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The impact of a low cost wheelchair on the quality of life of the disabled in the developing world

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| Background: | Summary People with disabilities in the developing world do not have equal and adequate access to education, employment, or medical care. Their physical or mental condition, compounded by a lack of financial and technological resources, imposes a burden on both the family and the State. A wheelchair is a form of assistive technology which eases that burden for many. This study examines the impact of a simple, donated chair on the health, quality of life, and function of a subject population. |
| Material/Methods: | Surveys were administered to 519 disabled recipients of a semi-rigid depot style wheelchair in 3 different countries at the time they received their chair and again after 12 months of use. Surveys evaluated physical and emotional health, functional independence, and lifestyle. |
| Results: | On initial reports, 46.6% of subjects said they never left home, 52.3% were hospitalized one or more days/month, 70.3% reported daily pain, and 48.7% reported a negative mood state. Following 12 months of using the wheelchair, both the reported overall health rating and mood state increased by 20%; pain was significantly diminished. Although some areas in the ICF function measure improved more than others, the overall reported level of independence rose by 11%. |
| Conclusions: | A representative sample of the disabled in 3 countries of the world is socially isolated, in poor health, and with limited function. Receipt of a simple, depot style wheelchair significantly improved their quality of life, health indicators, and the ICF function measure following 12 months of use. |
| key words: | wheelchairs • pressure ulcer • cross-cultural comparison • World Health Organization |

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BACKGROUND

According to the World Health Organization [1], there are currently 1 billion people in the world living with disabilities, many of whom do not have equal access to medical care, education, and employment. This is particularly true for those living in low and middle income countries [2]. Lack of resources in developing countries prohibits the disabled from participating to the fullest extent in society.

There is little published data about the lifestyle of the disabled in the developing world. According to a World Bank report [3], in India, which has 40–80 million people with disabilities, children with disabilities are 5 times more likely to remain out of school. Disabled adults are less likely to be employed; they represent a higher percentage in the lowest quintile of income. Families with a disabled member fare worse financially and are 25% less likely to have three solid meals per day.

In Chile, 15.4% of the overall population and 23.4% of people with disabilities are considered below the poverty line. According to Chile's First National Bank, in 2005, 81% of the disabled believed that their disability had affected their family's economic status, and 39.5% of them were in poor socioeconomic conditions. Ten percent of the disabled did not have even one year of education approved, and only 13% had finished high school [4].

According to a survey released by the Ministry of Labor, War Invalids and Social Affairs (MOLISA) in Vietnam in 1994–95, "56% of persons with disabilities were in need of assistive devices but cannot afford to pay for them, even though the Government of Vietnam has demanded in a number of legal documents that they be provided free or the price be reduced by 30-50% for persons with disabilities". It reports that, although 1.3 million people with severe disabilities received allowances and assistance from the government, a large number with less severe disabilities were relatively neglected, and that in particular, in mountainous or rural areas, they were marginalized from the state's welfare program [5]. In 2003, according to the Institute of Social Developmental Studies, almost 8% of Vietnamese households had a member with disabilities and most of these households were considered poor. Up to 80% of the disabled were dependent on support from their family, the State, or their community [6].

Even if income levels of the disabled were similar to those of their peers, there exists a "conversion handicap" according to Sen [7], a decreased ability to convert money into an adequate standard of living. Because of increased costs associated with a handicap, people with disabilities must earn more to have a similar lifestyle. If, however, they are unable to access employment, they are pushed into poverty or reliance on the State [8].

For many of the disabled, a wheelchair is a critical source of mobility which aids independence and integration into society [9], including their ability to earn a livelihood. For disabled children, a wheelchair aids their cognitive and psychosocial development [10].

The World Health Organization, together with the US Agency for International Development, the International Society for Prosthetics and Orthotics, and Disabled Peoples

International have produced a manual entitled *Guidelines on the provision of manual wheelchairs in less resourced settings* [8]. This manual summarizes the rights of the disabled to a mobility device. It underscores the downward spiral resulting in the lives of those who are denied this right and are therefore unable to better themselves.

Although it is the responsibility of individual nations to care for all of its citizens, limited resources in low or middle income countries force decisions regarding allocation of resources, which may leave the disabled in need. Assistance has been provided by various international "for profit" and "not-for-profit" organizations. However, in 2003, even with outside help, an estimated 20 million world citizens required a wheelchair but did not have access to one [8].

Even when outside assistance is given, not all donated products meet international standards for quality. Many low income nations, for example, do not have regulations about wheelchair donations [11]. There is a lack of background research by some manufacturers and distributors into the needs of recipients, causing many donations to fail or to be abandoned [12–14]. The recipient's lifestyle remains unchanged despite the presumed effect of the donation.

