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## **MEASURING INJURY CONSEQUENCES AMONG THE ELDERLY: PRELIMINARY FINDINGS**

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### **ABSTRACT**

Although individuals 65 years old or older account for 12% of the US population, they represent over one-third of all trauma hospitalizations, with approximately 1 million annual admissions. Slightly more than half of these hospitalizations are due to injuries other than isolated hip fractures. Yet, our understanding of the long-term consequences of these injuries is rather limited.

In the context two other projects, we aimed: (1) to investigate which outcomes scales have been used among elderly injury victims; (2) to understand their nature and characteristics; and (3) to gather what evidence on the long-term consequences of injuries had been accumulated through their use.

We searched for articles published between January 1995 and August 2001 to identify instruments that measured the health status of injured patients 55 years old or older. The instruments had to have been used in at least one peer-reviewed publication and they had to evaluate health outcomes of more than one organ or system function. The instruments had to be available either as a self-administered tool or through interview by non-health professionals. We characterized the identified instruments regarding whether they characterized the subjects' pathology, impairment, functional limitations, or disability status, and regarding which specific body or system functions they evaluated.

Fifty-five instruments and some 120 articles using them met our inclusion criteria. Review of all instruments has been completed. Most of the instruments combine items related to disability, impairment, functional limitation and quality of life (in decreasing frequency). Among the body functions covered, cognitive-, ambulatory-, and hand- and arm-related functions are the most frequently investigated areas. However, psychosocial aspects of the subjects' health are the most commonly evaluated function overall.

Of the 120 selected papers, 60 have been reviewed to date. Preliminary findings of this review are presented.

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## INTRODUCTION

Each year in the US, nearly one million individuals 65 years old or older are hospitalized for treatment of an acute traumatic injury. And this figure is bound to increase as a result of increases in the proportion of the population reaching 65 years old. During the past years, quite a few researchers have focused on the fatal and non-fatal consequences of isolated hip fractures, the single largest type of trauma in this population. Yet, hip fractures represent only 40-50% of the hospitalizations among the elderly. The non-fatal consequences of these other injuries have been much less frequently investigated (NCHS, 1997; IOM 1999, MacKenzie et al 1990).

In the context of two larger projects, one aiming to guide the future development of a geriatric index compatible with the Functional Capacity Index (FCI), and the second one aiming to describe the long-term consequences of elderly victims of motor vehicle crashes, we performed a literature review on the topic of health status measurement among the elderly. Our objective was to characterize which scales had been most commonly used. Specifically, we wanted to investigate which scales had been used to characterize long-term injury consequences, and to understand the characteristics of those scales (aspects of the disability process and bodily functions affected). We also wanted to review the literature on long-term consequences of injury to the elderly, and what (if any) risk factors or circumstances modified these outcomes, which types of pre-existing conditions the elderly commonly have before being injured and how these conditions affect the recovery process and limit the functions of the injured elderly.

In our review, we used the Nagi framework of "functional limitation". In this framework, the concepts of pathology, impairment, functional limitations and disability are presented as a sequential chain towards more extended disability (Pope and Tarlov, 1991). We also used the Functional Capacity Index (FCI) dimensions as a guide to classify the bodily functions covered by the reviewed scales. These dimensions are: eating, excretory, sexual, ambulation, hand/arm, bending/lifting, visual, auditory, speech, or cognitive (MacKenzie et al, 1996).

## METHODS

### A) SCALE IDENTIFICATION

We searched for health outcomes measures used in the peer-reviewed literature to investigate long term consequences of injured elderly individuals. Our search encompassed all English-written papers published between January 1995 and August 2001. We used Medline as our search engine and complemented its findings with the measures reported in the textbook "Measuring Health: A Guide to Rating Scales and Questionnaires" (McDowell and Neill, 1996), and in a document on Health Status Measures prepared for a previous Measuring the Burden of Injury conference (MacKenzie et al, 2000). Our objective was to identify scales that met the following inclusion criteria:

- The scale had to have been used at least once in a peer-reviewed paper,

- The paper had to specifically report on the health status of injured patients<sup>2</sup> 55 years old or older, and
- The scale had to be capable of assessing the health impact of the injuries at the level of individual (i.e., above and beyond limitations at the level of organ, body part or body system).

Upon further consideration, scales were eliminated if they met any of the following exclusion criteria:

- Scales primarily developed for clinical use and based on observation and detailed clinical examination by a trained clinician (e.g., Jebsen Hand Function Test).
- Measures that solely evaluated the impact of only one of the FCI bodily functions.<sup>3</sup>

For the selected scales, we obtained the full questionnaire and proceeded to their review and classification regarding the two following dimensions:

1. Whether their specific items or dimensions related to pathology, impairment, functional limitation, disability (using the Nagi definitions), or could not be fitted into any of these categories but reflected issues related to quality of life; and
2. Whether their specific items or dimensions related to eating, excretory, sexual, ambulation, hand/arm, bending/lifting, visual, auditory, speech, or cognitive areas

#### A.1) Characterization along the Nagi model

For each scale, all items/groups of items were assigned to one (and only one) of the Nagi model stages or to quality of life. Figure 1 illustrates the Nagi model. Yet, to enhance the reliability of this characterization process, one trained research assistant (only) evaluated all scales while using the following operational definitions:

**Pathology:** Any item that measured etiology without any specific mention of an impairment, functional limitation or disability (e.g., unconsciousness, coma).

**Impairment:** Any item that measured loss and/or abnormality of one organ or organ system (e.g., bowel or bladder problems, abnormality or loss of use of one limb or extremity), mental and emotional abnormalities (i.e., depression, anxiety, confusion, stroke, memory loss, confusion), or pain.

