XVI. Miscellaneous

Report on Phase I and Phase II: An Epidemiological Assessment of Disabled Veterans in Guam, American Samoa, and Hawaii

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Sponsor: *VA Rehabilitation Research and Development Service*

Purpose—VA medical services in the Hawaii, Guam, and American Samoa (HGS) region are currently very limited, and there is a lack of information on the size, characteristics, and health/medical care service needs of the disabled veterans of this area. This research project in three phases will address these informational needs and allow information-based planning and programming to be developed for this region.

Progress—In Phase I of this project, data related to the population characteristics of veterans in the HGS area were examined and gaps identified. Methodologies to collect these missing data were reviewed and recommendations made. In Phase II of the project, a sample of disabled veterans from Hawaii (N:225) were interviewed as a pretest of a survey instrument that was to be used in the larger population survey for Phase III.

Results—The review of the data related to the characteristics of the veteran population of Hawaii, Guam, and American Samoa revealed several important deficiencies. In particular, data on the ethnic diversity, and the mortality experience of Hawaii veterans were found to be inadequate. Data from Guam and American Samoa veterans were nonexistent. Data related to health status, socioeconomic resources, and service utilization were seen as unreliable and often dated.

The results of the pilot study of disabled veterans on Oahu, while not representative, were useful in defining several areas for subsequent investigation. A positive association between VA-rated levels of disability and service utilization was found. Among higher rated disabled veterans, perceived needs for assistance were reported for a multitude of problems (unemployment, poor physical health, etc.).

Lower levels of patient satisfaction were specified in terms of inpatient care for service-connected disabilities, DOD outpatient care, and compensation for service-connected disabled veterans. The highest levels of patient satisfaction were expressed for dental services, outpatient clinic services, GI Bill, and VA home loans.

Accessibility to VA services emerged as another problem area. Poor communication between VA recipients and providers in areas such as benefits and service eligibility, and difficulties in getting to see the "right" person at VA for help with VA-related problems were the focus of the access problems.

Future Plans—Phases I and II have laid the groundwork for the community survey of disabled veterans that will commence shortly. The dimensions of that survey will include demographic and socioeconomic characteristics, disability information, accessibility and satisfaction questions, and general service utilization patterns.

A Pilot Study on the Efficacy of Injected Cross-Linked Collagen in the Treatment of Symptomatic Glottic Insufficiency

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Sponsor: *VA Rehabilitation Research and Development Service (Pilot Proposal #A900-PA)*

Purpose—Glottic insufficiency is a significant health problem that commonly results from laryngeal nerve injury, conservation extirpative laryngeal surgery, laryngeal injury, neurologic disease, or aging. The most effective surgical treatment is injection of Teflon®, but this material evokes an intense foreign body reaction. Reported complications of Teflon® augmentation have largely been related to the properties of the material.

Collagen appears to be a safe bioimplant, which can be used for a broader range of glottic insufficiency problems. The properties of collagen that allow this include: low viscosity so that precise placement can be made through a fine bore needle, low reactivity permitting superficial implantation without extrusion, and collagen's tendency to soften scar tissue, as in the post-surgical and post-traumatic larynx. The techniques to be explored in this study will entail collagen injection into histologically similar collagen-containing tissue planes in the larynx. The effect of such injections will be studied in a much more comprehensive manner than has been previously described for any augmentation substance in the larynx.

The overall objective is to demonstrate how injectable cross-linked collagen can facilitate and enhance the rehabilitation of patients who suffer from glottic insufficiency. Preliminary work with Zyderm® collagen implant injections showed good short-term results over a 12-month period; improved initial and long-term results with glutaraldehyde cross-linked collagen (GAX) is anticipated.

Augmentative Communication for Intensive Care Unit Patients

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Sponsor: *VA Rehabilitation Research and Development Service*

Purpose—Although there are many commercially available augmentative communication devices, there is no one communication program that meets the immediate needs of the intensive care unit patient. Available devices tend to be cumbersome in size, require considerable movement and effort, have a limited vocabulary and poor storage of information, are difficult to learn in a short period of time, and do not allow the patient to see the communicated message easily. The *Intensive Care Communicator,* developed by Kevin Neelands, was designed solely for patients in intensive care units and addresses all of the problems found in other programs.

The major objective of this project is to determine whether the Intensive Care Communicator program can effectively be employed as a means of communication between patients, staff, and family. Specific questions include the following: 1) Can acutely ill patients learn to use a single switch computer program for communication? 2) Will patients be able to move to a five-switch computer program for communication within a limited short time period? 3) Can the patient's family and intensive care unit personnel interact with patients using an augmentive computer program for communication? and, 4) Are there significant differences on the communication satisfaction questionnaire between subjects using and subjects not using the computer program?

Progress—In order to meet safety regulations for the Intensive Care Unit, the computer system had to be connected to an isolation transformer. The equipment was also anchored securely to an overbedside table. Single switches and five switch controls were designed and fabricated. To develop word lists for the program, both intensive care patients and staff were interviewed to insure that appropriate words and categories would be included.

Preliminary Results—To date, only one patient has been selected for the program. The patient was a 45-year-old male with severe chronic obstructive pulmonary disease (COPD), tracheotomized and ventilator-dependent. He was unable to communicate except with head nodding and was reported to be extremely depressed. Orientation to the program for the patient and the patient's sister took approximately 20 minutes. He used the computer program daily for 16 days, at which time he was removed from the ventilator and was able to talk. During usage of the program he was reported to be less depressed and overall satisfaction of the program was rated high by the patient, the patient's sister, and the staff.

Future Plans—Plans are to continue using the Intensive Care Communicator with as many patients as possible to determine that this program can be effectively used by all types of patients. No changes of the word lists or the program format will be made at this time so that comparisons between patients can be made. Future plans to develop more appropriate word lists, as well as additional features of the program (i.e., patient programming, larger print, stored message elimination, and development of the program for IBM computer compatability) are anticipated.

Artificial Intelligence Strategies for Orthopedic Clinical Decision Making

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Sponsor: *VA Rehabilitation Research and Development Service; Bioengineering Alliance of South Carolina*

Purpose—The domain chosen for this expert system was a differential diagnosis of osteoarthritis and rheumatoid arthritis. Interviews were conducted with an expert orthopedic surgeon in an attempt to extract as much knowledge of the field as possible. The desired knowledge was not that which could be found in textbooks, but rather the expertise gained by the surgeon through years of experience. It was this intangible experience which was sought in order to convert it into an expert system for the computer.

Progress—Through an iterative process of interviews and knowledge base development using an expert system shell, an expert system has been developed which suggests a differential diagnosis of types of arthritis.

Four areas of symptoms and clinical signs form a basis for the decision making process: presenting symptoms, physical examination findings, X-ray results, and laboratory results. To qualitatively test the expert system, ten case studies were compiled from medical records. These case studies, along with attached questionnaires, were distributed to fifteen orthopedic surgeons. Each questionnaire requested a diagnosis of the associated case study, a percent certainty factor, and suggested treatment plan. These same case studies were used for consultations with the expert systems. In this manner, a comparison was made between the surgeon's opinions of the cases and the expert system's suggested diagnoses.

