Final report to NIOSH RO1 CCR312140
September 29, 2000
Principal Investigator: Patricia W. Gucer

The bulk of this work was conducted under the direction of James P. Keogh, M.D. who passed away in June, 1999. Janie Gordon took over and ably led the project until September 5, 2000. I have been privileged to work as co-investigator since its inception, and am pleased and proud to present the results of this collaborative effort.

ABSTRACT

One thousand fourteen respondents with upper extremity cumulative trauma disorders (UECTDs) were surveyed about the physical, social and economic consequences to themselves and their families; about the sources of, payment for, and satisfaction with their medical care; and about risk-reduction activities undertaken by employers in response to their injuries, both for themselves and for co-workers. Computer aided telephone survey instruments gathering information on activities of daily living, depression, employment, occupational conditions, medical care, and employer risk-reduction activities were designed and used to collect this data.

Fifty-three to 81% of UECTD injured workers suffered long term consequences to their ability to function normally, between 25% and 38% lost jobs held 9 to 11 years on average, and 26% to 31% reported depressive symptoms. Health care insurance and claimants themselves paid for much of the medical care. Among workers with work-related UECTD injuries requiring medical care found in private patient lists and from the lists of high-risk-unionized workers, less than one third had medical bills paid by workers' compensation. Injured workers were more satisfied with care if they could choose the physician. Around half of the employers responded to the injury with some action to reduce risk of further injury, and they were more likely to take these actions if a safety committee was present, and especially if a physician recommended the risk-reduction activity. Being in a female sex-typical job exposes the worker to higher UECTD risks, and decreases the likelihood that the employer will have a mechanism in place (safety committee) to promote prevention.

Physician involvement in the design of work for injured workers, and workplace safety committees can promote working conditions that are less likely to cause or worsen UECTDs, avoiding the long lasting consequences workers, and the expense to society at large.

MAJOR ACTIVITIES

Interview Completion

Computer aided telephone interviews have been completed for all three groups with upper extremity cumulative trauma disorders (UECTDs); 537 Maryland Workers'

Compensation claimants, 253 private patients with UECTD diagnoses, and 193 high-risk-unionized workers (grocery cashiers, butchers, deli workers) (Table 1). High-risk workers completed two surveys approximately one year apart. In addition, high-risk workers who initially reported no symptoms were interviewed approximately one year later to determine how many developed symptoms during that period. Thirty-one did. They too were interviewed again the following year (Figure 1). We are grateful for cooperation from the Maryland Workers' Compensation Commission, the United Food and Commercial Workers Union, and from private physicians in Baltimore, the Eastern Shore of Maryland and the suburban Washington, D.C. area.

Publications and Professional Presentations

Two papers based on Workers' Compensation claimant data have been accepted for publication (galley proofs attached),:

1. Keogh, JP, Nuwayahid, I. Gordon, J. and Gucer, P., "The Impact of Occupational Injury on Injured Worker and Family: Outcomes of Upper Extremity Cumulative Trauma Disorders in Maryland Workers" AJIM 2000a
2. Keogh, JP, Gucer, P., Nuwayahid, I. and Gordon, J. "Patterns and Predictors of Employer Risk-Reduction Activities (ERRAs) in Response to a Work-Related Upper Extremity Cumulative Trauma Disorder (UECTD): Reports from Workers Compensation Claimants". AJIM 2000b

Preliminary versions had been presented at meetings of the American Public Health Association (APHA) and the Workers Compensation Research Group. In addition, three papers were presented at APHA in the November, 1999 meetings (powerpoint presentations attached:

1. Janie Gordon et al., 1999 "Work-Related Upper Extremity Cumulative Trauma Disorders: Who Pays the Piper?" ;
2. Janie Gordon et al. 1999. "Who Cares for Injured Workers?" ;
3. Pat Gucer et al., 1999. "Occupational Gender Segregation: UECTDs and Risks and Remedies".

