p=0.055 |
| Unskilled workers | 9511.7 (8433.8)                        | 876.3 (5236.1)                         | 0.0921  | 16.8%          | 1.15 (0.21, 6.20) p=0.871 |
| Not working          | 14710.4 (13221.9)                      | 205.4 (290.6)                          | 0.0140  | 6.2%           | 0.52 (0.04, 7.47) p=0.628 |

The odds ratios were adjusted for sex, age, and all other characteristics. The pseudo R² of the multivariable logistic regression model was 0.163.

Table shows that patient services. There were systematic differences in the mechanisms of high economic burden of disability between difficulty in vision and difficulty in other domains.

In our analysis among children 6–17 years of age, a higher prevalence of disability was observed in the poorer households with regard to disability in hearing, remembering or concentrating, mobility, self-care, and communication. With regard to disability in vision, on the other hand, the prevalence was higher among those better off. In studies among adult populations, the prevalence of disability is generally higher among those worse off. It has been reported that a larger percentage of children among those who are less wealthy were screened positive with the disability questions, but the association was not consistent. The possible reason for the reverse trend with regard to difficulty in vision observed in this study is longer study hours among children from better off households than those from worse off households. In Vietnam, besides engaging in the standard school curriculum, children are enrolled in many kinds of academic tutorials to improve their knowledge and skills. These extra classes have proliferated, since teachers often organize home-based classes to supplement their income.

Extra classes mean an increased workload for the participating students compared with those not participating. The location can be at school, a teacher’s house, or a student’s house. Lengthy exposure to such factors as inadequate indoor illumination in the reading environment or a chair or table unsuitably large for a child’s body size are reported to adversely impact a student’s visual acuity. These environmental conditions and lifestyles are now suggested as modifiable causes. The increase in the working hours of children under uncontrolled conditions is considered as a potential concern for child visual development.

The authors hypothesized that the different impact of health-care expenditure by demographic and household characteristics of subjects was captured by the fitness of the regression model to the observed data. The model, which included socioeconomic factors, namely household income, educational attainment, and occupation of the household head, explained the variation in the ratio of health-care expenditure to the per capital household income better in the analysis including only children with a disability than in
the analysis including all children. This finding was interpreted as indicating that the association between socioeconomic status and household burden was stronger; in other words, the impacts of differences in socioeconomic status on the household burden of health-care expenditure were higher for children who had disabilities than for those who did not. Socioeconomically disadvantaged children not only suffered from higher risk of disability but also experienced heavier disadvantage from their socioeconomic status when they had a disability compared with those who were well off. More attention should be paid to reducing the disadvantage caused by poor socioeconomic conditions when households have children with disabilities. The results of the present study will be useful for the design of equitable health systems in Vietnam.

This study used a nationwide household sample that was representative for the whole country, that is, the 8 regions, urban/rural areas and 64 provinces in Vietnam. The sample size was large, allowing us to reliably estimate the prevalence of difficulties and to conduct multivariable analyses.

The information was self-reported, and there is a potential for information bias; however, the magnitude of the bias is considered to be low because of several reasons: The survey employed high-quality interviewer training and standardized data collection procedures across geographic regions; the response rates were high, and there were only a small amount of missing data; and validated measurement scale for disability was used, and the calculated prevalence of disability was within the range from studies in other countries. However, no temporal relation was definitively confirmed because of the possibility of reverse causation. To ascertain if poor socioeconomic status causes difficulty or the analysis including all children. This finding was interpreted as indicating that the association between socioeconomic status and household burden was stronger; in other words, the impacts of differences in socioeconomic status on the household burden of health-care expenditure were higher for children who had disabilities than for those who did not. Socioeconomically disadvantaged children not only suffered from higher risk of disability but also experienced heavier disadvantage from their socioeconomic status when they had a disability compared with those who were well off. More attention should be paid to reducing the disadvantage caused by poor socioeconomic conditions when households have children with disabilities. The results of the present study will be useful for the design of equitable health systems in Vietnam.

This study used a nationwide household sample that was representative for the whole country, that is, the 8 regions, urban/rural areas and 64 provinces in Vietnam. The sample size was large, allowing us to reliably estimate the prevalence of difficulties and to conduct multivariable analyses.

