United Nations Statistics Division
United Nations Children's Fund
Statistical Office of the European Communities
Centres for Disease Control and Prevention
of the United States of America

ESA/STAT/AC.81/4-1
24 May 2001

International Seminar on the Measurement of Disability

New York
4-6 June 2001

Gale Whiteneck: Validated Measures of Participation and the Environment from Craig Hospital: CHART and CHIEF

Validated Measures of Participation and the Environment From Craig Hospital: CHART and CHIEF

By Gale Whiteneck, Ph.D. and the Craig Hospital Research Department

For Further Information Contact

Craig Hospital
3425 S. Clarkson St.
Englewood, Colorado 80110
USA

Prepared for the United Nations International Seminar on Measurement of Disability
New York City
4-6 June, 2001

Beginning in the late 1980s Craig Hospital embarked on a research program to develop a measure of rehabilitation outcome more consistent with the goals of the institution—to return people with traumatic spinal cord and brain injury to active and productive lives, well integrated into family and community life. For a theoretical base, the Craig Hospital Research Department turned to the World Health Organization International Classification of Impairment, Disabilities, and Handicaps and designed a tool that proved to be applicable to all types of impairments and quantified the concept then known as handicap and now know as participation.

By the late 1990s the theoretical models of disability had undergone considerable change within the World Health Organization and other health and rehabilitation agencies and a general recognition of the importance of environmental factors emerged. In response, Craig Hospital turned its methodological attention to the development of a measure of environmental factors influencing participation.

The two measures developed by Craig Hospital to systematically quantify the two key concepts of the new paradigm of disability are the Craig Handicap Assessment and Reporting Technique (CHART) and the Craig Hospital Inventory of Environmental Factors (CHIEF). This paper documents the conceptual basis, developmental strategy, and the validation of theses two measures.

The Craig Handicap Assessment and Reporting Technique (CHART)

Theoretical Background

The model of disablement suggested by the World Health Organization (WHO) has provided useful conceptual distinctions for impairment, disability, and handicap. In practical terms, **impairment** occurs at the organ level, representing any loss or abnormality of psychological, physiological, or anatomical structure or function. **Disability** occurs at the time the persons level, demonstrated as any restriction or lack of ability (resulting from an impairment) to perform any activity in the manner or within the range considered normal for a human being. **Handicap** occurs at the societal level. It is a disadvantage for a given individual, resulting from an impairment or a disability, that limits or prevents the fulfillment of a role that is normal (depending on age, sex, and social and cultural factors) for that individual.

According to the WHO, **handicap** describes the total effects and interplay of all the consequences of disability: social, economic, cultural, and environmental.

The WHO has identified six dimensions by which the extent of a person's handicap can be described: 1) orientation, 2) physical independence, 3) mobility, 4) occupation, 5) social integration, and 6) economic self-sufficiency.

A great deal of work has been done in developing tools to measure and document impairment and disability; however, limited attempts have focused on the measurement and assessment of long-term handicap, despite the fact that psychosocial adjustment is clearly regarded as the ultimate outcome of rehabilitation.

The Craig Handicap Assessment and Reporting Technique (CHART) was developed to assess the WHO dimensions of handicap. The instrument was designed to provide a simple, objective measure of the degree to which impairments and disabilities result in handicaps in the years after initial rehabilitation.

Strategy for Development

In planning the design of a handicap measurement tool for people with disabilities, several questions were raised. First, was there any existing index of handicap as a whole or of any WHO defined dimension of handicap? Second, what items would need to be included on a questionnaire, and how would they be quantified such that indices of the various dimensions of handicap could be developed? Third, could the measurement tool be designed so that minor modifications would make it of more global value in measuring handicap for different types of disabilities? Fourth, can the instrument be shortened in length while still maintaining a certain degree of comparability with the original score?

Regarding the first question, while issues relating to the concept of handicap are included in a number of research studies, no single instrument addressed all handicap dimensions or produced an index of handicap using a scoring technique.

To address the second question, a team of rehabilitation and research professionals met regularly to discuss items for inclusion on the questionnaire and, finally, to select those items which would best measure the dimensions of handicap. Decisions also had to be made regarding quantification of the various items. As a result, the CHART includes items which focus on objectively observable criteria which are less likely to be open to subjective interpretation. Thus, CHART items identify behaviors rather than perceptions or attitudes. Based on the WHO model of handicap the original CHART included five of the six WHO domains. A pilot test was carried out with a sample of people with spinal cord injuries (SCI) in order to calibrate the scoring procedures for each of the dimension sub-scales, validate that significant differences in handicap existed between non-disabled persons and those with SCI, and determine the extent of handicap for the persons with SCI. Reliability and validity testing of CHART as well as analysis of the individual item weighting has been conducted, establishing the psychometric soundness of this instrument.

The efforts described above have resulted in a 100-point subscale for each dimension of handicap, which can be interpreted individually or, when totaled, give an overall index of handicap. While initially developed for persons with SCI, the CHART was later tested with the additional WHO domain of orientation among persons with various impairments. Reliability and validity testing for the new domain "Orientation" has been completed, while ongoing analysis of validity for differing impairment groups continue.

In 1999, analysis of CHART resulted in the creation of the CHART Short Form (CHART SF). Analysis of CHART-SF has been conducted on various disability populations including spinal cord injury, traumatic brain injury, stroke, MS, burn and amputee populations. Results indicate that there exists a high correlation between all the CHART-SF subscales and the CHART counterparts. Additionally, CHART-SF yielded reasonable estimates of Physical Independence, Cognitive Independence, Mobility, Social Integration and Occupation sub-scores in all impairment categories.

Characteristics: Dimensions of Handicap

Each CHART dimension of handicap is characterized by directly observable qualities which lend themselves to easy quantification. While an infinite number of factors might have been included to keep the instrument to a practical length. The following dimensions have been operationalized based on the WHO definitions.

Physical Independence is the individual’s ability to sustain a customarily effective independent existence. The major component of this sub-scale is the number of hours per day someone is needed to provide routine or occasional assistance (whether paid or unpaid). Individuals are viewed as somewhat less handicapped if they take primary responsibility for instructing and directing people who are providing assistance to them.

Cognitive Independence is the individual's ability to sustain a customary level of independence without the need for supervision. The factors included in this subscale reflect the amount of hours that a person needs supervision both inside and outside the home, as well as the amount of difficulty an individual has in remembering, communicating and managing money.

Mobility is the individual's ability to move about effectively in his/her surroundings and is demonstrated by the hours per day out of bed, days per week out of the house, nights per year spent away from home, accessibility of the home, and transportation utilization.

Occupation is the individual's ability to occupy time in the manner customary to that person's sex, age, and culture. The time spent in various activities is used to measure this dimension. The relative value society places on different activities is used to weight the time in each category. Although there was a potential for subjective bias based on value judgments in developing the scale in this dimension, priority has been give to gainfully employment, schooling, and active homemaking and maintenance, and this prioritization has been supported by validity and reliability testing. Other elements documented include volunteer work, recreational pursuits, and self-improvement activities.

Social Integration is the individual's ability to participate in and maintain customary social relationships. The factors included in this sub-scale include household composition; romantic involvement; the number of relatives, business associates, and friends with whom regular written or oral contract is maintained; and the frequency of initiating conversations with strangers.

Economic Self-Sufficiency is the individual's ability to sustain customary socio-economic activity and independence. This dimension is defined as the remaining disposable household family income after non-reimbursed medical expenses have been excluded.

Use of the Instrument

The CHART is designed as an interview tool, which can be administered face-to-face or by telephone. Each item on the instrument has been carefully and concisely worded to minimize ambiguity of interpretation. It is possible to use the instrument as a mailed questionnaire, although some valuable data potentially would be lost in the absence of interaction with an interviewer providing consistent prompts.

There is no set time period for administering the CHART; however, it is recommended that multiple measurements be taken over the course of a person's lifetime to assess changes with adaptation to the disability and to gain insight into changes in handicap which may occur over time.

Scoring Overview

A major asset of the CHART is that it produces an index of handicap. There are a number of ways for a person with a disability to demonstrate the absence of handicap, and the scoring procedures of the CHART give credit to these various behaviors. However, the instrument is designed to measure handicap, not to identify the characteristics shared by 'super-achievers.' Therefore, although it is possible to score more than 100 on most of the sub-scales, a maximum of 100 points has been allowed, as a score of 100 would indicate no handicap in that dimension.
It is recognized that value judgments are critical to the actual scoring of many items. These value judgments reflect the expectations of society for non-disabled persons, and a pilot test of

the CHART on non-disabled persons was used to calibrate the scoring. The vast majority of non-disabled persons received a score of 100 on each dimension while scores below 100 were common among individuals with spinal cord injury. The scoring guidelines and step-by-step instructions will be described later.

The data in the following tables are based on an analysis of nearly 500 individuals with SCI for whom CHART information is available. These individuals completed CHART while the cognitive domain was still being tested. Nevertheless, the tables are provided to illustrate the types of scores you may expect for people with various levels of disabilities. For example, in the 'Percentile Distribution of Physical Independence Scores' table, 10% of the 'Cervical-MIS =0' group achieved a score of 4 or less, while 25% achieved a score of 28 or less.

The motor index score, developed by the American Spinal Injuries Association, provides a numerical system to evaluate strength in ten key upper and lower extremity muscles. The scores for each muscle are added together to create a motor index score for an individual. In the following tables, the group labeled 'Cervical-MIS =0' represents persons with cervical level injuries and motor index scores of 0. These are individuals with high level neurologically complete quadriplegia. The 'Cervical-MIS = 1-49' group represents persons with cervical level injuries and motor index scores between 1 and 49. The 'Cervical-MIS .49' group scores greater than 49, including those with quadriparesis. The group labeled 'Thoracolumbar-MIS =50' represents individuals with neurologically complete paraplegia. The group labeled 'Thoracolumbar-MIS .50' represents persons with neurologically incomplete or low level paraplegia.

The groups represented in the following tables are of varying sizes. The percentile distributions of the larger groups are presumed to be more accurate.

Table 1: Percentile Distribution of Physical Independence Scores by ASIA Score

	Interdecile Range Interquartile Range Median				
	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
Cervical-MIS=0 (N=29)	4	28	57	85	94
Cervical-MIS 1-49 (N=131)	28	76	88	94	100
Cervical-MIS >49 (N=44)	89	96	100	100	100
Thoracolumbar-MIS=50(N=105)	95	99	100	100	100
Thoracolumbar-MIS >50 (N=33)	88	100	100	100	100
Nondisabled (N=88)	100	100	100	100	100

Table 2: Percentile Distribution of Mobility Scores by ASIA Score

	Interdecile Range Interquartile Range Median				
	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
Cervical-MIS=0 (N=29)	28	51	71	85	96
Cervical-MIS 1-49 (N=131)	41	72	89	100	100
Cervical-MIS >49 (N=44)	68	88	100	100	100
Thoracolumbar-MIS=50(N=105)	79	92	100	100	100
Thoracolumbar-MIS >50 (N=33)	94	100	100	100	100
Nondisabled (N=88)	100	100	100	100	100

Table 3: Percentile Distribution of Occupation Scores by ASIA Score

	Interdecile Range Interquartile Range Median				
	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
Cervical-MIS=0 (N=29)	3	10	22	53	63
Cervical-MIS 1-49 (N=131)	10	25	48	95	100
Cervical-MIS >49 (N=44)	19	32	62	100	100
Thoracolumbar-MIS=50(N=105)	23	42	78	100	100
Thoracolumbar-MIS >50 (N=33)	29	57	85	100	100
Nondisabled (N=88)	70	98	100	100	100

Table 4: Percentile Distribution of Social Integration Scores by ASIA Score

	Interdecile Range Interquartile Range Median				
	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
Cervical-MIS=0 (N=29)	30	65	85	100	100
Cervical-MIS 1-49 (N=131)	55	82	96	100	100
Cervical-MIS >49 (N=44)	65	85	100	100	100
Thoracolumbar-MIS=50(N=105)	62	88	100	100	100
Thoracolumbar-MIS >50 (N=33)	75	94	100	100	100
Nondisabled (N=88)	93	100	100	100	100

Table 5: Percentile Distribution of Economic Self-Sufficiency Scores by ASIA Score

	Interdecile Range Interquartile Range Median				
	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
Cervical-MIS=0 (N=29)	25	50	75	100	100
Cervical-MIS 1-49 (N=131)	25	50	100	100	100
Cervical-MIS >49 (N=44)	25	75	100	100	100
Thoracolumbar-MIS=50(N=105)	25	75	100	100	100
Thoracolumbar-MIS >50 (N=33)	50	75	100	100	100
Nondisabled (N=88)	75	100	100	100	100

Table 6: Percentile Distribution of Total CHART Scores by ASIA Score

	Interdecile Range Interquartile Range Median				
	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
Cervical-MIS=0 (N=29)	232	260	358	364	435
Cervical-MIS 1-49 (N=131)	227	334	410	457	491
Cervical-MIS >49 (N=44)	345	390	420	495	500
Thoracolumbar-MIS=50(N=105)	345	399	449	489	500
Thoracolumbar-MIS >50 (N=33)	357	450	472	492	500
Nondisabled (N=88)	425	468	500	500	500

Tables 7-13 provide the characteristics of CHART as the scores relate to persons with differing Impairments. Persons with spinal cord injury (SCI), traumatic brain injury (TBI), Stroke, MS, Burn and Amputees were administered the CHART. While caution should be used in comparing the handicappedness of various impairments, the data show that the use of CHART across

impairment groups is supported by its ability to differentiate assistance needs in a manner consistent with those needs that are associated with a certain disability.