**Functional Limitation:** Any item that reflected abnormal functioning in more than one organ or organ system, including an impact at the individual level (e.g., lower limb impairment that prevents walking, inability to communicate). Also, items that measured mobility, including things such as: ambulation, transfers (in and out of bed, in and out of wheelchair to bed or another chair, unable to climb flight of stairs or walk on level ground and inability to "get around").

<sup>2</sup> Regardless whether the patients had one common type of injury or multiple types or whether they had all been injured by the same type of mechanism.

<sup>3</sup> This was done in an effort to concentrate our attention on those scales that would help identify areas not already covered by the FCI.

For example, we considered tasks such as grasping or lifting related to this aspect because grasping involves more than just the hand but the thought to move the hand, the action of moving the hand and the ability to rotate the wrist and arm in such a manner as to grip, twist, lift, move or hold on to objects. We also considered communication to belong in here as it involves the eyes, the brain, the mouth, the vocal cords, and the hands, that is, a combination of many organs and organ systems and would be considered a functional limitation.

**Disability:** Any item related to the inability to the performance of basic self-care activities (i.e., eating, dressing, grooming) or to participating in regular social roles and activities (i.e., perform work outside of home, chores around the house, visit friends and relatives, attend religious ceremonies or celebrations like birthdays, graduations, weddings) or performing tasks of self-care such as pay bills, manage money, make financial decisions, go shopping, make telephone calls, get to doctor appointments, take medications or use prosthetic devices without assistance from others).

**Quality of Life:** Any items containing the subjective opinion of a respondent regarding their overall health or satisfaction with their life.

## A.2) Comparison along FCI dimensions

For each scale, we also classified all their items, or groups of items into the bodily function that they covered. For this classification, we used the 10 bodily functions described in the FCI and added 3 other categories: pain (not related to malfunction of any specific body function), psychosocial functioning (including things such as: depression, anxiety, family relationships, intimate relationships, social support, etc.), and other. In this classification process, we allowed for the possibility that a particular scale item applied to more than one dimension. For example, if the item related to communication and it did not specify which specific component of communication it referred to, we would categorize that item as related to speech, cognitive, audition, vision, and hand and arm movement.

## B) LITERATURE REVIEW

Using the same strategy described in the previous section, we identified papers that used the selected scales to characterize health outcomes of injured elderly individuals. For a paper to be included it had to meet the following inclusion criteria

- Specifically report health status on individuals 55 years old or older (although they could report health status on younger individuals, too).
- Specifically identify outcomes on injured patients (although they could report health status on other conditions, too).

Papers that solely focused on patients with isolated hip fractures were excluded from this review. When several papers using the same scale were available, we choose one or two of them for inclusion in the review. We normally chose the most complete reference that provided a good understanding of the applicability of the scale in the elderly injured population.

Again, and in an effort to ensure reliability, only one researcher reviewed all the papers. For each paper, the reviewer completed a review form containing the abstract and a summary of key aspects such as the age ranges of the individuals investigated, the type and nature of injuries sustained, the specific outcome measure(s) used, and the main implications of the paper in terms for health status findings, predictive factors, and whether pre-injury (or baseline) health status information had been recorded for those individuals.

## RESULTS

### A) SCALE REVIEW

Through our search, we identified 117 scales of which 62 met one or more of our exclusion criteria, thus leaving 55 scales for review. Table 1 presents, in chronological order of development, a list of all the scales considered for evaluation, whether they were actually included for the review and, if not, what the main reason was for their exclusion. (The full references of all 117 scales are listed in the Bibliography section). Although the earliest of these scales were developed in the late 1950's, it was during the 1980's that most of these scales were introduced in the literature.

Collectively, these 55 scales comprise 1534 individual questions on health status or enabling factors that we grouped in 971 "clusters" (items or groups of items). Table 2 summarizes the classification of these scales regarding the type of "disability" that they measure. Only 9 of the scales concentrated all their items in one of the Nagi dimensions: 5 in impairment-related issues (Center for Epidemiological Studies Depression Scale, Visual Analog Scale, Rand Mental Health, Brief Symptom Inventory, and Agitated Behavior Scale) and 4 in disability-related issues (Functional Activities, Community Integration, Supervision Rating Scale, and Craig Hospital Inventory of Environmental Factors<sup>4</sup>). One additional scale, the Philadelphia Geriatric Morale focused only in impairment- and quality-of-life-related issues. Two scales did not cover any Nagi-related aspect but concentrated on quality-of-life aspects: the Life Satisfaction Index and the Satisfaction with Life Scale. Among the remaining 43 scales, 5 (12%) covered at least 2 Nagi-related aspects; 31 (72%) covered 3 Nagi-related aspects; and the last 7 (16%) covered all 4 aspects (regardless of whether they also covered aspects related to quality of life).

Among the 971 questions or group of questions covered among these 55 scales, impairment was the area most commonly investigated (46%), followed by disability (26%), functional limitation (15%) and pathology (5%). The remaining 8% of the scales covered issues not easily classifiable according to the Nagi model and that we clustered around a "quality-of-life" category.

With regards to the specific body functions covered by these scales, we classified each question or groups of questions into one or more such functions. For example, if a question related to communicating capabilities, we categorized that question as relating to cognitive, hearing, and speech capabilities. Thus, we mapped the 55 scales and their 971 questions or groups of

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<sup>4</sup> It is important to note that the CHIEF is primarily used as a tool to investigate risk factors that contribute to disability, not as a tool that measures disability itself. Nevertheless, we decided to include it in this review.

questions related into 1095 functions covered. The single most common function covered by these items related to social and psychological consequences (46%). This predominance is related to the fact that 16 of the 55 scales only related to this type of consequences of injury (or disease). The other aspects covered by these scales related to cognitive functioning (10%), ambulatory functioning (9%), hand and arm functioning (8%), or bending and lifting (6%). The aspects less frequently evaluated related to pain, vision (3% each), eating, excretory, auditory, speech (2% each), and sexual functioning (less than 1%) (Table 3).