Preliminary Results—Of the ten cases studied, the results showed that in four of the cases the physician's diagnoses were in total agreement with the expert system. In four other cases, the responses agreed with the expert system after an-indepth study of the information. For one of the remaining cases, the results were undetermined. In only one of the cases was there disagreement between the physician's responses and the computer. The results indicated that an expert system is feasible in the orthopedic diagnosis domain. Expansion of the knowledge base could produce a system with great clinical efficacy.

Evaluation of One-Way Air Flow Valve Prostheses in Decannulation Procedures for Chronic Tracheotomized Patients

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Sponsor: *VA Rehabilitation Research and Development Service*

Purpose—This research project has two main objectives. First, we wish to determine if a new technique for discontinuing the chronic tracheotomy results in a higher success rate and/or a shorter period of weaning. Second, we wish to determine if tests of pulmonary function can be used to predict which patients are likely to be weaned from their chronic tracheotomy. The project commenced in July 1987 and will continue for two years.

Progress—We propose to study 40 patients over a 2-year period with the following protocol: an initial evaluation will consist of maximal inspiratory and expiratory flow volume loops, with the tracheotomy open and occluded; measurements of maximal inspiratory and expiratory pressures; measurements of airway pressures and pleural pressures (using an esophageal balloon) during tidal breathing; and measures of upper airway resistance on both inspiration and expiration. In addition, swallowing evaluations using videofluoroscopy and speech evaluations will be performed.

If the patient is found to be a suitable candidate for an attempt at decannulation, he will randomly be assigned to a standard treatment group or a treatment group using the Passy-Muir one-way valve. This valve allows inspiration through the tracheotomy but forces expiration through the larynx and mouth or nose. This allows the patient to speak and should facilitate mucociliary clearance. In each group the tracheotomy will be capped for progressively longer periods each day as tolerated by the patient. Patients in the valve group will have the valve in place when the airway is not occluded.

Psychiatric Rehabilitation in Nursing Homes

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Sponsor: *VA Rehabilitation Research and Development Service*

Purpose—Nursing homes are now the largest single place of care for the mentally ill, yet nursing home staff have had little or no training in working with psychiatric patients. Existing studies show deterioration in behavior of mental patients after nursing home placement when compared with similar patients randomly assigned to VA nursing care units or continued psychiatric hospitalization. In the face of further financial constraints and an aging population of patients, it is likely that even more psychiatric patients will be sent to community nursing homes. Many of these patients have a potential for psychosocial and functional rehabilitation and, in others, behavioral deterioration could at least be forestalled. Training and consultation to staff in nursing homes offer the potential for improving psychiatric care. The objective of this research is to test the effects of training and a cost-effective method of consultation for psychiatric rehabilitation in nursing homes.

Progress—Nine nursing homes were randomly assigned to either a training/consultation program designed to increase staff knowledge and attitudes about caring for the mentally ill or to a program with control conditions. Following the training, mental patients admitted to the homes will be studied regarding behavioral outcomes at 6 and 12 months, as well as whether treatment goals were attained. Half of the patients will be randomly assigned to have their treatment goals and attainments discussed with nursing home staff so the effects of individualized feedback to staff about patients can be evaluated. If this study shows that the training and feedback improve staff knowledge and attitudes as well as psychiatric patient outcomes, then the method

would be a cost-effective one for upgrading psychiatric services in nursing homes.

Preliminary Results/Future Plans—This project was funded in January, 1987. A training program was developed and pretested in the first three months of the study. In May, training of staff on each of three shifts in six homes assigned to the six-week training program was initiated. Staff were pre- and post-tested on attitudes, knowledge, and skill in the three homes where training had been completed. The training will be completed by December, 1987, and patient intake will begin in January, 1988.

Assessment of the Swallow Reflex in Patients with Dysphagia

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Sponsor: *VA Rehabilitation Research and Development Service (Project #XC443-R)*

Purpose—The purpose of this proposal is to develop a non-radiographic method by which investigators can study the swallow reflex with a variety of repeated measures designs. Although dynamic radiographic methods are the best means of assessing the competency of a swallow, repeated X-ray for assessment of improvement in swallowing may not be ethically justifiable nor conveniently arranged. This project is directed toward one aspect of swallowing, that of the swallow reflex. If the rest of the neuromuscular system functions well, but the reflex is not triggered, none of the protective movements of the larynx occur and the individual then becomes a prime candidate for the life-threatening problem of aspiration.

This study has three objectives. Objective I will confirm the use of the Laryngograph (EGG) and a high fidelity catheter pressure transducer as a valid and reliable method of measuring the time (T_sw) between the completion of the oral phase of the swallow (T_1) and elevation of the larynx (T_2). Objective II will study healthy young adults and healthy elderly adults in order to identify possible age-dependent differences in T_1-T_2. Analysis of the effect of age on swallow (T_sw) will be conducted by a four-way ANOVA using multiple observations per subject with three temperatures (cold, tepid, hot) and two viscosities (liquid, paste). Tests for interaction and main effects will be performed.

Objective III will test the effectiveness of two current treatments in three subpopulations of patients with an absent or delayed swallow reflex. These patients will be taken from three general diagnostic groups; those with a swallow reflex disorder subsequent to: 1) surgery for oral/pharyngeal cancer; 2) CVA; and, 3) degenerative neuromuscular diseases and progressive dysphagia. Subjects will be randomly assigned to one of three treatment groups: 1) thermal stimulation (Logemann, 1983); 2) the Ramsey feeder (Ramsey, 1986); and, 3) no swallowing therapy.

A 2 x 2 x 3 contingency table will be prepared to evaluate the rate of improvement for T_1-T_2 across treatment groups and diagnoses. A log linear model will evaluate whether there is a significant association between improved status and treatment that is independent of diagnosis. A two-way ANOVA for repeated measures on one factor will test for differences in subjects' responses to treatments. A profile analysis across the repeated measures wll be used to describe the different treatment responses. The results of this investigation will provide important information for determining appropriate rehabilitation techniques for patients with dysphagia.

Dissemination of Rehabilitation Technologies

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Sponsor: *VA Rehabilitation Research and Development Service*

Purpose—Many of the technological innovations that rehabilitation researchers produce do not become available to the disabled because they are never manufactured and distributed commercially. We are studying the process of transferring new rehabilitation technologies from research prototypes to manufacturers. Our primary goal is to produce guidelines that will help rehabilitation technology researchers and administrators at the Palo Alto VA Rehabilitation Research and Development Center (RR&D Center) improve the likelihood that the products they develop that are intended for market will be manufactured and used. Our secondary goal is to inform policymakers in the VA about significant barriers to the successful transfer of technology that are created by current policies.

Progress—During the first phase of our 3-year project, we gathered information and created a framework for describing the process of transferring rehabilitation technology from the design stage to manufacturing. We reviewed the literature on technology transfer, gathered new information through interviews with selected members of the rehabilitation technology community, and visited selected technology development centers and manufacturing organizations. The preliminary framework we created describes a generalized process for the development and transfer of rehabilitation technologies. It focuses on the barriers to successful transfer that can arise and some possible strategies to overcome those barriers.

