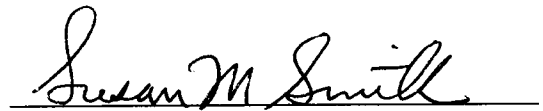


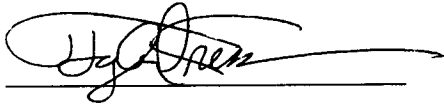
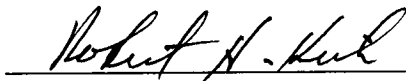
To the Graduate Council:

I am submitting herewith a thesis written by William Mark Hart entitled " The Frequency of Hand/Wrist Disorders Among Sign Language Communicators." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Safety Education and Service.



Susan M. Smith, Major Professor

We have read this thesis
and recommend its acceptance:



Accepted for the Council:



Associate Vice Chancellor and
Dean of The Graduate School

THE FREQUENCY OF HAND/WRIST DISORDERS AMONG
SIGN LANGUAGE COMMUNICATORS

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

William Mark Hart
December, 1998

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DEDICATION

This thesis is dedicated to my children

Kendra DeeAnn Hart

William Shawn Hart

Courtney Leigh Hart

for their continual patience, encouragement, and support.

ACKNOWLEDGEMENTS

Having experienced over a decade of learning and growing at The University of Tennessee, I want to convey my deepest appreciation to the many faculty, staff and fellow students that have support me. In particular I wish to thank the Departments of Health and Safety Sciences and Human Resource Development for their guidance, patience, and understanding. I would like to recognize my thesis committee members, Dr. Robert H.Kirk, Dr. Tyler A. Kress and especially Dr. Susan M.Smith.

I would like to thank Oak Ridge Associated Universities and Oak Ridge Institute for Science and Education for their financial support over the last two years. I am eternally grateful to Dr. R. Ricks, Dr. M.E. Berger, Dr. R.E. Goans and the staff of the Radiation Emergency Assistance Center and Training Site for allowing me to focus toward the completion of this goal.

I am appreciative of The University of Tennessee Center on Deafness and Bill Woodrick for helping to facilitate this research initiative. I would also like to recognize Alan Hughes and the Knoxville Area Community Center for the Deaf. Their participation in the testing of the questionnaire was invaluable.

Lastly, I would like to thank my loving family and devoted parents for their never-ending support and encouragement - without it, none of this would have been possible.

Abstract

Sign language is the fourth 'most used' language in the United States, yet sign language communicators have been largely ignored as an at-risk population for the development hand/wrist disorders. This study examined the frequency of hand/wrist disorders among sign language communicators through a self-reporting questionnaire. The population for this self-reporting, baseline study were participants from the 1998 Postsecondary Education Program Net Conference in Orlando, Florida. A three-page questionnaire was mailed out, completed by 215 (54%) former attendees, and returned by mail without identifying marks. The return questionnaires were analyzed using the Statistical Package for Social Sciences (Suite 8.0) software program. Thirty-one respondents completing the questionnaire reportedly did not use sign language as a form of communication and were eliminated.

Results demonstrate 108 of 184 sign language communicators (59%) self-reporting a hand/wrist problem. In 48 cases (26.1%), these hand/wrist problems were significant enough to limit the ability to work. A medical diagnosis of wrist tendonitis and/or carpal tunnel syndrome was self-reported by 33 respondents (18%). Overall, this study concluded that one in every four sign language communicators surveyed had experienced a hand/wrist problem significant enough to limit their ability to work.

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CHAPTER I

FORMULATION AND DEFINITION OF THE PROBLEM

Introduction

This study examined the frequency of hand/wrist disorders among sign language communicators. The primary focus of this self-reporting, quantitative, baseline study was to identify the frequency of self-reported hand/wrist disorders among professionals using sign language communications. The secondary purpose of this self-reporting study was to identify work-related behaviors, health, and demographic characteristics associated with those sign language communicators who self-report hand/wrist problems. This study will serve to provide baseline data regarding the type and frequency of symptoms experienced by sign language communicators in the United States.

The Statement of the Problem

The study gathered baseline data concerning the frequency of hand/wrist disorders among sign language communicators including professional interpreters, educators, trainers, administrators, managers, counselors, and social workers. A three-page self-reporting questionnaire was used to gather data. This study documented the frequency and number of symptoms associated with hand/wrist disorders among sign language communicators. This investigation also gathered work-related risk factors, behavioral and demographic characteristics of those sign language communicators self-reporting hand/wrist problems. This study provided additional baseline data for sign language interpreters and represents one of the first baseline studies to gather hand/wrist problem

data for those who use sign language for purposes of administration/management, education/training, and counseling/social work.

The following research questions were addressed in this study:

1. What is the frequency of the self-reported medical diagnosis of carpal tunnel syndrome and/or tendonitis of the wrist among the sign language communicators surveyed?
2. What is the frequency of sign language communicators self-reporting hand/wrist problems and/or one or more signs/symptoms indicative of hand/wrist disorders?
3. What is the frequency of sign language interpreters self-reporting hand/wrist problems or signs/symptoms indicative of hand/wrist disorders?
4. What is the frequency of sign language communicators self-reporting hand/wrist problems or signs/symptoms indicative of hand/wrist disorders that use sign language for other purposes than interpreting?
5. What is the frequency of sign language communicators self-reporting hand/wrist problems that limited their work performance?

The study population for this research was limited to participants of the 1998 Postsecondary Education Program Net Conference (PEPNet), held April 29-May 2, 1998 in Orlando, Florida. The PEPNet Conference participants included professional educators, interpreters, administrators, counselors, and support services staffs from across the United States. The purpose of the conference was an effort to enhance the quality of

post secondary educational opportunities for students with hearing deficits. The PEPNet Conference also provided a unique opportunity for professionals to interact with their colleagues and learn more about the best practices and effective strategies for meeting the needs of the postsecondary level who are deaf and hard of hearing. 413 participants were registered at the conference. Permission to send all participants at the conference a three-page questionnaire concerning hand/wrist problems was granted by the Postsecondary Education Consortium. A three-page questionnaire was mailed out to 397 participants in June 1998 with an introductory letter from the Director of the University of Tennessee Center on Deafness.

NEED FOR THE STUDY

Hand/Wrist Problems In The General Work Population

Occupational disease affects 15 to 20% of all Americans (U.S. Department of Labor, 1992). Cumulative trauma disorders (CTDs) are the fastest growing cause of work-related disease in the United States. CTDs are illness or injuries that result from repetitive motions of the extremities or body torso with or without other precipitating factors. The Bureau of Labor Statistics reported that CTDs accounted for 65% of all occupational illnesses in the United States. Hand/wrist disorders such as carpal tunnel syndrome and wrist tendonitis are included in the diagnoses of CTDs. In the document, Healthy People 2000, the U.S. Department of Health and Human Services reported that repetitive motions lead to such disorders as carpal tunnel syndrome (CTS), tendonitis, ganglionitis, tenosynovitis, bursitis and epicondylitis. In 1995, results from a National

Health Interview Survey indicated that during the past 12 months, 1.47% or 1.87 million of working U.S. adults reported a condition affecting the wrist and hand called carpal tunnel syndrome (CTS); yet only 61,710,000 were diagnosed by a healthcare professional as actually having CTS (Tanaka et al., 1995).

Carpal tunnel syndrome (CTS) is a type of hand/wrist disorder. CTS results from the compression of the median nerve in the volar aspect of the wrist between the longitudinal tendons of the forearm muscles that flex the hand (Berkow,R., 1992). The frequency of work-related hand/wrist disorders among today's workforce is on the rise. Blanc et al. (1996) found that work disability as a result of hand/wrist disorders effected 11% of 544 individuals self-reporting a form of hand/wrist disorder, carpal tunnel syndrome. In a 1997 document, the National Institute for Occupational Safety and Health (NIOSH) examined over 30 epidemiological studies to assess the relationship between physical workplace factors and the development of carpal tunnel syndrome (U.S. Department of Health and Human Services, 1995). A positive correlation was found between highly repetitive work and the development of carpal tunnel syndrome. The conclusion was that work-factors are one of the important causes (U.S. Department of Health and Human Services, 1995). The extensive NIOSH data represented 21 cross-sectional studies, six case studies and three longitudinal studies; all published since 1979 (U.S. Department of Health and Human Services, 1995).

Many occupations in the NIOSH data received exceptional scrutiny for their susceptibility to hand/wrist disorders. Studies like Silverstein et al. (1987) and Nathan et al. (1988) focused on workers in a variety of workplace settings to include appliance,

electronics, apparel, metal casting, and an iron foundry. Silverstein et al. (1987) found a CTS occurrence rate (OR) of 5.5 when comparing highly repetitive jobs to low repetitive. Nathan et al. (1988) found impaired sensory nerve median conduction in 39% of 471 randomly selected workers from four different manufacturing industries (Nathan et al., 1988).

Additional studies like Barnhart et al. (1991), Morgenstern et al. (1991), and McCormack et al. (1990) all focused on a specific occupational area such as ski manufacturing workers, grocery checkout clerks, and textile production workers. Barnhart et al. (1991) reported a significant prevalence ratio (PR) of 2.3 for the mean median-ulnar sensory latency nerve difference among those in repetitive jobs compared to those in non-repetitive jobs. The only published research found focusing on the occupational specialty of those who are sign language communicators were small studies involving only professional interpreters.

Hand/Wrist Problems Among Sign Language Communicators

Sign language is the fourth 'most used' language in the United States, yet sign language communicators have been largely ignored as an at-risk population for the development hand/wrist disorders (Podhorodecki & Spielholz, 1993). While information identifying the frequency of individuals developing hand/wrist disorders exist for numerous occupational specialties, no information is found in the literature regarding sign language communicators accept small studies looking only at professional interpreters. Understanding the frequency of hand/wrist problems of those who serve as

sign language communicators is important. Those using sign language as an occupational tool such as a teacher or as a primary means of communication need to be aware of the frequency of hand/wrist problems among sign language communicators and the behaviors that increase risk. Sign language communicators should understand at-risk work-related behaviors associated with hand/wrist problems and be familiar with a means by which they can minimize these hazards.

Within the community of sign language communicators and professional interpreters, only a few research studies have been published nationally evaluating this occupational specialty as at-risk for hand/wrist disorders. Most of these studies have focused on cumulative trauma disorders (CTDs) involving the hand or wrist including carpal tunnel syndrome.

In a 1992 study, DeCaro et al. (1992) found the most common hand/wrist disorder among a group of professional interpreters to be tendonitis. A study, Stedt [1990,1992] found evidence of carpal tunnel syndrome in a limited study of 40 educational sign language interpreters. In 1996, Dr. R.N. Norris, Director of the

Center of Repetitive Motion Disorders, National Rehabilitation Hospital, Bethesda, MD warned interpreters of work-related dangers and the potential for the development of repetitive strain injuries (RSIs) (Norris, 1996). Hand/wrist disorders can render a sign language communicator "speechless". To appreciate the potential exposure for the development hand/wrist disorders, one only needs to observe a typical signing session.

The frequency of motion generated by the hand and wrist during an interpreting session can be approximately 270 motions per minute or 13,600 motions during a 50-minute presentation (Shealy et al.,1991).

Basic Assumptions

The following statements were assumed to be true for this study:

1. Participants' self-reported responses were honest and accurate.
2. Participants' understood and correctly interpreted the questions completed on the questionnaire.
3. The questionnaire developed was valid and reliable.

Delimitations

The following delimitations were imposed based on the design of the study and understanding that the questionnaire was self-reported. The study participants were delimited to:

1. Those who had attended the 1998 Postsecondary Education Program Network (PEPNet) National Conference in Orlando, Florida.
2. Those attendees using sign language as a form of communications.

Limitations

The following were a limitation of the study:

1. The data reported were derived from information provided from a multiple-choice/short answer questionnaire with limited response choices.
2. Participants were asked to self-report, recall and /or estimate responses to some questions requiring an approximation and not the exact numerical response.

Definition of Terms

This section operationally defines the constructs used in this study.

1. Medical diagnosis - causation of medical/physical problem as determined by a licensed healthcare practitioner.
2. Symptomatic- expression of signs/symptoms characteristic of a specific ailment, injury or disease process.
3. Medication - prescription or over-the-counter substance, preparation, used in the act of treating an illness, injury or promotion of health.
4. Occupational specialty - a specific work-related field within a broader occupational spectrum sharing some work-related behaviors but clearly different in their scope of practice.
5. Onset of menopause - period of time when menstruation begins to stop. In about 50% of women, this 'change of life' occurs between 45 and 50 years of age. Marks decrease ovarian activity and significantly lower levels of the hormone estrogen.

6. Self-reporting - the act of disclosing information about one's self without any stipulation of proof.
7. Self-reporting questionnaire - questionnaire or written survey instrument asking recipients to read and answer specific inquiries without any stipulation of proof.
8. Sign language communicator - individual practicing a formal language system employing hand gestures for communications (as by the deaf).
9. Sign language interpreter - individual practicing a formal language system employing hand gestures for communications for the purpose of interpreting the spoken word into sign language for those hearing impaired.

Since many related research endeavors involving hand/wrist disorders are referenced in this study, the following terms are defined to provide clarity. The related research referenced in this study may also use a generic grouping or categorizing of similar physical anomalies to describe hand/wrist disorders. These terms or common groupings describing hand/wrist disorders are briefly defined:

1. Musculoskeletal disorders (MSDs) - related specifically to hand/wrist disorders in this study. General category used by NIOSH.
2. Carpal tunnel syndrome (CTS) - a symptom complex resulting from the compression of median nerve as it passes through the carpal tunnel at the wrist. Associated excessive wrist movements and producing pain and/or tingling paresthesias in the hands / fingers.