In general, studies on people with disabilities have focused on environmental or medical/rehabilitation issues rather than on lifestyle, integration, and social participation [6]. A systematic review of 7 data bases by Salminen et al. [9] agrees. They found that mobility devices, such as a wheelchair, increase the mobility of the user and improve their activity and participation. They cautioned, however, there is a lack of high-quality research on this topic and more is required.

One organization which donates wheelchairs to the disabled in developing countries is the Free Wheelchair Mission (FWM) [15]. To date, this organization has distributed over 600,000 wheelchairs. A former study examined the effect of one model of the organization's wheelchair on the lives of 188 persons in India and Peru. It concluded that this wheelchair provided "a positive, cost-effective benefit to both health and function without unusual risk". Although this study touched on social participation and employment in addition to health, its conclusions were limited by requiring recipients to retrospectively provide information, allowing risk of memory error [16].

The current study was undertaken to further evaluate the impact of a donated wheelchair on the quality of life of its recipients in the developing world. It examined not only physical and emotional health, but also functional independence and community engagement of disabled recipients in three different countries, both before and after receiving the wheelchair.

MATERIAL AND METHODS

Subjects

Local affiliates of the FWM in India, Chile, and Vietnam identified 200 potential wheelchair recipients in each country. These 3 countries were chosen because their sample represented both rural and urban populations in varying parts of the world. At the time of wheelchair distribution, recipients

Table 1. Demographic variables n=620.

| Age | Highest level of education | | Gender | Diagnosis | | Home Setting | | | |
|--------|----------------------------|------------------------------|-----------------|-----------------|-----------------|--------------------|-----------------|-----------------------|------|
| | % of recipients | % of recipients | % of recipients | % of recipients | % of recipients | % of recipients | % of recipients | | |
| 1–10 | 3.1 | Grades 1–4 | 34.4 | Male | 57.1 | Stroke | 19.2 | Rural | 62.3 |
| 11–20 | 8.3 | Grades 5–8 | 29.7 | Female | 39.8 | Cerebral palsy | 12.0 | Village or small town | 13.2 |
| 21–30 | 9.7 | Grades 9–12 | 17.7 | | | Hydrocephalus | 0.7 | Large metro area | 24.5 |
| 31–40 | 8.7 | Technical school/ university | 3.4 | | | Spina bifida | 1.0 | | |
| 41–50 | 11.2 | Special education | 14.3 | | | Muscular dystrophy | 17.2 | | |
| 51–60 | 15.3 | | | | | Club foot | 2.5 | | |
| 61–70 | 13.0 | | | | | Cancer | 3.3 | | |
| 71–80 | 15.9 | | | | | Spinal cord injury | 4.3 | | |
| 81–90 | 11.9 | | | | | Polio | 8.4 | | |
| 91–100 | 2.7 | | | | | Parkinson's | 0.8 | | |
| >100 | 0.2 | | | | | Trauma/ fractures | 12.6 | | |
| | | | | | | Amputee | 6.9 | | |
| | | | | | | Arthritis | 11.3 | | |

were given the opportunity to participate in the baseline survey. Following 12 months of wheelchair use, they were surveyed again. All subjects who wished to participate did so without exclusion. Final participants for the initial survey included 204 from Viet Nam, 206 from India, and 210 from Chile. After attrition, final participants for the 12 month follow-up included 189 from Viet Nam, 201 from India, and 129 from Chile. In Chile, 53% of attrition was due to death, 16% from worsening health with inability to use the chair, 16% could not be located, and 9.5% believed the chair did not meet their transportation needs. One chair had been stolen and one had been sold. Of the participants who dropped out of the study in Viet Nam and India, 80% were due to death; the other 20% could not be located. Age of the recipients ranged from 4 to 102 with an average of 54 years. More males (57.1%) than females received chairs. Of recipients, 35.9% were educated beyond grade eight, and 3.4% beyond grade 12. Thirty percent reported that they were unable to read or write, even at the basic level. The majority of the sample (60.7%) lived in a rural setting.

The most common medical diagnoses which necessitated use of a wheelchair were stroke (in Viet Nam, 40%) or muscular dystrophy (in Chile, 21.8%, and in India, 21.6%). Of all recipients, 41% had their diagnosis for at least 10 years.

Before receiving a wheelchair for mobility, 47.8% of recipients were carried or crawled, 38.6% walked with a cane or

crutch, and 9.7% were bedridden. Seventy eight percent had not owned a wheelchair before, largely due to lack of money (69.5%). Further ethnographic data may be seen in Table 1.