We are now surveying all projects at the RR&D Center and conducting interviews with selected researchers and engineers who have projects in different stages of development. We are giving special emphasis to projects in which computer technology is being applied to the communication, manipulation, mobility, or recreation needs of people with disabilities. We will use the results of the survey and interviews to help identify questions about transfer that RR&D Center staff should be addressing at successive stages of the development of a technology. We will design strategies in the form of alternative decisions and actions that might be taken in response to these transfer questions.

Preliminary Results—Our preliminary findings indicate that the major barriers to successful transfer come from two sources: the lack of mechanisms for establishing relationships with manufacturers and confusion about rules and regulations for dealing with manufacturers while avoiding any conflict of interest.

Future Plans/Implications—We plan to test our strategies for overcoming barriers to transfer by trying them out with a small set of products being developed by the RR&D Center. We will choose products that are approaching critical transition points in the development and transfer process. We will then work with researchers and engineers as they use the strategies that are appropriate for the current status of the products. We will make any necessary revisions to the strategies and put them into a guidebook for the RR&D Center staff. We will structure the guidebook so that researchers can easily use it as a decision aid. We will also prepare an executive report that will inform policymakers in the VA about factors that seem to be impeding the transfer of technology. We will prepare a guidebook for researchers and a report for administrators during the final phase of the project.

Rehabilitation of Neurogenic Communication Disorders in Remote Settings

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Purpose—This investigation is designed to test the efficacy of computer and video technology to provide appraisal and treatment for patients in remote settings who suffer neurogenic communication disorders. Currently, these patients either do not receive services, or they must travel long distances, or they must become inpatients for extended periods of time. We are simulating an existing treatment center's ability to provide appraisal and treatment in remote settings by closed circuit television and by computer-controlled video laserdisk over the telephone. Comparison of television and laserdisk delivery of services with traditional face-to-face appraisal and treatment will permit assessing the accuracy of appraisal and the efficacy of treatment in the television and laserdisk conditions.

Progress—Patients who suffer a neurogenic communication disorder—aphasia, apraxia of speech, dysarthria, dementia, etc.—are appraised by a different clinician in each of three conditions: traditional face-to-face, closed circuit television, and computer controlled video laserdisk over the telephone. A battery of standardized speech and language measures is administered in each condition. Thus, each patient receives a diagnosis by a different clinician in each condition. In addition, patients who are aphasic subsequent to a single left hemisphere thromboembolic infarct are randomly assigned to a 6-month treatment trail in one of the three conditions. Agreement in diagnosis and improvement during the treatment trial between face-to-face management and management by television or laserdisk will indicate the accuracy and efficacy of the latter two conditions for providing services to patients who reside in remote settings.

Preliminary Results—Over 400 patients have been screened for participation in the study. Sixty patients have met criteria for the appraisal study and 10 patients have met criteria for the treatment study. Results on the first block of 36 patients in the appraisal study show no significant differences in diagnoses among the three conditions. Percent agreement among conditions ranged from 83 to 100 percent. A kappa analysis of diagnoses indicates all but one of 21 comparisons shows significant agreement ($p < .05$) among the three conditions. Comparison of performance on the two primary appraisal measures shows no significant differences in patient performance among conditions on either measure. Thus, the accuracy of patient performance and agreement in diagnosis in the television and laserdisk conditions is essentially the same as performance and diagnosis in traditional face-to-face management.

Performance by the first 10 patients entered in the aphasia treatment trial must be interpreted with caution, because the sample size in each condition is small, and randomization has yet to equate groups on a number of variables, for example, initial severity. Nevertheless, there is clinically significant improvement in all groups, 12 to 17 percentile units on the *Porch Index of Communicative Ability*, our primary outcome measure. And, there are no significant differences in improvement among groups. Thus, results to date indicate treatment by television or video laserdisk is as efficacious as treatment in traditional face-to-face management.

Future Plans/Implications—We continue to increase sample sizes in both the appraisal and treatment studies. If the initial results are replicated with larger samples, we will have demonstrated the accuracy and efficacy of two methods for providing services for patients who suffer neurogenic communication disorders and reside where services are not available. A proposal to field-test the equipment and methods developed in the simulation study has been submitted. Because the cost of delivering services in the two conditions differs markedly, $200,000 for closed circuit television in one remote setting and $15,000 for video laserdisk in one remote setting, field-testing will be confined to the latter.

Publications Resulting from This Research

Appraisal and Diagnosis of Neurogenic Communication Disorders in Remote Settings. Wertz RT, Dronkers NF, Bernstein-Ellis E, et al. In R.H. Brookshire (Ed.), *Clinical Aphasiology Conference Proceedings*, Vol. 17, BRK Publishers, Minneapolis, MN (in press).

Alternatives to Traditional Management of Aphasia: Trained Nonprofessionals and Technology. Wertz RT, invited presentation to the Clinical Update: Neurogenic Communication Disorders Conference, Tempe, AZ, October 10, 1986.

Alternative Methods for Managing Aphasia: Use of Nonprofessionals and Technology. Wertz RT, invited presentation to the Conference, The Aphasic Adult: A Management Approach, Long Beach, CA, February 7, 1987.

Alternatives to Traditional Management of Aphasia. Wertz RT, invited presentation to St. Mary's Hospital, Paddington Health Authority, London, United Kingdom, March 16, 1987.

The Relationship Between Visual Perception and Social Perception in Cerebral Palsied Children

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Sponsor: *American Academy for Cerebral Palsy and Developmental Medicine*

Purpose—The objective of this study is to examine the ability of cerebral palsied (CP) children to decode facial expressions: and to investigate the possible relationship between visual perceptual impairment and the ability to make accurate inferences about internal states from facial expressions. The relationship between performance on the recognition of facial expression task and measures of social and behavioral characteristics will also be explored.

The clinical goals of this study are twofold: 1) to determine whether clinical observations of decreased social maturity in CP children are related to their neurological impairment (as manifested by visual perceptual deficits); and, 2) to determine whether training on specific aspects of social perception will improve performance.

Progress—Data will be collected in two sessions. In the first session, 40 cerebral palsied children, aged 9 to 12 years, with spasticity (hemiplegia and diplegia) and athetosis, will be compared with 30 normal children on measures of visual perception, recognition of facial expressions and social maturity. In the second session, both groups will be trained on a visual discrimination task, and asked to view the facial expression tapes for a second time. Multivariate statistics will be used to analyze the data.

Understanding Spasticity and the Effects of Rhizotomy Surgery

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Sponsor: *Clemson University, College of Engineering*

Purpose—This project was developed to study the effects of a neurosurgical procedure—selective posterior lumbar rhizotomy—on spasticity, particularly as applied to the cerebral palsy child.

Selective posterior lumbar rhizotomy (SPLR) is a procedure in which the afferent nerve roots of spastic patients are selectively divided in an effort to balance the facilitation and inhibition on the anterior horn cell. This project was initiated in Cape Town, South Africa, where we studied a series of 30 patients.

Progress—Our equipment consisted of a custom-designed digital camera system to study the patient's movement patterns immediately prior to surgery and between 6 and 12 months after surgery. We are now busy implementing this system with clinical colleagues at UCLA and the Rusk Institute in New York.

Preliminary Results—Our biomechanical studies on the patient's functional status before and after surgery would appear to provide strong evidence that

SPLR provides significant improvements for spastic cerebral palsy children. These data will be presented at two meetings in 1987—the International Society of Biomechanics Congress in Holland, and the American Academy of Cerebral Palsy meeting in Boston.