3. Work-related upper extremity disorders (WRUEDs) - grouping of physical problems associated with excessive or repetitive motion occurring in the workplace.
4. Upper extremity cumulative trauma disorder (Upper extremity CTD) - refers to a variety of inflammatory conditions that are associated with repetitive motions of the hands, arms and shoulders.
5. Repetitive stress injury (RSI) - general category for physical problems caused by repetitive motion. Similar to cumulative trauma disorders.

Summary

The primary purpose of the study was to gather baseline data and determine the frequency of self-reported hand/wrist disorders among sign language communicators. The development of hand/wrist disorders among the U.S. workforce is high. Research and exploration of hand/wrist problems has been widely reported in other occupational specialties where excessive repetitive hand/wrist motions are common. This study was initiated to expand baseline data related to hand/wrist disorders among sign language communicators.

Chapter II, reviews the literature as it relates to the content and methodology of hand/wrist disorders.

Chapter II

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Introduction

The primary focus of this baseline study was to identify the frequency of hand/wrist disorders among sign language communicators and gather baseline data. Secondly, the study examined work-related behaviors or risk factors associated with individuals self-reported hand/wrist disorders. Described in this chapter is the content and methodology of previous research initiatives in the field of hand/wrist disorders. This study focused on those professionals who utilize sign language communications in their work or home.

Framework

The research instruments used to assess problems of repetitive stress injuries and the development of hand/wrist disorders have ranged from self-reporting surveys and physical examinations to nerve conduction measurements using electromyography. The research instrument employed in this study was a self-reporting, three-page questionnaire.

The research criterion for assessing the problems of hand/wrist disorders has varied from study to study. The research criterion selected for this study and incorporated into this survey instrument was derived from the NIOSH. NIOSH has an approved case definition for work-related hand/wrist disorders (Katz et al., 1991).

The definition was structured around three salient features. Each salient feature or criterion was derived from symptoms, signs, and work-related experiences.

The first criterion corresponds to the classic rating on the hand pain diagram (Figure I-1). The presence of symptoms suggestive of CTS may be any one of three:

1. Paresthesia - an abnormal sensation like burning, prickling, or tingling.
2. Hypoesthesia - an abnormal decreased sensation or numbness.
3. Pain or numbness affecting at least part of the median nerve distribution of the hand.

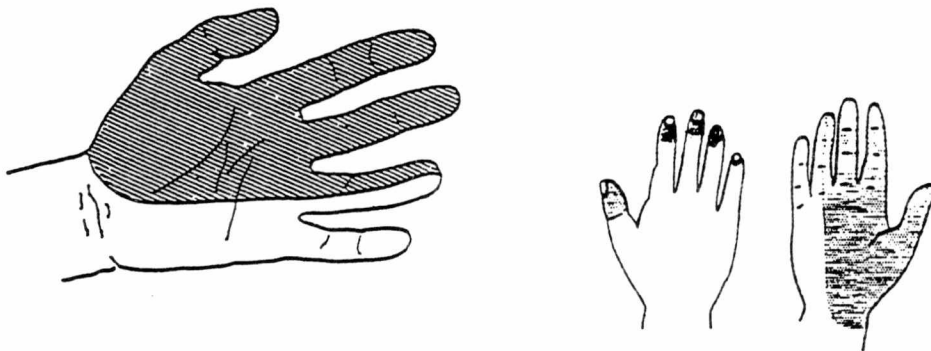


Figure I-1.

Courtesy: W.B. Saunders Co.

The second NIOSH criterion corresponds to a positive Tinel or Phalen sign or a diminished two-point discrimination test (Jarvis, p.690). Tinel's sign involves direct percussion of the location of the median nerve at the wrist. With certain hand/wrist disorders, percussion of the median nerve produces burning and tingling along its distribution in the hand. Phalen's test involves asking the person to hold both hands back to back while flexing the wrist at 90 degrees. Acute flexion of the wrist for 60 seconds produces no symptoms in the normal hand. Numbness or burning may be reported in an individual with a CTD. The presence of these objective findings is consistent with the development of known hand/wrist disorders (Jarvis, p.691).

The last NIOSH criterion, or surveillance case definition is the report of work-related behaviors describing exposure to vibration, repetition, pinching, grasping, or wrist flexion or extension. This study describes the burden of proof in reporting work-relatedness as the self-reporting of the following work-related behaviors:

1. Frequent, repetitive, or forceful hand work on the affected side.
2. Sustain awkward hand positions.
3. Use of vibrating tools.
4. Prolonged pressure over wrist or base of palm.
5. Temporal relationship of symptoms to work or association with CTDs noted in co-workers.

An understanding or acknowledgment of the general problem, associated risk behaviors and frequency of hand/wrist disorders in the workplace is very important to this research initiative. This understanding, referenced in previous research findings, will serve as a guide in development of the survey instrument utilized to explore specific problem of hand/wrist disorders among the sign language communicators in this report. The studies discussed in this chapter will serve to provide information, methodologies, and techniques needed to design and implement this study.

Studies Related to Hand/Wrist Disorders

In recent years, studies have been published associating occupational risk factors and the development of work-related upper extremity disorders. Multitudes of researchers have conducted research on work-related upper extremity disorders. Many causative relationships have been reported in a variety of occupations such as meat packing, poultry and the textile industry. The Bureau of Labor Statistics has continued to cite and track the rising incidence of repetitive motion injuries throughout the general workplace. In one year, CTDs represent 62% (308,000 cases) of all newly reported cases of occupational illnesses (U.S. Department of Labor, 1995). The Bureau of Labor Statistic compiles the frequency and distribution of workplace accidents and illnesses.

In July 1997, NIOSH published a critical review of epidemiologic evidence for work-related musculoskeletal disorders of upper extremities. NIOSH reviewed over 30 epidemiologic studies, only studies that focused on repetitive hand/finger or wrist movements such as wrist extension/flexion, ulnar/radial deviation, and supination or pronation will be described in this report (U.S. Department of health and Human Services, 1997).

The prevalence of hand/wrist disorders in the workplace has been the focus of numerous studies (Morgenstern et al., 1990, Osborn et al., 1990, 1995, & Barnhart et al., 1991). These studies have identified various occurrence rates depending on factors such as the individual worker, his occupational behavior and the environment in which the work occurs. Barnhart et al. (1991) found the occurrence of CTS to be 15.4% in ski manufacturing workers with a highly repetitive job as compared to an occurrence rate of 3.1% in ski workers with a non-repetitive jobs. Osborn et al. (1990) examined 493 dental hygienist in Minnesota and found that 34 hygienist (7%) had been medical diagnosed with a hand/wrist disorder. Morgenstern et al. (1991) found a 12% prevalence of hand/wrist symptoms characteristic of CTS among 1,058 female grocery clerks. Using a self-reporting, mail survey, Morgenstern et al. (1991) studied 1,345 union grocery clerks and a general population group. Work-related exposures were based on self-reporting time experienced as grocery clerks. A positive response was based on reporting the presence of four symptoms: pain in the hands or wrist; nocturnal pain; tingling in the hands or fingers; and/or numbness. These symptoms are often indicative in the clinical presentation of CTS. The study

demonstrated a significant association between the development of CTS with participant's age and the use of diuretic. While not plainly stated, an underlying medical condition necessitating the use of diuretics is presumed to have existed. These and other studies have clearly detected significant difference in occurrence rates dependent on many factors (U.S. Department of health and Human Services, 1997).

Researchers have reported a wide range of possible contributing risk factors ranging from sex to certain medications. McCormack et al. (1990) studied the prevalence to CTS among 1,579 textile production workers. These textile workers were then compared to 468 other non-office workers. This comparison group included machine workers, transportation workers, cleaners, and sweepers. The textile workers were divided into four broad categories depending on the similarity of upper extremity exertion. The workers were given a comprehensive health assessment questionnaire and underwent a physical examination. While no statistical differences between the groups were found to be significant, the frequency of hand/wrist disorders was more often detected among women (McCormack et al., 1990). This finding is widely accepted by most medical professionals. Pregnancy and/or related fluid changes are known to be associated with these findings (Berkow, 1992).

In another study, the determination of a sex preferential affecting the occurrence of hand/wrist disorders was associated with workplace factors. Schottland et al. (1991) studied male and female poultry workers to determine the

effects of forceful, repetitious hand/wrist motions on the median nerve conduction.

The poultry workers were then compared to job applicants seeking employment in the industry. The utilization of electromyography was employed to determine nerve conduction times. The study's results demonstrate measurable gender preference and reveals a more pronounced median nerve latency among female poultry workers than their male counterparts when compared to the control groups. The study concluded that a significant association existed between highly forceful motions, repetitious work, and delayed nerve conduction times in female poultry workers (Schottland et al., 1991).

Many studies identify multiple workplace factors presumed responsible, at least in part, for hand/wrist disorders. Chaing et al. (1990) studied the impact of repetitious work in a cold environment and its impact on the frequency of hand/wrist disorders. The study involved 207 workers from two frozen food-processing plants. Investigators first studied work-related behaviors and determined the extent of hand/wrist motions and the amount of repetition involved. Also observed and documented were the environmental conditions under which these work-related behaviors transpired. The subjects were divided into three exposure groups. These groups were representative of repetitive work-related behaviors in the presence of cold temperatures. Those subjects performing highly repetitive tasks with the hand and wrist under the influence of cold temperatures were determined to exhibit the highest degree of abnormal clinical findings. This study clearly demonstrated an increase in delayed median nerve conduction. Chaing et al., (1990) concluded that

exposure to cold temperature could increase the likelihood of a hand/wrist disorder when combined with highly repetitious motions (Chaing et al., 1990).

Some researchers have contested that the presence of risk factors only, is not as significant as the exposure rate experienced by workers. Wieslander et al. (1989) using a self-reporting technique via a telephone interview, studied the frequency of hand/wrist disorders related to amount of exposure to several work behaviors including repetition. Work exposures were defined by time in broad categories of less than one year, 1-20 years, and 20 years or greater. The frequency of significant findings increased as two or more risk factors were identified. The study concluded that repetition alone is not a significant risk factor until lengthy exposures have occurred or additional at-risk factors are present (Wieslander et al., 1989).

Not only has workplace behaviors and environmental conditions been found to play a role in the development of hand/wrist problems, but worker behaviors off the job are also thought to be consequential. Baron et al. (1991) studied CTS in 124 grocery clerks and a control group of 157 grocery clerks who were not checkers. The case definition for CTS required the presence of predetermined symptoms disclosed in a standardized questionnaire or evident on physical examination. The study demonstrated an increased frequency of symptoms among the grocery checkers in a model that included such variables as age, sex, hobbies, second jobs, systemic disease, and obesity. Much like the Wieslander et al. (1989) study, exposure times necessary to produce symptoms of hand/wrist disorders were related to other predetermining factors (Baron et al., 1991).

In still another revealing study, multiple factors in a variety of combinations produce significant finding. Osorio et al. (1994) examined 56 supermarket workers. Work behaviors were observed and recorded. Exposure to repetitive and forceful wrist motions were rated as high, moderate, or low. The study concluded that hand/wrist disorders occurred more often among workers with high exposure. Again, the synergistic effect of repetitive motion coupled with an additional modifier, such as forcefulness, proved demonstrative (Osorio et al., 1994).

Studies Related to Hand/Wrist Disorders Among Sign Language Communicators

While no research results were found for the broader population of sign language communicators, limited research has been performed focusing on the specific subgroup of those professionally interpreting for the deaf and the frequency of hand/wrist disorders among this population. Numerous at-risk behaviors can be readily identified when viewed in the content of other occupational specialties. Known at-risk behaviors like repetitious hand/wrist motions and forceful extensions/flexions of the fingers, hands, and wrists are easily observed in sign language communicators. Common workplace practices like finger spelling, exposure rates, comparable keyboarding requirements associated with computers, and telecommunication devices for the deaf (TDD) all potentially impact the individual. Feuerstein et al. (1997) found that actions associated with keyboarding tasks may contribute to the development and severity of hand/wrist disorders (Feuerstein et al., 1997).

While the etiology and physiology of many hand/wrist disorders are well understood, the frequency of the problem in this specific occupational specialty has not been clearly documented (U.S. Department of health and Human Services, 1997). The following studies have indicated the presence of a underlying problem and provide an initial insight into the scope and purpose of this study.

J.D. Stedt (1992) conducted a regional study of 40 educational interpreters attending a Registry of Interpreters for the Deaf conference. The study revealed the vast majority (87.5%) of participants questioned had experienced at least two associated symptoms of repetitive stress injury (RSI). Carpal tunnel syndrome was the most prevalent form of repetitive stress injury reported. The research methodology employed was descriptive. Voluntary participation in a one page, 13 question survey was requested. All respondents were from the southeastern United States and 36 of the 40 (90%) were female. The average age was 35.26 years and the average signing experienced about 17.36 years. Average interpreting experience was 10.51 years. Sample selection was not randomized and all data was self-reported. Because of the limited number of participants (40), Stedt's results cannot be extrapolated to larger population groups. Stedt's finding indicated that 87.5% of the participants reporting positive findings also stated that they knew of an average 4.49 other educational interpreters who had similar complaints (Stedt, 1992).

Another case study conducted by DeCaro et al. (1992) at the Rochester Institute of Technology, in cooperation with the National Technical Institute for the Deaf, evaluated the potential effect of repetitive motion injuries among a group of educational

interpreters. This study included 53 voluntary participants. The methodology of this study involved a self-reporting questionnaire and a medical examination by a occupational medicine physician board certified in physical medicine and rehabilitation. The participants were initially divided into three distinct groups. These groups represented those disabled with pain, those working with pain, and those working without pain. Average age was 29 years and only 8 of the 53 participants were male. Over half the participants (25) were college graduates and 11 of those reported performing graduate work. The resulting information from both physical examination and questionnaires revealed the most common injury associated with educational interpretation was not carpal tunnel syndrome, but another repetitive stress injury - tendinitis. Tendinitis of the wrist is often a precursory of more serious CTDs like carpal tunnel syndrome (DeCaro et al.,1992). This finding is in agreement with previous experimental models evaluated by Cohn, Lowry, and Hart (1990).