The wheelchair

The wheelchair (Figure 1), is a product of the Free Wheelchair Mission and has been described elsewhere [16]. It is a depot style chair with a semi-rigid seat and back, 8 inch natural rubber castors in the front, and 24 inch pneumatic tires in the back. It is distributed with a 2 inch covered polyurathane foam cushion, an air pump, patch kit, and, if needed, a 5 strap adjustable harness. It weighs 35 pounds. Wheelchairs are provided free of charge to recipients, made possible through local and national fundraising efforts. There was no interaction between individual donors and recipients in this study. The cost to produce, ship, assemble, and deliver the chair to recipients was \$59.20 worldwide.

Surveys

The baseline survey was designed to assess the quality of life of the disabled – access to medical care, employment, income, physical and emotional health, and independent function. The follow-up survey evaluated the change in health, function, and integration into society associated with use of the wheelchair. Health was evaluated by days of personal illness, hospitalization, nutrition, and emotional



Figure 1. Free Wheelchair Mission wheelchair, 2008.

health status. Pressure ulcers and pain were also included since they represent specific concerns for wheelchair users.

Lifestyle was evaluated in part through the framework of the World Health Organization's International Classification of Functioning, Disability and Health (ICF)'s [17] activity and participation section, which has been shown to be effective in describing disability in various patient populations [16,18–24]. This included the following areas: mobility, self-cares, domestic life, interpersonal interactions and relationships, major life areas, and community, social, and civic life. Areas of function are listed in Appendix 1 along with ICF designations.

In addition to the ICF, time and distance travelled from home, reported income, and employment were examined. Wheelchair maintenance was considered since it affects user satisfaction and the ability to integrate into the community.

Data analysis

The study received approval from the Institutional Review Board of Azusa Pacific University. Local affiliates of FWM from India, Chile, and Viet Nam were informed of the study and invited to participate. One national employee of the affiliate from each site was trained in the survey procedure, consisting of asking questions, recording answers, and entering data. Employee qualifications included university degrees in business and biotechnology. All had worked on various social work projects under national and international firms.

Six hundred twenty recipients of the FWM chair were surveyed at the time they received their wheelchair. 519 of those were surveyed again 12 months later. Because 25% of recipients had less than 4th grade formal education and an additional 15% were in special education, willingness to participate was considered formal consent. Parents were allowed to complete the survey on behalf of their children. No data was kept on those who chose not to participate. Potential participants were informed that the purpose of the survey

was to evaluate how the wheelchair affected their health and well-being, and to note any problems associated with its use. They were told that their answers would in no way bias their relationship with the FWM and that the wheelchair was theirs to keep. Survey data was collected in face-to-face interviews, recorded on paper, and then entered electronically into Survey Monkey[®]. Results were exported to Excel files in the United States, but detailed names with addresses were kept in local offices. Frequencies and descriptive statistics were analyzed using SPSS PASW 19. Data for health and function were combined across the 3 countries, since effect of the wheelchair was assumed to be the same. However, means and standard deviations from each variable were examined by country to verify that the statistical patterns of the whole were representative of individual countries. Statistics related to wheelchair durability and maintenance were analyzed by country, setting, and type of terrain. Although the intent of the study design was to evaluate change using paired data from baseline to 12 months, subject numbers were not consistently recorded in the field, and therefore, independent samples t-tests were used to test for group differences using a significance level of $p < 0.05$ for all analyses. Change in the distribution of responses regarding the presence of pressure ulcers, days hospitalized, and mood state was evaluated using Pearson Chi-Square.

In terms of function, the modified ICF scale used a 3 point system to evaluate the level of difficulty in performing each activity (0 = no difficulty, 1 = mild to moderate difficulty, 2 = severe difficulty/unable). Each major area of participation, as identified in the ICF, was evaluated through several questions where values were summed and treated as a component score. Thus, e.g. the total score for domestic life consisted of the sum from 5 questions: shopping, gathering daily necessities, preparing meals, doing housework, and caring for household objects. An independent samples t-test of the means was used to evaluate differences between group responses prior to wheelchair acquisition and responses one year later.

RESULTS

Data from the entire sample is reported as a whole. Each individual country's data uniformly followed the reported pattern unless otherwise noted.

Physical and emotional health

During the initial interview, only 44.9% of recipients reported access to medical care that was both available and affordable whenever it was needed. This was particularly true in India where only 38.7% reported such access compared to Viet Nam (43.6%) or Chile (52%). Other recipients said that care was either not available in their area (8.1%), available but not affordable (24.6%), or available and affordable, but inaccessible because of transportation issues (22.4%). Only 43.4% received ongoing medical care related to their condition; 7.4% had never been evaluated by a physician.