Table 7 : Percentile Distribution of Physical Independence Scores by Impairment Group

	Interdecile Range Interquartile Range Median				
	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
SCI	50	80	93	100	100
TBI	88	99	100	100	100
MS	88	97	99	100	100
Stroke	4	86	99	100	100
Amputee	94	99	100	100	100
Burn	99	100	100	100	100

Table 8: Percentile Distribution of Cognitive Independence Scores by Impairment Group

	Interdecile Range Interquartile Range Median				
	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
SCI	82	94	100	100	100
TBI	34	63	88	100	100
MS	62	88	94	100	100
Stroke	26	52	88	100	100
Amputee	88	100	100	100	100
Burn	92	96	100	100	100

Table 9 : Percentile Distribution of Mobility Scores by Impairment Group

	Interdecile Range Interquartile Range Median				
	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
SCI	51	65	81	95	100
TBI	54	73	90	97	100
MS	47	67	82	95	100
Stroke	31	52	68	89	97
Amputee	70	87	95	99	100
Burn	72	92	97	100	100

Table 10 : Percentile Distribution of Social Integration Scores by Impairment Group

	Interdecile Range Interquartile Range Median				
	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
SCI	45	70	85	100	100
TBI	30	90	80	100	100
MS	50	70	90	100	100
Stroke	20	40	61	84	98
Amputee	46	70	93	100	100
Burn	42	68	95	100	100

Table 11 : Percentile Distribution of Occupation Scores by Impairment Group

	Interdecile Range Interquartile Range Median				
	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
SCI	16	37	79	100	100
TBI	15	35	88	100	100
MS	19	39	82	100	100
Stroke	2	9	31	55	90
Amputee	38	67	99	100	100
Burn	48	76	100	100	100

Table 12 : Percentile Distribution of Economic Self-Sufficiency Scores by Impairment Group

	Interdecile Range Interquartile Range Median				
	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
SCI	25	50	100	100	100
TBI	25	63	100	100	100
MS	28	75	100	100	100
Stroke	25	50	100	100	100
Amputee	25	25	88	100	100
Burn	25	31	100	100	100

Table 13 : Percentile Distribution of CHART Scores by Impairment Group

	Interdecile Range				
		Interquartile Range			
			Median		
	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
SCI	394	438	493	539	586
TBI	361	460	517	571	590
MS	387	457	521	568	594
Stroke	241	366	454	510	558
Amputee	450	492	536	579	597
Burn	415	498	550	594	599

The tables presented are intended to be used as guidelines. It is unlikely that your own testing results will exactly match the data in the tables. It is hoped, however, that this information will help you in identifying trends in CHART scores obtained from other individuals.

Factors Influencing CHART Scores

There are a variety of pre-morbid or post-rehabilitation factors that might explain CHART scores which deviate from the scores of other persons with similar impairments and disabilities. It has been suggested in the literature that certain pre-morbid behaviors, attitudes, and prior life experiences have been found to be correlates of successful rehabilitation outcomes. In addition to pre-existing individual characteristics, post-rehabilitation constraints and limitations may influence CHART scores. These factors include such things as family interference, alcohol or drug use, and awareness of vocational options. While CHART does not isolate any of these causes, it measures the combined consequences to the individual from these various factors.

Chart Short Form

To reduce the number of questions in CHART a multi dimensional analysis plan was designed. First, using data already gathered from a previous study, item-scale and item-total correlation coefficients were calculated for each scale. Second, regression analysis was performed on each subscale with the dependent measure being the scale score and the variables contributing to the subscale acting as the predictor variables. It was hypothesized that each subscale score could be accurately be predicted by fewer items. With two exceptions, the only variables that were selected to be in a subscale were those that entered into a stepwise regression model together explaining over 90% of the variance. Third, once the items had been selected for each subscale, the items were re-scored. Each subscale was computed to have a maximum score of 100, which indicates no handicap in that domain. Furthermore, efforts were made to keep all of the score weightings of the variables proportionate to the original weightings. Fourth, the CHART Short Form items and scoring will be evaluated on 1800 persons that will contribute to the Behavioral Risk Factor Surveillance System's survey of Colorado residents.

All CHART subscale scores could be reduced by fewer questions to reach 90% explained variance except Economic Self-Sufficiency, which using the main variables could only explain 45%. A possible explanation for the lack of predictive ability for the Economic subscale was the alarmingly high rate of refusal for economic questions. 40% of the people failed to respond to either the question about income or expenditures not covered by insurance. In light of the missing data, it was determined that those questions would change with the addition of response categories rather than open ended questions. These overall findings show that:

- Using the fewest number of items to predict the largest amount of variation explained is a reasonable method for shortening a questionnaire.
- CHART-SF sub-scales closely approximate the scores of the subscales gathered by the Original CHART.
- CHART-SF takes less time to administer than the Original CHART

CHART-SF is a valuable tool for determining handicap for populations in which time is at a minimum. Although using a tool with fewer items may decrease the precision for smaller groups, the use of CHART-SF in larger populations will obviate the lack of precision by the change in confidence intervals

CHART References

1. Boninger, M., et al. (1998) Postural changes with aging in tetraplegia: effects on life satisfaction and pain. *Arch Phys Med Rehabil.,* 79, 1577.
2. Brooks, C., Gabella, B., Hoffman, R., Sosin, D., Whiteneck, G. (1997) Traumatic brain injury: designing and implementing a population-based follow-up system. *Arch Phys Med Rehabil.,* 78, S26-30.
3. Corrigan, J., et al. (1998) Outcomes in the first five years after traumatic brain injury. *Arch Phys Med Rehabil.,* 79, 298-305.
4. Cusick, C.P., Brooks, C.A., Whiteneck, G.G. Use of proxies in disability outcome research: an assessment of participant-proxy agreement across disability types. Manuscript in development.
5. Dijkers, M. (1991). Scoring CHART: survey and sensitivity analysis. *J Amer Paraplegia Soc.,* 14, 85-86.
6. Hall, K.M., Dijkers, M., Whiteneck, G., Brooks, C.A., Krause, J.S. (1998). The Craig handicap assessment and reporting technique (CHART): metric properties and scoring. *Top Spinal Cord Inj Rehabil,* 4(1), 16-30.
7. Mellick, D., Walker, N., Brooks, C.A., Whiteneck, G. (1999). Incorporating the cognitive independence domain into CHART. *J Rehabil Outcomes Meas,* 3(3), 12-21.
8. The National Spinal Cord Injury Statistical Center. (1995) The Model Spinal Cord Injury Care Systems Data Collection Syllabus for the National Spinal Cord Injury Database. Birmingham, AL: The University of Alabama at Birmingham.
9. Segal, M.E., Schall, R.R. (1995). Assessing handicap of stroke survivors. A validation study of the Craig Handicap Assessment and Reporting Technique. *Amer J Phys Med Rehabil.,* 74, 276-286.

10. Vogel, L. (1998) Long-term outcomes and life satisfaction of adults who had pediatric spinal cord injuries. *Arch Phys Med Rehabil.*, 79, 1496-1503.
11. Waters, R. (1998) Postrehabilitation outcomes after spinal cord injury caused by firearms and motor vehicle crash among ethnically diverse groups. *Arch Phys Med Rehabil.*, 79, 1237-1243.
12. Whiteneck, G.G., Charlifue, S.W., Gerhart, K.A., Overhosler, J.D., Richardson, G.N. (1992). Quantifying handicap: a new measure of long-term rehabilitation outcomes. *Arch Phys Med Rehabil.*, 73, 519-26.
13. Whiteneck, G.G. (1996). Evaluating outcome after spinal cord injury: what determines success? 1996 Munro Lecture. *J Spinal Cord Med.*, 20(2), 179-185.
14. Whiteneck, G.G., Brooks, C.A., Mellick, D.C. (1997). Handicap assessment - final report. Rehabilitation Research and Training Center on Functional Assessment and Evaluation of Rehabilitation Outcomes, Buffalo, NY: State University of New York.
15. Whiteneck, G.G., Fougeyrolles, P., Gerhart, K.A. (1997). Elaborating the model of disablement. In: Fuhrer, M, ed. Assessing Medical Rehabilitation Practices: The Promise of Outcomes Research. Baltimore: Paul H. Brooks Publishing Co.
16. Whiteneck, G., Tate, D., Charlifue, S. (1999). Predicting community reintegration after spinal cord injury from demographic and injury characteristics.
17. Whiteneck, G.G., Mellick, D., Walker, N., Brooks, C.A., Gerhart, K. Measuring handicap across impairment groups using CHART. Manuscript in development.
18. World Health Organization. (1980) International Classification of Impairments, Disabilities and Handicaps: A Manual of Classification Relating to the Consequences of Disease. Geneva: World Health Organization.
19. World Health Organization. (1997) International Classification of Impairments, Activities, and Participation: A Manual of Dimensions of Disablement and Functioning, Beta-1 Draft. Geneva: World Health Organization.

Craig Hospital Inventory of Environmental Factors

Background

The World Health Organization (WHO) has been both praised and criticized for the model of disablement conceptualized in the landmark publication, *An International Classification of Impairments, Disabilities, and Handicaps* (ICIDH) (WHO, 1980, 1993). The WHO model of disablement has been praised for its important conceptual distinctions among three types of outcomes – *impairments* (defined as limitations in the presence or performance of organs or organ systems), *disabilities* (defined as limitations in the performance of activities of daily living at the person level), and *handicaps* (defined as limitations in the performance of social roles as members of society). On the other hand, the WHO model of disablement has been criticized for its excessive reliance on the medical model, its failure to adequately recognize the importance of the environment in determining disablement outcomes, and its use of the term "handicap" (often used pejoratively in America) to describe limitations in the performance of social roles. The WHO recognized these shortcomings in its forward to the 1993 reprint of the ICIDH (WHO, 1980, 1993) by inaugurating a worldwide revision process that is under way. Current drafts of the revised model of disablement (WHO, 1999, 2000) address the areas that have been criticized while retaining the former areas of strength by adding a fourth domain of *Environmental Factors* and renaming the third domain of social role fulfillment (formerly handicap) as "*Participation*".

In the area of societal participation, considerable, conceptual and empirical research has been conducted to develop measurement instruments. Within the domain of Environmental Factors, however, almost no research has been conducted towards instrument development. What little work has been done, has focused exclusively on architectural barriers in the physical environment (Steinfeld, 1997). What is needed is a broad-based measure of the environment which quantifies the degree to which elements of the physical, social, and political environments act as barriers or facilitators to full participation for people with disabilities. This has therefore been the objective at the heart of the research described herein; its goal, to provide a new type of instrument that will allow the quantification of Environmental Factors and lead to a better understanding of the degree to which elements of the environment impede or facilitate the lives of people with disabilities.

Several methods of conceptualizing Environmental Factors and their relationship to disability have been suggested. (Fougeyrollas, 1995) was the first within the field of disability studies to offer a taxonomy of Environmental Factors. He and the Canadian Society for the International Classification of Impairments, Disabilities and Handicaps cataloged over a hundred elements of the environment which they viewed as important determinants of handicap or participation. This strategy has been incorporated into the current classification scheme of the environment included in the beta draft of the ICIDH-2 (WHO, 1999, 2000). While this strategy does provide an exhaustive list of environmental elements which may influence the disablement process, it does not provide a very useful conceptual framework for quantifying environment in survey tools.

In contrast to the approach of categorizing elements of the environment, Whiteneck, et al (1997) have attempted to identify a few salient characteristics of the environment which correspond to

major dimensions of the environment that act to either impede or facilitate participation by people with disability. This conceptualization proposes five characteristics of the environment:

1. Accessibility
2. Accommodation
3. Resource availability
4. Social support
5. Equality

Accessibility answers the question, "Can you get where you want to go?" It is defined in terms of physical access and includes architectural barriers such as steps and inaccessible bathrooms as well as the accessibility of transportation. These aspects of the environment either restrict or facilitate an individual's ability to move about freely in his or her community.

Accommodation addresses the question, "Can you do what you want to do?" It is defined in terms of the equipment, services, or modifications to tasks which facilitate full participation and independent living. Areas of accommodation include home, workplace, school, other business and organizations, and other community settings. This aspect of the environment either restricts or facilitates an individual's ability to participate in an activity once he or she is at the location of that activity.

Resource availability addresses the question of, "Are your special needs met?" It is defined in terms of the availability and provision of services and resources made necessary by the particular disability. These may include medical care, personal assistant services, and income security. This category assesses the degree to which the extra resources needed by a person with a disability are available.

Social support addresses the question, "Are you accepted and supported by those around you?" It is defined in terms of the attitudes and prejudices of others which either discourage community integration or provide a supportive environment that allows community integration to flourish. Social support may be provided by family and friends, employers and teachers, neighbors and peers, and other community members. This category focuses on the social barriers which can only be remedied by attitude change in others. Extra funding is not likely to solve these particular problems.

Finally, *equality* addresses the question, "Are you treated equally with others?" It is defined in terms of the degree to which the policies and regulation of governments and institutions insure equality of opportunity for people with disabilities. Included in this category are discrimination, financial disincentives, health care management and rationing, and legislative mandates to name a few.

These five environmental characteristics form useful criteria for evaluating environments. However, they must be applied to each individual's own situation, since the same environment that may restrict one person may assist or not affect another. In each case, these five environmental characteristics can be assessed on a continuum ranging from restrictive barriers to inclusive facilitators.

In addition to these two methods of conceptualizing the environment (by listing its elements and by defining influential characteristics) a more recent method of characterizing disability has also been suggested which plays a substantial role in the design of this project. For several years, the study of disability has progressed through research isolated on the study of diagnostic categories. For example, considerable research relating to disability issues has focused on either spinal cord injury, traumatic brain injury, stroke, visual impairments, hearing impairments, etc. Most research did not cross diagnostic groups and was categorically funded due to interest in a particular diagnosis. In 1997 the CDC announced two programs related to disability (730 and 731, which funded the research described herein) which defined four primary disability domains without reference to impairment diagnoses. These included *mobility limitations, personal care/home management limitations, communication limitations,* and *learning limitations*. This newer approach focuses disability research on common themes of limitation which cross multiple diagnoses. Furthermore, this approach is grounded in a growing body of literature which demonstrates that considerable commonality of secondary conditions result from a wide variety of primary diagnoses (White, et al, 1996).