Cohn, Lowry, and Hart (1990) examined 80 interpreters at a national center for the deaf. The researchers determined that 14 of the 80 interpreters previously had sought medical care for painful conditions of the upper extremities. According to the researchers, these conditions were reported to be associated with their work and all were representative of "overuse syndrome." All patients were examined by an orthopedist. Objective laboratory findings, including radiographs and blood work, were invariably normal. Determination of cause and diagnoses was based on the patient's subjective complaints and a detailed work history. The most common diagnoses in the study were myofasciitis, tendonitis, epicondylitis. Though

symptomology varied to some extent, many commonalities were found. In 85% of the patients, pain was experienced only in the dominant upper extremity. While both hands are used in signing, the dominant hand usually accomplishes the task of any required finger spellings. No cause-and-effect relationship was found by comparing the actual hours worked signing to the symptoms by the Cohn et al. (1990) study. Physical conditioning and warm-ups had little impact on prevention of pain. Interestingly the Cohn study also identified 11 additional interpreters who had not sought medical attention, but had reportedly experienced upper extremity pain with extended interpreting sessions. This finding indicated that less severe symptoms were reportedly relieved by rest (Cohn, Lowry, and Hart, 1990).

Podhorodecki and Spielholz (1993) investigated the prevalence of repetitive motion injuries among sign language interpreters through the use of electromyography. In this study focusing on correlational research, signers were recruited by letters and flyers from the New York Society for the Deaf, Interpreter and Deaf Registry. The study utilized a written self-reporting questionnaire with personal demographics, a medical and signing history, and a clinical examination with electromyography of the median and ulnar nerves. Thirty-three interpreters were selected from the 37 volunteers willing to participate in the study. The group was composed of 24 hearing interpreters (nonnative signers), six signers that were deaf and had been signing since childhood (native signers), and three interpreters with deaf parents (native signers, but not hearing impaired). Twenty-one age-matched, but not sex-matched, controls who did not sign were solicited to

participate. These controls were matched to the signers in IQ, lifestyles, and hobbies. Clinical evaluations revealed that 16 of the 33 signers (48.5%) reported pain in the upper extremities compared to none in the control group. Interestingly, the 16 interpreters reporting pain were not considered native signers. Further examinations using electromyography revealed that 5 signers exhibited findings suggestive of carpal tunnel syndrome, 3 signers showed findings indicative of mild ulnar neuritis, and 2 signers demonstrated symptoms common to both CTS and ulnar neuritis. Within the control group, 2 individuals had mild electrophysiological abnormalities suggestive of CTS and 2 others demonstrated signs of a mild ulnar neuritis. None of these cases within the control group reported the accompaniment of pain with electrophysiological changes. The conclusions stated in the Podhorodecki study attributed the rising incidence of work-related hand/wrist problems to soft tissue injuries and not nerve entrapments (Podhorodecki and Spielholz, 1993)).

Other publications have focused on the problem of hand/wrist disorders among sign language interpreters. In a monthly publication, *The Registry of Interpreters for the Deaf*, various authors and educators have written numerous articles addressing the problem. One of these authors is Richard N. Norris, M.D., an internationally recognized expert in repetitive motion injuries and Director of the National Rehabilitation Hospital in Bethesda, Maryland. Dr. Norris warns that the rising incidence of hand/wrist disorders among interpreters is intolerable. In his article, "Repetitive Strain Injuries in Sign Language Interpreters," Dr. Norris suggests the need to explore the conflict between the way traditional interpretation is

taught and the biomechanical risk factors that are known to exist (Norris, 1996). In another article of the same publication, author and health care provider, Kate Montgomery, recommends preventive measures and ways to mitigate hand/wrist disorders among signers. Montgomery offers a list of self-care techniques that can be performed to prevent repetitive strain injuries (Montgomery, 1996).

Summary

While several quantitative research models specific to work-related hand/wrist disorders among sign language interpreters were identified, the number of studies and their magnitude was considerably smaller than those reviewed in the general problem. The frequency of work-related hand/wrist in many occupational specialties has been determined, while research initiatives focusing on sign language interpreters were mostly suggestive of an underlying problem (Stedt, 1992 & DeCaro et al., 1992). In general, these studies of sign language users were limited in scope

Study Methodologies Related to Hand/Wrist Disorders

Methodologies used to study the general problem of hand/wrist disorders varied from researcher to researcher. In general, quantitative research approaches were used to investigate relationships and describe current conditions. The three most prevalent types of quantitative research reviewed included the descriptive, casual-comparative, and correlational research models. The experimental model to a

large extent was not feasible and no evidence of its use could be found. Other methodologies involving qualitative research approaches were not identified.

Data collection techniques employed in the review of the general studies regarding the frequency and/or development of hand/wrist disorders can be grouped into three broad categories or a particular combination thereof. The first category involves the gathering of information pertinent to the study through measured observation (Melhorn,1996). Measured observations were made either directly while watching the subjects perform work-related behaviors or indirectly reviewed through the use of video recordings. Another data gathering technique employed was the collection of physical laboratory data. Physicians, healthcare providers and other allied researchers made physical data measurements. Examples of this type of methodology ranged from simple physical examinations and collection of blood and urine specimens to elaborate procedures such as electromyography and radiography (Podhorodecki and Spielholz, 1993). For objective physical findings, nerve conduction studies were valued as the standard (Katims et al., 1991).

The third data gathering technique was self-reporting (Stedt,1992). With this technique, participants were asked a series of questions to which they responded. The questions either written in the form of a survey or questionnaire or expressed verbally through direct conversation, provided the data for the study. Most of the general studies reviewed used a combination of the above mentioned methodologies and all demonstrated at least one element of self- reporting (Tanaka et al.,1997).

Study Methodologies Related to Hand/Wrist Disorders Among Sign Language Communicators

Within the specific problem area, those research methodologies involving sign language interpreters mimicked those employed in the general problem of hand/wrist disorders. The quantitative research approach was employed in all cases. Most researchers administered a combination of data gathering techniques to elicit responses. The two most common techniques involved the use of a self-reporting questionnaire and/or physical examination by a professional healthcare provider. This type of research approach and data gathering technique has repeatedly been demonstrated in other studies (Tanaka et al., 1995).

While previous research on hand/wrist disorders involving interpreters and sign language communicators is limited to small samples, several assessment models, specific for that population, can be found. The first such example involves the study by Stedt (1992). Joe Stedt (1992) utilized a 13-question survey developed to indicate the presence of repetitive stress injuries due to work-related exposures. Participation in Stedt's self-reporting questionnaire was limited to the conference attendees and total responses returned for evaluation was only 40. Stedt's primary focus in the questionnaire dealt with the presence of CTDs related symptoms and the health impact of these symptoms (Stedt, 1992).

In the DeCaro et al. study (1992) a questionnaire and medical examination was used to implement their study of repetitive stress injuries among 42 sign language interpreters. DeCaro's questionnaire involved medical history, pain, work-

related behaviors, work environment, and the individual's perception of the job. The study found the most common CTD in this group to be wrist tendonitis (DeCaro et al., 1992).

Summary

Sign language is the fourth most common language in the United States. Interpreters provide services to over 16 million hearing impaired individuals. As an occupational specialty, the field of sign language interpretation is relatively small and has the appearance of a safe, secure workplace - free of obvious hazards. Consequently, widespread examination of work practices involving sign language interpreters and their associated health effects have been minimal. Conversely, exposure to repetitive motion injuries in other occupational professions has grown exponential throughout the last two decades (Lynch & Rodriguez, 1992). Occupational risks associated with use of sign language and the art of sign interpretation are just recently being explored. Currently, the most self-reported occupational risk associated with sign language appears to be a series of upper extremity disorders involving repetitive hand and wrist motions, commonly described as repetitive stress injuries or cumulative trauma disorders (Stedt, 1992, DeCaro et al., 1992). While much information is known about CTDs (Montgomery, 1996), little research has been conducted among the signing population with the exception of professional interpreters. This review of related literature has provided

some preliminary information regarding the general nature of the problem and subsequently, to the specific contents applicable to sign language communicators.

Further discussion will continue in Chapter III as to the methodology data gathering techniques employed in this study.

CHAPTER III

METHODOLOGY AND DESIGN

Introduction

The primary focus of this study was to determine baseline data related to the development of hand/wrist disorders among sign language communicators. The secondary purpose of this self-reporting study was to identify work-related behaviors, health, and demographic characteristics associated with those sign language communicators who self-report hand/wrist problems. Described in this chapter is the methodology and design employed by this study. This chapter further describes the study population, the instrument (a self-reporting questionnaire), its development, the collection method and the analyses of the data used in this study.

The Study Population

The target population of this study was delimited to those individuals who had previously attended the 1998 PEPNet (Postsecondary Education Program Net) Conference, April 29-May 2, 1998 in Orlando, Florida. Permission to mail the questionnaire to those who had attended the PEPNet Conference was obtained from the Postsecondary Education Consortium Planning Committee. A three-page, self-reporting questionnaire was developed and mailed along with an enclosed prepaid return envelope to 397 former attendees of the PEPNet Conference. An introductory letter signed by the Director of the University of Tennessee Center on Deafness accompanied the three-page

questionnaire. In this letter, the Director encouraged the former attendees to complete the questionnaire and voiced his support of the research endeavor.

The PEPNet Conference attendees included professional educators, interpreters, administrators, counselors, and support services staff from across the United States and Canada. These educators met in an effort to enhance the quality of post secondary educational opportunities for students with hearing deficits. The PEPNet Conference provided an unique opportunity for professionals to interact with their colleagues and learn more about the best practices and effective strategies for meeting the needs of the post secondary level students who are deaf and/or hard of hearing. The attendance at the conference included 413 registered participants. Only 397 participants had addressable mailing information. Sixteen workers at the conference were registered by name and title only. No mailing information was included on the registration list regarding these sixteen workers and no further attempt was made to contact them. Geographical regions were defined across the continental United States and included Hawaii, Puerto Rico, and Canada. All of the 397 former conference participants receiving the questionnaire were assigned to a specific geographic region depending on their mailing address. There were six geographical regions established. All but nine of the 397 attendees fell into the six geographical regions. These nine attendees were from areas outside the continental United States. The majority of attendees (43%) were from the southeast region, followed by the northeast (21%), the north central (14%), the southwest (10%), the south central (9%), and the northwest (1%). Table III-1. depicts the geographical origins of the 397 PEPNet attendees who were sent questionnaires.

Table III-1. Geographical Origins By Region Of 397 Pepnet Attendees		
NORTHWEST Nebraska, South Dakota, North Dakota, Wyoming, Montana, Idaho, Oregon, Washington, Alaska	NORTH CENTRAL Ohio, Indiana, Illinois Michigan, Wisconsin, Iowa, Minnesota	NORTHEAST Maine, New Hampshire, New York, Maryland, Vermont Connecticut, New Jersey, Rhode Island, Delaware Massachusetts, Pennsylvania, Washington, DC
6 Attendees	56 Attendees	82 Attendees
SOUTH WEST California, Arizona, Utah, Colorado, New Mexico, Nevada	SOUTH CENTRAL Texas, Arkansas, Oklahoma, Kansas, Missouri, Louisiana	SOUTHEAST Kentucky, West Virginia, Virginia, Mississippi, Tennessee, Alabama, Georgia, North Carolina, South Carolina, Florida
38 Attendees	35 Attendees	171 Attendees
CANADA	PUERTO RICO	HAWAII
2 Attendees	6 Attendees	1 Attendee

Additional social and demographic data reflecting the specific make-up of the attendees will be discussed further in Chapters IV and V of this report.

Instrumentation

The instrument used to collect data from the attendees was a three-page questionnaire (See Appendix). A request for exemption from the University of Tennessee Institutional Review Board (IRB) was submitted and approval granted. The research instrument (a three-page, self-reporting questionnaire) consisted of 34 questions. Of these questions, 30 were multiple choice and 4 were short answer. The multiple-choice questions utilized a variety of measurable responses. These measurable responses

were constructed using time, frequency, and descriptive standards. The standards were then value weighted. The short answer questions were opinion based, and allowed the respondent to provide his/hers rationale for a specific response.

The questionnaire employed in this study was initially developed by Dr. Tyler Kress to gather data on hand/wrist disorders from industrial jobs. This questionnaire was subsequently modified by Dr. S. Smith and Dr. T. Kress to target the particular task undertaken by those who use sign language. This revised instrument was then reviewed for validity by a panel of experts and field tested at the 24th Institute on Deafness & Rehabilitation held in Tampa, Florida in October 1997. Following the analysis of the specific responses from the returned pilot in Tampa, the questionnaire was further modified to improve validity.

In March 1998, a test/retest procedure was used to assure reliability of the questionnaire. The test/retest procedure was conducted before and at the end of a four-week period. The analysis of the test/retest focused on 30 of the 34 questions on the questionnaire. The resulting coefficient of stability was .93 with variation occurring only in questions #6, #20, and #21. Questions #7, #8, #9, #11, and #12, were indicative of an associated hand/wrist disorder and were viewed as critically important in the evaluation of the reliability of this self-reporting questionnaire. Question #7 and #8 asked about the presence of a hand/wrist problem and the impact such a problem had on the individual's ability to work. Question #9 asked the individual to describe hand/wrist related symptoms and questions #11 and #12 dealt with the acknowledgment of a medical diagnosis of carpal tunnel syndrome or tendonitis of the wrist. No deviations were

detectable in these critical questions and responses. The resulting reliability coefficient of 1.0 was representative of these questions in the test/retest evaluation.