## B) LITERATURE REVIEW [PRELIMINARY RESULTS]

The original search yielded more than 300 references, which upon further review were reduced to some 120 manuscripts, 60 of which have been reviewed to date. (The full references of the reviewed papers are in the Bibliography section).

The majority of the manuscripts use several of the outcomes scales under review. The age range of patients for whom specific findings are reported ranges from 45 to 89 years old. The papers reflect a variety of injury types, such as fractures (primarily hip, femur and rib), minor head injuries, contusions, lacerations, abrasions and puncture wounds and mechanisms of injury (predominantly falls, motor vehicle crashes and assaults). Time of assessment since injury ranged from right after discharge to 6 years, although most of the papers reflected outcomes 1 or 2 years post-injury.

The long-term functional limitations most commonly reported include problems of mobility, cognitive impairment, social support, inability to perform activities of daily living (eating, dressing, cooking), and excretory dysfunction, including bladder and/or bowel control. Another outcome often reported relates to discharge disposition and living arrangements for these patients: with the majority of patients released from rehabilitation centers being discharged to nursing homes or other institutional facilities rather than private homes or with family.

Injury severity was not too highly related to functional state when they have lower ISS scores. In contrast, pre-existing conditions and/or the medications that are being used in the treatment of these conditions seems to be a more important risk factor. The most commonly described pre-existing conditions in these papers were: hypertension, COPD, delirium, depression, diabetes, arthritis, osteoporosis, cerebrovascular disease, and ischemic heart disease. Social support systems and other psychological issues are also reported to be highly influential in the recovery of elderly patients who sustain major injuries.

In the reviewed papers, a commonly raised concern was the lack of baseline health status data for these patients that would allow for better assessment of the amount of recovery that should be expected with appropriate treatment. Also, most of the articles noted that the weakness of existing scales is that they are not easily conducted outside of clinical settings, which allows for poor follow-up in longitudinal studies concerning the elderly due to mobility and transportation issues.

## DISCUSSION AND CONCLUSIONS

In this review, we identified a variety of scales that are currently being used to measure outcomes among older injured individuals. Interestingly, none of them seems to clearly dominate over the others. Most of the evaluated scales covered a mix of aspects of the disability process to include pathology, impairment and functional limitations. In fact, it seems as if impairments and disability issues are the most commonly investigated issues. Yet, we believe that a scale that focuses on functional limitations along all relevant dimensions could provide great insight in regards to the environmental factors that could be modified to how to prevent disability.

We acknowledge some limitations to our classification systems. For example, and in regards to the Nagi model, it is important to acknowledge that practically none of the reviewed scales was developed using this framework. In addition, even Nagi argued that his model might not apply to scales that focus on mental or emotional aspects of health (Pope and Tarlov, 1991 - Page 315). The difficulties in this exercise are illustrated by the fact that we had to create a "quality of life" category for those items that could not be categorized anywhere else. Also, and in regards to the classification of the functions covered by the scale, we chose the FCI bodily functions as a starting point because of our ulterior goal of further developing the scale and we added a few more categories to accommodate for those items that did not fit within any of the FCI dimensions. Despite these limitations, we believe that the specific classification criterion is less important than the findings regarding the structure, depth and breadth of the existing scales.

Another interesting finding relates to the nature and type of functions investigated by these scales. We found interesting that most of the scales centered on a few particular aspects. For example, a majority of scales focused solely on the psychological and social consequences of the injuries. This included impairments due to mental and emotional disorders such as: depression, anxiety and mood changes. Among the scales that measure other aspects, cognitive issues were the most frequent item investigated. Another popular set of questions centered on mobility issues, but these were, very frequently framed in terms of functional limitations. This includes things such as: walking up and down stairs, walking up and down hills, walking on a level surface, carrying heavy or light objects, moving from the bed to a chair, etc. Only about one-third of the scales had measurements for IADLs or management of finances, ability to grocery shop, prepare meals or buy necessary toiletries.

Regarding the literature review, it seems as if the number of scales in use (together with the use of multiple scales even in the same manuscript) suggests that none of them fulfills all the outcomes related aspects that we believe are relevant among these individuals. We did not find any paper that showed the application of the same scale to measure pre-injury health status, yet most papers raised the problem of lacking this type of information. Also, most papers discussed the role of co-morbidity factors as risk factors for disability. Interestingly, the risk factors reported as most frequent are well within the range of disease prevalence among 65 years old or older in the latest US National Health interview survey, that suggest that 49% of these people suffer from arthritis; 37% of persons from high blood pressure; 32% of persons from hearing impairment; 30% of persons from heart disease; 17% of persons from cataracts; 16% of persons from deformity or orthopedic impairments; and 9% of persons from visual impairment. Overall,

41% of individuals age 65+ have at least 1 ADL or IADL limitation, with the most common activity limitation being that of limitations in walking.