Creation of the Environmental Instrument

Using multiple methodologies, pools of qualified persons were identified to participate in four separate advisory panels. Methods for identifying and selecting participants assured that a wide and varied range of abilities, disabilities, attitudes, philosophies, knowledge and skills were reflected in the panel meetings. This group included a diverse array of 32 participants with expertise in the four areas of disability: mobility, self-care, learning, and communication limitations. Each individual brought his or her personal and professional perspectives and experiences on disability, participation, and the impact of the environment. The group consisted of professors, researchers and academicians representing the fields of sociology, occupational therapy, economics, public health and philosophy. Universities represented included Boston University, Rutgers University, the University of Denver, Queens University in Ontario, the State University of New York (Buffalo, Plattsburgh), University of Illinois at Chicago, University of California-Berkeley, Ohio State University, and the University of North Carolina.

There were representatives from such advocacy and policy implementation groups as the Institute on Disability and Human Development, the American Foundation for the Blind, the Paralyzed Veterans of America, and the Access Board, while the U.S. government had representatives from the Centers for Disease Control and Prevention and the National Center for Health Statistics. Consumer representatives included Native Americans and individuals with hearing and visual impairments, spinal cord injuries, speech impairments, and cerebral palsy, as well as family members of people with mental retardation and traumatic brain injury. Finally, service providers' input was provided by physicians, occupational and physical therapists, a former independent living center director, a director of a university's disabled student services program, and a vocational rehabilitation counselor. These meetings were very productive resulting in 4 draft instruments, one from each group. Each draft instrument was designed to be used in a telephone or 'paper pencil' survey that would be appropriate for general population use, as well as applying to the full range of disability categories.

After reviewing and critically assessing the four instruments, project staff decided the best instrument would come from synthesizing the vital elements, conceptualizations, and spirit of each draft into a fifth or "next generation" survey. Advisory panel members continued to be involved, and to participate via mail. Project staff applied advisory group comments and advice to the development of the draft instrument which identified 25 key elements of the environment. Two forms of the draft instrument were proposed. Both had the same item content, but two different metrics were used to assess environmental impact. In one form, individuals were asked to indicate "how often" a barrier is encountered using response categories of "daily, weekly, monthly, less than monthly, and never". In the other form, individuals were asked to assess the degree to which the environmental element "facilitates or hinders" participation using response categories of "big barrier, little barrier, no impact, little help, and big help." The first form had the advantage of easier response categories, while the second form had the advantage of identifying facilitators as well as barriers.

Initial Pilot Testing

Both forms were tested on a group of 97 people, 50 with disabilities and 47 who indicated they did not have a disability. Results of that pilot testing indicated:

1. The "frequency" response categories were strongly preferred by participants over the "extent of barrier/facilitator" response categories.
2. The "frequency of barrier" response categories better differentiated people with and without disabilities than the "extent of barrier/facilitator" response categories.
3. Correlations between the two response categories, while significant, were relatively low.

Discussions of the results from the comparison of response categories with project staff and representatives who attended advisory panel meetings, yielded a consensus that all 25 items should be retained in the draft instrument, but that a follow-up impact question needed to be added since the correlation between frequency and impact was not particularly high. These discussions led to adding a follow-up question, "When this problem occurs, is it usually a big problem or a little problem?" This question was added after each item where the respondent indicated the frequency of the problem to be anything other than never. The final draft instrument, the Craig Hospital Inventory of Environmental Factors (CHIEF) was distributed to all advisory panel members for review.

Testing of the Environmental Instrument

Instrument Validation - "CHIEF 400 Dataset"

A convenience sample of 409 individuals with disability was recruited for a validation study to test the psychometric properties of the CHIEF. The sample included available people with spinal cord injury and traumatic brain injury who had been treated at Craig Hospital (but not included in prior pilot tests of the instrument). The sample also included individuals recommended for recruitment by advisory panel members, professional colleagues, and acquaintances of other project staff and research participants. In total, the sample included 124 participants with spinal cord injury, 120 participants with traumatic brain injury and 165 participants with a wide variety

of other disabilities. This included 55 persons with Multiple Sclerosis, 35 persons with amputations, and others with auditory and visual impairments, developmental disabilities, Cerebral Palsy and some with multiple impairments resulting in disability. While the spinal cord injury group was 80% male with an average age of 41 and the traumatic brain injury group was 61% male with an average age of 41, the variety of other impairments were 62% female with an average age of 48.

All 409 study participants were administered the CHIEF. In addition, 103 of the total 409 participants (46 with SCI, 44 with TBI, and 13 with other impairments) were interviewed using CHIEF a second time, approximately two weeks after the first administration in order to assess test-retest reliability. Finally, family members or friends of 125 subjects (46 with SCI, 54 with TBI, and 25 with other impairments), not included in the test-reliability sub-study, were successfully recruited and asked to complete the CHIEF as a proxy for the subject in order to assess subject-proxy agreement.

This completed dataset will be later referred to as the *"CHIEF 400 Dataset"*. Analysis of this data began by defining three methods of scoring each item:

1. A frequency score on a scale of 0-4 indicating the frequency with which barriers were encountered (0=never, 1=less than monthly, 2=monthly, 3=weekly, and 4=daily).
2. A magnitude score on a scale of 0-2 indicating the size of the problem which a barrier typically presented (0=no problem since the barrier was never encountered, 1=a little problem, and 2=a big problem).
3. A frequency-magnitude product score on a scale of 0-8 calculated as the product of the frequency score and the magnitude score, indicating the overall impact of the barrier.

Total scores across the 25 items were calculated as the average frequency score, the average magnitude score, and the average frequency-magnitude product score across all of the non-missing scale items.

Test-Retest Reliability

Test-retest reliability of individual items and the total scale were calculated using both the intra-class correlation coefficient and the percent of cases with exact agreement between both tests. Mean difference scores between the test and retest were also calculated and significance assessed. This process was repeated for frequency scores, magnitude scores, and frequency-magnitude product scores. In general, the product scores showed slightly higher reliability co-efficient and they became the focus of additional psychometric analysis.

Table 1 presents all test-retest comparison data (separately for frequency and magnitude), while Table 2 presents the test-retest reliabilities for the frequency magnitude product scores. These tables report item and total scale reliability scores. Data are presented separately for spinal cord injury, traumatic brain injury, and "other" impairment groups, as well as total sample reliability statistics. These data indicate a total scale score ICC reliability of .926, indicating acceptable reliability for the instrument.

Subject-Proxy Agreement

After establishing test-retest reliability for CHIEF, the extent of subject-proxy agreement was analyzed. Tables 3 and 4 present the results of frequency and magnitude comparisons and frequency magnitude product data respectively in a format identical to Tables 1 and 2. Across all disability sub-groups subject proxy interclass correlations ranged from .406-.699 with a total scale ICC of .618. These data indicate that subject proxy agreement is marginal and result in the recommendation that proxies not be asked to complete CHIEF when subjects are unavailable to do so.

As one method of validating the data collected in CHIEF, differences in response patterns were compared across impairment groupings in an effort to determine if the instrument differentiated among impairment groups in expected ways. Tables 5, 6 and 7, report percent frequency distributions of the raw data across the 25 items for spinal cord injury, traumatic brain injury, and other impairment groups respectively. Table 8 presents the mean frequency-magnitude product scores for persons with spinal cord injury, traumatic brain injury, MS, amputees, and other impairments as well as the total sample mean. Tests of differences among the five groupings were compared using one-way analysis of variance with Bonferroni post hoc comparisons. Significant main effects and significant differences between groups are indicated in the table. It can be seen that the majority of items and sub-scales produce statistically significant differences among the impairment groups. Cases with TBI scored dramatically lower on physical barriers than the other groups. These data lend support to the validity of CHIEF by indicating that the tool differentiates scores among different disability groups in ways that are consistent with the unique barriers faced by those groups.

Further Evaluation of the Environmental Instrument

Additional evaluation of the CHIEF was performed to: 1) examine the underlying dimensions that might exist within the context of the 25 items; 2) demonstrates its applicability to large-scale disability surveillance; 3) establish scoring norms; and 4) develop a CHIEF Short Form. This was accomplished by adding the CHIEF to the Behavioral Risk Factor Surveillance System (BRFSS) survey in Colorado. In 1999, a second population-based sample was drawn and this sample was administered the: 1) BRFSS core survey; 2) BRFSS Quality of Life Module; 3) BRFSS State-added Disability Questions; 4) Craig Handicap Assessment and Reporting Technique Short Form (CHART-SF); and 5) CHIEF. The survey was administered via telephone to 2,259 individuals. This completed dataset will be henceforth referred to as the *"BRFSS Dataset".*

The BRFSS data was weighted using the standard BRFSS weighting formula. In addition, post-stratification weighting has been applied to account for differences in age and gender between the sample and the population of Colorado. All analyses have been performed using the weighted data; therefore, the results can be generalized to the entire population of Colorado, 18 years or older.

Identification of CHIEF Subscales

Factor analysis was used to identify underlying dimensions, or subscales, within CHIEF.

This analysis was performed on the 25 CHIEF items with five factors accounting for 48% of the cumulative variance across the 25 items. After varimax rotation, each item was assigned to the factor with the highest positive loading. This resulted in five factors with 3-7 items included in each factor. Descriptive labels for the factors were assigned including "attitude and support barriers", "services and assistance barriers", "physical and structural barriers", "policy barriers" and "work and school barriers".

Scoring Differentiation Between Groups

Across items, subscales and total scores, the CHIEF was able to show differences in reported frequency and magnitude of environmental barriers between groups with a variety of impairments and activity limitations. Table 9 summarizes the mean and standard deviation for each CHIEF item, subscale and total score using the two datasets (CHIEF 400 and BRFSS) grouped by disability status.

Subjects within the BRFSS Dataset were differentiated by whether or not they had a "disability". This was determined by using a definition where a subject was considered "disabled" if they responded "yes" to any of the following questions: 1) Are you limited in the kind or amount of work you can do because of any impairment or health problem; 2) Because of any impairment or health problem, do you have any trouble learning, remembering or concentrating; 3) Do you use special equipment or help from others to get around; 4) Are you limited in any way in any activities because of any impairment or health problem. Within the "CHIEF 400 Dataset", subjects were differentiated by the same impairment categories as previously described.

Figures A through F provide a graphic summary of the information in Table 9. Figure A shows the CHIEF subscales and total scale mean scores by disability status. This figure indicates that both people with and without disabilities experience environmental barriers. However, those with disabilities reported an overall higher frequency and magnitude of environmental barriers. Further, individuals with TBI reported greater barriers than those identified as having a disability from the BRFSS data (see definition above), but fewer than individuals with SCI. Individuals with other types of impairments (i.e., MS, Amputees, other auditory, visual and multiple impairments, DD, CP) reported the greatest barriers.

Figures B through F show the mean scores for each CHIEF subscale and the items on that subscale by disability status. Overall, the same general trend is seen, however some items and subscales do vary by disability status. This analysis confirms that the CHIEF has the ability to differentiate between those with and without disability and between different impairment groups.

Development of the CHIEF Short Form

Several criteria were used to determine which items should be retained for a "short form" version of the CHIEF. In general, these criteria included items which: 1) had the highest frequency of barrier mean scores; 2) had the highest magnitude of barrier mean scores; 3) had the highest item score-subscale score correlations (using the mean frequency-magnitude product score); 4) had the highest item score-total score correlations (using the mean frequency-magnitude product score); 5) were the most frequently reported barriers; and 6) best differentiated between people

with and without disability. In addition, taking all of the criteria into consideration, if an item was to be excluded, but it was felt, conceptually should be in the scale, it was retained.

Results of this analysis identified 12 items within the original five subscales to be retained. Table 10 shows the mean and standard deviation for each CHIEF-SF item, subscale and total score using the two datasets (CHIEF 400 and BRFSS) grouped by disability status. Figures G and H provide a graphic summary of the information in Table 10. Figure G shows the CHIEF-SF subscales and total scale mean scores by disability status, and Figure H shows the total scale and item mean scores by disability status. These figures further substantiate the findings from the CHIEF Long Form.

REFERENCES

World Health Organization. International classification of impairments, disabilities, and handicaps: A manual of classification relating to the consequences of disease. Geneva: World Health Organization, 1980, 1993 reprint.

World Health Organization. International classification of functioning and disability (ICIDH-2): Geneva: World Health Organization, 1999, 2000.

Steinfeld EH. "Environment as a mediating factor in functional assessment." In Dittmar S, Gresham G, editors. Functional Assessment and Outcome Measurement for the Rehab Health Professional. Gaithersburg, MD: Aspen Publishers, 1997.

Fougeyrollas P. Documenting environmental factors for preventing the handicap creation process: Quebec contributions relating to ICIDH and social participation of people with functional differences. Disability and rehabilitation. 1995;17(3/4):145-153.

Whiteneck GG, Fougeyrolles P, Gerhart KA. "Elaborating the Model of Disablement." In, Assessing Medical Rehabilitation Practices: The Promise of Outcomes Research. Fuhrer M, editor. Paul H. Brooks Publishing Co., 1997.

White GW, Seekins T, Gutierrez RT. Preventing and managing secondary conditions: a proposed role for independent living centers. J Rehab 1996;62(3):14-21.