Questions 24 through 34 evaluated the demographic characteristics of the respondents. These demographic characteristics included age, education, gender, and ethnicity. Additionally, social and physical characteristics reported included height, weight, pre-existing medical conditions, medication usage, and the indication of the dominant hand. Several of these physical characteristics were described as predisposing factors by Silverstein et al. (1987). These predisposing conditions include non-occupational factors associated with the development of hand/wrist disorders. These factors such as diuretic medications and other pre-existing medical conditions were incorporated into a battery of responses in questions #6, #19, and #24.

Management of Data

Completed questionnaires were returned by mail between June 15 and September 25, 1998. Each returned questionnaire was numbered and secured in a three-ring binder. Data from each questionnaire was coded into 79 variable data points per questionnaire using SPSS computer program. There were no identifying codes on the individual questionnaires and the order of entry was random.

Fifty four percent or 215 of the 397 questionnaires mailed out were completed and returned. Initial screening revealed a total of 31 of the 215 questionnaires returned, were completed by PEPNet attendees who did not use sign language. The data from the 31

individuals who did not use sign language were separated prior to tabulation and analysis. Only the 184 individuals reporting the use of sign language were included for analysis.

Statistical Analysis

SPSS Suite 8.0 software was used to perform the statistical computations. All 184 questionnaires involving sign language communicators were evaluated. Frequencies were reported in raw actual numbers and percentages. Along with the actual count was an expected count, standard residual, and an adjusted residual. An adjusted residual of more than +2.0 is considered significant. Chi-square analysis was performed where appropriate to demonstrate levels of significant differences using a .05 level of significance.

Questions #1 and #2 focused at the defining the occupational specialty (job) of the sign language communicator completing the questionnaire. In particular, these two questions established the subgroups later used to compare data. The self-reported data by each of the three groupings (job) was then evaluated with a common expectation of incidence frequency and facilitated Chi-square testing for significant differences.

Measures of central tendency were used in some questions to measure group responses and were reported as the appropriate mean, mode, or median expression. Questions #3, #4, and #5 were employed to quantify the presence of work-related behaviors known to be associated with the development of hand/wrist disorders. Examples of these behaviors included time spent signing, keyboarding or communicating with a TDD. While a range of categories expressing time estimates was offered to the

attendee completing the questionnaire, a mean calculation was used in the actual time analysis. Measures of variability were expressed using the range of responses.

Summary

This chapter outlined the methodology used in this study. Sign language communicators attending the PEPNet Conference in Orlando, Florida received a three-page, self-reporting questionnaire by mail with prepaid return postage. The attendees would voluntarily complete and return the questionnaire by mail without any identifying marks. The self-reporting questionnaire included social, demographic and occupational sections describing the various characteristics of the respondents. The social section of the questionnaire revolved around physical and medical concerns. The demographic section looked at education, ethnicity, age and sex. The occupational section focused on work related behaviors. The questionnaires were tallied and entered in the SPSS Suite 8.0 statistical program for analysis. The results of this analysis will be discussed in Chapter IV.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

Introduction

This study examined the frequency of hand/wrist disorders among sign language communicators and served to further expand existing baseline data regarding the work-related behavior of sign language communicators reporting hand/wrist disorders. This chapter presents the analysis and interpretation of the data provided by 184 sign language communicators completing a self-reporting, three-page questionnaire.

In the analysis of this data, the results will include a description of initial findings related to demographic, social and occupational characteristics of the respondents. These characteristics will be expressed using descriptive statistics. Demographic characteristics include age, sex, hand preference, and location of residence, ethnicity and education. Social characteristics include self-reported health status, pre-existing medical conditions, medication usage, and smoking habits. Occupational characteristics include a description of job categories, amount of time spent signing, and amount time spent using a TDD and keyboarding. Occupational characteristics also include work-related behaviors experienced as a result of the job. These work-related behaviors include repetition, extreme hand positions, use of vibrating tools, cold temperatures, and palm pressure/force.

Selective comparisons within three of the subgroups (professional interpreters, administrator/managers, and educator/trainers) of this population are performed with Chi-square testing at a level of significance of .05. The frequency of self-reported hand/wrist

disorders of medically diagnosed carpal tunnel syndrome or wrist tendonitis and the one or more related hand/wrist symptoms was reported. Initial data analysis was presented in this chapter and then conclusions discussed in Chapter V.

Demographic Characteristic of Sign Language Communicators

Completing the Questionnaire

Of the 397 questionnaires mailed to former PEPNet Conference attendees, 215 questionnaires (54%) were completed and return. Initial evaluation of the questionnaires, revealed 31 individuals completing the questionnaires did not use sign language. These 31 questionnaires were eliminate from the statistic data and were not used in the analysis. The total number of completed, self-reporting questionnaires involving sign language communicators evaluated in this study numbered 184.

The population of those former PEPNet attendees completing the questionnaire was predominantly white, middle age, college-educated females (80%).

Participants were asked to indicate their dominant hand (See questionnaire, Appendix A). Results indicate 164 (89.1%) respondents reported being right-handed, 14 left-handed and 5 ambidextrous. One respondent failed to answer.

The respondents were asked to self-report their sex. Results indicate 148 (80.3%) females completed the questionnaire. Males respondents numbered 33 (18%). Three questionnaires were completed without an indication of sex.

Each respondent was asked to indicate his /her age by choosing an appropriate age group. Results indicate 82 (44%) respondents completing the questionnaire, reported

being between 40-49 years, 39 (21%) reported being between the years of 30-39, 34 (18%) reported being between the years of 50-59, and 24 (13%) respondents reported being between 20-29 years of age. Four individuals reported being between 60-69 years of age and one person reported being over 69 years of age. One respondent refused to disclose age, claiming a personal preference. See Table IV-1.

Participants were asked to self-report their height and weight. Three respondents failed to report height and six respondents did not indicate weight. See Tables IV-2 and IV-3.

Participants were asked to report his/her ethnicity. Results indicate 165 (90%) reporting Caucasian, 6 (4%) reporting African-American heritage, 7 (4%) Hispanic origins, and 1 (0.5%) Asian Pacific Islanders. One individual wrote-in an ethnic origin not listed and three individuals failed to answer the question. See Table IV-4.

Participants were asked to indicate his/ her level of completed formal education. Respondents completing the questionnaires were predominantly college graduates (79%), with 47 (26%) respondents reporting BS or BA degrees and 99 (53%) reporting graduated degrees. Fourteen (8%) reported 3-4 years of college and 19 (10%) respondents reported completing 1-2 years of college. Of the remaining participants, two reported technical school training above high school and two reported their highest education level as high school or GED. One individual failed to answer the question.

Table IV-1. Self-Reported Age In Years And Sex Of Respondents Completing Questionnaire

N=181	20-29 Years	30-39 Years	40-49 Years	50-59 Years	Over 60
Male N=33	3	4	14	9	3
Female N=148	21	35	68	23	1

Table IV-2. Self-Reported Height By Sex Of Respondents Completing Questionnaire

N=181	> 5 foot	5'0``thru 5'3``	5'3``thru 5'6``	5'6``thru 5'9``	5'9``thru 6'0``	6'0``thru 6'3``	> 6'3``
Male	0	0	0	6	17	8	2
Female	5	39	53	17	5	1	0

Table IV-3. Self-Reported Weight By Sex Of Respondents Completing Questionnaire

Weight	Male N=33	Female 145	Weight	Male	Female
Under 100 lbs.	0	1	171-180 lbs.	6	8
101-110 lbs.	0	10	181-190 lbs.	2	8
111-120 lbs.	0	10	191-200 lbs.	4	1
121-130 lbs.	0	19	201-210 lbs.	2	9
131-140 lbs.	0	17	211-220 lbs.	0	3
141-150 lbs.	2	18	221-250 lbs.	6	11
151-160 lbs.	2	15	Over 250 lbs.	3	4
161-170 lbs.	6	11			

Table IV-4. Self-Reported Ethnicity And Sex Of Respondents Completing Questionnaire

N=180	Caucasion	African- American	Hispanic Origin	Asian Pacific Islander	Other
Male N=33	31	1	1	0	0
Female N=147	134	5	6	1	1

Health Characteristics of Sign Language Communicators

Each respondent was asked to self-report his/her own health status. The majority of respondents self-reported an above average health status with relatively few diseases and/or preexisting medical conditions with the exception of hand/wrist disorders.

Each respondent rated his/her over-all health status. The respondents self-reported good-to-excellent health status with 76 (42%) reporting good and 81 (44%) reporting excellent. Only 22 (12%) reported his/her health status as average and 3 (2%) individuals stated their health as fair. Two individuals failed to respond to the question.

Respondents were asked if they smoked and if so, how much. Non-smokers accounted for 168 responses (91.3%), while 15 respondents reported smoking. The amount smoking reported by those smokers averaged less than a pack/day.

Participants were asked to mark any routine medications taken on a predetermined list. Vitamins and birth control pills were the most commonly marked medication on the list followed by antidepressants and diuretics. One individual reported taking medication for tuberculosis. See Table IV-5.

Participants were asked to self-report any of a list of pre-existing medical conditions. Neck problems and depression were the most common medical conditions reported followed by hypothyroidism and wrist ganglions. Other pre-existing medical conditions not on the list were not noted. Table IV-6 summarizes these results.

Participants were asked to self-report signs/symptoms indicative of hand/wrist disorders. Tingling, cramping, stiffness, and numbness were most often reported followed by loss of grip and swelling. See Table IV-7.

Table IV-5. Use Of Routine Medication By Sign Language Communicators			
MEDICATION	RESPONDENTS	MEDICATION	RESPONDENTS
Vitamins (B&C)	57 (31%)	Tuberculosis Drugs	1 (0.5%)
Birth Control Pills	24 (13.1%)	Sulfonamides	0
Antidepressants	17 (9.3%)	Theophylline	0
Diuretics	3 (1.6%)	Dilantin	0

Table IV-6. Pre-Existing Medical Conditions Among Sign Language Communicators			
MEDICAL CONDITION	RESPONDENTS	MEDICAL CONDITION	RESPONDENTS
Diabetes	5 (2.7%)	Wrist Ganglion	12 (7.1%)
Gout	3 (1.6%)	Hand/Wrist Fractures	8 (4.4%)
Depression	18 (9.8%)	Hypertension	8 (4.4%)
Neck Problems	22 (12%)	Raynaud's Disease	1 (0.5%)
Hypothyroidism	13 (7.1)	Kidney disease	3 (1.6%)
Osteoarthritis	8 (4.4%)	Lupus/Rheumatism	3 (1.6%)

Table IV-7. Symptoms Frequently Reported With Hand/Wrist Disorders Among Sign Language Communicators			
Symptoms	Respondents	Symptoms	Respondents
Numbness	47	Burning	17
Numbness interrupting sleep	29	Dropping of objects	14
Tingling	56	Cramping	49
Stiffness	48	Loss of color	3
Swelling	34	Loss of grip	38

Respondents were asked to self-report if they had experienced a hand/wrist problem. Results indicate 107 (59%) respondents reported to have experienced a hand/wrist problem. There was a significant difference between the number of females self-reporting hand/wrist problems and males at the .05 level of significance. Ninety-three of 146 females (64%) reported a problem while only 14 of 33 (42%) males reported similar problems. Chi-square testing resulted in a p value of 0.024. See Table IV-8.

Forty-three respondents reported seeking medical treatment for hand/wrist disorders. Women were significantly more likely to seek medical assistance at the .05 level of significance than men. Of those women self-reporting a hand/wrist problem, 42 out 146 (29%) sought medical treatment, where as only 1 in 14 (7%) men sought medical help. Chi-square testing resulted in p value of 0.006. See Table IV-9.

Respondents were asked to self-report if they had experienced hand/wrist problems significant enough to limit their ability to work. Forty-eight of the 113 respondents reported their hand/wrist problem severe enough to limit his/her ability to work. There was no significant difference between men and women reporting hand/wrist problem that limited his/her ability to work at the .05 level of significance. Seven of 17 males (41%) and 41 of 96 females (43%) reported a hand/wrist problem that limited their ability to work. Chi-square testing resulted in a p value of 0.906. See Table IV-10.

Respondents were also asked if they associated their hand/wrist problem with the onset of menopause or pregnancy. Six respondents self-reporting hand/wrist problems associated the disorder with menopause, only two associated the problem with pregnancy.

Table IV-8. Reported Hand/Wrist Disorders Among Sign Language Communicators

Have you experienced any hand/wrist problems		Male	Female	Total
YES	Count	14	93	107
	Expected Count	19.7	87.3	107.0
	Std. Residual	-1.3	.6	
	Adj. Residual	-2.3	2.3	
NO	Count	19	53	72
	Expected Count	13.3	58.7	72.0
	Std. Residual	1.6	-.7	
	Adj. Residual	2.3	-2.3	
Total	Count	33	146	179
	Expected	33.0	146.0	179.0
Pearson Chi-Square 5.067* (df=1) p=0.024				

*0 cells have expected count less than 5. The minimum expected count is 13.27.

Table IV-9. Reported Hand/Wrist Disorders And Medical Treatment Among Sign Language Communicators By Sex

Have you received medical treatment for hand/wrist problems		Male	Female	Total
YES	Count	1	42	43
	Expected Count	5.9	37.1	43.0
	Std. Residual	-2.0	.8	
	Adj. Residual	-2.8	2.8	
NO	Count	14	53	67
	Expected Count	9.1	57.9	67.0
	Std. Residual	1.6	-.6	
	Adj. Residual	2.8	-2.8	
Total	Count	15	95	110
	Expected	15.0	95.0	110.0
Pearson Chi-Square 7.669* (df=1) p=0.006				

*0 cells have expected count less than 5. The minimum expected count is 5.86.

Table IV-10. Hand/Wrist Problems Limiting Ability To Work By Sex

Have you experienced any hand/wrist problems limiting your ability to work		Male	Female	Total
YES	Count	7	41	48
	Expected Count	7.2	40.8	48.0
	Std. Residual	-.1	.0	
	Adj. Residual	-.1	.1	
NO	Count	10	55	65
	Expected Count	9.8	55.2	65.0
	Std. Residual	.1	.0	
	Adj. Residual	.1	-.1	
Total	Count	17	96	113
	Expected	17.0	96.0	113.0
Pearson Chi Square 0.014 (df=1) p =0.906				

*0 cells have expected count less than 5. The minimum expected count is 7.22.