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Figure 1. Nagi's model (Pope and Tarlov, 1991)

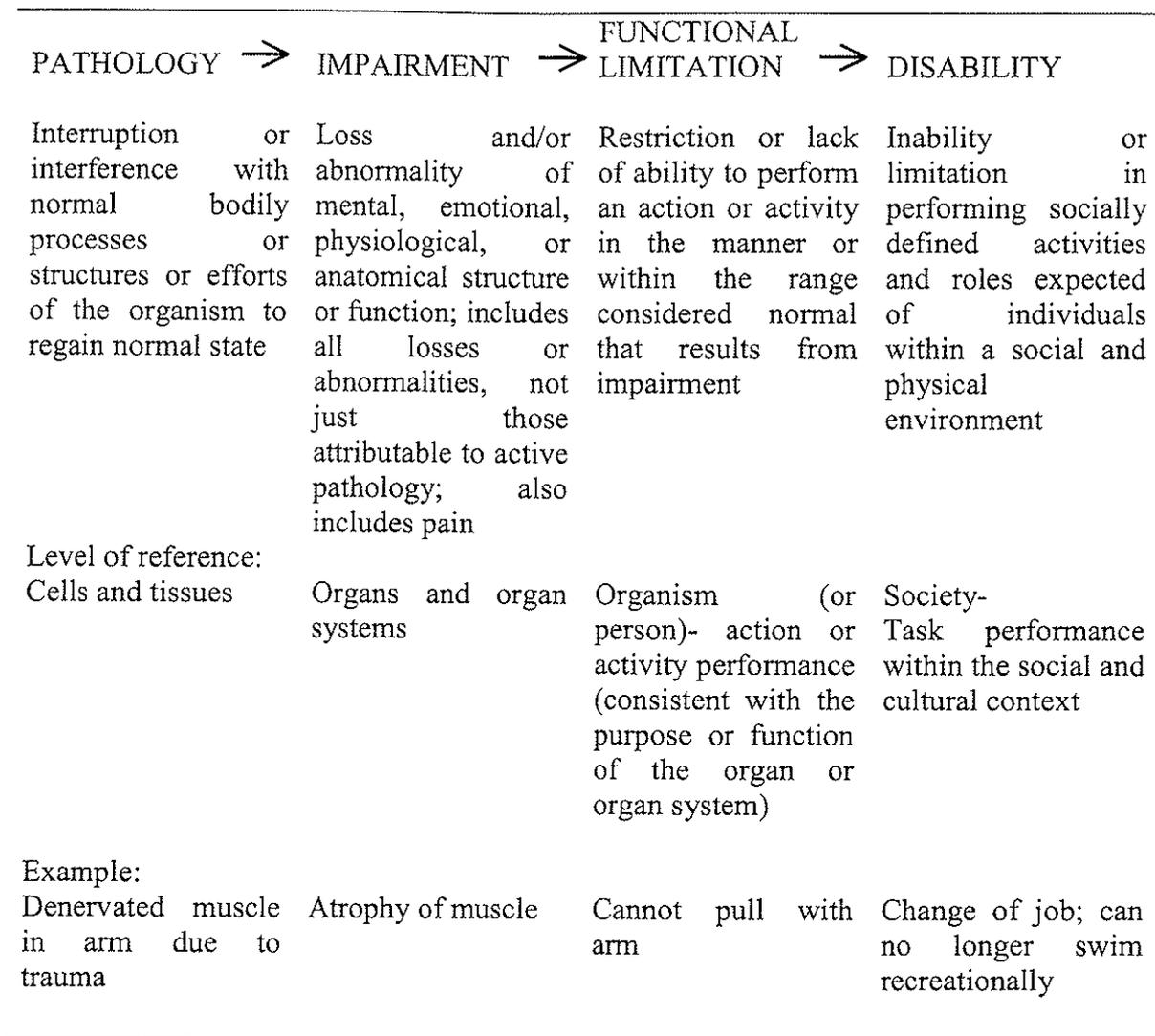


Table 1. Scales considered for review and their disposition. (N=117)

Year	Author	Name of Scale	Scale Acronym	Included Yes/No	If not included, reason
1955	Mahoney	BARTHEL Index	BARTHEL	Yes	
1957	Macmillan	Health Opinion Survey	HOS	No	Literature not about elderly or injury
1957	Moskowitz	PULSES Profile	PULSES	Yes	
1959	Katz	Activities of Daily Living/ Independent Activities of Daily Living	ADL/IADL	Yes	
1960	Hamilton	Hamilton Rating Scale for Depression	HRSD	No	Literature not about elderly or injury
1960	Kahn	Mental Status Questionnaire	MSQ	No	Covers only one bodily function
1961	Neugarten & Havighurst	Life Satisfaction Index		Yes	
1962	Langner	Twenty-Two Item Screening Score of Psychiatric Symptoms		No	Literature not about elderly or injury
1963	Katz	Katz Adjustment Scales		No	Not frequent enough in literature
1965	Lubin	Depression Adjective Checklists	DACL	No	Literature not about elderly or injury
1965	Schoening	KENNY Self-Care Evaluation		Yes	
1965	Zung	Self-Rating Depression Scale	SDS	No	Literature not about elderly or injury
1968	Blessed	Dementia Scale	BLS-D	No	Covers only one bodily function
1968	Blessed	Information-Memory-Concentration Test	IMC	No	Covers Only (1) aspect FCI
1969 (orig 1965)	Bradburn	Affect Balance Scale		No	Literature not about elderly or injury
1969	Lawton	Physical Self-Maintenance	PSMS	Yes	
1969	Linn	Social Dysfunction Rating Scale	SDRS	No	Literature not about elderly or injury
1970	Bennet	Disability Interview Schedule	DIS	Yes	
1971	Weissman	Social Adjustment Scale	SAS	No	Literature not about elderly or injury
1972	CES-D	Center for Epidemiologic Studies Depression Scales	CES-D	Yes	
1972	Goldberg	General Health Questionnaire		Yes	
1972	Gurel	Physical and Mental Impairment of Function Evaluation	PAMIE	Yes	
1972	Gurland	Structured and Scaled Interview to Assess Maladjustment	SSIAM	No	Literature not about elderly or injury
1972	Hagen	Level of Cognitive Functioning Scale	LCFS	No	Covers only one bodily function
1972	Lawton	Philadelphia Geriatric Center Morale Scale		Yes	
1973	Bush & Kaplan	Quality of Well-Being Scale	QWB	Yes	
1973	Mattis	Dementia Rating Scale	DRS	No	Covers only one bodily function
1974	Various	Visual Analogue Pain Rating Scales	VAS	Yes	