Table 1: Test-Retest comparisons (ICC, percent agreement, and mean differences) across impairment group and total

Test-Retest		**SCI**	**n=46**		**TBI**	**n=44**		**Other**	**n=13**		**Total**	**n=103**	
Question	*Measurement*	*ICC*	*% Correct*	*Mean Difference*	*ICC*	*% Correct*	*Mean Difference*	*ICC*	*% Correct*	*Mean Difference*	*ICC*	*% Correct*	*Mean Difference*
Transportation	Frequency	.713	73.9	.020	.703	79.5	.341*	.951	76.4	-.077	.749	76.7	.146
	Magnitude	.772	76.9	.065	.603	63.6	.159	.905	80.0	.000	.743	80.6	.097
Design home	Frequency	.563	63.0	.217	.239	81.8	.609	.859	84.6	.307	.556	73.8	.165
	Magnitude	.564	71.4	.091	.306	66.7	-.023	.851	75.0	.154	.573	78.2	.049
Design work/school	Frequency	.635	50.0	.300	.252	75.9	.276	.698	63.6	.454	.598	65.0	.316*
	Magnitude	.412	81.8	.100	.568	100.0	.000	.798	100.0	.000	.629	75.0	.033
Design community	Frequency	.476	58.7	.369*	.528	79.5	-.027	.808	69.2	.307	.629	68.9	.194
	Magnitude	.666	75.8	.087	.568	60.0	.021	.688	100.0	.154	.733	74.8	.068
Natural Environment	Frequency	.510	58.7	.044	.561	67.4	.116	.740	46.2	.154	.625	60.8	.088
	Magnitude	.478	78.9	.087	.629	58.8	.139	.721	88.9	.000	.642	68.6	.098
Surroundings	Frequency	.573	54.3	.021	.678	65.9	.023	.762	61.5	.154	.648	60.2	.038
	Magnitude	.378	93.3	.089	.670	88.9	.023	.861	87.5	.000	.575	72.5	.049
Information	Frequency	.619	63.0	.304*	.639	67.4	.047	.375	53.8	.154	.597	63.7	.176
	Magnitude	.343	81.8	.217	.583	87.5	-.024	.363	66.7	.154	.461	69.3	.109
Education/training	Frequency	.511	73.9	-.109	.327	68.2	.000	.075	38.5	-*.231	.369	67.0	-.077
	Magnitude	.618	70.0	.065	.559	57.1	-.023	-.030	33.3	-.077	.496	68.6	.009
Medical Care	Frequency	.659	63.0	-.109	.318	77.3	-.182	.434	61.5	.615	.511	68.9	-.048
	Magnitude	.681	83.3	-.174	.446	50.0	-.139	.480	33.3	.231	.626	71.6	-.107
Equipment	Frequency	.665	60.9	.130	.535	84.1	.045	.483	38.5	.077	.635	68.0	.087
	Magnitude	.752	61.1	.000	.502	100.0	.093	.434	75.0	.000	.677	78.4	.039
Technology	Frequency	.627	63.0	.413*	.479	76.7	.116	.149	61.5	-.462	.537	68.6	.177
	Magnitude	.565	64.3	.109	.453	66.7	.186	.536	100.0	-.307	.524	74.5	.088
Help home	Frequency	.752	50.0	.217	.652	84.1	-.068	.616	53.8	.077	.730	65.0	.077
	Magnitude	.624	72.7	.111	.706	60.0	.023	.515	60.0	.154	.684	72.5	.078
Help work	Frequency	.513	68.4	-.211	.537	65.5	-.035	.816	63.6	.091	.601	66.1	-.067
	Magnitude	.823	100.0	-.105	.554	66.7	-.071	.878	75.0	.000	.755	75.9	-.069
Help community	Frequency	.563	63.0	.044	.796	86.4	.069	.385	46.2	.307	.627	71.6	.088
	Magnitude	.751	82.4	.022	.797	85.7	.023	.854	80.0	-.077	.794	80.4	.009
Attitudes home	Frequency	.718	73.9	.022	.719	68.2	-.046	.390	76.9	.153	.674	72.5	.009
	Magnitude	.644	83.3	-.022	.697	63.6	-.048	.536	33.3	.000	.649	75.2	-.029
Attitudes work/school	Frequency	.382	60.0	-.400	.870	86.2	-.035	.762	81.8	-.272	.687	76.7	-.200*
	Magnitude	.282	80.0	-.250	.906	100.0	.000	.710	50.0	-.182	.676	77.6	-.120
Attitudes community	Frequency	.853	78.3	-.044	.907	79.5	.136	.753	53.8	.000	.864	75.7	.038
	Magnitude	.599	58.3	.087	.789	92.3	.114	.536	40.0	.154	.445	74.8	.029
Support in home	Frequency	.560	89.1	.022	.845	86.4	-.045	.793	84.6	.077	.772	87.4	.000
	Magnitude	.460	50.0	.044	.864	80.0	-.068	.692	100.0	.307	.712	85.4	.029
Support work/school	Frequency	.404	60.0	.300	.801	79.3	-.034	.268	63.6	.000	.557	70.0	-.116
	Magnitude	.326	50.0	-.050	.679	60.0	.034	.250	100.0	-.300	.469	72.9	-.051
Support community	Frequency	.743	67.4	.044	.659	75.0	.136	.676	53.8	-.307	.696	68.9	.038
	Magnitude	.473	60.0	.044	.584	85.7	.000	.700	75.0	-.154	.540	73.8	.000
Discrimination	Frequency	.768	67.4	.043	.788	70.5	.045	.787	69.2	-.307	.779	98.9	.000
	Magnitude	.867	80.8	.067	.719	91.7	.045	.799	66.7	-.230	.806	81.4	.019
Services community	Frequency	.695	57.8	.244	.589	79.5	.000	.786	61.5	-.077	.693	67.6	.098
	Magnitude	.688	75.0	.114	.689	80.0	-.024	.680	50.0	.154	.703	74.7	.060
Policies of business	Frequency	.753	60.9	-0.11	.521	68.2	.091	.728	61.5	.385	.645	64.1	.068
	Magnitude	.506	64.3	-.065	.501	100.0	.046	.741	50.0	.231	.543	69.6	.019
Educat/Employ policies	Frequency	.278	67.7	-.097	.419	69.2	.205	.560	33.3	-.167	.407	63.4	.036
	Magnitude	.442	50.0	-.129	.129	60.0	.103	.173	66.7	.083	.258	61.0	.012
Government policies	Frequency	.630	52.2	.000	.749	76.7	.000	.720	61.5	.000	.698	63.7	.000
	Magnitude	.590	77.3	.000	.721	87.5	.000	.649	60.0	.000	.679	71.6	.000
Total Frequency		.904		.067	.911		.050	.915		.061	.912		.059*
Total Magnitude		.849		.034	.890		.029	.886		.025	.881		.031

Table 2: Test-Retest comparisons (ICC, percent agreement, and mean differences) across impairment group and total using the product for each item

Test-Retest score	**SCI**	**n=46**		**TBI**	**n=44**		**Other**	**n=13**		**Total**	**n=103**	
Question	*ICC*	*% Correct*	*Mean Difference*	*ICC*	*% Correct*	*Mean Difference*	*ICC*	*% Correct*	*Mean Difference*	*ICC*	*% Correct*	*Mean Difference*
Transportation	.769	71.7	.000	.634	77.3	.386	.924	76.9	.153	.753	74.8	.184
Design home	.584	59.1	.318	.107	81.8	.136	.865	76.9	.615	.535	71.3	.277
Design work/school	.543	50.0	.150	.543	75.9	.344	.885	63.6	.454	.680	65.0	.300
Design community	.485	50.0	.652	.735	75.0	.068	.883	67.2	.538	.689	63.1	.388*
Natural Environment	.628	47.8	.087	.610	62.8	.139	.782	46.2	.077	.694	53.9	.107
Surroundings	.662	53.3	-.044	.698	63.6	.045	.764	61.5	.462	.703	58.8	.058
Information	.621	60.9	.413	.656	69.0	.071	.307	53.8	.615	.588	63.4	.297
Education/training	.557	69.6	-.022	.401	67.4	-.139	-.016	38.5	-.307	.409	64.7	-.108
Medical Care	.700	60.6	-.195	.249	76.7	-.348	.337	61.5	1.00	.504	67.6	-.107
Equipment	.659	54.3	.283	.548	86.0	.069	.336	38.5	-.076	.610	65.7	.147
Technology	.530	60.9	.652	.547	72.1	.465	.317	61.5	-.615	.533	65.7	.412
Help home	.742	44.4	.467	.756	84.1	.000	.653	46.2	-.769	.752	61.8	.303
Help work/school	.728	68.4	-.105	.697	67.9	-.214	.718	54.5	.454	.725	65.5	-.051
Help community	.685	60.9	.152	.755	88.4	.116	.434	46.2	.846	.678	70.6	.225
Attitudes home	.790	73.9	.174	.788	66.7	.047	.169	69.2	.384	.705	70.3	.148
Attitudes work/school	.383	55.0	-.450	.961	88.9	-.074	.454	81.8	-.636	.741	75.9	-.310*
Attitudes community	.878	69.6	-.195	.949	77.3	.204	.553	53.8	.538	.882	70.9	.068
Support home	.612	87.0	.065	.853	84.1	-.136	.736	76.9	.461	.727	84.5	.029
Support work	.336	60.0	-.250	.821	75.9	.034	.678	70.0	-.300	.564	69.5	-.118
Support community	.745	63.0	.217	.698	75.0	.159	.886	53.8	-.307	.743	67.0	.126
Discrimination	.829	64.4	.111	.804	70.5	.181	.746	61.5	-.615	.807	66.7	.049
Services community	.823	56.8	.409*	.643	83.3	.071	.824	53.8	.307	.771	67.7	.252
Policies business	.838	54.3	-.043	.567	69.8	.069	.677	46.2	1.00	.689	59.8	.137
Educat/Employ policies	.339	54.8	-.290	.236	66.7	.462	.570	33.3	.333	.332	57.3	.158
Government policies	.703	47.8	.130	.745	76.7	.093	.710	53.8	.153	.728	60.8	.117
Total	.915		3.26*	.933		1.97	.923		6.31*	.926		3.09*

Table 3: Test-Proxy comparisons (ICC, percent agreement, and mean differences) across impairment group and total

Test-Proxy		**SCI**	**n=46**		**TBI**	**n=54**		**Other**	**n=25**		**Total**	**n=125**	
Question	*Measurement*	*ICC*	*% Correct*	*Mean Difference*	*ICC*	*% Correct*	*Mean Difference*	*ICC*	*% Correct*	*Mean Difference*	*ICC*	*% Correct*	*Mean Difference*
Transportation	Frequency	.571	67.4	.044	.488	64.2	.000	.616	44.0	-.320	.572	61.3	-.048
	Magnitude	.451	69.6	-.239	.543	69.8	-.094	.537	64.0	-.400*	.542	68.5	-.209*
Design home	Frequency	.491	58.7	.044	.478	81.5	.148	.391	52.0	-.520	.513	67.2	-.024
	Magnitude	.442	65.2	-.022	.512	85.2	.074	.263	48.0	-.480*	.477	70.4	-.072
Design work/school	Frequency	.242	35.0	-.200	.345	79.4	-.235	.147	14.3	-1.57*	.403	57.4	-.377*
	Magnitude	.013	50.0	-.150	.281	76.5	.000	.172	28.3	-.857*	.351	62.3	-.147
Design community	Frequency	.488	30.4	-.30	.653	77.8	.000	.576	40.0	-.400	.662	52.8	-.128
	Magnitude	.172	45.7	-.231	.543	81.5	.037	.622	64.0	-.160	.572	64.8	-.104
Natural Environment	Frequency	.194	41.3	.065	.317	49.1	-.132	.473	28.0	-.040	.369	41.9	-.040
	Magnitude	.055	30.4	-.087	.410	52.8	.037	.274	48.0	.080	.393	43.5	.000
Surroundings	Frequency	.351	41.3	.022	.514	40.0	-.326	.399	25.0	-.083	.478	37.7	-.147
	Magnitude	.408	47.8	-.044	.632	61.5	-.134	.588	45.8	-.125	.573	53.3	-.098
Information	Frequency	.009	54.3	.109	-.001	50.9	-.207	.375	36.0	-.280	.182	49.2	-.105
	Magnitude	.365	56.5	.022	-.027	53.8	-.076	.124	36.0	-.160	.187	51.2	-.057
Education/training	Frequency	.283	63.0	-.456*	.218	63.0	-.296	.206	28.0	-.600	.281	56.0	-.416*
	Magnitude	.309	65.2	-.261*	.454	70.4	-.074	.225	32.0	-.520*	.389	60.8	-.232*
Medical Care	Frequency	.357	54.3	.108	.456	6938	-.226	.436	41.7	-.485*	.428	58.5	-.146
	Magnitude	.599	56.5	.000	.309	67.9	-.163	.369	50.0	-.333	.478	60.2	-.113
Equipment	Frequency	.026	37.0	.196	.125	89.0	-.185	.525	48.0	-.600*	.324	60.8	-.128
	Magnitude	.091	45.7	.196	.216	89.0	-.074	.524	56.0	-.400*	.398	65.6	-.040
Technology	Frequency	-.140	57.8	.089	.381	76.5	.039	195	40.0	.640	.206	62.0	-.181
	Magnitude	-.058	55.6	.022	.295	78.0	-.040	.416	48.0	.120	.261	63.3	-.050
Help home	Frequency	.603	45.7	-.087	.282	67.3	-.500*	.398	44.0	-.160	.486	54.5	-.276*
	Magnitude	.262	36.4	-.409*	.356	69.2	-.231	.182	48.0	-.440	.342	52.9	-.338*
Help work/school	Frequency	.026	65.0	.100	.076	69.7	-.090	.451	42.9	-.428	.309	65.0	-.067
	Magnitude	.452	65.0	-.100	-.024	72.3	-.030	.600	42.9	.000	.475	66.7	-.050
Help community	Frequency	.234	47.8	-.282	.152	75.5	-.264	-.085	32.0	.120	.201	56.5	-.193
	Magnitude	.519	52.2	-.130	.555	80.8	-.096	.229	40.0	.080	.516	61.8	-.073
Attitudes home	Frequency	.341	60.9	-.311	.436	60.4	-.056	.633	44.0	.040	.457	57.7	-.130
	Magnitude	.223	64.4	-.222	.393	67.9	.037	.528	48.0	-.160	.378	62.6	-.097
Attitudes work/school	Frequency	.010	60.0	-.300	.332	60.6	-.181	.455	33.3	-.667	.334	57.6	-.271
	Magnitude	-.034	65.0	-.300	.383	66.7	-.090	-.102	33.3	-.883	.226	62.7	-.237*
Attitudes community	Frequency	.454	47.8	.108	.345	67.3	-.135	.554	37.5	-.208	.461	54.1	-.057
	Magnitude	.333	47.8	.087	.535	69.2	-.077	.350	54.2	-.333	.434	58.2	-.065
Support home	Frequency	.222	62.2	-.159	.116	67.3	.039	.127	48.0	.080	.161	62.0	-.024
	Magnitude	.020	65.9	-.272*	.229	67.2	.057	.034	52.0	.000	.105	64.5	-.074
Support work/school	Frequency	-.026	75.0	-.050	.316	69.7	.212	.546	33.3	-.500	.397	67.8	.051
	Magnitude	.159	75.0	-.050	.683	78.8	.151	.300	33.3	-.167	.575	72.9	.051
Support community	Frequency	.087	65.2	-.196	.043	75.5	-.283*	.211	40.0	-.200	.145	64.5	-.233*
	Magnitude	.185	63.0	-.174	.062	73.6	-.188*	.233	48.0	-.280	.206	64.5	-.202*
Discrimination	Frequency	.572	52.2	.023	.401	66.0	-.113	.549	37.5	.000	.543	55.3	-.041
	Magnitude	.318	57.8	-.089	.319	67.9	-.189	.449	50.0	.083	.395	60.7	-.098
Services community	Frequency	.282	60.9	-.239	.492	73.6	-.094	.135	25.0	-.083	.358	59.3	-.146
	Magnitude	.413	63.0	-.108	.684	76.9	.039	.182	45.8	-.208	.479	65.6	-.065
Policies business	Frequency	.146	58.7	-.369*	.069	62.3	.056	.204	32.0	-.160	.205	54.8	-.145
	Magnitude	.307	58.7	-.174	.125	66.7	.098	.281	45.8	.000	.309	59.5	-.024
Educat/Employ policies	Frequency	.449	66.7	-.138	.269	68.6	-.235	.658	615	-.384	.455	67.0	-.220
	Magnitude	.418	65.7	-.171	.287	73.5	-.102	.416	50.0	-.333	.398	67.7	-.156*
Government policies	Frequency	.146	28.3	.239	.336	68.5	.000	.414	32.0	.040	.323	46.4	.096
	Magnitude	.204	50.0	.087	.389	69.8	-.075	.521	64.0	-.120	.408	61.3	-.024
Total Frequency		.572		-.075	.587		-.134	.506		-.179	.625		-.121*
Total Magnitude		.522		-.112*	.718		-.047	.462		-.191	.658		-.100*