Occupational Characteristics of Sign Language Communicators

Work and work-related behaviors were examined. Respondents were asked to report their job and estimate the amount of time spent using sign language, telecommunication devices for the deaf (TDD) and keyboarding. Job descriptions of educator/trainer and professional interpreter self-reported an average of 31.5 hours weekly using sign language. Administrator/managers and service support staff self-reported using sign language an average of 26 hours weekly. Other occupational specialties reported a range of sign language use from 5-22 hours weekly. Average values reported were derived using a singular hour value for each of the seven categories. See Table IV-11.

The categories were constructed by taking the mean value for each increment of time reported. This averaging to achieve a singular numeric value is demonstrated for all categories: 1-5 hours = 2.5 hours, 5-10 hours = 7.5 hours, 10-20 hours = 15 hours, 20-30 hours = 25 hours, 30-40 hours = 35 hours, 50-60 hours = 55 hours and hours greater than 60 = 60 hours. Each value was multiplied by the number of respondents indicating that category to obtain a total amount of time for that category. This numerical value was then divided by the total respondents in that occupational specialty and the quotient derived represented an over-all average time for the occupational specialty.

TDD usage between occupational specialty ranged between 2-4 hours weekly. Educator/trainers averaged 3.1 hours weekly, professional interpreters average of 2.2 hours weekly, and administrator/managers self-reported 3.3 hours weekly. The average number of hours spent using a TDD is presented in Table IV-12.

Table IV-11. Hours Reported Using Sign Language By Occupational Specialty								
Occupational Specialty of 184 Sign Language User	1-5 Hrs.	5-10 Hrs.	10-20 Hrs.	20-30 Hrs.	30-40 Hrs.	50-60 Hrs.	> 60 Hrs.	Avg. Hrs.
Professional Interpreters 56 (30.6%)	0	1	9	17	23	5	1	31
Administrator/Manager 45 (24.6%)	6	9	9	7	3	4	7	26
Educator/Trainer 35 (19.1%)	2	2	5	8	10	5	3	32
Counselor/Social Worker 19 (10.4%)	4	4	2	3	2	3	1	22
Service Support Staff 17 (9.3%)	4	1	2	4	3	0	3	26
Clerical/Secretarial 3 (1.6%)	2	0	1	0	0	0	0	7
House Parent 2 (1.1%)	1	0	0	1	0	0	0	14
Maintenance 1 (0.5%)	0	1	0	0	0	0	0	5
Other 6 (4.9%)	1	1	2	1	0	1	0	20

Table IV.12. Hours Reported Using TDDs By Occupational Specialty								
Occupational Specialty of 184 Sign Language User	None	0-1 Hrs.	1-2 Hrs.	3-4 Hrs.	5-6 Hrs.	6-8 Hrs.	> 8 Hrs.	Avg. Hrs.
Professional Interpreters 56 (30.6%)	3	17	19	9	2	3	3	2.2
Administrator/Manager 45 (24.6%)	0	13	13	4	3	6	6	3.3
Educator/Trainer 35 (19.1%)	0	12	7	7	1	3	5	3.1
Counselor/Social Worker 19 (10.4%)	1	5	2	3	2	4	2	3.6
Service Support Staff 17 (9.3%)	1	8	2	2	2	1	1	2.4
Clerical/Secretarial 3 (1.6%)	0	0	0	2	1	0	0	4.1
House Parent 2 (1.1%)	0	1	0	1	0	0	0	2.0
Maintenance 1 (0.5%)	0	1	0	0	0	0	0	0.5
Other 6 (4.9%)	0	2	2	1			1	2.6

Self-reported hours using a keyboard ranged between 7.5-20 hours per week. Job descriptions involving clerical/secretarial skills reported the highest average keyboarding usage time at 20 hours per week. Administrator/managers and educator/trainers followed with an average weekly keyboarding time reported at 13.5 hours. Counselor/social workers reported using a keyboard 10.3 hours per week and professional interpreters averaged 7.4 hours per week. Response averaging as previously described was used to convert hour categories into singular values. See Table IV-13.

Work-related risk factors which occur in the course of a job were self-reported by respondents. The most prevalent work-related conditions reported by sign language communicators was repetitive motions of the hand/fingers and extreme hand positions. The uncommon conditions experienced on the job involved vibrating tool usage and the presence of cold temperatures less than 32 degrees Fahrenheit. Reported at-risk work-related factors are included in Table IV-14.

Respondents were asked to self-report hand/wrist problems associated with periods of sign language usage, particularly those work periods involving interpretation. Sixty four of the 108 respondents self-reporting hand/wrist problems associated the occurrence of his/her hand/wrist problem with periods of sign language communications and 40 (62.5%) of the 64 respondents reported these periods occurred while interpreting. As for the duration of the work period, only 11(17%) respondents associated the occurrence of hand/wrist problems after an hour of sign language use, while 46 (72%) of the respondents associated the occurrence after three hours of signing without a rest period. See Table IV-15.

Table IV-13. Hours Reported Keyboarding By Occupational Specialty								
Occupational Specialty of 184 Sign Language User	None	0-1 Hrs.	1-2 Hrs.	3-4 Hrs.	5-10 Hrs.	11-20 Hrs.	> 20 Hrs.	Avg. Hrs.
Professional Interpreters 56 (30.6%)	2	2	11	9	17	12	3	7.4
Administrator/Manager 45 (24.6%)	1	0	1	4	9	13	17	13.7
Educator/Trainer 35 (19.1%)	0	1	3	1	8	9	13	13.2
Counselor/Social Worker 19 (10.4%)	0	0	3	1	7	5	3	10.3
Service Support Staff 17 (9.3%)	0	0	0	1	4	7	5	14.0
Clerical/Secretarial 3 (1.6%)	0	0	0	0	0	0	3	20.0
House Parent 2 (1.1%)	0	0	0	0	2	0	0	7.5
Maintenance 1 (0.5%)	0	0	0	0	0	0	1	20
Other 6 (4.9%)	2	0	0	0	1	0	3	11.3

Table IV-14. Risk Factors Experienced On The Job					
184 Sign Language Communicators	Seldom	Sometimes	Often	Constantly	Total Respondents
Repetitive motions	15	24	60	70	172
Extreme hand positions	65	53	32	4	154
Gripping objects	63	51	35	2	151
Force/pressure on palm	90	43	14	1	148
Vibration from tools	132	13	2	0	147
Cold temperatures	113	28	3	1	145

Table IV-15. Lengths Of Sign Language Communication Periods Without A Break In Which Hand/Wrist Problems Were Associated						
Time Spent Signing in Hours without a Break						
N=30	1 Hour	1-2 Hours	2-3 Hours	3-4 Hours	4-5 Hours	5 Hours or more
Respondents	11	18	17	7	6	5

The frequency of hand/wrist problems reported among professional interpreters, administrator/managers, and educator/trainers was examined. No significant difference was found in reporting hand/wrist problems between professional interpreters, administrator/managers, and educator/trainers with a p value of .509 and a .05 level of significance. See Table IV-16.

The frequency of hand/wrist problems severe enough to limit the ability to work among three occupational specialty subgroups (professional interpreters, administrator/managers, and educator/trainers) was examined. No significant difference was found in reporting hand/wrist problems that limited the ability to work among professional interpreters, administrator/managers, and educator/trainers with a p value of .354 and a .05 level of significance. See Table IV-17.

A comparison of three subgroups by occupational specialty was done to determine if the number of hours of sign language communications, TDD usage and keyboarding were a factor in the reporting of hand/wrist problems. Table IV-18 represents a consolidated report on work-related behaviors (keyboarding, TDD usage, signing) and the frequency at which each occupational subgroup self-reported hand/wrist problems.

A comparison of professional interpreters, administrator/managers, and educator/trainers the frequency of medically diagnosed wrist tendonitis was examined. The frequency of medically diagnosed wrist tendonitis among the subgroups was not found significant with a p value of .261 at a .05 level of significance. See Table IV-19.

Table IV-16. Frequency Of Hand/Wrist Problems By Occupational Specialty Subgroups						
Have you experienced any hand/wrist problems		Professional Interpreters	Educator Trainer	Administrator Manager	All Other	Total
YES	Count	38	19	27	24	108
	Expected Count	33.8	20.8	26.7	26.7	108.0
	Std. Residual	.7	-.4	.1	-.5	
	Adj. Residual	1.4	-.7	.1	-.9	
NO	Count	19	16	18	21	74
	Expected Count	23.2	14.2	18.3	18.3	74.0
	Std. Residual	-.9	.5	-.1	.6	
	Adj. Residual	-1.4	.7	-.1	.9	
Total	Count	57	35	45	45	182
	Expected	57.0	35.0	45.0	45.0	182.0
Pearson Chi-Square 2.320* (df=3) p=0.509						

*0 cells have expected count less than 5. The minimum expected count is 14.23.

Table IV-17. Frequency Of Hand/Wrist Problems Limiting Work By Occupational Specialty Subgroups						
Did your any hand/wrist problems limit your ability to work		Professional Interpreters	Educator Trainer	Administrator Manager	All Other	Total
YES	Count	19	7	14	9	49
	Expected Count	16.8	8.6	11.6	12.0	49.0
	Std. Residual	.5	-.5	.7	-.9	
	Adj. Residual	.9	-.8	1.1	-1.9	
NO	Count	20	13	19	19	65
	Expected Count	22.2	11.4	16.	16.0	65.0
	Std. Residual	-.5	.5	-.6	.8	
	Adj. Residual	-.9	.8	-1.1	1.3	
Total	Count	39	20	27.	28	114
	Expected	39.0	20.0	27.0	28.0	114.0
Pearson Chi-Square 3.253* (df=3) p=0.354						

*0 cells have expected count less than 5. The minimum expected count is 8.60.

Table IV-18. Listing Of Occupational Specialties, Exposures Times Of Work-Related Behaviors, And Frequency Of Self-Reported Hand/Wrist Problems					
Occupational Specialty	Keyboarding Hours	TDD Hours	Signing Hours	Total Hours	Frequency of Hand/Wrist Problem
Professional Interpreters N=56	7.4	2.2	31	40.6	38 (67.8%)
Administrator Managers N=45	13.7	3.3	26	43.0	27 (60.0%)
Educator/Trainers N=35	13.2	3.1	32	48.3	19 (54.3%)

Table IV-19. Listing Of Occupational Specialties And The Frequency Of Self-Reporting Medically Diagnosed Wrist Tendonitis						
Have you been medically diagnosed with wrist tendonitis		Professional Interpreters	Educator Trainer	Administrator Manager	All Other	Total
YES	Count	9	1	6	3	19
	Expected Count	6.7	3.4	4.6	4.3	19.0
	Std. Residual	.9	-1.3	.6	-.6	
	Adj. Residual	1.2	-1.6	.8	-.8	
NO	Count	30	19	21	22	65
	Expected Count	32.3	16.6	22.4	20.7	65.0
	Std. Residual	-.4	.6	-.3	.3	
	Adj. Residual	-1.2	1.6	-.8	.8	
Total	Count	39	20	27.	25	111
	Expected	39.0	20.0	27.0	25.0	111.0
Pearson Chi-square 4.004* (df3) p= 0.261						

*3 cells (37.5%) have expected counts less than 5. The minimum expected count is 3.42.

In another detailed comparison of the three subgroups, the frequency of medically diagnosed carpal tunnel syndrome was examined. The frequency of medically diagnosed carpal tunnel syndrome among the subgroups was not found significant with a p value of .910 at a .05 level of significance. See Tables IV-20.

Signs/symptoms indicative of hand/wrist problems were examined. Eighty-five respondents reported their hand/wrist problems in terms of specific symptoms. There was no significant difference in the number of signs/symptoms between males and female with a p value of .346 at a .05 level of significance. Symptoms of tingling, cramping, stiffness, and numbness were most often reported followed by loss of grip and swelling. See Table IV-21.

In a more detailed examination of occupational specialties, professional interpreters, administrator/managers, and educator/trainers were investigated. The results found 26 (46%) professional interpreters, 20 (46%) administrative/managers, and 19 (54%) educator trainers self-reported one or more signs/symptoms indicative of hand/wrist disorders. No significant difference was seen at the .05 level of significance. See Table IV-22.

Participants were asked to report the number of sign language communicators they knew with hand/wrist problems. Over 90% of the sign language communicators surveyed self-reported knowing one or more sign language communicator with hand/wrist problems. See Table IV-23.

Table IV-20. Listing Of Occupational Specialties And The Frequency Of Self-Reporting Medically Diagnosed Carpal Tunnel Syndrome

Have you been medically diagnosed with carpal tunnel syndrome		Professional Interpreters	Educator Trainer	Administrator Manager	All Other	Total
YES	Count	4	3	3	4	14
	Expected Count	4.9	2.5	3.4	3.3	14.0
	Std. Residual	-.4	.3	-.2	.4	
	Adj. Residual	-.5	.4	-.3	.5	
NO	Count	35	17	24	22	98
	Expected Count	34.1	17.5	23.6	22.8	98.0
	Std. Residual	.1	-.1	.1	-.2	
	Adj. Residual	.5	-.4	.3	-.5	
Total	Count	39	20	27.	26	112
	Expected	39.0	20.0	27.0	26.0	112.0
Pearson Chi-square .539* (df3) p= 0.910						

*4 cells (50%) have expected counts less than 5. The minimum expected count is 2.50.