MAJOR FINDINGS AND SIGNIFICANCE

UECTD Impact on Workers

UECTDs deliver long lasting consequences to workers. Workers Compensation claimants experience more serious impairements to activities of daily living than do private patients, and more serious still than impairements experienced by high-risk-unionized workers (for whom the eligibility bar is set a little lower: symptoms with or without a UECTD diagnosis). See the attached galley proof (Keogh et al. 2000a;) for a full description of the impact of UECTDs on the lives of workers' compensation claimants, and Table III attached to this document for a comparison of the impact of UECTDs among the three groups surveyed here. The impact appears to be long lasting. Activities of daily living are impaired 11 to 46 months after the claim was filed, and remain abnormal on average for the high risk workers a year after the initial interview. Job change is common among all groups. Thirty-eight percent of claimants quit, were fired or laid off. Thirty four percent of private patients also lost their jobs, as did 25% of the high-risk-unionized workers, despite the fact that average job tenure ranged from 9 to

11 years. Looking at all three groups, 28% to 53% reported continuing difficulty with work, and 29% to 64% reported continuing difficulty with activities in the home. This difficulty with home activities impacts women Workers' Compensation claimants (68%) a little harder than men (55%). Respondents seem to have accepted their impairment. Looking at all three groups 53% to 81% believe that they are "less able to do things as well now as before the problem began", and 73% to 87% believe that their recovery is complete.

Significance
Much attention has been focused on UECTD costs to workers' compensation, and to lost productivity in the workplace, but less attention has been focused on the cost to the injured workers themselves. Findings from this study adds to those of others (e.g. Morse et al. 1998) by highlighting the impact of UECTDS on workers' ability to function at home and at work, and on the costs to their families.

Employer Risk-Reduction
Only 52% of respondents reported employer actions to investigate or reduce UECTD risk. Engineering and pace changes were prominent for keyboard workers. Transfers to other jobs were prominent for manufacturing workers. Safety programs and physician recommendations increased the likelihood of risk-reduction activities. See the attached galley proof (Keogh et al. 2000b).

Significance
This study is unique in its focus on predictors of employer risk-reduction activities (ERRAs) in response to a UECTD case. An opportunity to intervene post-injury to reduce risks for the injured worker and prevent new UECTD cases is being missed. Physician recommendations are strongly associated with specific employer risk-reduction activities thought to be most effective. Educating employers and physicians about ergonomics could result in prevention of UECTDs.

Health Care
Sixty-one percent of Maryland Workers' Compensation claimants went first to a private doctor's office for care. Eighty-six percent described this care giver as their 'regular doctor". While family practitioners provided care for the initial visit to 41% of claimants, 74% say a surgical specialist provided the majority of care. Claimant satisfaction with the physician was high. Ninety-one percent were satisfied with the physician who provided the majority of care. Respondents were less satisfied if the physician was chosen by the employer and if the care was given at the jobsite. Not all claimants actually received workers compensation benefits, but they were more likely to receive them if they were better off economically and if they saw a surgical specialist. For a more detailed description of health care please see attached presentation "Who Cares for Injured Workers?" given by Janie Gordon at American Public Health Association in November, 1999.

Significance
Patients with work-related UECTDS appear to be more satisfied when they choose the doctor themselves, a circumstance relevant when states consider whether employers can choose the source of medical care for injured workers.

Cost Shifting
Who foots the bill for medical care and wages lost due to work-related UECTDs? Our evidence suggests many work-related injuries are not reported to workers' compensation at all, and that private health insurance pays the medical bills for a large number of work-related UECTDs. Surveying the private patients and the high-risk unionized workers allowed us to capture the medical and wage replacement sources for those with work-related UECTDs whether or not they filed a workers' compensation claim. We asked whether a series of sources paid for some or all of the medical costs.

Even among Workers' Compensation claimants, 47% report that health insurance paid medical costs. Among the private patients, 75% report that health insurance paid medical costs, and only 23% identified workers' compensation as a payer. Surprisingly, half (53%) said that they themselves paid medical costs. Sixty one percent of the high-risk unionized workers had their medical care paid by health insurance, and only 30 % reported that workers' compensation paid for medical costs.

