

THE COMPARISON OF HEALTH AND FUNCTION OUTCOMES FOLLOWING USE OF A DEPOT STYLE WHEELCHAIR VERSUS ONE WITH A CUSTOMIZED FIT

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ABSTRACT

Wheelchair design is known to impact both the function and satisfaction of the user. Few studies have compared identical outcome measures in similar population samples following use of two different styles of wheelchair. This study includes 196 subjects from Peru and 132 subjects from Uganda who used two models of wheelchairs developed by the Free Wheelchair Mission for 12 months – one a depot style chair, and one which was adjusted for fit. Variables of health, function, and satisfaction were evaluated along with repair and maintenance statistics. Subjects in Uganda were younger and from rural locations. They were more satisfied with the Generation 2 chair, possibly because of easier rolling on uneven terrain due to the larger rear wheel size. There did not appear to be significant differences in pain or pressure ulcers between the 2 styles of chair. In both countries and chair styles, the rear wheels required the most repair, but still in keeping with other US reported data. There was high usage of both Gen 1 and Gen 2 chairs, particularly outdoors, but no real difference in data between the two styles. In summary, there are very few differences in reported health and function indicators between the two styles in the developing world. Higher satisfaction of the Generation 2 in Uganda appears to be related to usage in rural areas.

BACKGROUND

There is a significant need to provide manual wheelchairs in less resourced countries of the world. According to the World Health Organization, in 2003 there were approximately 20 million people who required a wheelchair but did not have access to one (WHO, 2008). 80% of these individuals live in low-income countries, where state resources for manufacturing, transport, or service delivery, may be inadequate. A majority of the disabled are poor, unemployed, and unable to purchase services including assistive technology (DAR, 2006). This limits their ability to participate in and contribute to society through education and employment.

Provision of assistive technology, therefore, has often fallen to international non-governmental or governmental organizations. The goal of provision is to optimize mobility with the greatest possible independence while at the same time, maintaining fiscal responsibility.

In WHO's "Guidelines on the Provision of Manual Wheelchairs in Less Resourced Settings" (WHO, 2008), appropriate wheelchairs are described as those which meet both the user's need and environmental conditions while providing proper fit and postural support, safety, durability, and local and affordable maintenance.

Safety depends, in part, on the stability of the chair. According to Tomlinson (2000) the rear stability of a wheelchair tends to decrease as the chair is made easier to propel. Most experts believe that adjustable manual chairs have less rearward stability than standard chairs, which are also harder to propel and turn (Brubaker, 1986).

Durability is known to affect the satisfaction of the wheelchair user (Fitzgerald, 2005). Increased maintenance is associated with decreased satisfaction.

While meeting the user's need varies from person to person, basic mobility because of a wheelchair has been shown to increase social participation, societal integration, and quality of life (Shore and Juillerat (2010).

Another factor that may affect quality of life for wheelchair users is the biomechanics of wheeling a chair (Chow and Levy 2011). According to Cowan et al (2009), peak resultant and tangential forces increase as chair weight increases and when the axle is in a posterior position, thus increasing the stress of wheeling.

Pain and illness decrease quality of life. Previous studies have examined the incidence of pressure ulcers and illness in wheelchair users (Shore and Juillerat, 2010). Sitting on a properly designed cushion with fitted backrest has been shown to reduce pelvic posterior rotation and increase lumbar intervertebral disc heights, lowering the risk of low back pain. (Makhsous et al, 2003).

PURPOSE

While it is known that wheelchair design affects the indicators of quality of life and function, there is a paucity of studies comparing identical outcomes following use of varying wheelchair designs. The purpose of the current study was to compare outcomes of health, function, and

satisfaction following use of a standard depot style chair compared to one that has been customized for fit.

METHOD

Subjects

Local affiliates of the Free Wheelchair Mission in Peru and Uganda identified potential subjects in need of a wheelchair. Affiliates were asked to provide equal numbers of each wheelchair style. Surveys were administered prior to wheelchair distribution and then again 6 and 12 months later.

Initial participants consisted of 224 people in Peru and 198 in Uganda. After attrition, there were 196 subjects in Peru at 6 months and 136 people at 12 months. In Uganda, there were 132 subjects at 6 months and 98 subjects at 12 months.

Surveys

Surveys were modified from those previously developed to evaluate the change in health and function following receipt of a donated wheelchair (Shore, 2008). Lifestyle and function were assessed in part through the framework of WHO's International Classification of Functioning, Disability and Health (ICF). Data also included illness, employment, independence in daily activities, as well as the reported maintenance of the wheelchairs.

Wheelchairs

The Free Wheelchair Mission (FWM) has developed two models of wheelchair that are donated to recipients in the developing world. The Generation One chair (Figure 1) is a depot style polypropylene resin chair with a semi-rigid seat and back. The seat width is 44 cm (17.3 inches) at the front and 41 cm (16 inches) at the rear. Depth is 39.4 cm (15.5 inches). There are 24-inch pneumatic tires in the rear with push-rims, and adjustable leg lengths. The chair comes with an optional harness for extra postural support.