Table IV-21. Reported Number of Signs/Symptoms By Sex

Number of signs/symptoms		Male	Female	Total
None	Count	17	77	94
	Expected Count	17.1	76.9	94.0
	Std. Residual	.0	.0	
	Adj. Residual	-.1	.1	
1-2	Count	14	63	77
	Expected Count	14.0	63.0	77.0
	Std. Residual	.0	.0	
	Adj. Residual	.0	.0	
3-4	Count	2	7	9
	Expected Count	1.6	7.4	9.0
	Std. Residual	.3	-.1	
	Adj. Residual	.3	-.3	
5 or more	Count	0	1	1
	Expected Count	.2	.8	1.0
	Std. Residual	-.4	.2	
	Adj. Residual	-.5	.5	
Total	Count	33	148	181
	Expected	33.0	148.0	181.0
Pearson Chi Square 0.321 (df=3) p =0.956				

*3 cells (37.5%) have expected count less than 5. The minimum expected count is 18.

Table IV-22. Listing Of Occupational Specialties And The Self-Reporting Signs/Symptoms Indicative of Hand/Wrist Disorders

Number of Signs/Symptoms		Professional Interpreters	Educator Trainer	Administrator Manager	All Other	Total
None	Count	31	16	25	23	95
	Expected Count	29.4	18.1	23.2	24.3	95.0
	Std. Residual	.3	-.5	.4	-.3	
	Adj. Residual	.5	-.8	.6	-.4	
1-2	Count	23	16	16	24	79
	Expected Count	24.5	15.0	19.3	20.2	79.0
	Std. Residual	-.3	.3	-.8	.9	
	Adj. Residual	-.5	.4	-1.2	1.3	
3-4	Count	3	2	4	0	9
	Expected Count	2.8	1.7	2.2	23	9.0
	Std. Residual	.1	.2	1.2	-1.5	
	Adj. Residual	.2	.3	1.4	-1.8	
5 or More	Count	0	1	0	0	1
	Expected Count	.3	.2	.2	.3	1.0
	Std. Residual	-.6	1.9	-.5	-.5	
	Adj. Residual	-.7	2.1	-.6	-.6	
Total	Count	57	35	27.	47	184
	Expected	57.0	35.0	27.0	47.0	184.0
Pearson Chi-square 10.058* (df9) p= 0.346						

*8 cells (50%) have expected counts less than 5. The minimum expected count is .19.

Table IV-23. Knowledge Of Other Sign Language Communicators With Hand/Wrist Problems

Number of sign language communicators with hand/wrist problems N=178	Knowledge of others sign language communicators with hand/wrist problems	Knowledge of other sign language communicators medically diagnosed with hand/wrist problems
None	7 (4%)	16 (9%)
1	4 (2%)	9 (5%)
2-3	29 (16%)	46 (26%)
4-5	30 (17%)	35 (20%)
5-6	31 (17%)	23 (12%)
7-8	10 (6%)	11 (6%)
9-10	16 (9%)	12 (7%)
Greater than 10	51 (29%)	26 (15%)

1. The Frequency Of The Self-Reported Medical Diagnosis Of Carpal Tunnel Syndrome And/Or Tendonitis Of The Wrist Among The Sign Language Communicators Surveyed

Analysis of the data provided by the self-reporting, three page questionnaire found 19 respondents reported a medical diagnosis of tendonitis of the wrist and 14 respondents a medical diagnosis of carpal tunnel syndrome. The following paragraphs contain demographic findings related to those respondents reporting a medical diagnosis of wrist tendonitis and carpal tunnel syndrome.

Findings indicate all 14 respondents self-reporting a medical diagnosis of carpal tunnel syndrome were female. Pearson Chi-square found $p=0.114$ and no level of significant was determined at the .05 level. See Table IV-24.

Respondents self-reporting a medical diagnosis of wrist tendonitis indicated 17 (89.5%) females and 2 (10.5%) males. Pearson Chi-square testing found $p=0.664$ and no level of significant was determined at the .05 level. See Table IV-25.

Respondents self-reporting a medical diagnosis of wrist tendonitis, 2 (10.5%) were between the ages of 20-29, 5 (26.2%) between the ages of 30-39, 11 (57.8%) between 40-49, 1 (0.5%) between 50-59, and 1 (0.5%) individual was between 60-69.

Those self-reporting a medical diagnosis of carpal tunnel syndrome, 3 (21.4%) were between the ages of 20-29 years, 3 were between the ages of 30-39 years, 4 (28.6%) were between 40-49 years, and 4 (28.6%) was between 50-59 years. See Table IV-26.

Table IV-24. Medically Diagnosis Carpal Tunnel Syndrome By Sex

Have you been medically diagnosed with carpal tunnel syndrome		Male	Female	Total
YES	Count	0	14	14
	Expected Count	1.9	12.1	14.0
	Std. Residual	-1.4	.5	
	Adj. Residual	-1.6	1.6	
NO	Count	15	82	97
	Expected Count	13.1	83.9	97.0
	Std. Residual	.5	-.2	
	Adj. Residual	1.6	-1.6	
Total	Count	15	96	111
	Expected	15.0	96.0	111.0
Pearson Chi Square 2.503* (df=1) p =0.114				

*1 cells (25%) have expected count less than 5. The minimum expected count is 1.89.

Table IV-25. Medically Diagnosis Wrist Tendonitis By Sex

Have you been medically diagnosed with wrist tendonitis		Male	Female	Total
YES	Count	2	17	19
	Expected Count	2.6	16.4	19.0
	Std. Residual	-.4	.1	
	Adj. Residual	-.4	.4	
NO	Count	13	78	91
	Expected Count	12.4	78.6	91.0
	Std. Residual	.2	-.1	
	Adj. Residual	.4	-.4	
Total	Count	15	95	110
	Expected	15.0	95.0	110.0
Pearson Chi Square 0.189* (df=1) p =0.664				

*1 cells (25%) have expected count less than 5. The minimum expected count is 2.59.

Table IV-26. Diagnosed Carpal Tunnel Syndrome Or Wrist Tendonitis By Age

Medical Diagnosis	Age 20-29	Age 30-39	Age 40-49	Age 50-59	Age 60-69	Age over 69
Carpal tunnel syndrome N=14	3	3	4	4	0	0
Wrist Tendonitis N=19	2	5	11	1	0	0

Of the respondents self-reporting a medical diagnosis of carpal tunnel syndrome, 13 (92.8%) were Caucasian and one was of African-American decent . The respondents self-reporting a medical diagnosis of wrist tendonitis, 18 (94.7%) self-reported Caucasian and one (5.3%) self-reported being of Hispanic origin.

Respondents self-reporting a medical diagnosis of carpal tunnel syndrome were all college educated. Three (21.4%) respondents reported 1-2years of college, 3 (21.4%) reported 3-4 years of college, 4 (28.6%) reported a BA or BS degree, and 4 (28.6%) reported graduate degrees. Education of those self-reporting a medical diagnosis of wrist tendonitis revealed 3 (15.7%) reported 1-2 years of college, 2 (10.7%) reported 3-4 years of college, 7 (36.8%) reported a BA or BS degree, and 7 (36.8%) reported a graduate degree.

Of the respondents self-reporting a medical diagnosis of carpal tunnel syndrome, 93% were right handed. Of the 14 respondents indicating a medical diagnosis of carpal tunnel syndrome, 13 were right handed and only one left handed. For those respondents self-reporting a medical diagnosis of wrist tendonitis, 17 (89.5%) were right handed, one left handed, and one respondent reported being ambidextrous.

The presence of self-reported pre-existing disease among those either medically diagnosed with carpal tunnel syndrome or wrist tendonitis was examined. Analysis of the data provided by the self-reporting, three-page questionnaire reveals 19 respondents reported being medically diagnosed with tendonitis of the wrist and 14 respondents having been medically diagnosed with carpal tunnel syndrome. Most reported pre-existing diseases were depression, hypothyroidism, neck problems and osteoarthritis.

Two carpal tunnel syndrome respondents associated the onset of symptoms with menopause. No sign language communicators diagnosed with carpal tunnel syndrome or wrist tendonitis self-reported tobacco use. Table IV-27 and Table IV-28 contain findings related to respondents with a self-reported medical diagnosis of wrist tendonitis and /or carpal tunnel syndrome, and their pre-existing medical conditions and medication usage.

No one occupational specialty was any more likely to have been diagnosed by a healthcare professional for wrist tendonitis and/or carpal tunnel syndrome than any other group of sign language communicators. The incidence of sign language communicators self-reporting wrist tendonitis was more prevalent than carpal tunnel syndrome. This finding concurs with another study of professional interpreters in which wrist tendonitis was the most prevalent repetitive motion injury found (DeCaro et al.,1992).

Exposure to at-risk behaviors among sign language communicators medically diagnosed with carpal tunnel syndrome and/or wrist tendonitis was examined. Sign language communicators diagnosed with wrist tendonitis self-reported an average of 36.5 hours a week signing, using a TDD, and keyboarding. Sign language communicators diagnosed with carpal tunnel syndrome reported an average of 33.6 hours a week signing, using a TDD, and keyboarding. See Table IV-29, Table IV-30, and Table IV-31.

Table IV-32 and Table IV-33 list factors attributed to the development of many hand/wrist disorders. Sign language communicators diagnosed with either wrist tendonitis or carpal tunnel syndrome self-reported the frequency of these conditions. Repetitive motions and extreme hand/wrist positions were the most common work-related condition reported.

Table IV-27. Pre-Existing Medical Diseases Among Sign Language Communicators Self-Reporting A Medical Diagnosis Of Carpal Tunnel Syndrome Or Wrist Tendonitis

Pre-Existing Medical Disease	Medical Diagnosis of Wrist Tendonitis	Medical Diagnosis of Carpal Tunnel Syndrome
Diabetes	1 (5%)	1 (7%)
Hypothyroidism	1 (5%)	4 (29%)
Wrist Ganglion	0	2 (14%)
High Blood Pressure	1(5%)	2 (14%)
Gout	1 (5%)	0
Osteoarthritis	2 (11%)	2 (14%)
Amyloidosis	0	0
Raynaud's Disease	0	0
Depression	3 (16%)	5 (36%)
Lupus/Rheumatism	1(5%)	0
Neck Problems	4 (21%)	4 (29%)
Kidney Disease	0	1 (7%)
Hand/Wrist Fractures	0	0
Acromegaly	0	0
Related to Pregnancy	1 (5%)	1 (7%)
Related to Menopause	0	2 (14%)

Table IV-28. Medication Usage Among Sign Language Communicators Self-Reporting A Medical Diagnosis Of Carpal Tunnel Syndrome Or Wrist Tendonitis

Self-reported Medication Usage	Medical Diagnosis of Wrist Tendonitis	Medical Diagnosis of Carpal Tunnel Syndrome
Theophylline	0	0
Antidepressants	2 (11%)	4 (29%)
Dilantin	0	0
Diuretics	1 (5%)	1 (7%)
Birth Controls Pills	2 (11%)	1 (7%)
Sulfonamides	0	0
Tuberculosis Drugs	0	0
B & C Vitamins	11 (58%)	9 (64%)

Table IV-29. Hours Reported Signing Weekly By Diagnosed Condition								
Medically diagnosed	1-5 Hrs.	5-10 Hrs.	10-20 Hrs.	20-30 Hrs.	30-40 Hrs.	50-60 Hrs.	> 60 Hrs.	Avg. Hrs.
Wrist tendonitis (N=19)	1	1	5	4	5	1	2	28.2
Carpal Tunnel Syndrome (N=14)	4	1	3	3	2	1	0	18.8

TABLE IV-30. Hours Reported Using TDDs Weekly By Diagnosed Condition								
Medically diagnosed	None	0-1 Hrs.	1-2 Hrs.	3-4 Hrs.	5-6 Hrs.	6-8 Hrs.	> 8 Hrs.	Avg. Hrs.
Wrist tendonitis (N=19)	0	7	4	3	2	1	2	2.8
Carpal Tunnel Syndrome (N=14)	1	7	2	1	3	0	0	1.9

TABLE IV-31. Hours Reported Keyboarding Weekly By Diagnosed Condition								
Medically diagnosed	None	0-1 Hrs.	1-2 Hrs.	3-4 Hrs.	5-10 Hrs.	11-20 Hrs.	> 20 Hrs.	Avg. Hrs.
Wrist tendonitis (N=19)	0	1	3	3	3	4	5	5.5
Carpal Tunnel Syndrome (N=14)	0	0	0	1	5	4	4	12.9

Table IV-32. Frequency Of Risk Behaviors Experienced On The Job By Sign Language Communicators Diagnosed With Carpal Tunnel Syndrome					
N=14	Seldom	Sometimes	Often	Constantly	Total Respondents
Repetitive motions	1	1	4	7	13
Extreme hand positions	2	6	4	0	12
Gripping objects	4	6	3	0	13
Force/pressure on palm	5	4	2	1	12
Vibration from tools	10	1	1	0	12
Cold temperatures	8	3	1	0	12

Table IV-33. Frequency Of Risk Behaviors Experienced On The Job By Sign Language Communicators Diagnosed With Wrist Tendonitis					
N=19	Seldom	Sometimes	Often	Constantly	Total Respondents
Repetitive motions	0	1	6	12	19
Extreme hand positions	5	1	8	1	15
Gripping objects	3	7	5	0	15
Force/pressure on palm	6	3	4	0	13
Vibration from tools	12	1	1	0	14
Cold temperatures	10	4	0	0	14

2. The Frequency Of Sign Language Communicators Self-Reporting Hand/Wrist Disorders Or One Or More Signs/Symptoms Indicative Of Hand/Wrist Disorders

The frequency of sign language communicators self-reporting one or more sign/symptoms indicative of a hand wrist disorder was examined.

Respondents self-reporting one or more signs/symptoms, 16 of 33 males (49.5%) reported one or more signs/symptoms as did 71 of 148 females (49.0%).

No significant difference between the sexes could be determined. See Table IV-21.

Ages of respondents self-reporting one or more signs/symptoms indicative of hand/wrist disorders were investigated. Thirty-one percent (56 of 177) of respondents self-reporting one or more signs/symptoms indicative of hand/wrist disorders were between the age of 40 and 60 years. See Table IV-34.