Cost shifting also affects who pays for lost wages. In Maryland a worker must not only be injured at work but must lose three or more days from work before being eligible for wage replacement. Seventy one percent of eligible workers compensation claimants received wage replacement from workers compensation. However, only 32% of the eligible private practice patients and 27% of the eligible high-risk-unionized workers received wage replacement from workers' compensation. Private practice patients (19%) and high-risk-unionized workers (14%) used sick leave. It looks as though many of those who lost work simply lost pay. For a more detailed description of cost shifting please see attached presentation "Work-Related Upper Extremity Cumulative Trauma Disorders: Who Pays the Piper" given by Janie Gordon at American Public Health Association in November, 1999.

Significance
Our work has added to the evidence that only part of the costs of work-related UECTDs are born by workers' compensation. Hence the costs of work-related UECTDs, while high, may be under estimated due to under reporting of work-related UECTDs both to Workers' Compensation systems and in the BLS survey of injuries and illnesses (for a recent review see Pransky et al. 1999). Under reporting has far reaching consequences. Since UECTD costs may be more extensive than estimated, estimation of the benefits of prevention may also be low. Also, as we have seen, it is not only health insurance that picks up the tab, but the injured worker also appears to bear much of the cost.

Gender Segregation in the Workplace and UECTDS

Women experience a disproportionate share of work-related UECTDs. We find that after adjusting for demographic characteristics, the more female sex typical (percent female of job incumbents) the job, the more likely the respondents were to report repetitive motion as a job risk, and the more likely they are to report keyboarding as a major work task. Working in a female sex-typical job also has consequences for prevention. We had earlier found safety committees to be a predictor of employer-risk-reduction activities, but working in a female sex typical job decreases the likelihood of the presence of a safety committee.

Significance

"Women's work" has generally been considered safe, but when it comes to UECTDs women are at greater risk than men. This is due in part to their segregation into higher-risk female sex-typical jobs. Occupational segregation by gender also has consequences for prevention, since one of the mechanisms that promotes safety in the workplace, the safety committee, is often absent in female-sex-typical jobs. For a more detailed description of cost shifting please see attached presentation "Occupational Gender Segregation: UECTDs and Risks and Remedies" given by Pat Gucer at the American Public Health Association meetings in November, 1999.

SPECIFIC AIMS

In the following section we address results as they relate to each specific aim.

Specific aim #1

Describe the incidence and prevalence of work-related UECTDs in Maryland using several existing data sources.

The numbers of workers interviewed from each UECTD pool (workers' compensation claimants, private patients and high-risk-unionized workers) is not sufficient to permit estimation of true incidence or prevalence in those pools. Nevertheless, the number is sufficient to reflect the experiences of a very large number (920 – of the 1014 interviewed) of Marylanders with work-related UECTDs. We were able to contact 42% of those in the pool of Maryland Workers' Compensation Commission (MWCC) claimants, 44% of those in the pool of high-risk-unionized workers, and 66% in the pool of private patients. Of those we contacted, 69% of MWCC claimants, 77% of private patients and 71% of high-risk-unionized workers agreed to the interview. For a more detailed description of a comparison of those workers' compensation claimants we were able to reach (older, more likely to be married, female, and better off economically) with those we did not reach, please see the methods sections in the attached galley proof: "The Impact of Occupational Injury on Injured Worker and Family: Outcomes of Upper Extremity Cumulative Trauma Disorders in Maryland Workers". While we did not have a representative sample, we adjusted for these demographic factors which we knew distinguished respondents from non-respondents in multivariate analysis.

Specific aim #2

Explore the relationship between the development of upper extremity symptoms and subsequent medical evaluation, diagnosis, and treatment in workers in high-risk occupations.

High-risk unionized workers with acute symptoms at the first interview were more likely to have sought treatment within a week. After one year, delay to treatment appeared to have no relationship to ability to function in activities of daily living. See Table VI.

Specific aim 3

Identify specific consequences of work-related UECTDs that are of sufficient severity and frequency to be useful as measures of outcome in prospective studies.