Table 4: Test-Proxy comparisons (ICC, percent agreement, and mean differences) across impairment group and total using the product for each item

Test-Proxy score	**SCI**	**n=46**		**TBI**	**n=54**		**Other**	**n=25**		**Total**	**n=125**	
Question	*ICC*	*% Correct*	*Mean Difference*	*ICC*	*% Correct*	*Mean Difference*	*ICC*	*% Correct*	*Mean Difference*	*ICC*	*% Correct*	*Mean Difference*
Transportation	.567	63.0	-.217	.522	64.2	.018	.612	44.0	-.680	.592	59.7	-.209
Design home	.604	56.5	-.043	.567	81.5	.278	.457	40.0	-.880	.580	64.0	-.072
Design work	.005	35.0	-.650	.363	76.5	-.352	.194	14.3	-3.14*	.352	55.7	-.771*
Design community	.551	26.1	-.456	.668	77.8	-.037	.697	32.0	-.400	.699	49.6	-.264
Natural Environment	.204	26.1	.108	.328	47.2	-.169	.419	28.0	-.200	.363	35.5	-.072
Surroundings	.469	41.3	.043	.502	42.3	-.807*	.444	16.7	-.583	.511	36.9	-.443*
Information	.162	54.3	-.043	-.109	50.0	-.500	.256	32.0	-.480	.154	48.0	-.325
Education/training	.207	152	-.826*	.291	63.0	-.574	.269	20.0	-1.28*	.290	53.6	-.808*
Medical Care	.358	43.5	-.044	.443	67.9	-.339	.491	37.5	-.750	.431	52.8	-.309
Equipment	.043	39.1	.239	.066	87.0	-.314	.596	48.0	-1.00*	.345	61.6	-.248
Technology	-.116	55.6	.266	.377	78.0	.180	.558	36.0	.640	.312	60.8	.308
Help home	.493	36.4	-.409	.262	67.3	-.750*	.381	32.0	-.840	.433	48.8	-.645*
Help work	.110	60.0	.000	.013	69.7	-.060	.572	28.6	-.283	.408	61.7	-.083
Help community	.238	47.8	-.587	.225	76.9	-.500*	.023	32.0	.400	.242	56.9	-.349
Attitudes home	.446	62.2	-.577	.268	60.4	-.188	.640	40.0	.200	.456	56.9	-.252
Attitudes work	-.057	60.0	-.600	.310	60.6	-.212	.398	33.3	-1.16	.333	57.6	-.441
Attitudes community	.265	43.5	-.152	.355	61.5	-.307	.468	33.3	-.333	.365	49.2	-.254
Support home	.293	63.6	-.295	.157	67.3	-.057	.253	48.0	.280	.239	62.0	-.074
Support work	-.025	75.0	-.050	.614	69.7	.212	.619	50.0	.167	.632	69.5	.085
Support community	.029	60.9	-.413	.004	73.6	-.585	.339	40.0	-.400	.148	62.1	-.484*
Discrimination	.652	51.1	-.089	.339	66.0	-.245	.533	33.3	.250	.534	54.1	-.090
Services community	.197	58.7	-.326	.467	75.0	-.269	.138	25.0	-.083	.316	59.0	-.254
Policies business	.123	56.5	-.804*	.175	64.7	.078	.218	33.3	.042	.230	55.4	-.264
Educat/Employ policies	.545	65.7	-.485	.338	73.5	-.388	.557	50.0	-.333	.479	67.7	-.416*
Government policies	.177	28.3	.261	.364	67.9	-.113	.444	32.0	.240	.348	46.0	.096
Total	.494		-5.28	.618		-.507	.570		-7.20	.618		-5.57*

Table 5: Frequency Distribution for SCI

Question	Never	Less than monthly	Monthly	Weekly	Daily	Little problem	Big problem
	Percent					Percent	
Transportation	64.2	15.4	8.1	5.7	6.5	15.4	20.3
Design of home	52.1	17.4	5.8	5.8	19.0	36.4	11.6
Design of work	37.9	31.0	6.9	13.8	10.3	51.7	10.3
Design of community	22.0	26.8	20.3	22.8	8.1	46.3	31.7
Natural Environment	15.4	35.0	25.2	14.6	9.8	43.1	41.5
Surroundings	49.6	30.1	13.0	5.7	1.6	38.2	12.2
Information	59.3	22.0	8.1	8.1	2.4	29.3	11.4
Education	71.3	18.0	5.7	2.5	2.5	15.6	13.1
Medical Care	52.8	25.2	15.4	4.1	2.4	25.2	22.0
Equipment	48.0	27.6	11.4	4.9	8.1	30.1	22.0
Technology	68.3	9.8	4.1	9.8	8.1	17.9	13.8
Help in home	43.8	21.5	14.0	8.3	12.4	33.1	23.1
Help at work	64.9	10.5	7.0	14.0	3.5	21.1	14.0
Help in community	61.0	19.5	12.2	4.1	3.3	27.6	11.4
Attitudes at home	79.7	8.9	2.4	4.1	4.9	13.0	7.3
Attitudes at work	75.9	15.5	5.2	3.4	0.0	22.4	1.7
Attitudes in community	58.5	20.3	15.4	4.1	1.6	32.5	8.9
Support in home	88.6	4.9	0.8	0.8	4.9	5.7	5.7
Support in work	79.3	13.8	3.4	3.4	0.0	17.2	3.4
Support in community	75.6	12.2	6.5	3.3	2.4	17.1	7.3
Discrimination	48.8	29.8	12.4	5.8	3.3	34.7	16.5
Services in community	60.3	19.0	10.7	4.1	5.8	20.7	19.0
Policies of business	64.2	17.9	13.0	1.6	3.3	17.1	18.7
Educational policies	68.3	17.8	7.9	4.0	2.0	19.8	11.9
Government policies	42.3	21.1	17.9	7.3	11.4	19.5	38.2

Table 6: Frequency Distribution for TBI

Question	Never	Less than monthly	Monthly	Weekly	Daily	Little problem	Big problem
	Percent					Percent	
Transportation	65.0	10.8	5.0	8.3	10.8	20.0	15.0
Design of home	83.3	2.5	3.3	5.0	5.8	10.0	6.7
Design of work	79.0	11.1	2.5	3.7	3.7	14.8	6.2
Design of community	73.3	13.3	5.8	6.7	0.8	18.3	8.3
Natural Environment	47.1	31.9	11.8	6.7	2.5	30.3	22.7
Surroundings	44.2	23.3	13.3	10.0	9.2	38.3	17.5
Information	68.1	10.3	6.0	7.8	7.8	15.5	16.4
Education	76.5	16.0	1.7	2.5	3.4	15.1	8.4
Medical Care	79.8	10.1	5.9	3.4	0.8	9.2	10.9
Equipment	88.2	6.7	5.0	0.0	0.0	7.6	4.2
Technology	77.3	5.0	1.7	7.6	8.4	6.7	16.0
Help in home	80.0	6.7	5.8	4.2	3.3	10.0	10.0
Help at work	81.5	9.9	3.7	4.9	0.0	12.3	6.2
Help in community	83.9	6.8	5.9	2.5	0.8	8.5	7.6
Attitudes at home	62.7	15.3	6.8	7.6	7.6	21.2	16.1
Attitudes at work	73.4	12.7	6.3	5.1	2.5	15.2	11.4
Attitudes in community	69.2	15.8	7.5	3.3	4.2	19.2	11.7
Support in home	72.5	15.8	5.8	2.5	3.3	18.3	9.2
Support in work	71.6	17.3	4.9	4.9	1.2	22.2	6.2
Support in community	80.8	9.2	3.3	4.2	2.5	13.3	5.8
Discrimination	66.7	17.5	6.7	4.2	5.0	20.8	12.5
Services in community	78.0	9.3	4.2	3.4	5.1	11.9	10.2
Policies of business	70.9	12.0	10.3	3.4	3.4	12.8	16.2
Educational policies	79.5	8.0	4.5	4.5	3.6	8.9	11.6
Government policies	75.2	6.0	6.8	2.6	9.4	9.4	15.4

Table 7: Frequency Distribution for Other Impairments

Question	Never	Less than monthly	Monthly	Weekly	Daily	Little problem	Big problem
	Percent					Percent	
Transportation	49.1	14.9	9.9	16.1	9.9	18.6	32.3
Design of home	57.4	9.3	5.6	7.4	20.4	18.5	24.1
Design of work	57.5	13.8	11.5	6.9	10.3	26.4	16.1
Design of community	29.4	26.4	20.9	15.3	8.0	38.7	31.9
Natural Environment	16.9	37.5	19.4	15.6	10.6	37.5	45.6
Surroundings	45.4	19.0	12..9	12.9	9.8	27.0	27.6
Information	51.5	14.7	12.3	11.7	9.8	20.9	27.6
Education	68.7	11.7	6.1	6.1	7.4	11.7	19.6
Medical Care	61.3	19.0	9.8	5.5	4.3	12.3	26.4
Equipment	54.7	17.4	10.6	4.3	13.0	15.5	29.8
Technology	55.7	13.9	7.0	10.1	13.3	19.6	24.1
Help in home	51.9	11.9	11.3	13.1	11.9	18.8	29.4
Help at work	63.3	13.9	6.3	11.4	5.1	16.5	20.3
Help in community	59.0	116.8	11.8	6.2	6.2	19.9	21.1
Attitudes at home	68.1	11.9	5.6	6.9	7.5	15.0	16.9
Attitudes at work	73.4	7.6	8.9	6.3	3.8	15.2	11.4
Attitudes in community	58.6	17.9	12.3	4.9	6.2	23.5	17.9
Support in home	75.0	11.3	3.8	5.0	5.0	7.4	15.6
Support in work	71.8	11.5	6.4	2.6	7.7	12.8	15.4
Support in community	66.3	15.3	8.6	5.5	4.3	19.0	14.7
Discrimination	50.3	27.7	9.4	6.3	6.3	23.9	25.8
Services in community	56.2	15.4	13.0	7.4	8.0	16.0	27.8
Policies of business	51.3	25.0	9.4	5.6	8.8	16.9	31.9
Educational policies	72.2	10.4	3.5	6.9	6.9	6.9	20.8
Government policies	51.9	16.7	13.6	6.2	11.7	9.3	38.9