At 12 months, recipients reported less personal illness, less hospitalization, and diminished pain. The percentage who experienced pressure ulcers diminished significantly ($\chi^2(2)=6.09, p=.048$) (Table 2), with those who reported 3 or

Table 2. Health indicators.

| Health Indicator | Baseline (data reported from past 12 months) n=606 | 12 months (data reported from past 6 months) n=518 | Pearson Chi-Square |
|---|--|--|---------------------------------|
| Illness | | | |
| One day or less/month | 42.7% | 76.8% | $\chi^2 (3)=149.084$ p=0.000 |
| Two days/month | 25.4% | 14.9% | |
| One day/week | 9.2% | 4.2% | |
| More than one day/week | 22.6% | 4.1% | |
| Hospitalized | | | |
| No days | 47.7% | 69.7% | $\chi^2 (6)=216.673$ p=0.000 |
| One or two days | 6.8% | 21.0% | |
| About a week | 10.9% | 6.6% | |
| About two weeks | 14.5% | 1.7% | |
| About three weeks | 6.8% | 0.0% | |
| About four weeks | 5.3% | 0.0% | |
| More than four weeks | 8.1% | 1.0% | |
| If had pressure ulcers, how many | | | |
| One | 48.8% | 67.9% | $\chi^2 (2)=6.090$ p=0.048 |
| Two | 36.1% | 24.5% | |
| Three | 15.1% | 7.5% | |
| Pain on a regular basis | | | |
| Mild | 15.2% | 31.4% | $\chi^2 (2)=26.287$ p=0.000 |
| Moderate | 46.4% | 44.8% | |
| Severe | 38.3% | 23.8% | |
| Mood on day to day basis | | | |
| Very negative | 11.4% | 0.8% | $\chi^2 (3)=262.438$ p=0.000 |
| Somewhat negative | 37.3% | 6.2% | |
| Somewhat positive | 39.2% | 53.3% | |
| Very positive | 12.1% | 39.5% | |
| Feelings about life on day to day basis | | | |
| Awful | 8.8% | 1.0% | $\chi^2 (4)=355.963$ p=0.000 |
| Pretty bad | 33.9% | 5.2% | |
| OK | 43.7% | 30.2% | |
| Pretty good | 11.1% | 37.8% | |
| Great | 2.5% | 25.8% | |

more ulcers dropping 7.6%, and those reporting two ulcers dropping 12% from baseline.

Overall health rating on a 10-point scale, where 1 = very poor and 10 = very good, increased significantly from 4.2 to 6.2 (t (1, 1122)=-14.222, p=.000). There was an improved mood state, and the number of people who felt that life was pretty good or great increased from 12.6% to 63.6% (Table 2).

Lifestyle and integration into society

On the initial survey, the majority reported spending their waking hours sitting in another chair (53.9%) or lying in bed (36.1%). At 12 months, there was a significant change in the amount of time spent outside the home ($\chi^2(4)=103.013$, p=0.000). The percentage of subjects that never left their home dropped from 46.6% to 22.4%. The change was most dramatic in Chile where 47.0% originally never left home, compared to 2.3% afterwards. Those who travelled between 100 and 500 meters/day increased from 13.2% to 37.2% ($\chi^2 (4)=151.732$, p=.000) (Figure 2).

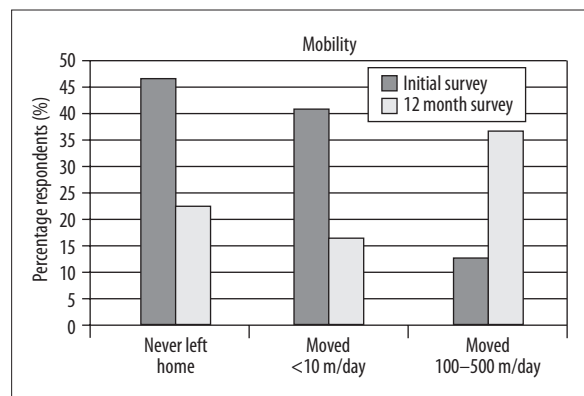


Figure 2. Change in mobility following 12 months of wheelchair use.