Loss of job, impairment in activities of daily living, and depression of mood are sequelae of UECTDs. See the attached galley proof of Keogh et al. 2000a "The Impact of Occupational Injury on Injured Worker and Family: Outcomes of Upper Extremity Cumulative Trauma Disorders in Maryland Workers".

Specific aim #4

Further refine and validate a practical survey instrument to measure these outcomes in a prospective manner.

The computer aided telephone survey instruments have been developed and, with slight modifications, used with three groups of respondents. With further modifications they will be used again in the current NIOSH grant "Prevention of Upper Extremity Cumulative Trauma Disorders".

Specific aim #5

Identify characteristics of the worker/patient, of the workplace, of the employer and of the health care system that are associated with differences in frequency of these outcomes.

Scoring abnormally on the ADL scale was more likely if the respondent was female, older and had reported more problems at time of onset (see Keogh et al. 1990a)

Specific aim #6

Estimate the time lapse between onset of symptoms and initial medical evaluation or intervention. Determine the association between this delay and characteristics of the workplace, availability of medical surveillance, and access to medical services at the workplace and in the community.

It was hypothesized that delay to treatment would result in decreased ability to do tasks of daily living (ADL). We found no evidence of this in any of the three groups (see Table VI). This was likely do to inability to measure severity at onset, but in the ongoing grant funded by NIOSH, "Prevention of Upper Extremity Cumulative Trauma Disorders", we will survey respondents shortly after filing a claim which will permit more timely measures of their ability to do activities of daily living, a proxy for severity of injury.

Specific aim #7
Estimate the frequency with which diagnosis of work-related UECTD results in change, modification, or loss of the specific worker/patient's job.
Please see Keogh et al. 2000a and Keogh et al 2000b attached galley proofs. These analyses have been done using MWCC claimant data, but analyses about employer –risk-reduction activities remain to be done using data from private patients and high- risk-unionized workers.

Specific aim #8
Estimate the frequency with which diagnosis of work-related UECTDs results in identifiable changes in the initial working conditions.
See response to specific aim # 7, above.

Specific aim #9
Further refine and validate a simple survey instrument to estimate the direct economic costs of upper extremity cumulative trauma disorders, and to identify the extent that these are born by the employer, the worker/patient and the community.
The survey instrument elicited the source of payment for medical care and wage replacement. Please see Table IV and V., as well as the attached APHA presentation by Janie Gordon et al., 1999. "Work-Related Upper Extremity Cumulative Trauma Disorders: Who Pays the Piper?"

Specific aim #10
Describe, in the context of these illnesses, the extent to which cost shifting occurs between worker compensation and other forms of health insurance, and identify factors associated with such shifts.
We have demonstrated that workers' compensation bears only a part of the costs of work-related injuries. Medical costs are paid for by health insurance, and the workers themselves bear many of the costs. Workers also lose money they would have earned had they been able to work (Table VI.)

Specific aim #11
Further refine and validate a practical survey instrument to measure the non-economic costs of UECTD, including changes in functional level and emotional health
We have constructed the UM-ADL scale, an instrument designed to measure function in activities of daily living specifically among those impacted by UECTDs, and have used it to measure functional outcomes for three groups (Keogh et al, 2000a and Table III in this document). For a description of this instrument see Keogh et al, 2000a). We adapted the CES-D, a measure of affect, to be used in a computer aided telephone survey. We surveyed all three groups.

FUTURE PUBLICATIONS

Data analysis and preparation of papers for submission to peer-reviewed journals are in preparation. Subjects include cost shifting, health care and the consequences of occupational segregation by gender to UECTD risk. More extensive analyses of private-patient and high-risk-unionized-worker groups are planned. A full analysis of the high-risk unionized series of interviews will permit description of the natural consequences of UECTD symptoms, such as progression to more severe problems and impact on social relationships, work, activities of daily living, mood and economic circumstances. In addition we will replicate the analysis done on employer-risk reduction activities using private patients and high-risk-unionized workers. Expected submission date will be July, 2001.