1975	Duke University	Older Americans Resources and Services Multidimensional Functional Assessment Questionnaire	OARS	Yes	
1975	Folstein	Mini-Mental State Examination	MMSE	No	Covers only one bodily function
1975	Jennett	Glasgow Outcome Scale	GOS	No	Not about elderly in literature
1975	Melzack	McGill Pain Questionnaire	MPQ	Yes	
1975	Pattie	Clifton Assessment Procedures for the Elderly	CAPE	No	Covers only one bodily function
1975	Pfeiffer	Short Portable Mental Status Questionnaire	SPMSQ	No	Covers only one bodily function
1975	Pilowsky	Illness Behavior Questionnaire	IBQ	No	Not frequent enough in literature
1976	Andrews	Four Single-Item Indicators of Well-Being		No	Literature not about elderly or injury
1976	Bergner	Sickness Impact Profile	SIP	Yes	
1976	Chambers	McMaster Health Index Questionnaire	MHIQ	No	Not frequent enough in literature
1976	Tursky	Pain Perception Profile	PPP	No	Not frequent enough in literature
1976	Ware	Health Perceptions Questionnaire	HPQ	No	Literature not about elderly or injury
1977	Dupuy	General Well-Being Scale	GWB	No	More long-term injury than acute
1977	Gurland	Comprehensive Assessment and Referral Evaluation	CARE	No	Not frequent enough in literature
1977	Jacobs	Cognitive Capacity Screening Examination	CCSE	No	Covers only one bodily function
1978 (orig 1961)	Beck	Beck Depression Inventory	BDI	Yes	
1978	Clare	Social Maladjustment Schedule		No	Literature not about elderly or injury
1978	Leavitt	Back Pain Classification Scale	PBCS	No	Not frequent enough in literature
1978	Rand Corporation	Rand Social Health Battery		No	Literature not about elderly or injury
1978	Rosser	Disability and Distress Scale		Yes	
1979	Montgomery & Asberg	Montgomery-Asberg Depression Rating Scale	MADRS	No	Literature not about elderly or injury
1979	Rand Corp. & John Ware	Rand Mental Health Inventory	MHI	Yes	
1979	Remington	Social Functioning Scale	SFS	No	Literature not about elderly or injury
1980	Fries	Health Assessment Questionnaire	HAQ	Yes	
1980	Henderson	Interview Schedule for Social Interaction	ISSI	No	Literature not about elderly or injury
1980	Jette	Functional Status Index	FSI	Yes	
1980	Meenan	Arthritis Impact Measurement Scale	AIMS	Yes	
1980	Spitzer	Quality of Life Index	QL Index	Yes	
1981	Carroll	Carroll Rating Scale for Depression	CRS	No	Literature not about elderly or injury
1981	Crewe	Functional Assessment Inventory	FAI	Yes	
1981	Forer	Functional Status Rating System	FSRS	Yes	

1981	Harvey	Patient Evaluation Conference System	PECS	Yes	
1981	Hunt	Nottingham Health Profile	NHP	Yes	
1981	OECD	Organization for Economic Development Long-Term Disability Questionnaire	OECD	Yes	
1981	Patrick	Lambeth Disability Screening Questionnaire		Yes	
1982	Brink & Yesavage	Geriatric Depression Scale	GDS	Yes	
1982	Cleeland	Brief Pain Inventory	BPI	No	Not frequent enough in literature
1982	Lawton	Multilevel Assessment Instrument	MAI	No	Not frequent enough in literature
1982	Lehman	Quality of Life Inventory	QOLI	No	Not frequent enough in literature
1982 (orig 1967)	Linn	Rapid Disability Rating Scale	RDRS	Yes	
1982	Pfeffer	Functional Activities Questionnaire	FAQ	Yes	
1982	Rappaport	Disability Rating Scale		Yes	
1983	Derogatis	Brief Symptom Inventory	BSI	Yes	
1983	Kurtzke	Expanded Disability Status Scale	EDSS	No	More Disease-oriented
1983	Rosen	Alzheimer's Disease Assessment Scale	ADAS	No	Covers only one bodily function
1983	Zung	Pain & Distress Scale	PAD	No	Not frequent enough in literature
1984	Linn	Self-Evaluation of Life Function Scale	SELF	No	Not frequent enough in literature
1984	Schipper	Functional Living Index	FLI	Yes	
1985	Carr	Motor Assessment Scale	MAS	No	Not specific to elderly in literature
1985	Diener	Satisfaction With Life Scale	SWLS	Yes	
1986 (orig 1980)	Fairbank	Oswestry Low Back Pain Disability Questionnaire		No	Not frequent enough in literature
1986	Jette	Functional Status Questionnaire		Yes	
1986	Linn	Perceived Stress Scale	PSS	No	Related to job stress or disease stress
1986	Prigatano	Patient Competency Rating Scale	PCRS	Yes	
1986	Roth	Cambridge Mental Disorders of the Elderly Examination	CAMDEX	No	Literature not about elderly or injury
1986	Various	Clock Drawing Test		No	Covers only one bodily function
1987	Granger	Functional Independence Measure	FIM	Yes	
1987	Lezak	Mayo-Portland Adaptability Inventory-3	MPAI-3	Yes	
1987	Nelson	Dartmouth Primary Care Cooperative Information Project (or COOP Charts for Primary Care Practice)	COOP	Yes	
1988	Anda	Behavioral Risk Factor Surveillance System	BRFSS	No	About risk of injury not injuries
1988	Broadhead	DUKE-UNC Functional Social Support Questionnaire	DUFSS	No	Literature not about elderly or injury