Associated with use of the wheelchair, there was an increase in independence. The rating of overall independence was based on a 10 point scale, where 1 = total dependence on a caregiver, 5=50% independence, and 10

Table 3. Changes in function using international classification of function.

| | Time of survey | N | Range | Mean | Std. deviation | Independent samples t-test |
|--|--------------------|-----|-------|-------|----------------|----------------------------|
| Mobility component score | Initial | 603 | 0–12 | 7.46 | 3.051 | |
| | 12-month follow-up | 516 | 0–12 | 6.19 | 3.046 | p=.000 |
| Self-care component score | Initial | 603 | 0–16 | 8.06 | 5.421 | |
| | 12-month follow-up | 516 | 0–16 | 7.18 | 5.541 | p=.007 |
| Domestic life component score | Initial | 603 | 0–12 | 9.72 | 2.977 | |
| | 12-month follow-up | 515 | 0–12 | 9.53 | 3.052 | p=.286 |
| Interaction and relationship component score | Initial | 603 | 0–4 | 1.84 | 1.386 | |
| | 12-month follow-up | 515 | 0–4 | 1.32 | 1.329 | p=.000 |
| Major life area component score | Initial | 603 | 0–6 | 4.90 | 1.530 | |
| | 12-month follow-up | 514 | 0–6 | 4.56 | 1.939 | p=.001 |
| Community, social and civic component score | Initial | 603 | 0–6 | 4.52 | 1.705 | |
| | 12-month follow-up | 514 | 0–6 | 4.57 | 1.631 | p=.620 |
| Total function score | Initial | 603 | 0–56 | 36.50 | 13.076 | |
| | 12-month follow-up | 514 | 0–56 | 33.40 | 13.713 | p=.000 |

Component scores based on the sum of items scaled as follows: 0 = no difficulty; 1 = mild difficulty; 2 = severe difficulty/unable to perform. See Appendix 1 for item distribution.

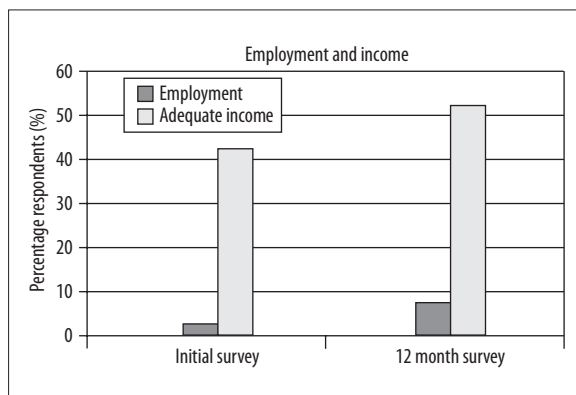


Figure 3. Change in employment and income after 12 months of wheelchair use.

= total independence. At baseline, average independence from a caregiver was 3.9. After 12 months using the wheelchair, the overall independence rating was 5.0, indicating a significant difference in ratings of independence ($t(1115) = -7.757, p=0.000$).

Using questions based on the ICF, there was improvement in several functional areas. Self-care component scores were reportedly improved; there was increased ease in moving in or outside the home, and in forming and maintaining social relationships; function in major life areas including education, employment and non-remunerative work also improved. The component scores in domestic life and

community, social, and civic life remained unchanged. Further details can be viewed in Table 3.

In keeping with improved scores in major life areas, on the follow-up survey, the percentage of respondents who reported having some employment had increased ($\chi^2(1)=18.549, p=0.000$), as had the number who reported adequate income ($\chi^2(2)=19.741, p=0.000$) (Figure 3). All of those employed said the wheelchair was at least partially responsible for their ability to work. Almost nine percent of the sample said the family income had increased due to acquisition of a wheelchair. These numbers were driven mainly by large changes in India where employment reportedly rose from 7.0% to 18.4% following use of the wheelchair, and those with adequate income increased from 12.6% to 23.4%.

Of all the recipients who remained unemployed, 15.4% considered themselves capable of a desk job (computer work, answering phones). The reasons given for continued unemployment included inaccessible buildings and an inability to use the wheelchair with public transportation.

Repairs to the wheelchairs were necessary in 3.3% of cases (17 subjects) during 12 months of use (Table 4). In all cases, repairs cost less than one typical day's wage. Cause of the chair's breakdown was generally viewed as usual wear and tear in the environment (94.1% of those who needed repairs). Overall satisfaction with the chair across all three countries averaged 8.75 out of 10, where 1 = very dissatisfied, and 10 = very satisfied.

Table 4. Wheelchair maintenance n=516.

| Location of repairs in 12 months | Percentage of respondents |
|----------------------------------|---------------------------|
| Front wheels | 2.2% |
| Back wheels | 2.3% |
| Brakes | 0.2% |
| Foot rest | 0.2% |
| Harness | 0.2% |

DISCUSSION

There were several important trends found in this study which support the efficacy of the simply designed, donated wheelchair. This is seen in terms of physical and emotional health, as well as in lifestyle and integration into society.