Figure 1: Unionized workers at high risk for UECTDs;
Grocery cashiers, butchers, poultry workers, food processors

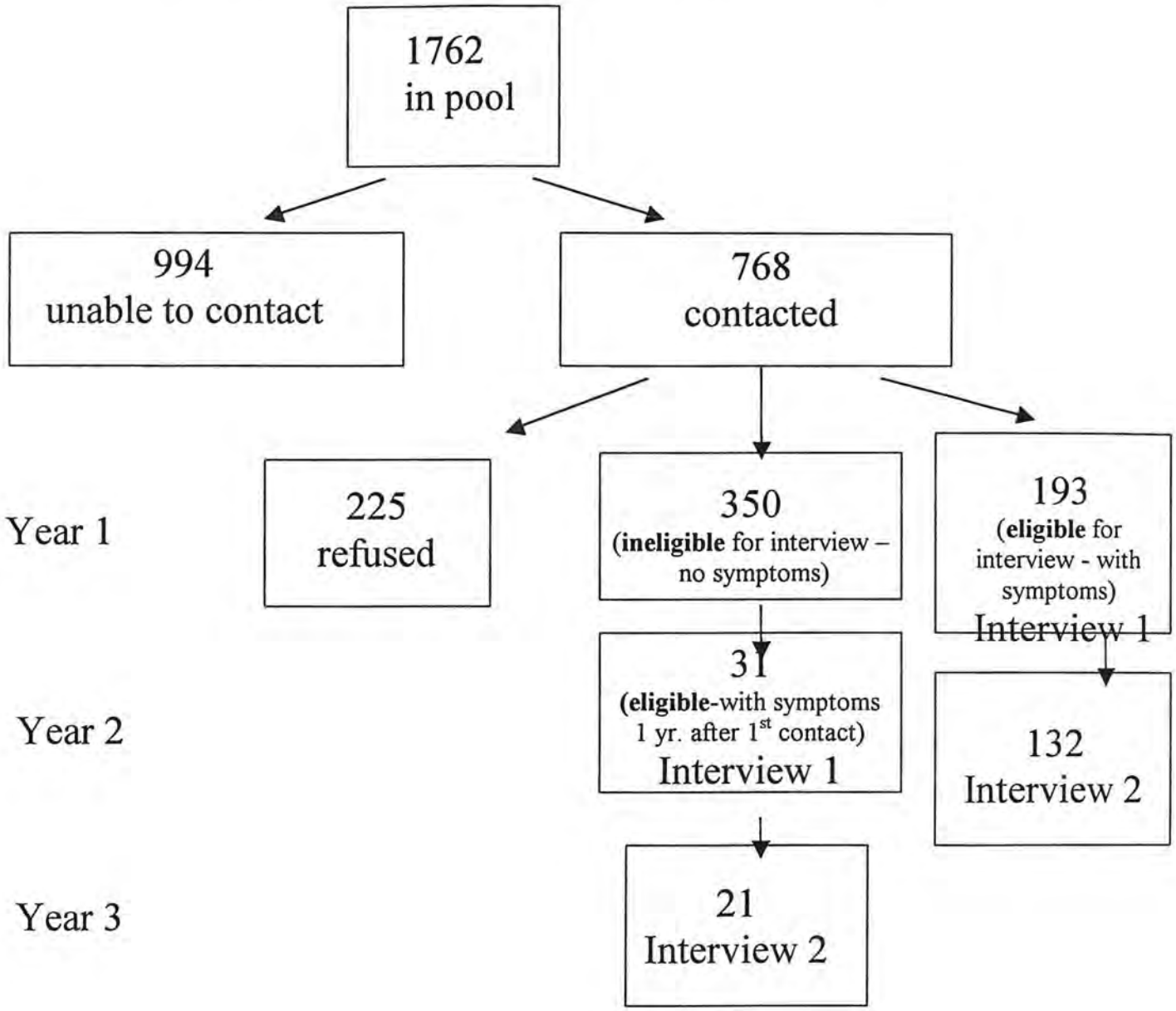

Table I

Response by Group			
	Workers Compensation Claimants	Private Patients	High Risk Unionized Workers
Number in pool	5257	785	1762
Unable to contact (bad phone numbers)	3032	267	994
Contacted			
Number refused	698	122	225
Number ineligible	990	144	350
Number interviewed	537	253	193