The level of education of respondents self-reporting one or more signs/symptoms indicative of hand/wrist disorders was examined. Results indicate 81 % (72 of 89) of the respondents self-reporting one or more signs/symptoms indicative of hand/wrist disorders were college graduates. See Table IV-35.

Of the respondents self-reporting one or more signs/symptoms indicative of hand/wrist disorders, 77 (88.5%) were Caucasian and 5 (5.7%) were of African-American decent, 5 (5.7%) were of Hispanic origin, and one was an Asian Pacific Islander. See Table IV-36.

Table IV-34. Age Of Those Respondents Reporting One Or More Signs/Symptoms Indicative Of Hand/Wrist Disorders

# of Signs / Symptoms	Age 20-29	Age 30-39	Age 40-49	Age 50-59	Age 60-69	Age over 69
None	13	21	43	16	1	0
1-2 Symptoms	10	16	32	17	3	1
3-4 Symptoms	1	2	6	0	0	0
5 or more Symptoms	0	0	1	0	0	0

Table IV-35. Education Of Those Respondents Reporting One Or More Signs/Symptoms Indicative Of Hand/Wrist Disorders

# of Signs / Symptoms	High School	Technical School	1-2 yrs. College	3-4 yrs. College	BA or BS Degree	Graduate Degree
None	0	1	12	7	26	48
1-2 Symptoms	2	1	5	6	18	47
3-4 Symptoms	0	0	2	1	2	4
5 or more Symptoms	0	0	0	0	1	0

Table IV-36. Ethnicity Of Those Respondents Reporting One Or More Signs/Symptoms Indicative Of Hand/Wrist Disorders

# of Signs / Symptoms	Caucasian	African American	Hispanic Origins	Asian Pacific Islanders	Other
None	89	2	2	0	0
1-2 Symptoms	67	5	5	1	1
3-4 Symptoms	9	0	0	0	0
Over 5 Symptoms	1	0	0	0	0

Pre-existing medical conditions and medication usage among sign language communicators self-reporting one or more signs/symptoms indicative of a hand/wrist disorder was examined. Neck problems and depression were the two most prevalent health problems reported. Vitamins and antidepressants were the most frequently used medications. No significant findings were reported. See Tables IV-37 and IV-38.

As for the occupational specialty, 26 of 57 (46%) professional interpreters, 20 of 45 (44%) administrator/managers, and 19 of 35 (54%) educator/trainers self-reported one or more signs/symptoms indicative of hand/wrist disorders. See Table IV-22.

Respondents self-reporting 1-2 signs/symptoms indicative of hand/wrist disorders averaged 28.6 hours a week signing. Those respondents self-reporting 3-4 signs/symptoms averaged 29.4 hours a week signing. Those respondents self-reporting 5 or more signs/symptoms averaged a 25.0 hours a week signing. Only one respondent self-reported 5 or more signs/symptoms.

Respondents self-reporting 1-2 signs/symptoms indicative of hand/wrist disorders averaged 3.22 hours a week using a TDD. Those respondents self-reporting 3-4 signs/symptoms averaged 2.28 hours a week using a TDD. Those respondents self-reporting 5 or more signs/symptoms averaged a 0.5 hours a week using a TDD.

Respondents self-reporting 1-2 signs/symptoms indicative of hand/wrist disorders averaged 11.28 hours a week keyboarding. Those respondents self-reporting 3-4 signs/symptoms averaged 13.1 hours a week keyboarding. Those respondents self-reporting 5 or more signs/symptoms averaged a 7.5 hours a week keyboarding.

Table IV-37. Medication Usage Among Sign Language Communicators Self-Reporting One Or More Signs/Symptoms Indicative Of Hand/Wrist Disorders

Self-reported Medication Usage	1-2 Symptoms	3-4 Symptoms	5 or more Symptoms
Theophylline	0	0	0
Antidepressants	7	0	0
Dilantin	0	0	0
Diuretics	0	1	0
Birth Controls Pills	11	1	0
Sulfonamides	0	0	0
Tuberculosis Drugs	1	0	0
B & C Vitamins	19	2	1

Table IV-38. Pre-Existing Medical Diseases Among Sign Language Communicators Self-Reporting One Or More Signs/Symptoms Indicative Of Hand/Wrist Disorders

Pre-Existing Medical Disease	1-2 Symptoms	3-4 Symptoms	5 or more Symptoms
Diabetes	2	0	0
Hypothyroidism	3	0	0
Wrist Ganglion	3	0	1
High Blood Pressure	1	0	0
Gout	1	0	0
Osteoarthritis	1	0	0
Amyloidosis	0	0	0
Raynaud's Disease	0	0	0
Depression	6	0	0
Lupus/Rheumatism	1	0	0
Neck Problems	7	2	0
Kidney Disease	2	0	1
Hand/Wrist Fractures	1	1	0
Acromegaly	0	0	0
Related to Pregnancy	0	0	0
Related to Menopause	1	0	0

3. The Frequency Of Sign Language Interpreters Self-Reporting Hand/Wrist Problems And/Or Signs/Symptoms Indicative Of Hand/Wrist Disorders

The frequency of sign language interpreters self-reporting of hand/wrist problems and/or signs/symptoms indicative of hand/wrist disorders was examined. Professional interpreters, 38 of 57 (67%) self-reported a hand/wrist problem. No significant difference at the .05 level was found. See Table IV-39. The frequency of sign language interpreters self-reporting one or more signs/symptoms was 26 of 57 (46%). No significant difference at the .05 level was found. See Table IV-22.

4. The Frequency Of Sign Language Communicators Self-Reporting Hand/Wrist Disorders Or Signs/Symptoms Indicative Of Hand/Wrist Disorders That Use Sign Language For Purposes Other Than Interpreting

The frequency of sign language communicators, other than interpreters, self-reporting hand/wrist problem and/or signs/symptoms indicative of hand/wrist disorders was examined. Fifty-six percent (70 of 125) respondents self-reported a hand/wrist problem. No significant difference found between professional interpreters and other occupational specialties with a p value of .509 using a .05 level of significance. See Table IV-39. Signs/symptoms indicative of hand/wrist disorders self-reported by occupational specialties other than professional interpreters was examined. Fifty percent (63 of 125) respondents self-reported one or more signs/symptoms indicative of a hand/wrist problem. No significant difference was found between professional interpreters and other occupational specialties using a .05 level of significance. See Table-22.

Table IV-39. Listing Of Occupational Specialties And The Frequency Of Self-Reporting Hand/Wrist Disorders

Have you experienced a hand/wrist problem		Professional Interpreters	Educator Trainer	Administrator Manager	All Other	Total
YES	Count	38	19	27	24	108
	Expected Count	33.8	20.8	26.7	26.7	108.0
	Std. Residual	.7	-.4	.1	-.5	
	Adj. Residual	1.4	-.7	.1	-.9	
NO	Count	19	16	18	21	74
	Expected Count	23.2	14.2	18.3	18.3	74.0
	Std. Residual	-.9	.5	-.1	.6	
	Adj. Residual	-1.4	.7	-.1	.9	
Total	Count	57	35	45	45	182
	Expected	57.0	35.0	45.0	45.0	182.0
Pearson Chi-square 2.320* (df3) p= 0.509						

*0 cells have expected counts less than 5. The minimum expected count is 14.23.

5. The Frequency Of Sign Language Communicators Self-Reporting Hand/Wrist Problems That Limited Their Work Performance

The frequency of sign language communicators self-reporting a hand/wrist disorder or signs/symptoms indicative of a hand/wrist disorder that limited their ability to work was examined. Of the 113 respondents, 48(42%) self-reported a hand/wrist problem significant enough to limit their ability to work. No significant difference at the .05 level was found between occupational specialties or sexes when applying the Chi-square test. See Table IV-10.

Summary

This chapter provided an analysis of the self-reported data by 184 sign language communicators responding to a three-page questionnaire. The results include a description of initial findings related to demographic, social and occupational characteristic of the respondents. Three primary subgroups (professional interpreters, administrator/managers, and educator/trainers) were identified for comparison. These subgroups containing professional interpreters, administrator/managers, and educator/trainers were defined by their occupational description and comprised of predominantly white, middle age, college-educated females. The data found no significant difference in frequency of self-reporting hand/wrist disorders among sign language communicators of various occupational specialties. Female respondents were more likely to have self-reported hand/wrist problems and sought medical treatment.

CHAPTER V

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

The primary focus of this study was to determine baseline data related to the development of hand/wrist disorders among sign language communicators. The secondary purpose of this self-reporting study was to identify work-related behaviors, health, and demographic characteristics associated with those sign language communicators who self-report hand/wrist problems. This chapter describes the research findings following the analysis of a self-reported, three-page questionnaire completed by 184 sign language communicators. Ninety percent of the sign language communicators returning the questionnaire self-reported Caucasian. Sixty-two percent reported being between the ages of 40 and 60 years. Seventy-nine self-reported graduating from college and 86% reported being in good-to-excellent health. Ninety-one percent reported no tobacco use and the most common medications used were vitamins (31%), birth control pills (24%), and antidepressants (9%). The most common pre-existing medical conditions were reported to be neck problems (12%), depression (10%), and hypothyroidism (7%).

Findings pertaining to the sign language communicators responding to the questionnaire will be reported in reference to the research questions stated in Chapter I. The study's recommendations will follow the conclusions developed in this research report.

Findings

Based on the data gathered in this study, the following findings were found regarding the frequency of hand/wrist disorders among sign language communicators.

The Frequency Of Self-Reported Medical Diagnosis Of Carpal Tunnel Syndrome And/Or Tendonitis Of The Wrist Among Sign Language Communicators Surveyed

1. Fourteen of 184 (7.6%) sign language communicators self-reported a medical diagnosis of carpal tunnel syndrome.
2. Each of the fourteen sign language communicators self-reporting a medical diagnosis of carpal tunnel syndrome was female.
3. Nineteen of 184 (10%) sign language communicators self-reported a medical diagnosis of wrist tendonitis.
4. Of those 19 respondents self-reporting a medical diagnosis of wrist tendonitis, 17 (90%) were female and 2 (10%) were males.
5. Of the women self-reporting a hand/wrist problem, 42 of 93 (45%) sought medical treatment.
6. Of males self-reporting a hand/wrist problem, 1 of 14 (7%) sought medical treatment.
7. A significant difference at the .05 level was found between men and women reporting a hand/wrist problem who self-reported seeking medical treatment.

**The Frequency Of Sign Language Communicators Self-Reporting
Hand/Wrist Problems Or One Or More Signs/Symptoms Indicative Of
Hand/Wrist Disorders**

1. Of 182 respondents, 108 (59%) report experiencing hand/wrist problems.
2. Of 182 respondents, 85 (47%) self-reported one or more signs/symptoms indicative of hand/wrist disorders.
3. Fifty-nine percent (64 of 108) of respondents self-reporting a hand/wrist problem associated the occurrence of his/her hand/wrist problem with periods of sign language communications.
4. Sixty-three percent (40 of 64) of respondents self-reported hand/wrist problems with periods of sign language communication involving interpretation.
5. Only 11 (17%) respondents associated the occurrence of hand/wrist problem after an hour of sign language use; while 46 (72%) associated the occurrence of hand/wrist problems after three hours of signing.
6. Sixty-four percent (93 of 146) of the female sign language communicators self-reported a hand/wrist problem.
7. Forty-two percent (14 of 33) of the male sign language communicators self-reported a hand/wrist problem.
8. Women were significantly more likely to self-report a hand/wrist problem than men at a .05 level of significance.
9. Of 56 professional interpreters, 38 (68%) self-reported a hand/wrist problem.

10. Of 45 administrator/managers, 27 (60%) self-reported a hand/wrist problem.
11. Of 35 educator/trainers, 19 (54%) self-reported a hand/wrist problem.
12. Of 18 counselor/social workers, 9 (50%) self-reported a hand/wrist problem.
13. No significant level of differences in self-reported hand/wrist problems was detected among the occupational specialties.
14. As for the most common signs/symptoms, tingling was reported 56 times, cramping 49 times, and numbness 47 times.

The Frequency Of Sign Language Interpreters Self-Reporting Hand/Wrist Problems Or Signs/Symptoms Indicative Of Hand/Wrist Disorders

1. Sixty-eight percent (38 of 56) of professional interpreters self-reported a hand/wrist problem.
2. Thirty-nine percent (22 of 56) of professional interpreters reported one or more signs/symptoms indicative of hand/wrist disorders.
3. Thirty percent (17 of 56) of professional interpreters reported a hand/wrist problem limiting their ability to work
4. Sixteen percent (9 of 56) of professional interpreters self-reported having a medical diagnosis of wrist tendonitis.
5. Seven percent (4 of 56) of professional interpreters self-reported having a medical diagnosis of carpal tunnel syndrome.

**The Frequency Of Sign Language Communicators Self-Reporting
Hand/Wrist Disorders Or Signs/Symptoms Indicative Of Hand/Wrist
Disorders That Use Sign Language For Purposes Other Than Interpreting**

1. Sixty-five percent (70 of 108) of sign language communicators who use sign language for purposes other than interpreting self-reported a hand/wrist problem.
2. Fifty percent (63 of 127) of sign language communicators who use sign language for purposes other than interpreting self-reported one or more signs/symptoms indicative of hand/wrist disorders.
3. Sixty percent (27 of 45) of administrator/managers reported a hand/wrist problem.
4. Forty-four percent (20 of 45) of administrator/managers reported one or more signs/symptoms indicative of hand/wrist disorders.
5. Fifty-four percent (19 of 35) of educator/trainers reported a hand/wrist disorder.
6. Fifty-one percent (18 of 35) of educator/trainers reported one or more signs/symptoms indicative of hand/wrist disorders.
7. Fifty percent (9 of 18) of counselor/social workers reported a hand/wrist problem.
8. Fifty-three (10 of 19) of counselor/social workers self-reported one or more signs/symptoms indicative of hand/wrist disorders.