Table 8: Mean Differences Across Groups

	[S]CI	[T]BI	[M]S	[A]mputee	[O]ther	Total
Transportation	1.19 ^{o}	1.31^{o}	2.18 ^{o}	1.11^{o}	2.52 ^{sta}	1.59**
Design home	1.60	0.72 ^{mao}	2.21 ^{t}	2.31 ^{t}	1.79 ^{t}	1.51**
Design work	1.62 ^{t}	0.51 ^{so}	0.75	1.57	1.57 ^{t}	1.16**
Design community	2.51 ^{t}	0.64 ^{smao}	2.51 ^{t}	1.88 ^{t}	2.30 ^{t}	1.87**
Natural Environment	2.60 ^{t}	1.29 ^{smao}	3.22 ^{t}	2.51 ^{t}	2.49 ^{t}	2.27**
Surroundings	1.05 ^{o}	1.66	1.94	1.08 ^{o}	2.41 ^{sa}	1.60**
Information	0.95 ^{o}	1.24 ^{o}	1.29 ^{o}	1.14 ^{o}	2.72 ^{stma}	1.42**
Education/training	0.74	0.62	1.02	1.14	1.32	0.88
Medical Care	1.20	0.58 ^{a}	1.20	1.68 ^{t}	1.05	1.03*
Equipment	1.45 ^{t}	0.24 ^{smao}	1.54 ^{t}	1.62 ^{t}	2.14 ^{t}	1.24**
Technology	1.22	1.16	2.20	0.80	2.07	1.44**
Help home	1.90 ^{t}	0.71 ^{so}	1.76	1.00 ^{o}	2.71 ^{ta}	1.59**
Help work	1.17	0.45 ^{o}	0.30	1.00	1.70 ^{t}	0.95**
Help community	0.97	0.47 ^{o}	1.24	0.82	1.70 ^{t}	0.98**
Attitudes home	0.69	1.27	1.38	0.68	1.35	1.07
Attitudes work	0.37	0.82	0.22	1.00	1.06	0.75
Attitudes community	0.89	0.87	1.09	0.91	1.60	1.04
Support home	0.48	0.71	1.29	0.62	0.77	0.72
Support work	0.37	0.62	0.33	0.96	1.31	0.72
Support community	0.64	0.55	0.91	0.68	1.24	0.76
Discrimination	1.17	0.97 ^{o}	1.38	0.82	1.87 ^{t}	1.23**
Services community	1.23	0.81 ^{o}	1.52	1.00	2.09 ^{t}	1.28**
Policies business	1.00 ^{o}	0.93 ^{o}	1.72	0.97	2.04 st	1.26**
Educat/Employ policies	0.76 ^{o}	0.75 ^{o}	0.53 ^{o}	0.97	1.75 ^{stm}	0.94**
Government policies	2.25 ^{t}	1.14 ^{so}	1.69	1.94	2.35 ^{t}	1.84**
Total Average	1.26 ^{o}	0.88 ^{mo}	1.60 ^{t}	1.19	1.90 st	1.31**

Superscript letter indicates significant difference from the group with initial in bracket.
* p<.05
* p<.01

Table 9: Mean product scores for CHIEF items, subscales and total by Disability Status

CHIEF	BRFSS Data						CHIEF 400 Data							
	All Cases		Disabled		Not Disabled		All Cases		SCI		TBI		Other Dx's	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Policies Subscale	***0.51***	***0.96***	***0.63***	***1.09***	***0.47***	***0.92***	***1.38***	***1.81***	***1.37***	***1.65***	***0.94***	***1.65***	***1.71***	***1.99***
Policies businesses	0.71	1.61	0.96	1.99	0.64	1.48	1.26	2.17	1.01	1.84	0.93	1.88	1.70	2.51
Policies employment/education	0.46	1.31	0.49	1.39	0.45	1.29	0.94	2.03	0.76	1.54	0.75	1.85	1.20	2.41
Services community	0.22	0.86	0.27	0.85	0.21	0.87	1.28	2.29	1.23	2.14	0.81	2.05	1.67	2.51
Policies government	0.64	1.64	0.82	1.92	0.60	1.55	1.84	2.72	2.22	2.73	1.15	2.48	2.06	2.79
Physical/Structural Subscale	***0.47***	***0.79***	***0.78***	***1.22***	***0.39***	***0.60***	***1.72***	***1.58***	***1.80***	***1.34***	***1.05***	***1.30***	***2.15***	***1.77***
Design home	0.33	1.15	0.65	1.78	0.24	0.88	1.52	2.59	1.60	2.37	0.72	1.93	2.05	3.00
Surroundings	0.54	1.42	0.91	1.99	0.44	1.20	1.60	2.25	1.05	1.56	1.67	2.30	1.97	2.55
Design community	0.21	0.92	0.42	1.26	0.16	0.79	1.87	2.31	2.51	2.39	0.64	1.37	2.28	2.45
Design work/school	0.31	1.19	0.50	1.60	0.27	1.08	1.16	2.00	1.62	2.13	0.52	1.28	1.45	2.31
Natural environment	0.76	1.44	1.25	2.19	0.63	1.11	2.27	2.34	2.61	2.26	1.29	1.84	2.74	2.51
Technology	0.64	1.61	0.88	1.99	0.57	1.48	1.45	2.57	1.23	2.34	1.16	2.48	1.84	2.77
Work/School Subscale	***0.66***	***1.13***	***0.89***	***1.34***	***0.62***	***1.08***	***0.81***	***1.52***	***0.64***	***0.91***	***0.63***	***1.36***	***1.12***	***1.93***
Support work/school	0.48	1.29	0.71	1.58	0.44	1.22	0.73	1.75	0.38	0.99	0.63	1.44	1.09	2.34
Attitudes work/school	0.99	1.72	1.31	2.17	0.93	1.61	0.75	1.73	0.38	0.77	0.82	1.86	0.95	2.06
Help work/school	0.54	1.43	0.76	1.82	0.50	1.34	0.95	1.90	1.18	2.08	0.46	1.23	1.30	2.23
Attitudes/Support Subscale	***0.46***	***0.88***	***0.72***	***1.39***	***0.39***	***0.66***	***0.97***	***1.44***	***0.78***	***1.25***	***0.88***	***1.44***	***1.19***	***1.55***
Support community	0.19	0.91	0.39	1.52	0.14	0.64	0.77	1.72	0.64	1.59	0.56	1.58	1.01	1.90
Attitudes community	0.37	1.04	0.52	1.38	0.32	0.92	1.04	1.91	0.89	1.51	0.88	1.88	1.28	2.16
Support home	0.41	1.21	0.74	1.79	0.32	0.98	0.73	1.85	0.49	1.76	0.72	1.66	0.92	2.04
Attitudes home	0.82	1.65	1.29	2.37	0.69	1.38	1.07	2.21	0.69	1.87	1.28	2.29	1.22	2.35
Discrimination	0.53	1.37	0.79	1.78	0.47	1.23	1.24	2.02	1.17	1.69	0.98	2.02	1.48	2.22
Services/Assistance Subscale	***0.39***	***0.72***	***0.58***	***0.93***	***0.33***	***0.64***	***1.27***	***1.42***	***1.20***	***1.16***	***0.75***	***1.18***	***1.70***	***1.62***
Transportation	0.48	1.38	0.50	1.44	0.48	1.36	1.59	2.44	1.19	2.08	1.32	2.31	2.10	2.70
Medical care	0.48	1.39	0.96	1.96	0.34	1.16	1.04	1.85	1.20	1.81	0.59	1.50	1.24	2.05
Help home	0.40	1.15	0.57	1.40	0.35	1.07	1.59	2.48	1.90	2.58	0.72	1.83	2.01	2.67
Education/training	0.34	1.18	0.43	1.33	0.32	1.13	0.89	1.92	0.75	1.66	0.62	1.67	1.18	2.21
Help community	0.20	0.70	0.30	0.88	0.17	0.64	0.98	1.89	0.98	1.76	0.47	1.38	1.36	2.21
Information	0.61	1.37	0.81	1.75	0.56	1.24	1.42	2.31	0.96	1.60	1.24	2.35	1.90	2.64
Personal equipment	0.19	0.99	0.46	1.55	0.11	0.76	1.25	2.23	1.46	2.12	0.24	0.80	1.83	2.72
CHIEF Total	***0.47***	***0.63***	***0.69***	***0.87***	***0.41***	***0.53***	***1.31***	***1.30***	***1.25***	***1.08***	***0.89***	***1.19***	***1.66***	***1.42***