Future Plans/Implications—We are planning further and more basic studies in which an animal would be rendered spastic surgically. We would then use standard neurophysiological techniques (stimulation and EMG recording) to study the effects of SPLR. We are presently building our own hardware environment in which the experiments would be executed and controlled from an IBM PC/AT. We will look at some of the fundamental aspects of SPLR and for this we will need to perform appropriate studies on animals.

The implications of this research are that it will provide new knowledge and a better understanding of SPLR, which has probably been one of the most significant developments in treating spastic cerebral palsy in the last decade.

Design and Validation of a Subject/Instrument Interface to Allow Collection of Selected Pulmonary Function and Selected Metabolic Measures of Children with Cerebral Palsy

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Sponsor: *Easter Seal Research Institute, Toronto, Canada; Variety Club of Ontario, Tent #28*

Purpose—The purpose of this study was to design, construct and validate an instrument/subject interface to collect selected metabolic measures of children with cerebral palsy. Specifically, this instrument is intended for use with subjects who, because of their impairment, are unable to tolerate the traditional testing protocol (mouthpiece and noseclip).

Progress—Subjects for this study were solicited from a summer day camp program sponsored by Variety Village Sport Training and Fitness Centre. A total of 13 subjects (n = 8 impaired; n = 5 able-bodied) were used in the validation study. All testing was conducted during one session. Experimental procedures included an equipment orientation, and collection of resting and exercise metabolic data.

Values were collected at rest and during the performance of three exercise workloads for each of two experimental conditions, mouthpiece and the metabolic interface. Exercise was performed on a Siemens-Elema electrically-braked ergometer configured for arm pedaling. Metabolic values were obtained from a Beckman Metabolic Cart modified to allow the collection of mouthpiece and low-flow metabolic interface values. Data of particular interest in this investigation included oxygen uptake ($V.O_2$) and carbon dioxide production (CO_2). Validation of the equipment was evaluated using a concurrent criterion procedure using the mouthpiece/noseclip as the criterion measure.

Results—Correlations at rest and across exercise levels for oxygen consumption and carbon dioxide production were found to be high (range .94 -.84) and statistically significant ($P<.05$). All correlations were also tested for reliability and found to be significantly reliable ($P<.05$). The metabolic interface, designed for this project, when used in a sealed, low-flow configuration appears to be a valid method to collect metabolic data on children at rest and during moderate levels of physical activity. All subjects tolerated the metabolic interface better than the mouthpiece and noseclip. These measures allow the clinically-based researcher to quantify the effects of selected rehabilitative techniques on the energy expenditure of the child.

Protective Headwear for Disabled Children

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Sponsor: *The Hospital for Sick Children Foundation, Toronto, Canada*

Purpose—The objective of this study is to provide effective head and facial protection for children with a high risk of injury due to falls. The project's specific goals are twofold: 1) to develop an inexpensive helmet with good fit, comfort, ventilation for coolness, adequate cosmesis and light weight; and, 2) to fit 10 children in a clinical trial and monitor the helmet's performance and durability.

Progress—The helmet that has been developed and tested consists of a hard outer shell and a softer inner liner. The outer shell, made of high-density polyethylene, is comprised of three parts: an anterior section, a posterior section and a chin cup. Corresponding liner parts, made of foamed polyethylene, fit into the shell, serving both to cushion the impact of falls and to interface the head shape with the shell.

During fitting, the orthotist adjusts each of the three parts of the helmet on the child's head. When the correct fit is achieved, the three parts are riveted together to maintain the custom fit. If necessary, further customizing is possible by trimming the edges or by the addition of liner inserts. Once donned, the helmet is fastened in place using plastic clips which are part of the hinge mechanism. The snug fit prevents the fastened helmet from being removed. However, by releasing the plastic clips and operating the hinge, the rear part can pivot up with respect to the front, thus permitting the entire device to be removed from the head.

Results—The helmet's performance was evaluated clinically by ten people who wore it for 2 months. It was also tested for its impact properties in a biomechanical laboratory. Results showed that the helmet affords effective protection and was well received by both caregivers and wearers.

Future Plans/Implications—While this helmet provides the same protection as a custom-molded helmet, the cost is significantly reduced for several reasons. First, the parts are industrially produced in quantity, and secondly, the fitting procedure necessitates only one appointment with the orthotist. Only a medium-size helmet of this design was developed and tested. Two more sizes are necessary to fit the range of head sizes from 2 to 19 years old.

Monitoring Respiratory Patterns and Their Coordination with Swallowing in Cerebral Palsy

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Sponsor: *National Health Research and Development Programme, Health and Welfare Canada*

Purpose—The aim of this project is to objectively monitor respiratory patterns in children with cerebral palsy and assess the coordination of swallowing and respiration.

The specific goals of the study are: 1) to further elucidate the nature of respiratory patterns and their function in children with cerebral palsy; 2) to refine and develop monitoring and calibration techniques based on inductance plethysmography for children with cerebral palsy; and 3) to collect and evaluate respiratory pattern data relative to airway control during swallowing.

Progress—Twelve subjects (Ss), aged 5 to 12 years, will participate in each of the three groups. Group I: non-neurologically impaired children; Group II: children with a primary diagnosis of spastic cerebral palsy; Group III: children with a primary diagnosis of athetoid cerebral palsy. The study consists of 4 one-hour sessions. Each session format is as follows: 1) quiet breathing, S at ease (not to exceed 5 minutes); 2) 3 minutes of monitored quiet breathing; 3) S asked to take as big a breath as possible and then relax; 4) repeat step 3 above; 5) one distinct sip of 5 ml. of water from a cup; 6) repeat step 5 above; 7)

continuous drinking of 75 ml. of water; 8) eating a bite-sized piece of cookie; 9) repeat step 8 above; 10) repeat step 7 above; and, 11) 3 minutes of monitored quiet breathing.

A respiratory inductance plethysmograph is utilized to monitor the respiratory patterns related to rib cage and abdominal synchrony. In addition, the EMG recordings of swallowing and mastication activity are monitored by the placement of surface electrodes over the infra-hyoid muscle group and masseter muscle.

Results—Statistically, the respiration rate of normal children is *less* than either of the two cerebral palsy groups. Normal tidal volume is *greater* than both cerebral palsy groups. Most importantly, the minute ventilation of the normal group was *greater* than both of the cerebral palsy groups.

Publication Resulting from This Research

Monitoring Respiration and Its Coordination with Swallowing in Cerebral Palsy by Means of Respiratory Inductance Plethysmography. Koheil R, Sochaniwskyj A, Bablich K, Ross D, *Developmental Medicine and Child Neurology* 28(S53):37, 1986.

Effects of Relaxed Breathing and Biofeedback on Bronchospasm in Chronic Asthma

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Sponsor: *National Health Research and Development Programme, Health and Welfare Canada*

Purpose—This study was designed to assess the immediate effects of relaxed breathing and electromyographic (EMG) biofeedback upon pulmonary functioning after methacholine-induced bronchospasm.