The information was self-reported, and there is a potential for information bias; however, the magnitude of the bias is considered to be low because of several reasons: The survey employed high-quality interviewer training and standardized data collection procedures across geographic regions; the response rates were high, and there were only a small amount of missing data; and validated measurement scale for disability was used, and the calculated prevalence of disability was within the range from studies in other countries. However, no temporal relation was definitively confirmed because of the possibility of reverse causation. To ascertain if poor socioeconomic status causes difficulty or
difficulty leads to poor socioeconomic status or both, further studies are necessary. This study did not take into account the difference in access to health care. If the poor families had difficulty in accessing health care and did not receive all the needed care, their health-care expenditure would tend to be lower than needed, leading to underestimation of the potentially higher burden of disability among the poor households. Data included siblings living in the same household, and underestimation of standard errors was possible, because the analyses did not take the intraclass correlation into account. The magnitude of the bias, however, is considered to be small because there was only one child with a disability in most of the households.

**Conclusion**

Health-care needs of children with a disability pose a higher burden on households with lower financial resources. Visual disability was more prevalent among children from richer households, whereas other disabilities were more prevalent among children from poorer households.

**References**

1. World Health Organization. The Global Burden of Disease: 2004 Update. World Health Organization, Geneva, 2008.
2. United Nations Children’s Fund. The State of the World’s Children 2013: Children with Disabilities. United Nations Children’s Fund, New York, 2013.
3. Maulik PK, Darmstadt GL. Childhood disability in low- and middle-income countries: Overview of screening, prevention, services, legislation and epidemiology. Pediatrics 2007; 120 (Suppl): S1-S55. [Medline] [CrossRef]
4. Testa MA, Simonson DC. Assessment of quality-of-life outcomes. N Engl J Med 1996; 334: 835-840. [Medline] [CrossRef]
5. United Nations Children’s Fund, University of Wisconsin. Monitoring Child Disability in Developing Countries: Results from the Multiple Indicator Cluster Surveys. United Nations Children’s Fund, New York, 2008.
6. Mont D. Measuring disability prevalence. Human Development Network Social Protection, Washington, 2007.
7. Washington Group on Disability Statistics. Development of an internationally comparable disability measure for censuses. http://www.cdc.gov/nchs/washington_group.htm (accessed 2013/06/27)
8. Palmer M, Nguyen T, Neeman T, et al. Health care utilization, cost burden and coping strategies by disability status: an analysis of the Viet Nam National Health Survey. Int J Health Plann Manage 2011; 26: e151-168. [Medline] [CrossRef]
9. Russell S. The economic burden of illness for households in developing countries: a review of studies focusing on malaria, tuberculosis, and human immunodeficiency virus/acquired immunodeficiency syndrome. Am J Trop Med Hyg 2004; 71: 147-155. [Medline]
10. Mitra S, Posarac A, Vick B. Disability and poverty in developing countries: a snapshot from the world health survey. Human Development Network Social Protection, Washington, 2011.
11. Van Minh H, Kim Phuong NT, Saksena P, et al. Financial burden of household out-of-pocket health expenditure in Viet Nam: Findings from the National Living Standard Survey 2002-2010. Soc Sci Med 2012. [Medline]
12. Smit J, Liu W. Comparing disability questions for censuses and surveys in Asia and the Pacific. United Nations Economic and Social Commission for Asia and the Pacific, Discussion Paper, 2007.
13. Peduzzi P, Concato J, Kemper E, et al. A simulation study of the number of events per variable in logistic regression analysis. J Clin Epidemiol 1996; 49: 1373-1379. [Medline] [CrossRef]
14. van Doorslaer E, O’Donnell O, Rannan-Eliya RP, et al. Catastrophic payments for health care in Asia. Health Econ 2007; 16: 1159-1184. [Medline] [CrossRef]
15. Alexander P, Rahi JS, Hingorani M. Provision and cost of children’s and young people’s eye services in the UK: findings from a single primary care trust. Br J Ophthalmol 2009; 93: 645-649. [Medline] [CrossRef]
16. World Health Organization. World report on disability 2011. World Health Organization, Geneva, 2011.
17. Tran TH, Harpham T. Primary education in Vietnam: Extra classes and outcomes. Int Educ J 2005; 6: 626-628.
18. Saw SM. A synopsis of the prevalence rates and environmental risk factors for myopia. Clin Exp Optom 2003; 86: 289-294. [Medline] [CrossRef]
19. Neil Charman W. Myopia, posture and the visual environment. Ophthalmic Physiol Opt 2011; 31: 494-501. [Medline] [CrossRef]
20. Maly E. Frequency and natural history of retinopathy of prematurity (ROP). A prospective study in a Swedish city 1986-1990. Acta Ophthalmol Suppl 1993; 210: 52-55. [Medline]