Figure A: CHIEF Subscales and Total by Disability Status

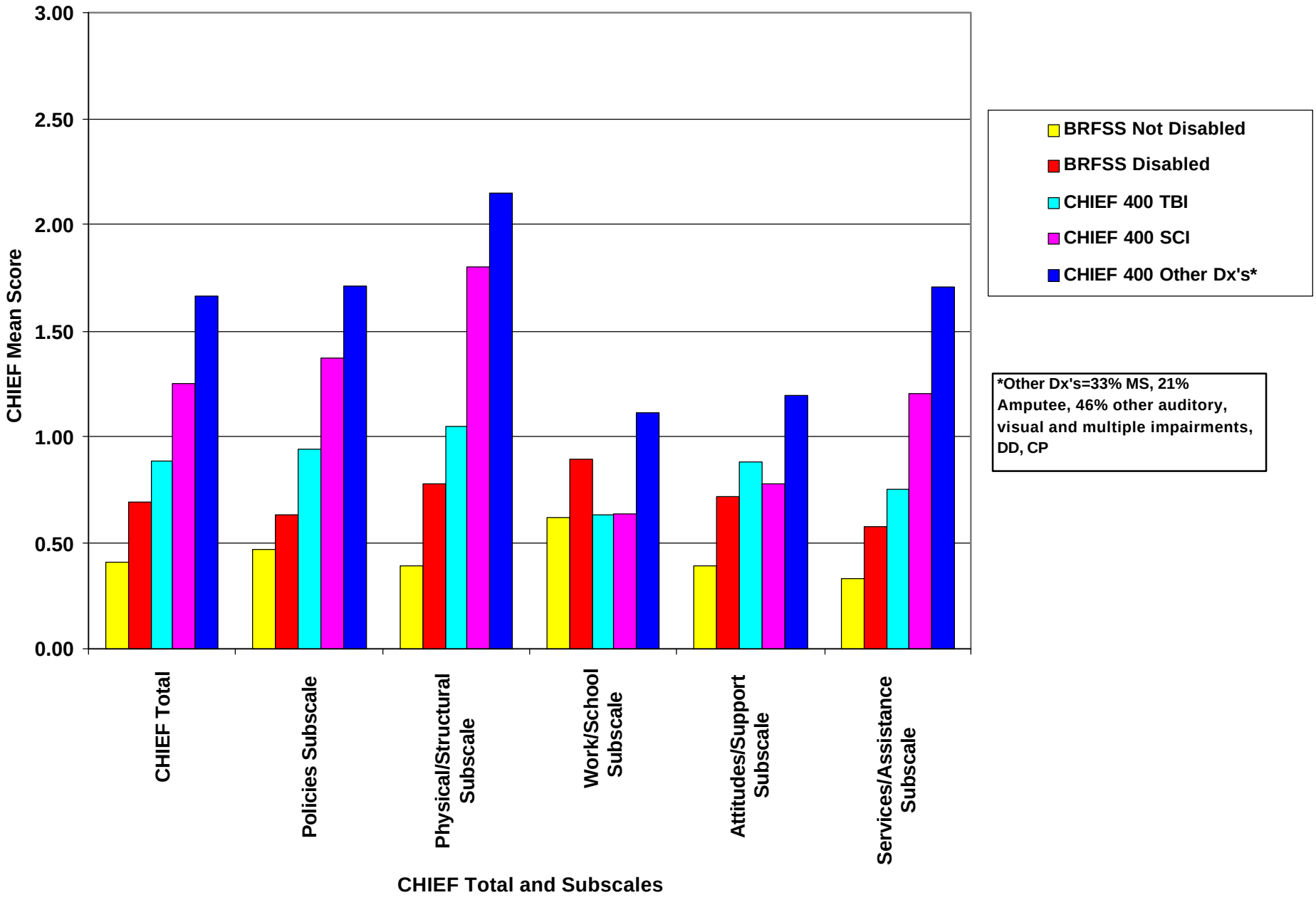

Figure B: CHIEF Policies Subscale by Disability Status

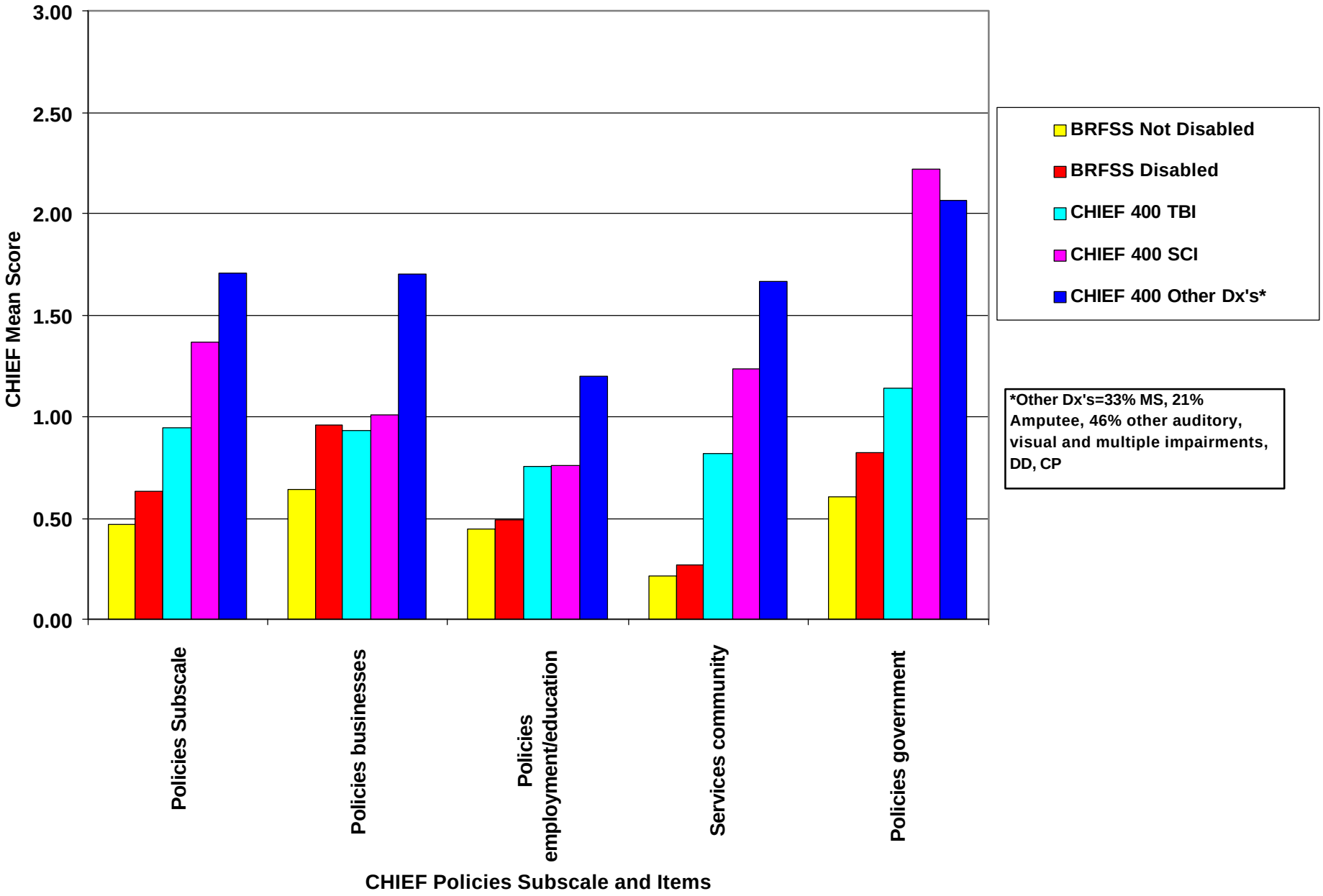

Figure C: CHIEF Physical/Structural Subscale by Disability Status

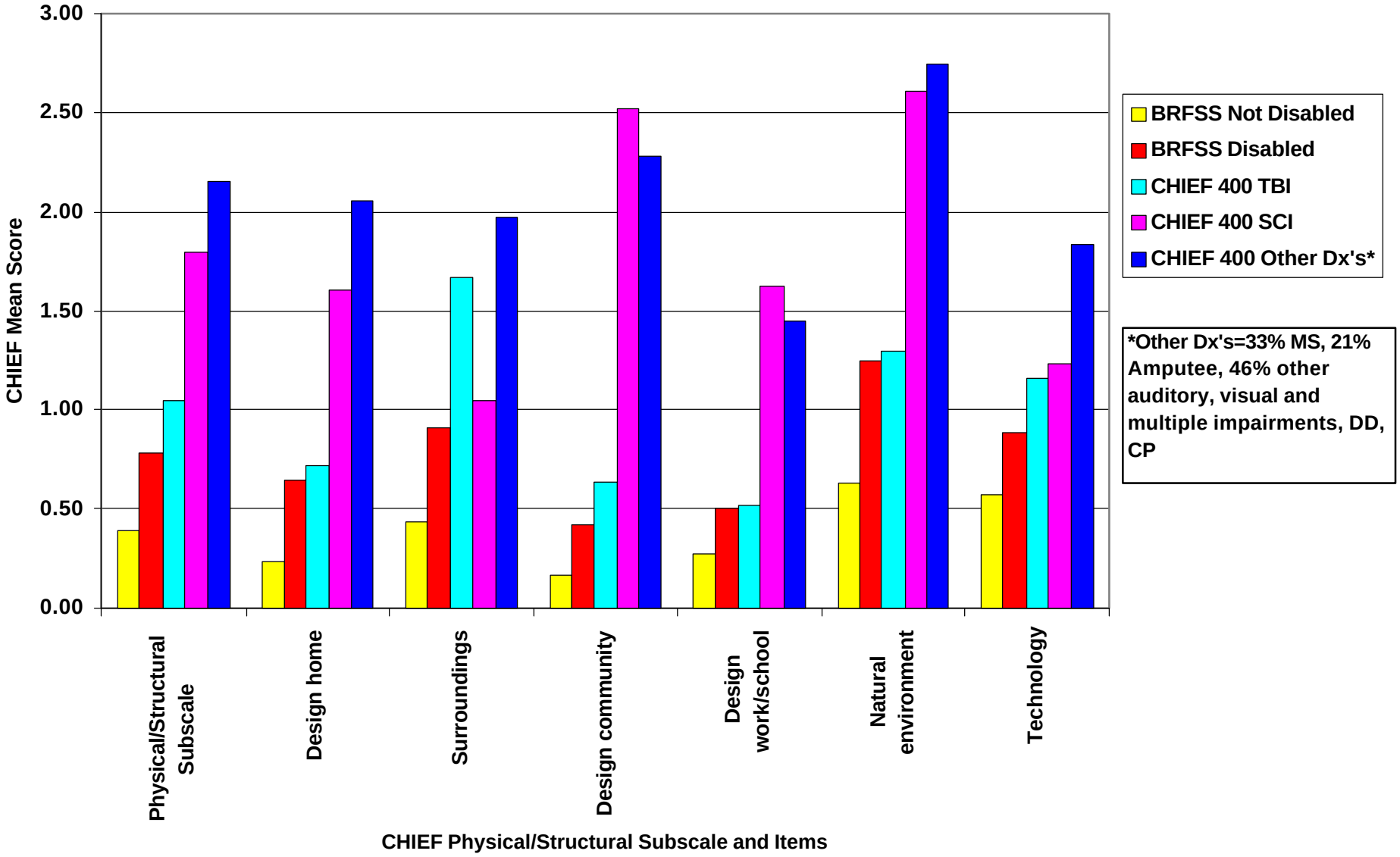

Figure D: CHIEF Work/School Subscale by Disability Status

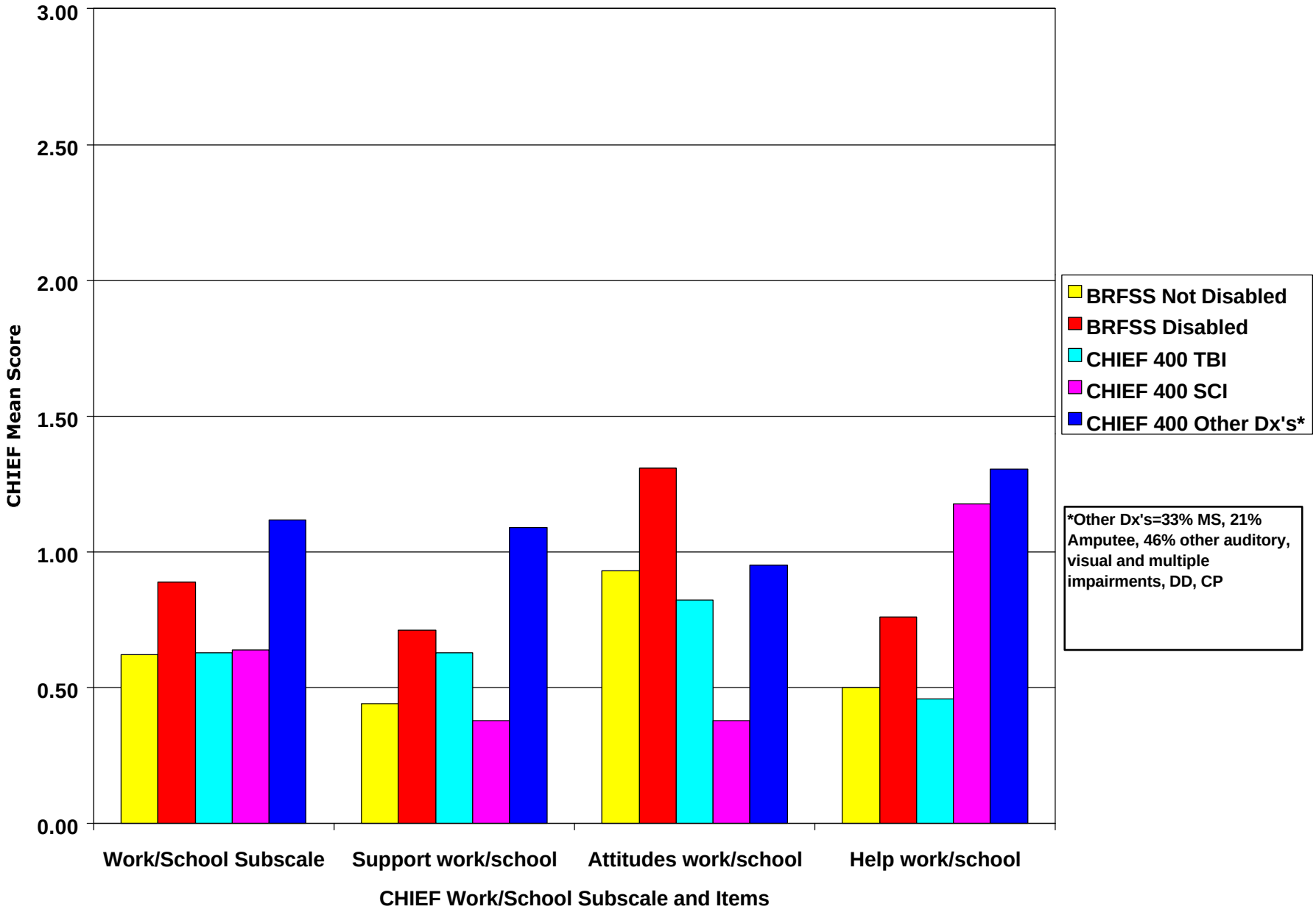

Figure E: CHIEF Attitudes/Support Subscale by Disability Status

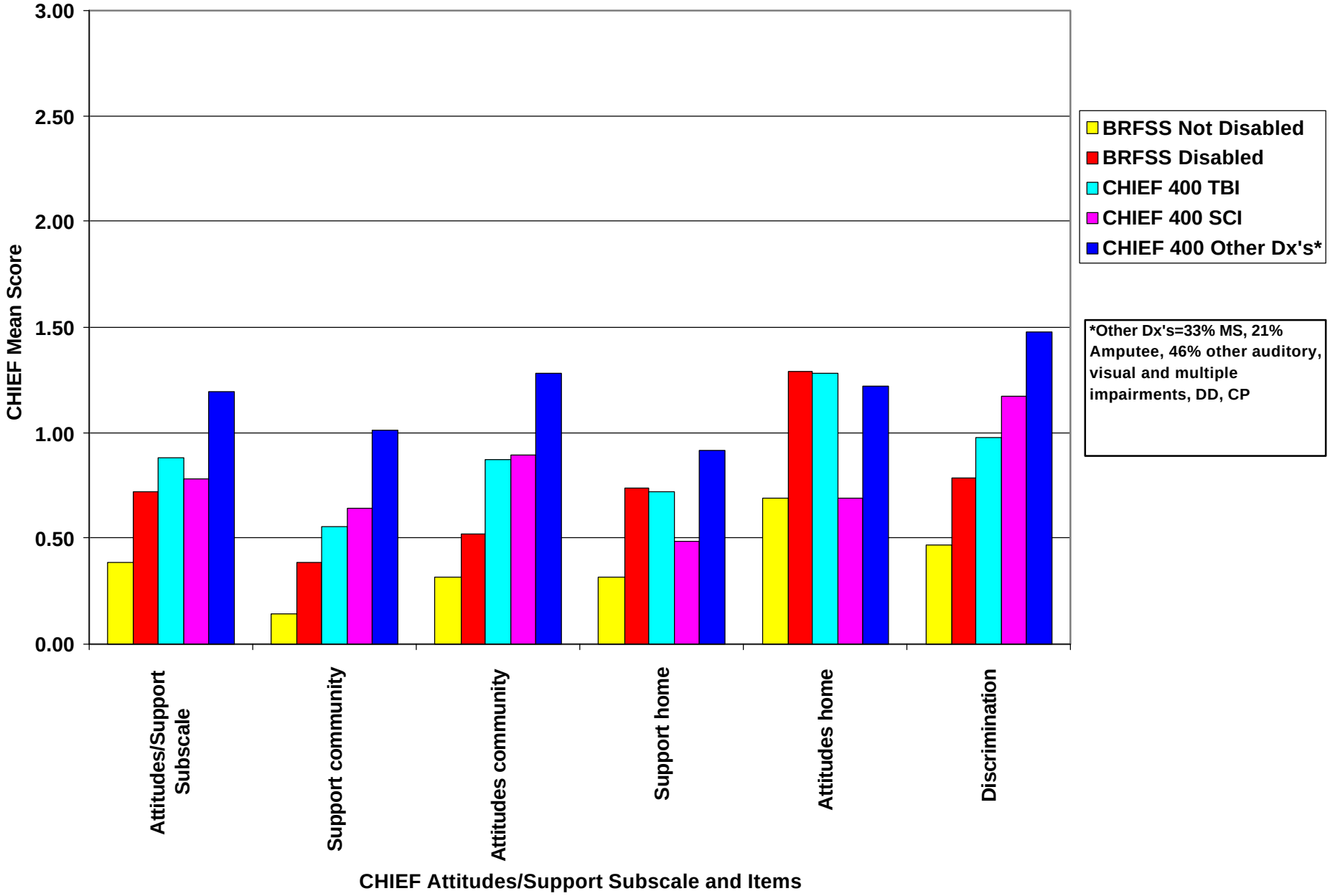

Figure F: CHIEF Services/Assistance Subscale by Disability Status

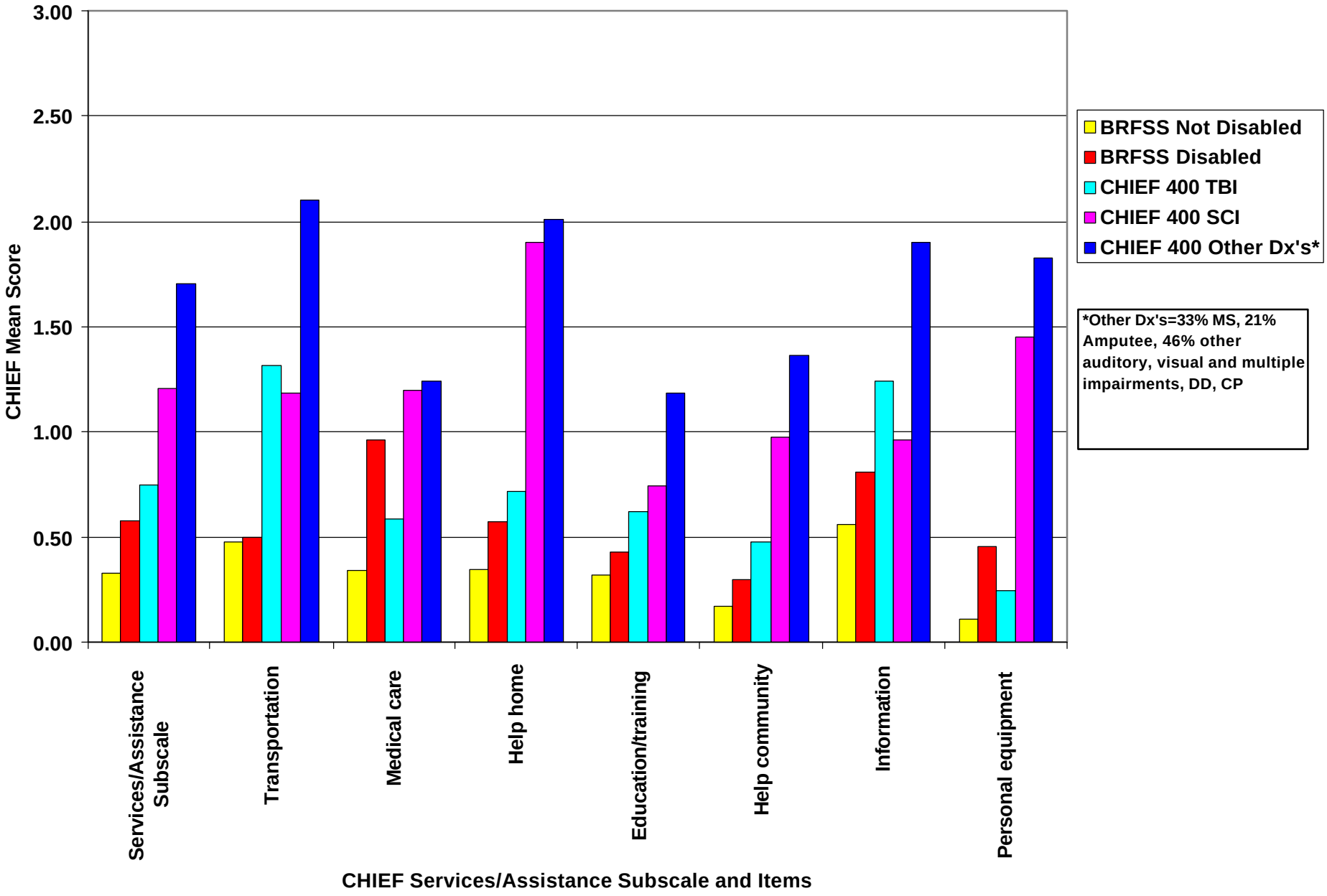

Table 10: Mean product scores for the CHIEF Short Form items, subscales and total by Disability Status

CHIEF-SF	1999 BRFSS Data						CHIEF 400 Data							
	All Cases		Disabled		Not Disabled		All Cases		SCI		TBI		Other Dx's	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Policies Subscale	***0.68***	***1.34***	***0.89***	***1.66***	***0.64***	***1.34***	***1.55***	***2.05***	***1.61***	***1.86***	***1.04***	***1.84***	***1.88***	***2.25***
Policies businesses	0.71	1.61	0.96	1.99	0.63	1.48	1.26	2.17	1.01	1.84	0.93	1.88	1.70	2.51
Policies government	0.64	1.64	0.82	1.92	0.60	1.55	1.84	2.72	2.22	2.73	1.15	2.48	2.06	2.79
Physical/Structural Subscale	***0.65***	***1.18***	***1.08***	***1.79***	***0.53***	***0.92***	***1.95***	***1.83***	***1.83***	***1.52***	***1.48***	***1.69***	***2.38***	***2.04***
Surroundings	0.54	1.42	0.91	1.99	0.44	1.21	1.60	2.25	1.05	1.56	1.67	2.30	1.97	2.55
Natural environment	0.76	1.44	1.25	2.19	0.63	1.11	2.27	2.34	2.61	2.26	1.29	1.84	2.74	2.51