The specific goals of the project were: 1) to objectively assess the immediate effects of relaxed breathing upon pulmonary functioning subsequent to bronchospasm induced by a methacholine challenge; 2) to assess whether EMG biofeedback potentiates relaxed breathing; and, 3) to explore the efficacy of frontalis and trapezius as feedback sources during EMG biofeedback training.

Progress—This study involved 22 subjects ranging in age from 6 to 18 years who were enrolled in the in-patient Family Asthma Rehabilitation Program (FARP) at the HMMC. A single-case study format A - B - AB - C - AC was the paradigm employed. All A phases are assessments of effects of non-use and use of self-regulatory strategies on pulmonary functions subsequent to methacholine challenge; B represents participation in FARP, including the learning of relaxed breathing; and C is the EMG biofeedback training using either the frontalis or trapezius muscle. Pulmonary function assessments during A phases were carried out with an Eagle 1 spirometer and all EMG monitoring and biofeedback training was done using Autogen 1700 feedback electromyographs.

Results—Thirteen children passed through this protocol. Nine children underwent the assessment protocol only, without participating in the relaxed breathing and biofeedback phases. This was to assess the influence of medications on the stability of the asthma. It does not appear that the technique of relaxed breathing, either with or without EMG biofeedback augmentation has an effect upon recovery subsequent to methacholine-induced bronchospasm. However, it has been noted that the sensitivity to methacholine decreases over the course of the study for all children. Whether this result is due to drug changes or some psychological/physiological control of the bronchi is at this time unknown.

Publication Resulting from This Research

Evaluation of Relaxed Breathing and Its Augmentation with Biofeedback Upon Methacholine-Induced Bronchospasm in Paediatric Patients with Chronic Asthma. Levison H, Milner M, *Rehabilitation Digest* 17(2):13, 1986.

The Finance of Medical Rehabilitation Services: Interim Report on the Mary E. Switzer Distinguished Research Fellowship in Medical Rehabilitation Finance

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Sponsor: *National Institute on Disability and Rehabilitation Research*

Purpose—Pursuant to the Social Security Act Amendments of 1983, P.L. 98-21, Congress enacted Medicare's DRG-based Prospective Payment System (PPS), but exempted qualifying rehabilitation hospitals and units from payment under the Medicare PPS. In that legislation, Congress required that the Department of Health and Human Services report on the feasibility of developing a prospective payment system for medical rehabilitation. Since the enactment of P.L. 98-21, payors and providers of rehabilitation have been strongly interested in the options available for the payment of rehabilitative care.

NIDRR, the federal agency that funded this research fellowship, has indicated two priority objectives in the area of rehabilitation finance: 1) to develop payment models to achieve the most effective use of funds for medical rehabilitation services; and, 2) to identify and assess federal and state sources of payment for medical rehabilitation, and to describe the major private sector resources of payment and reimbursement. The purpose of this research fellowship is to address the various theoretical, empirical, and descriptive issues associated with NIDRR's priority objectives.

Progress—The two priority objectives of this research fellowship are addressed in two papers currently being developed, which are summarized as follows:

A. An Analysis of Models for the Payment of Rehabilitative Care. This paper, which addresses the theoretical (and to some extent, empirical) component of this research fellowship, has six sub-parts. They provide: 1) a background on medical rehabilitation and its finance; 2) a policy-oriented definition of the scope of medical rehabilitation; 3) criteria for evaluating medical rehabilitation payment policies; 4) an analysis of various payment models for medical rehabilitation; 5) an agenda for future research; and, 6) conclusions.

This paper considers all of the basic payment models (i.e, cost-based reimbursement, per diem or per service-based prospective payment, DRG-based prospective payment, severity of illness-adjusted DRG prospective payment, per capita payment, and preferred provider arrangements) likely to be seriously considered for payment of medical rehabilitation services. Criteria for evaluating the probable effects of the various models on the provision of medical rehabilitation services are developed, weighed according to their relative importance to the rehabilitation industry, and applied systematically to the models.

It also examines the effects of the Medicare prospective payment system (and the PPS exemption for rehabilitation hospitals and units) on the provision of rehabilitative care. It reviews year-to-year hospital survey data furnished by the American Hospital Association (AHA) to determine the extent to which the increased supply of rehabilitation beds is part of a long-term trend or a specific response to Medicare's PPS exemption for medical rehabilitation hospitals and units. It also proposes an agenda for future research in the area of rehabilitation finance.

B. The Payors of Medical Rehabilitation. This series of two related papers describes all of the major payors of medical rehabilitation services and their payment policies. The first paper considers the rehabilitation payment policies of the *public sector* payors of medical rehabilitation: 1) Medicare; 2) Medicaid; 3) the Veterans Administration; and, 4) state vocational rehabilitation agencies. The second paper considers the *private sector* payors of medical rehabilitation: 1) private health insurance carriers (including Blue Cross/Blue Shield); 2) disability insurers; 3) casualty insurers; 4) workers' compensation plans; 5) health maintenance organizations; and, 6) self-insured employers.

Both papers in the series consider the eligibility, coverage, and payment policies of these payors for twelve rehabilitative services, and the extent to which the payors are meeting the rehabilitative needs of the disabled population. The papers attempt to address payment policies as they relate to all pro-

viders of medical rehabilitation services, not only the more intensive comprehensive medical rehabilitation programs.

Future Plans/Implications—The first paper, a theoretical treatment of rehabilitation payment models, will be published as a monograph by the American Hospital Association, Rehabilitation Hospitals and Programs Section, later this year. The second paper, a descriptive treatment of the various payors of medical rehabilitation and their payment policies, will probably be published as a series of two articles in a rehabilitation-related journal shortly. The investigator presented these papers at the Annual American Hospital Association Conference at Los Angeles in November, 1987.

Information Dissemination in Communication, Control and Computer Access

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Sponsor: *National Institute on Disability and Rehabilitation Research; University of Wisconsin-Madison; College-Hill Press, Div. of Little Brown and Company, Boston, MA*

Purpose—The activities and projects in this section of the Trace Center are aimed at disseminating current information about products, resources, and techniques available in the areas of communication, control and computer access, and identifying optimal methods for information dissemination in this field.

Progress—The Trace Center Reprint Service disseminates approximately 7,000 reprints per year. Forty-five different publications were listed this past year. Additionally, the Information and Referral Service continues to respond to approximately 1,200 requests received each year. Information is updated on a continual basis and includes information from the Trace product database, quick resource sheets, and sets of clinical application notes. A major project completed in the fall of 1986 was the production of the *Rehabilitation Resource Books on Communication, Control and Computer Access* (Volumes 1-3). These books replaced *The International Software/Hardware Registry, Second Edition,* and the *Nonvocal Communication Resource Book,* which were published in 1984 and 1985, respectively. *Resource Book 1—Communication Aids; Resource Book 2—Switches and Environmental Control;* and *Resource Book 3—Software and Hardware,* were published in January 1987 by College-Hill Press. This comprehensive 1,000-page set includes over 900 entries with 500 photographs of hardware devices. Using desktop publishing techniques, the Trace Center was able to produce the most current resources available with a turnaround time of less that 2 months from compilation to distribution. This three-book series is extensively cross-referenced for logical and easy access. Using the series, consumers and professionals can quickly search for and identify assistive devices, software, and hardware for their needs.