Physical and emotional health

Recipients of chairs reported a decrease in the frequency of illness and hospitalization after receiving the wheelchair. This finding may be because recipients were kept off of unsanitary floors or streets. Use of the chair and the act of propulsion may have prevented some negative sequela from bed rest and immobilization.

Since pressure ulcers are a disabling and potentially life threatening occurrence in wheelchair users, their prevention is critical. They are reported as a cause of thousands of deaths per year in the United States [25]. Between 50% and 85% of patients with spinal cord injury experience a pressure ulcer in their lifetime, and 15% within the first year after injury [26].

In this sample of varied diagnoses, at baseline 27.2% had experienced pressure ulcers at some time in the past, and an equal number within the past year. Since 41% of recipients had been disabled for at least 10 years, the occurrence of ulcers appeared relatively constant over time. At the 12 month follow up, only 9.9% had experienced pressure ulcers during the previous 6 months, apparently indicative of healing. This finding aligns with the previously reported study of 188 wheelchair recipients in India and Peru [16], where the decrease in pressure ulcers was hypothesized to be due to the effect of propelling the chair. Movement associated with propulsion modifies seated pressure, possibly allowing increased blood flow to high pressure areas. In the current study, of those who reported ulcers during the previous 6 months, 92.3% also reported inadequate daily nutrition. This shows the compounding health risks of the disabled who are economically disadvantaged.

Shoulder and back pain are common in wheelchair users due to the mechanics of pushing the chair. According to Boninger et al. [27], 60% of a convenience sample of wheelchair users reported neck pain within the last month. In another study, nearly 70.0% of a sample of spinal cord injured wheelchair users reported pain at some site; 45% experienced back pain and 40% experienced shoulder pain

[28]. The number of subjects in this study who reported pain (41%) is not greater than in other studies and is significantly less than what they reported before using the wheelchair (70.3%). This improvement may be due to less strain in lifting themselves, either on the floor or with another previous means of mobility.

There is an increased prevalence of mood disorders in people with chronic illness which have been shown to negatively impact its course [29]. Improved mood state and feelings about life in this study may be associated with perceived hope for health and function or perceived control over their environment. The change in mood may, in turn, positively affect the outcome of their physical disability. The higher rating given to overall health is likely a reflection of decreased illness, diminished pressure ulcers, and improved feelings about life.

Lifestyle and integration into society

This study agrees with previous studies by Salminen et al. [9] and Shore [16] which showed that a mobility device improves the users' function and participation. In the current sample, however, there were limitations. Recipients were able to better form relationships with family, friends, and neighbors, but not to participate in social clubs, or religious and leisure activities. Although self-cares and mobility improved, the recipient's ability to help with domestic chores (preparing meals and doing housework) did not. Even if they were unable to help others, however, the increased ability to care for one's self frees family members for other duties. These findings may explain why 99.8% said the wheelchair had helped their family. While statistically significant, the change in function scores was small. However, the difference between a task being impossible or severely difficult to becoming possible with moderate difficulty is an important distinction.

The small but significant increase in employment and income in this study will lessen, to some degree, the financial burden on families and the State. However, 91.7% remained unemployed. Based on reported data, addressing transportation and accessibility issues in these countries could potentially have added an additional 15% of the sample to the workforce. Nguyen describes the problem with the bus systems in Vietnam. They were found to lack adequate boarding ramps to help people getting on and off the bus, and there was insufficient allocated space inside for people with a disability [30]. If this was remedied, transportation could diminish as a hindrance to employment.

Because increased mobility and function in the current study were associated with improved mood state, temporary loss of this advantage through breakdown of the wheelchair would be expected to cause frustration and dissatisfaction. According to Fitzgerald [31], satisfaction with a wheelchair is linked closely to the number of repairs. In their study of 130 wheelchair users, 26% of participants had completed a wheelchair repair, and 27% a tire repair in the previous 6 months. In McClure's sample of spinal cord injured wheelchair users [32], 44.8% had repaired their chair in the previous 6 months. Repairs in the current study did not exceed these numbers, and this is reflected in the overall satisfaction ratings of the chair.

Use of the wheelchair appears to have markedly changed the lifestyle of recipients as evidenced by increased time spent outside the home and increased distance travelled/day. This change represents increased exposure of the recipient to the outside world, and of the outside world to the disabled.

Limitations of the study

As is common in studies that rely on self-report and data collection across multiple locations and time periods, this study had several limitations that necessitate caution when drawing conclusions. It used a single sample design of a subject population and lacks comparison with a control group of subjects who did not receive a wheelchair. All subjects within the local area of the affiliates who were lacking a wheelchair and considered in need of one received it. Although future studies could compare the responses of eligible subjects who were given wheelchairs to those who were not, temporarily denying one group the known advantage of mobility makes this ethically unviable. Next steps should include a repeated measures analysis, which was the intent of this study, but was not achieved due to recording error in the follow-up interviews which prevented the researchers from matching subject responses across time.