Work/School Subscale	***0.76***	***1.24***	***1.00***	***1.50***	***0.71***	***1.18***	***0.85***	***1.57***	***0.77***	***1.12***	***0.63***	***1.43***	***1.13***	***1.90***
Attitudes work/school	0.99	1.72	1.31	2.17	0.93	1.61	0.75	1.73	0.38	0.77	0.82	1.86	0.95	2.06
Help work/school	0.54	1.43	0.76	1.82	0.50	1.34	0.95	1.90	1.18	2.08	0.46	1.23	1.30	2.23
Attitudes/Support Subscale	***0.67***	***1.21***	***1.00***	***1.77***	***0.57***	***0.99***	***1.17***	***1.77***	***0.96***	***1.50***	***1.13***	***1.74***	***1.36***	***1.97***
Attitudes home	0.82	1.65	1.29	2.37	0.69	1.38	1.07	2.21	0.69	1.87	1.28	2.29	1.22	2.35
Discrimination	0.54	1.37	0.79	1.79	0.47	1.23	1.24	2.02	1.17	1.69	0.98	2.02	1.48	2.22
Services/Assistance Subscale	***0.49***	***0.91***	***0.71***	***1.13***	***0.43***	***0.83***	***1.43***	***1.61***	***1.31***	***1.32***	***0.98***	***1.50***	***1.85***	***1.78***
Transportation	0.48	1.38	0.50	1.44	0.48	1.36	1.59	2.44	1.19	2.08	1.32	2.31	2.10	2.70
Medical care	0.48	1.39	0.96	1.96	0.34	1.16	1.04	1.85	1.20	1.81	0.59	1.50	1.24	2.05
Help home	0.40	1.15	0.57	1.40	0.35	1.07	1.59	2.48	1.90	2.58	0.72	1.83	2.01	2.67
Information	0.61	1.37	0.81	1.75	0.56	1.24	1.42	2.31	0.96	1.60	1.24	2.35	1.90	2.64
CHIEF-SF Total	***0.62***	***0.80***	***0.88***	***1.10***	***0.54***	***0.68***	***1.47***	***1.43***	***1.35***	***1.12***	***1.09***	***1.38***	***1.83***	***1.58***

Figure G: CHIEF-SF Subscales and Total by Disability Status

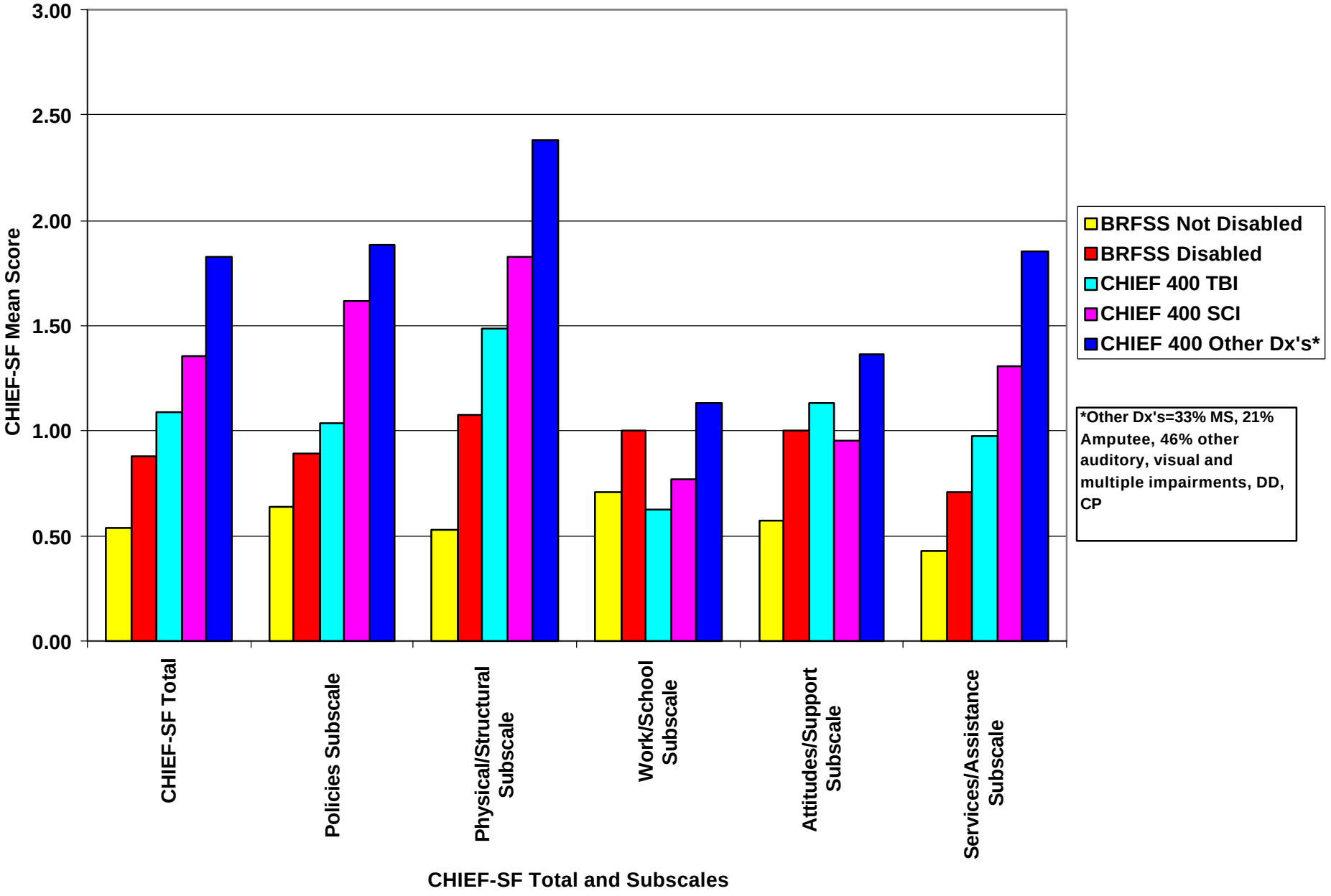
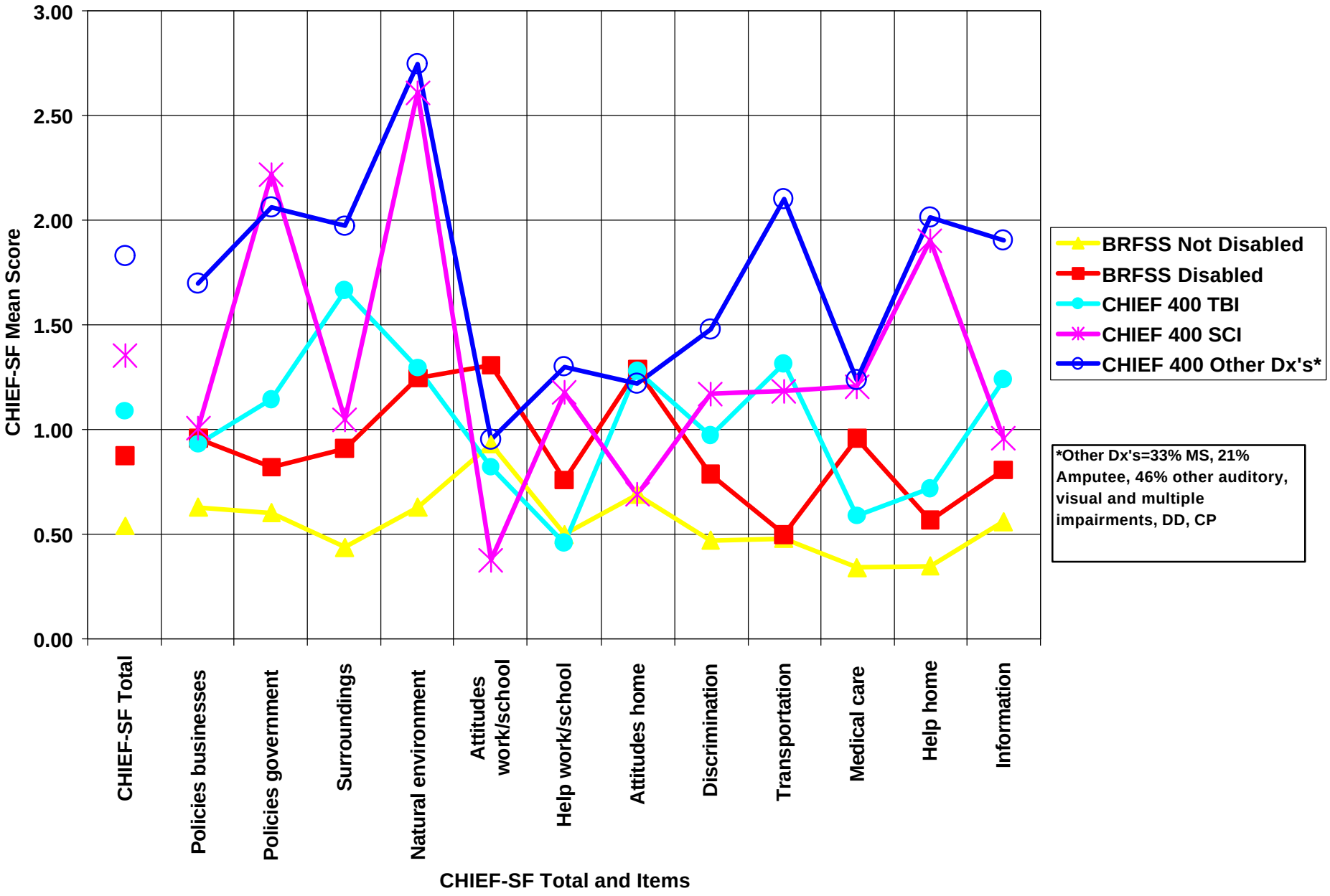
Figure H: CHIEF-SF by Disability Status