1988	Heimberg	Social Avoidance and Distress	SAD	No	More for Mental Health patients
1988	Schwartz	Geriatric Evaluation of Relative's Rating Instrument	GERRI	No	Not frequent enough in literature
1988	Stewart	Short Form -20	SF-20	Yes	
1989	Corrigan	Agitated Behavior Scale	ABS	Yes	
1989	Kreutzer	Family Needs Questionnaire	FNQ	No	Concerns the family member only
1989	Parkerson	Duke Social Support and Stress Scale	DUSOCS	No	Literature not about elderly or injury
1990	EUROQOL	EuroQol Quality of Life Scale	EuroQol	Yes	
1990	Parkerson	Duke Health Profile	DUKE	Yes	
1990	Ware	Short Form -36 items	SF-36	Yes	
1991	Sherbourne	Medical Outcomes Study Social Support Survey	MOS	No	Literature not about elderly or injury
1992	Bafe	Gross Motor Function Measure	GMFM	No	Used more for children and disease
1992	Sherbourne	Medical Outcomes Study Pain Measures		No	Not frequent enough in literature
1992	Stewart	Medical Outcomes Study Physical Functioning Measure	MOS	Yes	
1992	Whiteneck	Craig Handicap Assessment and Reporting Technique Scoring Form	CHART	Yes	
1993	EORTC	European Organization for Research and Treatment of Cancer Quality of Life Questionnaire	EORTC	Yes	
1993	Washburn	Physical Activity Scale for the Elderly	PASE	No	More Disease-oriented
1994	Health Outcomes Institute	Health Status Questionnaire 2.0	HSQ 2.0	No	Not frequent enough in literature
1994	Willer	Community Integration Questionnaire	CIQ	Yes	
1996	Boake	Supervision Rating Scale	SRS	Yes	
1996	Carr	Disease Repercussion Profile	DRP	No	More Disease-oriented
1996	Feeney	Health Utilities Index III	HUI-III	Yes	
1996	Kreutzer	Neurobehavioral Functioning Inventory	NFI	Yes	
1996	Lips	Quality of Life questionnaire of the European Foundation for Osteoporosis	QUALEFFO	No	Disease-oriented
1996	Marwitz	Services Obstacle Scale	SOS	No	Concerned with Delivery of Service
1997	Whiteneck	Craig Hospital Inventory of Environmental Factors	CHIEF	Yes	
1998	Hoening	Self-Reported Functional Measure	SRFM	No	Not frequent enough in literature
1998	Jackson	The Orientation Log	O-Log	No	Covers only one bodily function
1998	Sherer	Awareness Questionnaire	AQ	Yes	

Table 2. Characteristics of selected 55 scales according to their coverage of Nagi's disability model.

Year	Scale	# Items	# Dimensions	Pathology	Impairment	Functional	Disability	Nagi # Nagi	QOL
1955	BARTHEL INDEX	10	10	0	2	4	4	3	0
1957	PULSES PROFILE	24	6	1	1	2	2	4	0
1959	INDEX OF ADL	18	6	0	1	1	4	3	0
1961	LIFE SATISFACTION INDEX	20	20	0	0	0	0	0	20
1965	KENNY SELF-CARE	16	5	0	0	3	2	2	0
1969	PHYSICAL SELF-MAINTENANCE	30	6	0	1	1	4	3	0
1970	DISABILITY INTERVIEW SCHEDULE	16	7	0	0	4	3	2	0
1972	CENTER FOR EPIDEMIOLOGIC STUDIES DEPRESSION SCALES	20	20	0	20	0	0	1	0
1972	GENERAL HEALTH QUESTIONNAIRE	60	60	5	39	0	8	3	8
1972	PHYSICAL AND MENTAL IMPAIRMENT OF FUNCTION	77	18	0	13	1	4	3	0
1972	PHILADELPHIA GERIATRIC CENTER MORALE SCALE	22	22	0	11	0	0	1	11
1973	QUALITY OF WELL-BEING SCALE	30	30	14	7	6	2	4	1
1974	VISUAL ANALOGUE PAIN RATING SCALE	1	1	0	1	0	0	1	0
1975	OLDER AMERICANS RESOURCES AND SERVICES	15	15	0	1	3	11	3	0
1975	MCGILL PAIN QUESTIONNAIRE	25	25	2	22	0	1	3	0
1976	SICKNESS IMPACT PROFILE	23	12	0	3	4	5	3	0
1978	BECK DEPRESSION INVENTORY	84	21	3	6	0	3	3	9
1978	DISABILITY & DISTRESS SCALE	9	9	1	1	2	5	4	0
1979	RAND MENTAL HEALTH INVENTORY	38	38	0	38	0	0	1	0
1980	HEALTH ASSESSMENT QUESTIONNAIRE	44	19	0	1	10	8	3	0
1980	FUNCTIONAL STATUS INDEX	54	15	0	5	4	6	3	0
1980	AIMS	45	9	0	3	4	2	3	0
1980	QUALITY OF LIFE INDEX-Self	15	5	0	0	2	3	2	0
1981	FUNCTIONAL ASSESSMENT INVENTORY	30	8	1	2	1	4	4	0
1981	FUNCTIONAL STATUS RATING SYSTEM	30	5	0	2	1	2	3	0
1981	PATIENT EVALUATION CONFERENCE SYSTEM	82	16	0	3	5	8	3	0
1981	NOTTINGHAM HEALTH PROFILE	45	13	0	5	1	7	3	0
1981	ORGANIZATION FOR ECONOMIC DEVELOPMENT LONG-TERM DISABILITY QUESTIONNAIRE	16	16	0	1	12	3	3	0
1981	LAMBETH DISABILITY SCREENING QUESTIONNAIRE	23	23	0	7	10	6	3	0
1982	GERIATRIC DEPRESSION SCALE	30	30	0	27	1	0	2	2