The medical diagnoses attached to each subject were self-reported rather than from a review of medical records, leaving room for reporting error or distortion. Additionally, medical diagnostic methods may vary by country and should not be considered 100% consistent.

Because the affiliating agencies were members of the local community, the potential for saving face and inaccurate reporting by recipients is acknowledged. This risk was deemed preferable to the use of outside interviewers who may not have been familiar with local cultural customs and norms, thus resulting in distrust or other forms of data inaccuracy.

On the 12 month survey, subjects were asked about any factors other than the wheelchair which might have influenced the change in their function or mobility. Three people reported receiving rehabilitation training, and 1 reported increased access to medical care. Thus for these 4/519 subjects, other factors may have contributed to the positive changes in health and function.

CONCLUSIONS

This study illustrates improvement in the difficult lifestyle of a sample of the disabled in various parts of the world. Lack of access to medical care and inadequate nutrition complicated their physical state. Lack of mobility inhibited their interaction with society. Limited access to employment and education prohibited their fullest contribution to society, and burdened the family. Receipt of a simple and durable wheelchair improved the reported health, quality of life, and function of recipients following 12 months of use. Despite the possible inflation from self-reported measures, this study demonstrates the perceived benefit resulting from receipt of a simple means of personal mobility. This practice should be encouraged.

APPENDIX 1

Categories of function

| Categories of function |
|---|
| Mobility |
| d4153 Maintaining a sitting position |
| d4209 Transferring self from one location to another (from chair to bed, to toilet, etc.) |
| d4309 Carrying an object from one place to another |
| d4600 Moving around within the home |
| d4602 Moving around outside home and other buildings |
| d4702 Using public transportation |
| Self-care |
| d5109 Washing self |
| d5201 Brushing teeth |
| d5202 Caring for hair, shaving |
| d5309 Toileting |
| d5409 Dressing |
| d550 Eating |
| d5700 Ensuring personal comfort (light, heat, shade, position) |
| d5702 Maintaining personal health (avoiding risk for injury, disease) |

Domestic life

d6200 Shopping (selecting food, household items)

d6201 Gathering daily necessities (food, fuel)

d6309 Preparing meals

d6409 Doing housework

d6508 Caring for household objects (furnishings, plants)

d6609 Assisting others (family, friends)

Interpersonal interactions and relationships

d7509 Forming and maintaining social relationships (neighbors, friends, acquaintances)

d7609 Forming and maintaining family relationships (parent, child, siblings, extended family)

Major life areas

d839 Acquiring education (school, vocational)

d8509 Acquiring or keeping employment (for self, or for family member if recipient is a child or dependent)

d855 Engaging in non-remunerative work (charity, voluntary work)

Community, social and civic life

d9109 Engaging in community social life (clubs, associations)

d9209 Engaging in recreation/leisure activities (hobbies, play, sports, travel)

d9309 Engaging in religious activities (church, temple, mosque)