Table II

Characteristics of Eligible* Respondents			
	Workers Compensation Claimants	Private Patients	High Risk Unionized Workers
Age mean	42	52	44
SD	10	14	12
N	528	253	193
Ethnicity			
African American	26%	10%	22%
White	68%	88%	74%
Other/unknown	6%	2%	5%
Education			
Less than high school	16%	12%	22%
High School	36%	28%	44%
More than high school	48%	60%	34%
Gender			
Male	30%	24%	38%
Female	70%	76%	62%
CTS diagnosis	78%	75%	Interview 1: 17% Interview 2: 25%
* eligibility for workers' compensation claimants & private patients is injury from neck to finger tip not due to accident, while the bar is a little lower for high-risk-unionized workers – pain or discomfort to an area from the neck through finger tips lasting one week during the last year, or off and on for 20 days during the last year.			

Table III

Impact of Upper Extremity Cumulative Trauma Disorders				
	Workers Compensation Claimants	Private Patients	High-Risk-Unionized Workers	
			Interview 1	Interview 2: approximately one year later
ADL (1= no difficulty, 2= some difficulty, 3= can't do by myself) Mean SD N	 1.41 .35 536	 1.33 .37 253	 1.20 .26 193	 1.18 .22 132
Difficulty at interview with Sleep Work Home/Recreation	 44% 53% 64%	 35% 32% 44%	 35% 34% 36%	 38% 28% 29%
Less able to do things as well now as before	81%	64%	60%	53%
Believes recovery is complete**	79%	84%	**73%**	**87%**
Above 16 on CES-D depression	31%	26%	27%	33%
Lost job** (avg yrs in job prior to injury)	38% (9)	34% (11)	**8%** (10)	**21%** ----
** P < .01 among high risk workers between first & second interviews				

Table IV

Cost Shifting for Medical Care Source of Payment for Majority of Care for Work-Related UECTDs			
	Percent of Patients		
	Workers Compensation Claimants N=514	Private Patients* N=162	High Risk Unionized Workers* N=77
	Percent	Percent	Percent
Workers' Compensation	75	32	30
Health Insurance	20	59	55
Government Program	1	1	2
Self/Family	2	7	12
Not Paid	2	1	1
* Problem sufficient to send patient for medical care and problem judged work-related by patient or doctor			

Table V

Cost Shifting: Wage Replacement *Source Of Payment For Work-Related UECTDs When 3 Or More Work Days Were Lost Due To UECTDs*			
	Patients		
	Workers Compensation Claimants N=407	Private Patients* N=117	High Risk Unionized Workers* N=37
	Percent	Percent	Percent
Workers' Compensation	71	32	27
Unemployment Insurance	3	3	0
Government Program	2	2	0
Self/Family	13	7	3
Disability Insurance	8	6	0
Social Security Disability	1	4	0
Other			
Vacation Benefits	2	0	0
Sick Leave Benefits	5	19	14
Regular Wage Paid	5	0	3

Table VI

Mean ADL by Time to Medical Care				
	Workers Compensation Claimants	Private Patients	High-Risk-Unionized Workers	
Time between problem onset and medical visit			Interview 1*	Interview 2: approximately one year later
One day or less				
Mean	1.45	1.48	1.32	1.22
SD	.38	.53	.32	.22
N	93	8	15	9
One day to one week				
Mean	1.40	1.28	1.60	1.31
SD	.36	.29	.50	.40
N	90	31	8	5
One week to one month				
Mean	1.31	1.35	1.23	1.20
SD	.29	.35	.26	.28
N	73	68	26	20
One month to six months				
Mean	1.42	1.27	1.25	1.15
SD	.35	.34	.28	.13
N	173	78	25	16
More than six months				
Mean	1.41	1.38	1.18	1.13
SD	.34	.41	.18	.14
N	103	53	13	10
* $p<.05$				

List of references

Gordon, J.,Gucer, P. and Keogh, J.P. et al., 1999. "Work-Related Upper Extremity Cumulative Trauma Disorders: Who Pays the Piper?. "Paper presented at the American Public Health Association meetings.