1982 RAPID DISABILITY RATING SYSTEM	18	18	0	7	5	6	3	0
1982 FUNCTIONAL ACTIVITIES	10	10	0	0	0	10	1	0
1982 DISABILITY RATING SCALE	8	4	0	1	2	1	3	0
1983 BRIEF SYMPTOM INVENTORY	53	53	0	53	0	0	1	0
1984 FUNCTIONAL LIVING INDEX	22	22	0	7	0	6	2	9
1985 SATISFACTION WITH LIFE SCALE	5	5	0	0	0	0	0	5
1986 FUNCTIONAL STATUS QUESTIONNAIRE	6	5	0	1	1	3	3	0
1986 PATIENT COMPETENCY RATING SCALE	30	30	0	20	1	9	3	0
1987 FUNCTIONAL INDEPENDENCE MEASURE	18	6	0	1	2	3	3	0
1987 MAYO-PORTLAND ADAPTABILITY INVENTORY-3	34	34	3	11	4	16	4	0
1987 DARTMOUTH PRIMARY CARE COOPERATIVE INFORMATION PROJECT	13	9	0	2	3	3	3	1
1988 SHORT FORM - 20	15	15	5	6	1	3	4	0
1989 AGITATED BEHAVIOR SCALE	14	14	0	14	0	0	1	0
1990 EuroQol QUALITY OF LIFE SCALE	15	5	0	2	1	2	3	0
1990 DUKE HEALTH PROFILE	17	17	0	13	2	2	3	0
1990 SHORT FORM-36 HEALTH SURVEY	36	11	0	3	2	3	3	3
1992 MEDICAL OUTCOMES STUDY PAIN MEASURES	14	14	0	1	11	1	3	1
1992 CRAIG HANDICAP ASSESSMENT AND REPORTING TECHNIQUE SCORING FORM	32	32	0	4	6	17	3	5
1993 EUROPEAN ORGANIZATION FOR RESEARCH AND TREATMENT OF CANCER QUALITY OF LIFE QUESTIONNAIRE	30	30	0	18	4	7	3	1
1994 COMMUNITY INTEGRATION QUESTIONNAIRE	15	15	0	0	0	15	1	0
1996 SUPERVISION RATING SCALE	13	5	0	0	5	0	1	0
1996 HEALTH UTILITIES INDEX III	45	8	0	4	3	1	3	0
1996 NEUROBEHAVIORAL FUNCTIONING INVENTORY	76	76	13	49	11	3	4	1
1997 CRAIG HOSPITAL INVENTORY OF ENVIRONMENT FACTORS	25	25	0	0	0	25	1	0
1998 AWARENESS QUESTIONNAIRE	18	18	0	10	2	5	3	1
Total	1534	971	48	450	148	248	--	78
Percentage (N=959)			5%	46%	15%	26%	--	8%

Table 3. Characteristics of selected 55 scales regarding body functions covered.

Year	Scale (Acronym)	Eating	Excretory	Sexual	Ambulatory	Hand and Bending and Vision	Auditory	Speech	Cogni. Func	Psycho- Social Pain	Other			
1955	BARTHEL	1	2	0	3	4	3	0	0	0	0	0		
1957	PULSES	0	1	0	1	1	1	1	1	1	1	0	1	
1959	ADL/IADL	0	1	0	1	5	4	0	0	0	0	0	0	
1961	LIFE SATISFACTION	0	0	0	0	0	0	0	0	0	20	0	0	
1965	KENNY SELF-CARE	0	1	0	1	2	3	0	0	0	0	0	0	
1969	PSMS	1	1	0	1	4	1	0	0	0	1	0	0	
1970	DIS	1	1	0	1	1	1	0	0	0	0	2	0	0
1972	CES-D	0	0	0	0	0	0	0	0	0	0	20	0	0
1972	GENERAL HEALTH	0	0	0	0	0	0	0	0	0	60	0	0	
1972	PAMIE	2	1	0	4	2	3	2	2	1	1	11	0	0
1972	PHILLY GERI CENTER	0	0	0	0	0	0	0	0	0	0	22	0	0
1973	QWB	0	1	1	3	2	1	2	0	1	1	5	0	14
1974	VAS	0	0	0	0	0	0	0	0	0	0	0	1	0
1975	OARS	1	1	0	6	7	4	1	1	1	7	1	0	0
1975	MPQ	0	0	0	0	0	0	0	0	0	0	2	21	2
1976	SIP	1	0	0	2	2	1	0	0	1	1	6	0	0
1978	BDI	0	0	1	0	0	0	0	0	0	0	20	0	0
1978	DISABILITY & DISTRESS	0	0	0	0	0	0	0	0	0	0	0	0	9
1979	MHI	0	0	0	0	0	0	0	0	0	0	38	0	0
1980	HAQ	0	0	0	3	5	2	0	0	0	0	0	1	0
1980	FSI	0	0	0	2	3	1	0	0	0	0	1	0	0
1980	AIMS	0	0	0	4	3	4	1	1	1	1	3	1	0
1980	QL Index	1	1	0	1	1	1	1	0	0	1	4	0	0
1981	FAI	0	0	0	1	1	0	1	1	0	1	3	0	1
1981	FSRS	1	1	0	1	2	2	0	1	1	3	1	0	0
1981	PECS	1	1	0	4	6	4	2	2	2	10	4	1	0
1981	NHP	0	0	1	2	2	2	0	0	0	0	9	1	0
1981	OECD	1	0	0	5	2	4	2	2	1	0	0	0	0
1981	LAMBETH	0	1	0	11	3	3	2	1	0	2	4	0	0
1982	GDS	0	0	0	0	0	0	0	0	0	0	30	0	0
1982	RDRS	2	2	0	2	4	0	1	1	1	2	3	0	1
1982	FAQ	0	0	0	3	2	1	0	0	0	10	0	0	0
1982	DISABILITY RATING	1	1	0	1	2	2	2	2	2	3	1	0	0
1983	BSI	0	0	0	0	0	0	0	0	0	0	53	0	0
1984	FLI	0	0	0	0	0	0	0	0	0	0	22	0	0
1985	SWLS	0	0	0	0	0	0	0	0	0	0	5	0	0
1986	FSQ	1	0	0	1	1	1	0	0	0	1	2	0	0
1986	PCRS	0	1	0	4	5	5	2	0	0	13	15	0	0
1987	FIM	1	1	0	1	1	2	0	0	1	2	0	0	0