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REFERENCES

- <http://www.who.int/disabilities/en/> Accessed Jan 5, 2012
- http://whqlibdoc.who.int/publications/2011/9789240685215_eng.pdf. Accessed Jan 5, 2012
- <http://www.worldbank.org.in/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/INDIAEXTN/0,,contentMDK:21557057~pagePK:1497618~piPK:217854~theSitePK:295584,00.html> Accessed January 10 2012
- Contreras D, Ruiz-Tagle J, Garces P, Az'ocar I: Socio-Economic Impact of Disability in Latin America: Chile and Uruguay. <http://www.inlatina.org/educacion-inclusiva/doc-materiales/socio-economic-impact-of-disability-in-chile-and-uruguay.pdf> July 21, 2006, accessed January 10, 2012
- http://siteresources.worldbank.org/DISABILITY/Resources/Regions/East-Asia-Pacific/JICA_Vietnam_2.pdf. Accessed January 12, 2012
- <http://www.choike.org/2009/eng/informes/6512.html> Accessed Nov 13, 2011
- 2004 International Disability Conference – Second Day Kaynote with Dr. Amartya Sen. <http://info.worldbank.org/etools/bspan/PresentationView.asp?PID=1355&EID=667> accessed Nov 11, 2011
- WHO, 2008. ([http://www.who.int/disabilities/publications/technology/English%20Wheelchair%20Guidelines%20\(EN%20for%20the%20web\).pdf](http://www.who.int/disabilities/publications/technology/English%20Wheelchair%20Guidelines%20(EN%20for%20the%20web).pdf) accessed Nov 11, 2011
- Salminen A, Samuelsson K, Outi T, Malmivaara A: Mobility Devices to Promote Activity and Participation: A Systematic Review. *J Rehabil Med*, 2009; 41(9): 697–706
- Tefft D, Guerette P, Furumasu J: Cognitive Predictors Of Young Children's Readiness For Powered Mobility. *Developmental Medicine and Child Neurology*, 1999; 41(10): 665–70
- Pearlman J, Cooper R, Krizack M et al: Lower Limb Prosthesis and Wheelchairs in Low-Income Countries. *IEEE Eng Med Biol Mag*, 2008; 27(2): 12–22
- Mukherjee G, Samanta A: Wheelchair Charity: a useless benevolence in community-based rehabilitation. *Disability & Rehabilitation*, 2005; 27: 591–96
- Cooper R: Wheelchair Standards: It's all about quality assurance and evidence-based practice. *J Spinal Cord Med*, 2006; 29(2): 93–94
- Zipfel E, Cooper RA, Pearlman J et al: New design and development of a manual wheelchair for India. *Disabil Rehabil*, 2007; 29(11–12): 949–62
- <http://www.freewheelchairmission.org/site/c.fgLFIXOJKtF/b.4916275/k.BE91/Home.htm> accessed Jan 5, 2012
- Shore S: Use of an economical wheelchair in India and Peru: Impact on health and function. *Med Sci Monit*, 2008; 14(12): PH71–79
- World Health Organization: International Classification of Functioning, Disability and Health: ICF. Geneva: WHO, 2001
- Grill E, Stucki G, Boldt C et al: Identification of relevant ICF categories by geriatric patients in an early post-acute rehabilitation facility. *Disabil Rehabil*, 2005; 27(7–8): 467–73
- Stucki A, Stucki G, Cieza A et al: Content comparison of health-related quality of life instruments for COPD. *Respir Med*, 2007; 101(6): 1113–22
- Stucki A, Borchers M, Stucki G et al: Content comparison of health status measures for obesity based on the international classification of functioning, disability and health. *Int J Obes (Lond)*, 2006; 30(12): 1791–99
- Khan F, Pallant JF: Use of International Classification of Functioning, Disability and Health (ICF) to describe patient-reported disability in multiple sclerosis and identification of relevant environmental factors. *J Rehabil Med*, 2007; 39(1): 63–70
- Zochling J, Grill E, Scheuringer M et al: Identification of health problems in patients with acute inflammatory arthritis, using the International Classification of Functioning, Disability and Health (ICF). *Clin Exp Rheumatol*, 2006; 24(3): 239–46
- Van Echteld I, Cieza A, Boonen A et al: Identification of the most common problems by patients with ankylosing spondylitis using the international classification of functioning, disability and health. *J Rheumatol*, 2006; 33(12): 2475–83
- Barker DJ, Reid D, Cott C: The experience of senior stroke survivors: factors in community participation among wheelchair users. *Can J Occup Ther*, 2006; 73(1): 18–25
- Redelings M, Lee N: Pressure ulcers: more lethal than we thought? *Advanced Wound Care*, 2005; 18(7): 367–72
- Maurer C, Sprigle C: Effect of seat inclination on seated pressures of individuals with spinal cord injury. *Physical Therapy Journal*, 2004; 84(3): 255–61

27. Boninger ML, Cooper RA, Fitzgerald SG et al: Investigating neck pain in wheelchair users. *Am J Phys Med Rehabil*, 2003; 82(3): 197–202
28. Jain NB, Higgins LD, Katz JN, Garshick E: Association of shoulder pain with the use of mobility devices in persons with chronic spinal cord injury. *PMR*, 2010; 2(10): 896–900
29. Gadalla T: Association of comorbid mood disorders and chronic illness with disability and quality of life in Ontario, Canada. *Chronic Dis Can*, 2008; 28(4): 148–54
30. Nguyen TTH: Which accessible and safe road is ensured for the elders and the disabled people? The case in Hanoi and Ho Chi Minh, Vietnam. *Social Research in Transport Clearinghouse*. <http://www.sortclearinghouse.info/research/652/> Accessed April 27, 2011
31. Fitzgerald SG, Collins DM, Cooper RA et al: Issues in maintenance and repairs of wheelchairs: A pilot study. *J Rehabil Res Dev*, 2005; 42: 853–62
32. McClure LA, Boninger ML, Oyster ML et al: Wheelchair repairs, breakdown, and adverse consequences for people with traumatic spinal cord injury. *Arch Phys Med Rehabil*, 2009; 90(12): 2034–38