Gordon, J.,Gucer, P. and Keogh, J.P. 1999. "Who Cares for Injured Workers?" Paper presented at the American Public Health Association meetings.

Gucer, P., Gordon, J. and Keogh, J.P., 1999. "Occupational Gender Segregation: UECTDs and Risks and Remedies". Paper presented at the American Public Health Association meetings.

Keogh et al., 2000a. "The Impact of Occupational Injury on Injured Worker and Family: Outcomes of Upper Extremity Cumulative Trauma Disorders in Maryland Workers". AJIM. In press.

Keogh et al.,2000b. "Patterns and Predictors of Employer Risk-Reduction Activities (ERRAs) in Response to Work-Related Upper Extremity Cumulative Trauma Disorders (UECTD): Reports from Workers' Compensation Claimants" AJIM. In press.

Morse, T.F., Dillon, C., Warren. N., Levensein, C. and Warren, A. "The Economic and Social Consequences of work-related musculoskeletal disorders: the Connecticut Upper-Extremity Surveillance Project (CUSP)". Int. J. Occup. Environ. Health. Vol. 4. 2089-216. 1998.

Pransky ,G., Snyder T., Dembe., and Himmelstein, J. "Under-Reporting of Work-Related Disorders in the Workplace: a Case Study and a Review of the Literature". Ergonomics. Vol. 42. 171-182. 1999.

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service
Centers for Disease Control
and Prevention (CDC)

Memorandum

Date: March 12, 2001

From: Roy M. Fleming, Sc.D., Director, Research Grants Program RMF
Office of Extramural Programs, NIOSH, D30

Subject: Final Report Submitted for Entry into NTIS for Grant 5 R01 CC312140-03.

To: William D. Bennett
Data Systems Team, Information Resources Branch, EID, NIOSH, P03/C18

The attached final report has been received from the principal investigator on the subject NIOSH grant. If this document is forwarded to the National Technical Information Service, please let us know when a document number is known so that we can inform anyone who inquires about this final report.

Any publications that are included with this report are highlighted on the list below.

Attachment
cc: Sherri Diana, EID, P03/C13

List of Publications

Keogh JP, Nuwayhid I, Gordon J, Gucer P: The Impact of Occupational Injury on Injured Worker and Family: Outcomes of upper Extremity Cumulative Trauma Disorders in Maryland Workers. American Journal of Industrial Medicine, accepted, 2000

Keogh JP, Gucer P, Gordon JL, Nuwayhid I: Patterns and Predictors of Employer Risk-Reduction Activities (ERRAs) in Response to a Work-Related Upper Extremeity Cumulative Disorders (UECTD): Reports from Workers' Compensation Claimants. American Journal of Industrial Medicine, accepted, 2000

Outcomes of Upper Extremity Cumulative Trauma Disorders
Final report.

NIOSH RO1 CCR312140

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September 29, 2000

Final report to NIOSH RO1 CCR312140
September 29, 2000
Principal Investigator: Patricia W. Gucer

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List of Abbreviations

UECTD	Upper extremity cumulative trauma disorder
ERRA	Employer risk-reduction activitiy
UM-ADL	University of Maryland Activities of Daily Living Scale
CES-D	Center for Epidemiological Study Depression Scale

Appendicies

Keogh et al., 2000a. "The Impact of Occupational Injury on Injured Worker and Family: Outcomes of Upper Extremity Cumulative Trauma Disorders in Maryland Workers".

Keogh et al.,2000b. "Patterns and Predictors of Employer Risk-Reduction Activities (ERRAs) in Response to Work-Related Upper Extremity Cumulative Trauma Disorders (UECTD): Reports from Workers' Compensation Claimants"

Janie Gordon et al., 1999. "Work-Related Upper Extremity Cumulative Trauma Disorders: Who Pays the Piper?"

Janie Gordon et al. 1999. "Who Cares for Injured Workers?"

Pat Gucer et al., 1999. "Occupational Gender Segregatgion: UECTDs and Risks and Remedies".