1987 MPAI-3	1	1	0	2	3	1	3	2	2	6	19	0	3
1987 COOP	0	0	0	1	0	1	0	0	0	0	5	1	2
1988 SF-20 <sup>5</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-
1989 ABS	0	0	0	0	0	0	0	0	0	0	14	0	0
1990 EUROQOL	0	0	0	1	1	0	0	0	0	0	1	1	1
1990 DUKE	0	0	0	2	0	0	0	0	0	0	12	1	1
1990 SF-36	0	0	0	1	1	1	0	0	0	0	7	1	2
1992 MOS	0	0	1	10	3	4	0	0	0	0	1	0	0
1992 CHART	1	1	0	1	1	1	0	0	0	1	3	0	2
1993 EORTC	1	0	0	2	1	1	0	0	0	0	12	1	13
1994 CIQ	0	0	0	0	0	0	0	0	0	0	15	0	0
1996 SRS	0	0	0	0	0	0	0	0	0	0	0	0	5
1996 HUI-III	0	0	0	1	1	0	1	1	1	1	1	1	0
1996 NFI	0	0	0	2	4	2	3	4	4	36	20	10	11
1997 CHIEF	0	0	0	0	0	0	0	0	0	0	25	0	0
1998 AQ	0	0	0	2	2	1	3	2	1	9	6	0	0
Total	19	21	4	94	90	68	30	24	22	114	509	32	68
Percentage (N=1095)	2%	2%	0%	9%	8%	6%	3%	2%	2%	10%	46%	3%	6%

<sup>5</sup> Due to its similarity with the SF-36, we did not perform this comparison for the SF-20.

May 16 *continued*

**Session II: Measuring the Psychosocial and the Behavioral Consequences of Injury**

- **Crash outcomes and psychosocial effects**  
*K. Read, J.A. Kufera, P.C. Dischinger, T.J. Kerns, A.R. Burgess, S.M. Ho, C.A. Burch: National Study Center for Trauma & Emergency Medical Systems University of Maryland USA*
- **Psychic morbidity resulting from motor vehicle crashes**  
*S. Luchter, Applied Injury Science, USA*
- **A longitudinal study of former trauma patients: The association between admission ISS and subsequent death from another injury.**  
*P.C. Dischinger, JK Kufera, K.A. Auman, C.A. Soderstrom: National Study Center for Trauma & Emergency Medical Systems University of Maryland USA*
- **The burden of long-term health reduction among drivers surviving serious car crashes: A population-based prospective cohort study**  
*S. Ameratunga, J. Conner, E. Robinson, R. Jackson, D. Bennett: University of Auckland, New Zealand  
R. Norton, U. of Sydney, I. Civil, Auckland Public Hospital, J. Coverdale Baylor School of Medicine, USA*

May 17 (*Breakfast 7 to 8 AM*)

8 AM to 4 PM

**Session III: Cost Calculations**

- ✓ • **Cost of injury to employers: Concept, measurement methods and US application**  
*T. Miller E. Zaloshnja, K. Cox, D. Taylor : Pacific Institute for Research & Evaluation*
- ✓ • **The ERAT: An electronic tool for incidence costing of unintentional injury**  
*J.E. Cloutier, The Hygeia Group, P. Groff, SMARTRISK, Ontario Canada*
- ✓ • **The cost of off-the-job injury**  
*E.A. Biddle, National Institute for Occupational Safety and Health, USA  
M. L. Lin, S. Sinelnikov, National Safety Council, USA  
K.A. Lusby-Treber, Network of Employers for Traffic Safety (USA) B. Sauers, NHTSA, USA*
- ✓ • **The Direct Healthcare Costs of Hospital Bed-Related Injuries**  
*D. D. Bradham, L. R. MacClellan, Baltimore VAMC, USA,  
B. South, M. Tate, G. Powell-Cope, S. Luther, S. Blahut, A. Nelson*

**Session IV: Developments in Injury Coding**

- ✓ • **A comparison of methods used to measure population based injury morbidity**  
*W. Watson, Monash University Accident Research Centre, Australia*
- **Comparing measures of injury severity for use with large databases**  
*S. Stephenson, J. Langley, Injury Prevention Research Unit, Dunedin New Zealand, I. Civil Auckland Hospital, Auckland, New Zealand*

**Lunch**

**Session V: Workshop: Future changes to the AIS and FCI** *Chaired By Maria Segui-Gomez*

**Close**



## *Measuring the Burden of Injury*

May 16-17, 2002

*Promote the understanding, the use and development of interdisciplinary health status and injury outcome measures and Encourage a harmonized research approach*

Montreal, May 17, 2002

### CERTIFICATE OF ATTENDANCE

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The following is to acknowledge that **Maria Segui-Gomez** attended the 4<sup>th</sup> International Conference "Measuring the Burden of Injury" held at the Hilton Montreal Bonaventure, in Montreal, Canada , from May 16 to 17, 2002.

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