Figure 1. Generation 1 Wheelchair

The Generation Two chair (Figure 2) comes in three different size frames, with an adjustable back rest made of EVA foam padding inside a nylon cover with 4 possible

back rest heights. It has 26-inch rear pneumatic wheels, swing away footrests and adjustable leg lengths.

Both wheelchair styles have 8-inch natural rubber castors in the front, steel over-lock brakes, and are supplied with a polyurethane foam cushion covered with nylon. The net weight of each is 16.5 kg (36.4 pounds).



Figure 2. Generation 2 Wheelchair

Data Analysis

Survey data was collected in face-to-face interviews by local staff of FWM affiliates, and results were exported to Excel files in the United States. Independent samples t-tests were used to test for group differences using a significance level of $p < 0.05$ for all analyses.

RESULTS

Demographic characteristics

Mean reported age for participants in Peru was 51 years. Approximately 80% were from a large metropolitan area. Half had used a wheelchair of some type previous to the FWM wheelchair. Ninety seven percent report access to medical care.

In Uganda, the mean age was 27 years. Eighty five percent lived in rural communities. Forty four percent had used a previous wheelchair. Sixty-seven percent report access to medical care.

Respondents for both countries across all surveys and wheelchairs model report adequate daily nutrition at least 70% of the time. **?with no significant difference between the 2 countries or models?**

Satisfaction

Overall self-perceived satisfaction with a FWM wheelchair (on a scale of 1 (lowest) – 10 (highest)) was at least 7.59. The responses for those in Uganda trended higher than those in Peru (Table 1).

Table 1 FWM Wheelchair Satisfaction

	GEN 1	GEN 2
Peru 2	7.59 (n=143)	7.52 (n=27)
Peru 3	7.70 (n=99)	7.70 (n=20)
Uganda 2	8.36 (n=28)	8.35 (n=68)
Uganda 3	8.11 (n=27)	8.46 (n=41)

When asked how the wheelchair impacted their lives, respondents from each country, regardless of wheelchair model, reported a “somewhat better” or “much better” life since receipt of the wheelchair. These scores for each data point in either country were at least 71.8%. **and not significantly different by model?**

Wheelchair Usage

Two key indicators for usage in these surveys included questions related to whether or not the wheelchairs are utilized in the home and outside the home. The follow up to these questions was related to responses indicating explanations for (lack of) usage. **Maybe list percentages as usage in home and out of home rather than no usage ?**
Appears that Gen 2 used more outside than Gen 1?

Health Indicators

There was no consistency with report of new pressure ulcers across the surveys. For example, with the report of new pressure ulcers in the 2nd (six month) Peru survey, there were 8 new ulcers identified. None of these persons utilized the cushion provided, nor did they use any other cushion. With each of these instances, none of the wheelchair recipients believe that the FWM wheelchair was a contributing factor to this pressure ulcer.

This is in contrast with Uganda, where the report of a new pressure ulcer at the 12 month data point was linked to the recipient utilizing the cushion provided. With all of these instances, the ulcers were on the buttocks. Pressure ulcer staging was not completed at the time of the survey.

Pain?

Independent Function

INDEPENDENCE

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	GEN 1	GEN 2
Peru 2	6.22	4.18
Peru 3	7.10	7.04
Uganda 2	6.98	6.91
Uganda 3	7.43	7.29

Maintenance and Repairs

Self-reported repairs are as listed in Table 2.

Table 2

	Total % Requiring Repair	Back wheels	Front Wheels	Frame	Nuts and Bolts
Uganda Gen 1 n=12	12.2%	25.0%	0%	0%	0%
Uganda Gen 2 n=14	14.3%	57.1%	21.4%	0%	0%
Peru Gen 1 n=30	22%	17.6%	8.1%	0.1%	0.1%
Peru Gen 2 n=4	2.9%	.1%	.1%	0%	1.5%

DISCUSSION

Demographic Characteristics

The population sample from Uganda is generally younger and resides in more rural locales. This may affect reported satisfaction with chair models. The terrain is assumed to be more rough in the rural areas and higher satisfaction with the Generation 2 chair may be due to the larger rear wheel diameter which improves rolling efficiency.

FWM recipients reported a positive change in life since receipt of their wheelchair (regardless of model). The between models difference is not statistically significant for these surveys. The combination of few new pressure ulcers or pain indicate a perceived high quality of life for recipients.

In terms of repairs, the rear (pneumatic) wheels required the greatest amount of maintenance, as is expected. The percentage of Generation 1 chairs in Peru requiring maintenance is higher, attributed to the increased numbers of front wheels

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CONCLUSION

In summary, there are very few differences in reported health and function indicators between the two styles of wheelchair used in the developing world. Satisfaction is high. Higher satisfaction of the Generation 2 in Uganda appears to be related to usage in rural areas.

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