Future Plans—As of the summer of 1987, a fourth volume to the Resource Book Series was being compiled. When completed, this volume will include approximately 300 new entries not available in Volumes 1-3. This fourth volume will be available from the Trace Center by the end of 1987. The Trace Center also is beginning to examine the needs for a computer-assisted information searching system for this area.

Publications Resulting from This Activity

Resource Book 1: Communication Aids; Resource Book 2: Switches and Environmental Controls; Resource Book 3: Software and Hardware. Brandenburg SA, Vanderheiden GC (Eds.), College-Hill Press, a division of Little Brown and Co., Inc., Boston, MA, 1987.

Industry-Based Employee Assistance Program

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Sponsor: *National Institute on Disability and Rehabilitation Research*

Purpose—The goal of SWBIRA's Industry-Based Employee Assistance Program Model is to determine possible solutions to problems of job retention encountered by developmentally disabled individuals once they are placed in an employment setting. It is hypothesized that the loss of employment by developmentally disabled persons is due to inadequate adjustment problems.

Progress—The structure of the project is quasi-experimental in design. Twenty individuals who 1) have a documented and confirmed diagnosis of developmental disability; 2) have access to transportation; 3) have previous vocational experience; 4) are at least eighteen years of age; 5) have documentation and can demonstrate specific skill training; and, 6) demonstrate a need for time-limited/ongoing support services within an employment setting, have been selected and divided into three groups. Descriptions of the three groups are summarized below.

A) *The Treatment Group* has been placed in organizations with an existing Employee Assistance program. In addition to the services which the corporate Employee Assistance Program offers, this group is provided with intervention from the project staff. The set of interventions are adapted to a specialized Employee Assistance Program model for developmentally disabled employees.

B) *Control Group I* has been placed in corporations which have an existing Employee Assistance Program; however, this group will receive no additional intervention from the project staff. This group is being monitored periodically for data collection purposes.

C) *Control Group II* has been placed in corporations which do not presently have an established Employee Assistance Program. These individuals are being monitored but receive neither intervention from the project staff, nor the benefits of corporate Employee Assistance Program services.

Results—There are some factors that appear to be establishing trends in the project. The most obvious factor deals with the job retention and the degree of support provided by the employer. It appears that without the support of a company that provides employee assistance or a specialized employee assistance program, developmentally disabled employees experience a high degree of failure in the employment setting. A comparative analysis of the three groups indicates that the participants in the treatment group and in Control Group I are coping and adapting to the work environment. They appear to be making the transition into the labor force and developing commitments. The termination of participants in these two groups has been extremely low. Five of the participants in the treatment group continue to be employed in their original job and two are unemployed at the present time. Of the two that are unemployed, one resigned her position and moved out of state. The other was working in a federally funded project which was discontinued. Her termination was not related to job performance, work adjustment, or work establishment. One hundred percent of the participants in Control Group I continue to be employed in their original positions. In contrast, the job retention of participants in Control Group II is minimal. Seventy-one percent are presently unemployed. One of these participants has held two positions in the past 6 months. Only 28 percent of the participants in control group II remain employed in their original positions.

Future Plans/Implications—This project intends to levy an impact directly on the developmentally disabled participant as well as focal groups in the community whose decisions and priorities determine the post employment resources available to developmentally disabled persons.

The impact on participants will be: increased annual earnings; increased job satisfaction and mobility; more available employment options; anticipated 80 percent retention rate at the end of 12 months. The impact on private and public sections will be: a reduction in chronic dependency on government programs; positive changes in family and community attitudes; decreases in retraining

and placement services.

Several manuals and publications will result from the Employer Assistance Program. An EAP manual comprised of 3 inservice training modules (one for the DD worker, one for the coworkers and supervisors, and one for support persons) has been developed. Additionally, replication and outcome effectiveness information will be made available as the program progresses through its third year of operation.

Uses and Potential Uses of Information Technology by Rehabilitation Agencies

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Sponsor: *National Institute on Disability and Rehabilitation Research (Fellowship Award)*

Purpose—The fellowship focused on one overall goal: to produce a model for information technology selection and application to the decision-making and networking needs of rehabilitation service providers, administrators, educators, and researchers. Research activities involved state rehabilitation agency staff, directors of Regional Rehabilitation Continuing Education Programs, and directors of 5-year grants from the National Institute on Disability and Rehabilitation Research.

Four major objectives guided the research: 1) identify information technology uses; 2) determine the patterns, frequencies, and formats of information needed to facilitate performance; 3) develop a model to assess the cost effectiveness of these technologies; and, 4) propose new methods (a) to increase or refine the volume of useful information that can be exchanged among state agencies and between state agencies and information providers, such as NIDRR grantees; and, (b) by which automated programs can be used by the rehabilitation counselor to improve "hand-on" services.

Progress—A survey instrument provided data on the kinds of information kept and the kinds of technology used by the three research populations: agencies, RCEPS, and NIDRR research grantees. The survey identified the actual costs and budgeted costs (in ranges) for information technology. In addition, the instrument provided a checklist of perceived benefits and problems related to information technology systems used in the respondents' settings.

Visits to several state agencies produced case studies on system development and implementation in terms of potential cost effectiveness areas. Informal and formal interviews at several national conferences contributed innovative ideas for automating counselor functions and for inter-/intra-organizational communications.

Survey responses were high. The results represent 89 percent of the state rehabilitation agencies, 77 percent of the NIDRR five-year grantees, and 73 percent of the 11 RCEPS. Survey findings include:

1) Costs of program-owned computer equipment is predominantly under $15,000 for RCEPS, under $100,000 for NIDRR five-year grantees, and under $500,000 for state rehabilitation agencies.

2) The most popular hardware among the respondents are IBM microcomputers and compatibles and then Apple microcomputers and compatibles; among mainframes IBM leads with DEC & Honeywell trailing slightly behind.

3) The most popular commercially available software among the respondents are Lotus 1 2 3, D-Base, Word Perfect, Word Star, and SPSS.

4) Respondents state that all levels of staff use or are encouraged to use the computers. In 30 percent of the agencies clients have begun using the equipment.

5) More respondents perceived quicker access to stored information and greater capacity to process information for making more effective decisions than other benefits to computer systems.

6) None of the technical or nontechnical problems associated with computers generated more than a 49 percent response rate.

7) All respondents use telephone conference calls, state/national teleconferences, on-line national databases, and television broadcasts as needed. Of the agency respondents 81 percent use computer bulletin boards/networks daily or weekly. Thirty percent of the agencies use electronic mail daily and 15 percent as needed.

8) The degree of computerization by categories for agencies are: (1) client/caseload data (e.g., RSA R300/911, IWRPs, time/status), Range = 0-90 percent, Mean = 56 percent, Median = 60 percent, Mode = 60 percent; (2) services support data (e.g., authorizations, vendors, eval.) Range = 0-88 percent, Mean = 45 percent, Median = 50 percent, Mode = 50 percent; (3) personnel data (e.g., job descriptions, salary/fringes) Range = 0-100 percent, Mean = 39 percent, Median = 43 percent, Mode = 43 percent; (4) inservice training data (e.g., needs, workshop data, fiscal) Range = 0-67 percent, Mean = 19 percent, Median = 22 percent, Mode = 0; (5) program planning and evaluation data (e.g., audits, reviews) Range = 0-77 percent, Mean = 24 percent, Median - 22 percent, Mode = 11 percent; (6) other administrative data (e.g., manuals, inventories, lists) Range = 0-100 percent, Mean = 42 percent, Median = 38 percent, Mode = 11 percent.