**The Frequency Of Sign Language Communicators Self-Reporting
Hand/Wrist Problems That Limited Their Work Performance**

1. Twenty-seven percent (49 of the 181) of the sign language communicators responding to the questionnaire self-reported a hand/wrist problem significant enough to limit their ability to work.
2. Forty-six percent (49 of 106) of the sign language communicators reporting a hand/wrist disorder indicated the problem significant enough to limit their ability to work.
3. Thirty percent (32 of 106) of the sign language communicators, who use sign language for purposes other than interpreting, reported a hand/wrist problem significant enough to limit their ability to work.
4. Thirty percent (17 of 56) of the professional interpreters self-reported a hand/wrist problem significant enough to limit their ability to work.
5. No significant difference was found between sign language communicators in the occupational specialties of administrator/manager, educator/trainer, counselor/social worker, and clerical/ secretarial with regard to hand/wrist problems that limited their ability to work at a .05 level of significance.
6. No significant difference was found between male and female sign language communicators reporting a hand/wrist problem that limited their ability to work at a .05 level of significance.

Conclusions

Based on the study's findings and literature review, the following conclusions were made regarding hand/wrist disorders among sign language communicators.

1. Sign language communicators self-reported a high frequency of medically diagnosed carpal tunnel syndrome. The frequency of self-reported, medically diagnosed carpal tunnel syndrome for the sign language communicators in this study was 7.6%. This frequency (7.6%) was five times greater than the rate of carpal tunnel syndrome (1.47%) experienced by working Americans between the ages of 18-60 years (Tanka et al., 1995). Additionally, female sign language communicators were significantly more likely to self-report a hand/wrist problem and seek medical assistance than men.
2. The frequency of self-reported hand/wrist problems among those using sign language for interpretation, administration/management, education/training, and counseling/social work was not significantly different. Each occupational specialty self-reported a high rate of hand/wrist problems ranging from 50% to 64%.
3. Many interpreters reported having experienced hand/wrist problems that limited their ability to work. Almost half (45%) of professional interpreters indicating a hand/wrist problem reported the problem significant enough to limit their ability to work.
4. Sign language communicators who use sign language for purposes other than interpreting report high levels of hand/wrist problems and symptoms

indicative of hand/wrist disorders. Almost two-thirds (65%) of sign language communicators who use sign language for purposes other than interpreting report a hand/wrist problem and half report one or more signs/symptoms indicative of hand/wrist disorders.

5. Those sign language communicators, who use sign language for purposes other than interpreting, report hand/wrist problems that limit their ability to work at the same frequency as sign language communicators, who use sign language for interpretation.

Recommendations

Based on the study's findings and conclusions, the following recommendations were made regarding hand/wrist disorders among sign language communicators.

1. While professional interpreters reported a high frequency of hand/wrist problems, other occupational specialties such as administrator/managers, educators/ trainers, and counselor/social workers report similar rates. Follow-up studies should focus on sign language communicators in other occupational specialties beyond interpretation such as with educators/trainers.
2. More studies investigating the frequency of hand/wrist disorders among sign language communicators are needed to provide addition data. In particular, additional information on professional interpreters and the frequency of hand/wrist disorders among this occupational specialty is warranted.

3. Future studies should also focus on causative-comparative approaches as well as baseline data and frequency.
4. Educational programs among sign language communicators and professional organizations should be initiated to expand the existing knowledge base about hand/wrist disorders, outlining potential risk factors, and emphasizing the need to implement risk reduction strategies.

Summary

This chapter described the research findings following the analysis of a self-reported, three-page questionnaire by 184 sign language communicators. The frequency of hand/wrist problems self-reported by sign language communicators in this study was high. One-fourth of the sign language communicators surveyed had experienced a hand/wrist problem significant enough to limit their ability to work. Regardless of their occupational specialties, sign language communicators reported similar frequencies in the development of hand/wrist disorders. Additional longitudinal studies focused on the prevalence and cause of hand/wrist disorders among sign language communicators are needed. Educational programs focusing on preventing hand/wrist disorders for sign language communicators should be designed and implemented to increase knowledge levels and understanding of related risk factors.

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APPENDIX

10/29/98

A Questionnaire about Risk Factors Associated with Sign Language Communication

Whether you use sign language communication or not, please answer the following questions as carefully as possible. This questionnaire should take about 5 minutes to complete and your participation is voluntary and strictly confidential. Your responses will be used to help with research concerning hand/wrist disorders in sign language communication. Thank you for your participation.

Please answer the following questions to the best of your ability. Blacken appropriate answer circle.

Example question: Color of eyes: ☐ Blue ☒ Brown ☐ Green ☐ Gray

1. Which best describes your job:
 - ☐ Professional Interpreter
 - ☐ Counselor / Social worker
 - ☐ Service support staff / Personnel
 - ☐ Maintenance / Housekeeping
 - ☐ Other, describe _____
 - ☐ Educator / Trainer
 - ☐ Administrator / Manager
 - ☐ House Parent
 - ☐ Clerical / Secretarial
2. Mark the category or categories that best describe your use of sign language:
 - ☐ My use of sign language occurs primarily in the performance of my work.
 - ☐ My use of sign language occurs primarily away from work.
 - ☐ I use sign language equally both on and off the job.
 - ☐ I am hearing impaired or deaf, and sign language is my primary means of communication.
 - ☐ I do not use sign language.
 - ☐ I serve as an interpreter for others.
 - ☐ I use sign language as a teacher / trainer
3. Approximate amount of time you use sign language as a form of communication:
 - ☐ None
 - ☐ 1-5 hours weekly
 - ☐ 5-10 hours weekly
 - ☐ 10-20 hours weekly
 - ☐ 20-30 hours weekly
 - ☐ 30-40 hours weekly
 - ☐ 50-60 hours weekly
 - ☐ More than 60 hours weekly, number of hours _____
4. Approximate amount of time you communicate with a TDD:
 - ☐ None
 - ☐ 0-1 hour weekly
 - ☐ 1-2 hours weekly
 - ☐ 3-4 hours weekly
 - ☐ 5-6 hours weekly
 - ☐ 6-8 hours weekly
 - ☐ More than 8 hours weekly, number of hours _____
5. Approximate amount of time you use a keyboard for word processing, email, data entry, etc.:
 - ☐ None
 - ☐ 0-1 hour weekly
 - ☐ 1-2 hours weekly
 - ☐ 3-4 hours weekly
 - ☐ 5-10 hours weekly
 - ☐ 11-20 hours weekly
 - ☐ More than 20 hours weekly
6. If you experience any of the following on your job, please indicate how often by marking the appropriate circle.
(Note: Often means at least 2 hours per day on the average).
 - a. Repetitive motion of hand/fingers: ☐ Seldom ☐ Sometimes ☐ Often ☐ Constantly
 - b. Vibration from a tool: ☐ Seldom ☐ Sometimes ☐ Often ☐ Constantly
 - c. Force/pressure on palm: ☐ Seldom ☐ Sometimes ☐ Often ☐ Constantly
 - d. Extreme hand positions: ☐ Seldom ☐ Sometimes ☐ Often ☐ Constantly
 - e. Cold temperatures (32°F or less): ☐ Seldom ☐ Sometimes ☐ Often ☐ Constantly
 - f. Gripping (tools, objects, instruments): ☐ Seldom ☐ Sometimes ☐ Often ☐ Constantly
7. Have you experienced hand/wrist problems? ☐ Yes ☐ No (if no skip to question 19)

8. Did your hand/wrist problem limit your ability to work? ☐ Yes ☐ No
9. Mark the items that best describe your hand/wrist problem(s).
- | | | | |
|-------------------------------------|--|--------------------------------|--------------------------------|
| ☐ Numbness | ☐ Numbness that interrupts sleep | ☐ Tingling | ☐ Swelling |
| ☐ Stiffness | ☐ Frequent dropping of objects | ☐ Burning | ☐ Cramping |
| ☐ Loss of color | ☐ Loss of grip strength | | |
10. What do you think caused the problem? This question is very important! Please answer carefully and write down what you think contributed to the items checked in question 9.
- _____
- _____
11. Have you been medically diagnosed with tendonitis of the wrist?
- ☐ Yes, (if yes: ☐ right ☐ left ☐ both) ☐ No
12. Have you been medically diagnosed with carpal tunnel syndrome?
- ☐ Yes, (if yes: ☐ right ☐ left ☐ both) ☐ No
13. Have you received any medical treatment for you hand/wrist problem? ☐ Yes ☐ No
14. If yes to question 13, what kind of treatment and when did you receive it? _____
- _____
15. Do you associate sign language communication work periods with the occurrence of hand/wrist problems? Indicate if these work periods were in interpretation.
- | | | |
|---|---|--|
| ☐ Yes | ☐ No (If no, skip to question 17) | ☐ I don't know (skip to question 17) |
| ☐ Yes, they were interpretation | | ☐ No, they were not interpretation |
16. How long were the sign language communication periods (without a break), which you associate with the occurrence of your hand/wrist problems?
- | | | |
|---------------------------------|---------------------------------|---|
| ☐ 1 hour | ☐ 1-2 hours | ☐ 2-3 hours |
| ☐ 3-4 hours | ☐ 4-5 hours | ☐ More than 5 hours |
17. Can you associate your hand/wrist problem with pregnancy? ☐ Yes ☐ No
18. Can you associate your hand/wrist problem with the onset of menopause? ☐ Yes ☐ No
19. Mark any of the following medications you routinely take.
- | | | |
|---|---|---|
| ☐ Theophylline | ☐ Antidepressants | ☐ Dilantin |
| ☐ Diuretics (Lasix) | ☐ Birth Control Pills | ☐ Sulfonamides (Bactrin/Septra) |
| ☐ Tuberculosis drugs (rifampin/isoniazid) | | ☐ Vitamins (B&C) Supplements |
20. Mark the response which best represents the number of individuals you know who use sign language as a form of communication and have experienced some of the items listed in question 9.
- ☐ None ☐ 1 ☐ 2-3 ☐ 4-5 ☐ 5-6 ☐ 7-8 ☐ 9-10 ☐ Greater than 10

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21. Mark the response which best represents the number of individuals you know who use sign language as a form of communication and have been diagnosed with any hand/wrist disorder.

☐ None ☐ 1 ☐ 2-3 ☐ 4-5 ☐ 5-6 ☐ 7-8 ☐ 9-10 ☐ Greater than 10

22. What off-the-job recreational activities (bowling, tennis, etc.) do you participate in regularly? Please indicate how often you do these activities.
-

23. What off-the-job work activities or hobbies (sewing, carpentry, etc.) do you participate in regularly? Please indicate how often you do these activities.
-

24. Mark any of the following medical conditions for which you have been diagnosed.

☐ Diabetes ☐ Hypothyroidism ☐ Wrist ganglion ☐ High blood pressure
☐ Gout ☐ Osteoarthritis ☐ Amyloidosis ☐ Raynaud's disease
☐ Depression ☐ Lupus/Rheumatism ☐ Hand/wrist fractures ☐ Kidney disease
☐ Neck problems ☐ Acromegaly

25. I am primarily: ☐ Right-handed ☐ Left-handed ☐ Ambidextrous

26. Do you smoke? ☐ Yes ☐ No

27. If yes, how many packs per day? _____

28. My general health status is: ☐ Poor ☐ Fair ☐ Average ☐ Good ☐ Excellent

29. Sex: ☐ Male ☐ Female

30. Age: ☐ Under 20 ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59
 ☐ 60-69 ☐ Over 69

31. Height: ☐ Below 5 Ft. ☐ 5'0"-5'3" ☐ 5'3"-5'6" ☐ 5'6"-5'9" ☐ 5'9"-6'0" ☐ 6'0"-6'3"
 ☐ Over 6'3"

32. Weight: ☐ Under 100 lbs. ☐ 101-110 lbs. ☐ 111-120 lbs. ☐ 121-130 lbs. ☐ 131-140 lbs.
 ☐ 141-150 lbs. ☐ 151-160 lbs. ☐ 161-170 lbs. ☐ 171-180 lbs. ☐ 181-190 lbs.
 ☐ 191-200 lbs. ☐ 201-210 lbs. ☐ 211-220 lbs. ☐ 221-250 lbs. ☐ Over 250 lbs.

33. Ethnicity: ☐ Caucasian ☐ African-American ☐ Hispanic origin ☐ Native American Indian
 ☐ Asian Pacific Islander ☐ Other _____

34. Education: ☐ High School/GED ☐ Technical School ☐ 1-2 years College
 ☐ 3-4 years College ☐ BA or BS Degree ☐ Graduate Degree

Please share any comments regarding this survey and, particularly, your thoughts on hand/wrist problems. Use the space below or the back of this page. Thanks again for your participation.

VITA

William Mark Hart, son of William Robert and Margaret Hart, was born February 14, 1955 in Maryville, Tennessee. His father's military career afforded the family ample travel opportunities. He and his younger sister accompanied their parents from one duty station to another and until finally returning to Tennessee 1972. In 1977, Mark graduated from State Technical Institute at Knoxville, Tennessee as an Emergency Medical Technician - Paramedic. While working as a paramedic, Mark obtained his Associate Degree in Nursing from Walters State Community College in Morristown, Tennessee in 1982. In 1984, Mark became Aeromedical Supervisor of the LIFESTAR helicopter at The University of Tennessee Medical Center, Knoxville. While working at The University Medical Center, he completed his Bachelors of Science Degree in Education in 1990. In 1996, Mark became a member of the Radiation Emergency Assistance Center and Training Site operated for The U.S. Department of Energy by Oak Ridge Associated Universities. Work toward his Master of Science Degree began in 1992. Mark is married to Rhea Waring Hart and has three children: Kendra, Shawn, and Courtney.