9) The agencies having highest percentages of computerized items across all categories are (beginning with the highest) :*WI-C, *IL-C, *PA-G, *GA-C, *NY-G, MD-C, *AL-C, *NE-G, *AZ-C, *MN-G, *TX-G, OR-G, OK-C, SC-G, VA-G, RI-G, *WY-C, *CA-C. The states with asterisks have 60 percent or more in three to six categories. LA-C and NC-G are high in three categories but not in percent of items computerized.

10) Among the research respondents 60 percent or more computerize statistical analyses, progress/final reports, articles, mailing lists, budget/income/expenses, salaries/fringe benefits.

11) Research respondents ranked information areas as follows: research data and analysis; potential funding sources requirements; literature reviews; needs surveys; impact of research results; potential subject sources and names; names of potential users of results; names of political/funding source contacts; sources of research support (e.g., advisory); names of experts for research design and content.

12) Fifty percent or more RCEP respondents computerize budget/income/expenses, mailing lists, training calendars, workshop descriptions and evaluation/statistical data.

Future Plans—A final report will present case studies, cost effectiveness models, and discussion of innovative techniques. Survey respondents will be receiving a resource guide to the selection and use of information technology for their participation in the research.

Disability Management and Rehabilitation: An Analysis of Programs, Costs and Outcomes

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Sponsor: *National Institute on Disability and Rehabilitation Research*

Purpose—In 1984, Michigan State University was awarded a 3-year, field-initiated research grant by the National Institute on Disability and Rehabilitation Research to study the incidence, costs, and outcomes of rehabilitation and disability management among three major employers in Michigan. The purpose of the study was to investigate organizational culture, human resource policies, and specific benefit and intervention practices adopted by these employers to manage the incidence, costs, and outcomes of disability among their workforce.

Progress/Methodology—Three levels of analysis, including macroeconomic, organizational, and employee factors, were developed. Their interrelationships provide an overall appreciation of the impact of the external environment on business operations as well as identifying potential barriers in each respective employer's management practices at the organizational and individual level.

At the macroeconomic level, a substudy of national and state economic and labor demographic data was developed to assess the impact of labor market economics, legislative initiatives, and health care trends and costs in Michigan. At the organizational level of each of the participating employers, information was derived from interviews with key personnel, data from questionnaires, on-site observations, reviews of company reports and data tracking systems, contractual agreements, and specific

program outcome data. Employee data were gathered in two companies through review of case files or surveys. A specific protocol was developed to capture demographic, medical and benefit costs, and employee outcome data for each individual. A policy initiative was studied by field interview in the third employer.

Results—Data analysis is currently being completed for two of the employers. A completed final report for the third employer is currently being reviewed by the company before release to the public. Specific reports with recommendations are in preparation for each employer along with a compilation of general findings that will summarize basic costs, outcomes, and factors affecting the disability management process.

The components of organizational cultures that elicit a positive response for human resource development, interventions that reduce costs, factors that distinguish effective disability management practices, and characteristics of employees at high risk for disability outcomes are summarized in the final reports and future publications of the project. Over the 3-year grant period, project staff have provided technical assistance to employers and rehabilitation providers.

Future Plans/Implications—It is anticipated that the results of the project will provide business, labor, government, health professionals, and disabled individuals with information useful in guiding the development of future programs. The culture of the organization has been determined in this study to play a significant role in employee investment in their work role and in contributing to the advent and outcome of injury and chronic disability conditions among employees. Further research is needed to investigate the relationship among company policies, incidence of illness and injury, and the length of time an individual is away from the workforce to understand the specific linkages between the organization and its employees in relation to health and disability.

Publications Resulting from This Research

Employer-based Disability Management and Rehabilitation Programs. Galvin DE. In E.L. Pan, S.S. Newman, T.E. Backer and C.L. Vash (Eds.), *Annual Review of Rehabilitation* 5:173-215, Springer Publishing Company, New York, NY, 1986.

Disability Management: A Comprehensive Framework for Prevention and Rehabilitation in the Workplace. Tate DG, Habeck RV, Schwartz G, *Rehabilitation Literature* 47(9-10):230-235, 1986.

Health Promotion, Disability Management, and Rehabilitation in the Workplace. Galvin DE, *Rehabilitation Literature* 47(9-10):218-223, 1986.

Disability Management and Rehabilitation in the Workplace. Tate DG, Habeck RV (Eds.), *Journal of Applied Rehabilitation Counseling* (Special Issue), 17(3), 1986.

Disability Management: Origins, Concepts, and Principles for Practice. Tate DG, Habeck RV, Galvin DE, *Journal of Applied Rehabilitation Counseling* 17(3):5-12, 1986.

Rehabilitation in an Industrial Setting. Munrowd DC, Beecher PJ, *Journal of Applied Rehabilitation Counseling* 17(3):23-27, 1986.

Disability Management Research: Current Status, Needs and Implications for Policy. Galvin DE, Tate DE, Schwartz G, *Journal of Applied Rehabilitation Counseling* 17(3):43-48, 1986.

Implications of Worksite Practice for Training and Educating Rehabilitation Counselors. Habeck RV, Ellien V, *Journal of Applied Rehabilitation Counseling* 17(3):49-54, 1986.

Overhauling Rehabilitation. Tate DE, Munrowd DC, Habeck RV, **Business and Health** 4(9):32-35, 1987.

Employer-based Rehabilitation Practice: An Educational Perspective. Habeck RV, Munrowd DC, *Rehabilitation Education* 1(2), 1987.

Epidemiological Study of Pain

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Sponsor: *National Institutes of Health*

Progress—The purpose of this project was to evaluate the overall and age-specific incidence rates of various chronic pain syndromes by developing a statistical technique to estimate incidence rates from age of onset data. The technique developed uses available estimates of age of onset data for headache and approximates incidence rates by superimposing the age of onset rates onto the age distribution of the given population. The incidence rates of disabling and/or severe headache were evaluated with

data obtained from a Midwest nonclinical population survey.

Results—The validity of this procedure was evaluated by comparing the results with the incidence of disabling headache estimated from the British Second National Study of Morbidity Statistics. A report on this work has been prepared and will be submitted for publication.

A Neurosensory Interdisciplinary Research Program: Tactile Stimulator Development

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Sponsor: *National Institutes of Health*

Purpose—The broad objective is to focus the latest techniques of the physical sciences and modern technology on the solution of problems encountered in studies of the development, structure, function, and dysfunction of the nervous system, the neuromuscular system, and the communicative system. The School of Medicine and the Applied Physics Laboratory will collaborate to provide the stimulus, the expertise, and the environment to achieve this objective.

Progress—There are five specific research projects and one core project set forth. Two of the research projects are concerned with the design of instruments and apparatus to facilitate study of the electrical activity of neurons within the cortex of an awake, behaving monkey.

One is to develop multiple element microprobes which would allow simultaneous recording from several neurons. Only through simultaneous recordings can decisive data be obtained on functional connections between cortical cells. The other is to develop 2-dimensional isometric/torqueable manipulandums to facilitate the study of cortical neurons involved in the generation and spatial organization of arm movements aimed at visual targets. This will permit testing two opposing hypotheses concerning the cortical control of movement.

The third project applies advanced signal processing techniques to detect and localize spatially epileptiform discharges through magnetoencephalographic measurements. The noninvasive spatial localization of epileptic foci is important investigationally and clinically.

In the fourth project, two distinct types of tactile stimulators will be developed: a closely-packed array of independently controllable elements for use in basic neurophysiological and psychophysical research, and a small, low power wearable device for use in human prosthetic systems. Suitable devices are currently unavailable.

In the fifth project, new instruments will be developed to improve the technical quality of microneurosurgical procedures with particular emphasis on neurosurgery. Microsurgery is of necessity a solo operation and there is need for technological assistance. The purpose of the Core Function is to facilitate the development and feasibility testing of new concepts for future neurosensory projects.

Development of a Data Management System for the Family Asthma Rehabilitation Program (FARP)

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Sponsor: *Private Donation to the Family Asthma Rehabilitation Program*

Purpose—The objectives of the project are two-fold: 1) to establish a data management system suitable for the management and evaluation of FARP activities; and 2) to examine the medical, psychological and demographic factors that influence the effectiveness of an in-patient asthma treatment program.

Progress—The project involves two phases. Phase One consisted of designing a database system for the program. Design activities included the review of current data collection methods and the development of computer-compatible inventories. The inventories encompass demographic information, medical indices, psychosocial adjustment levels of child and family, and the children's knowledge of asthma. Program computer resources were reviewed and upgraded for the establishment of a data entry and data maintenance system.

Phase Two of the project involves the implementation of the database system. The implementation activities include: 1) teaching staff to administer measures and manage data on the computer; 2) monitoring system activities to ensure fidelity of system design; and, 3) initiating descriptive and evaluative research.

Parallel to the implementation procedures, the project will develop appropriate fitness measures for the program. To date, phase one of the project is completed and present activities are focused on the implementation phase of the project.

An Innovative Approach to Continuing Health Care Education

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Sponsor: *RGK Foundation of Austin, TX; College of Engineering, Clemson University*

Purpose—Technology has had a major impact on the delivery of health care in the past decade. Patients and clinicians alike are faced with a bewildering array of choices. Traditional education methods are simply inadequate to meet the challenges of the technological revolution. Our objectives are: 1) to set up an innovative teaching laboratory; 2) to integrate three exciting new technologies; and, 3) to specialize in the needs of patients with back pain, and the engineering skills required by orthopaedic surgeons.

Progress—Our system will be generally applicable to a wide range of students. We want to seek appropriate solutions to the problems of continuing health care education, so our system will adapt to the special needs of the individual student. We plan to implement a unique concept by combining three emerging technologies: artificial intelligence (e.g., the ability of a machine to understand human speech), computer-aided instruction (already shown to motivate students and increase achievement), and the videodisc (instantaneous access to thousands of images). The Bioengineering Alliance of South Carolina is well-placed to succeed with this project: we have the people (engineers, scientists, and clinicians from the participating universities and hospitals), and we have the experience (demonstrated success for a related project with industrial and state support).

Future Plans/Implications—Within three years our laboratory will be self-sufficient: our educational courseware will be implemented not only in South Carolina, but elsewhere in the United States as well. We realize that the challenges that lie ahead are substantial, but we believe that our model, based on a human-centered approach, has great potential for success.

Assessing the Need for Management of the Neurogenic Bowel in the Pediatric Population

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Sponsor: *Research Department, Hugh MacMillan Medical Centre*

Purpose—The objective of this study is to develop a database identifying present management practices and factors which might influence bowel management in a sample of spina bifida children.

Progress—This study involves 65 children ranging in age from 0 to 16 years old who attend the bimonthly combined Spina Bifida Clinics and the monthly Teen Spina Bifida Clinic. The subjects were chosen randomly from the total sample and then grouped by age and sex. A computer-compatible questionnaire, consisting of 54 questions, was developed and individually administered by an experienced Registered Nurse/Research Assistant, through prescheduled parent/child/teen interviews.

Individual interviews were planned in order to gain a thorough understanding of: 1) early and present bowel functioning; 2) methods of bowel management; 3) parental knowledge of factors affecting bowel functioning and management; 4) impact of bowel routine on child and family; 5) parents' assessment of need for a bowel management program; and, 6) urinary functioning and management.

The questionnaire data will be tabulated by computer, on a question by question basis, for all subjects grouped by age and sex. Descriptive statistics will be employed to analyze the data and comparisons between and across groups of subjects will be made.

Longitudinal Study of Public Expenditures for Services to the Handicapped

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Sponsor: *None Listed*

Purpose—The Evaluation and Public Policy Analysis Program conducts research on state and federal policies in mental retardation/developmental disabilities (MR/DD) services, and has developed extensive databases on state government expenditures for the decade from fiscal year (FY) 1977 through 1986. Also analyzed were federal government expenditure data spanning FY 1935 to 1985 for 82 separate programs. The third component of the study analyzed total (federal, state and local) MR/DD expenditures.

The study's methodology consisted of the collection of state budget documents from the Council of State Governments in Lexington, Kentucky, and in Washington, D.C., and from the Center for Research Libraries in Chicago. Documents were also obtained directly from the states, and extensive contacts with state officials augmented and confirmed data obtained from published sources. Comprehensive monographs (e.g., Braddock, Hemp, and Fujiura, 1986) were distributed to state and federal officials and to state advocacy organizations to encourage thorough review of analytical results prior to the publication of journal articles.

Results—A major finding of the study over-all was the extensive Federal Medicaid support from the Intermediate Care Facility for the Mentally Retarded (ICF/MR) program devoted to large congregate institutions (87 percent of Federal ICF/MR dollars in FY 1986). This finding has significant implications in Congressional discussions of Medicaid Reform (the Community and Family Living Amendments). The State Government analysis also documented the continuing steady decline in average daily population of public MR/DD institutions, a recent increase in federal ICF/MR support for small, community-based services, and a declining level of federal support for community services from the Title XX/Social Services Block Grant.

The Federal Government analysis noted that since the 1950's MR/DD spending as a share of the total Federal budget has grown rapidly, consisting primarily of income maintenance (Supplemental Security Income and Adult Disabled Child payments) and services programs (ICF/MR, special education and vocational rehabilitation). However, Federal support of training and of research for MR/DD has declined rapidly in real dollar terms since the early 1970's. The third study component indicated that nearly $17 billion in federal, state, and local funds were deployed for MR/DD services in FY 1984.

Honors in 1987—The Longitudinal Study received two singular honors in 1987: Dr. David Braddock was the recipient of the Distinguished Research Award, the most prestigious offered by the Association for Retarded Citizens of the U.S. The Na-

tional Study article (Braddock, Hemp, and Fujiura, 1987) was selected as the feature article in the September issue of the *American Journal of Mental Deficiency*, with commentary from Elizabeth Boggs, Laird Heal, H. Rutherford Turnbull, III, Sen. Lowell Weicker, and Wolf Wofensberger.

The Institute for the Study of Developmental Disabilities offers a list of publications in journals and books, related to this research.