FINAL PROGRESS REPORT

UNIVERSITY OF MIAMI
CORAL GABLES, FLORIDA 33124

OCCUPATIONAL SAFETY AND HEALTH TRAINING

JULY 1, 1996-JUNE 30, 2001

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Program Director: **Dr. Tarek M. Khalil**

CDC/NIOSH Grant No. **TO1CCT410466**

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ABSTRACT

The explosion of work related injuries such as cumulative trauma disorders and the increased incidence of job stress, as well as the economic plight of most U.S. industries from workers' compensation and litigation underscores the need to improve the working conditions in both industrial and office environments. In addition, the changing demography of the work environments due to the aging of the workforce, the ADA legislation and the influx of women into the workplace necessitate redesigning jobs and work systems. This in turn requires professionals who understand ergonomics, safety and health in the workplace and who are qualified to identify and implement appropriate design and engineering control measures. OSHA guidelines in Ergonomics and Work Related Musculoskeletal Disorders require a well-trained work force capable of helping industry cope with the problems.

In response to this need for professionals trained in ergonomics and safety the Department of Industrial Engineering at the University of Miami has developed a training program in Occupational Ergonomics and Safety. The objective of the program is to prepare engineers, occupational safety and health specialists to meet the changing demands of industry, government, and service organizations such as insurance and utility industries. The curriculum is designed to meet both the immediate and long-term needs of these organizations in the areas or workplace and job design, safety and accident prevention. A unique feature of the training program is the emphasis on the holistic approach for injury and disability prevention. The holistic approach involves primary prevention: application of ergonomic and safety principles to job and workplace design; secondary prevention: rehabilitation, functional restoration and quick return to gainful employment; and tertiary prevention: re-engineering of the work environment to deter re-injuries and match the workers residual abilities. Special attention is given to the Occupational Safety and Health Act of 1970, the Americans with Disabilities Act of 1991 and other existing health and safety regulations for the workplace to ensure compliance by employers with their provisions. Another unique feature of the program is that emphasis is given to issues surrounding automation and computer technologies as well as issues surrounding special populations such as older adults and disabled populations.

The training program consists of a 36-hour Master's degree program in Occupational Ergonomics and Safety in the Department of Industrial Engineering. The program includes 33 semester credit hours of course work in the areas of ergonomics and safety and 3 hours of internship in an industrial or health care related facility. Research areas include musculoskeletal injuries, occupational stress, automation, and design for older workers and special populations.

Students are required to hold a BS degree in Engineering, Psychology, or health related fields, such as Environmental Health or Physical Therapy. Applicants must meet the regular admissions criteria of the Graduate School of the University of Miami.

Primary sites of training include the University of Miami, Department of Industrial Engineering and its laboratories, the Comprehensive Pain and Rehabilitation Center of the School of Medicine, Miami Center on Human Factors and Aging Research, and several collaborating industries throughout the South Florida region.

SIGNIFICANT FINDINGS

This is a training grant in Occupational Safety and Health; the training program has been fully implemented in the University of Miami Industrial Engineering Department. With the support of NIOSH several graduate fellows were appointed and took advantage of all the course offerings available. Many more students who are not funded by the NIOSH training grant, but attending other regular engineering and environmental health programs were able to benefit by taking one or more courses offered by this program. The availability of the training grant contributes in a significant way to the enhancement of course offering in occupational safety and health at the University of Miami. It provides an area of concentration in occupational safety and health within the Department of Industrial Engineering permitting many graduate engineers and other environmental health professionals to be sensitized to the occupational health problems. Graduates with B.S. in Industrial Engineering, M.S. in Industrial Engineering, Environmental Engineering, Environmental Health and Public Health, taking courses made available by this program, were able to carry this knowledge to industry and various workplaces. This is a proof of the importance of the sponsored NIOSH programs' ability to have a much farther impact than the actual amount of financial support

Program funding also motivated the faculty and the Department to offer courses in Occupational Safety and Health on a regular basis. It permitted the program director to devote a portion of his time to advancing the causes of the program.

More specific enhancements taking place during this program period include obtaining audiovisual materials to reinforce teaching effectiveness in Safety and Industrial Hygiene Courses. Acquiring new Laboratory instruments was also made possible. In addition, the visibility of our program permitted us to include courses in Safety and Industrial Hygiene as part of the curriculum of the newly accredited program in Environmental Engineering.

NIOSH Fellows appointed during the reporting period

A number of students receiving grant fellowships during this program period have graduated or expected to graduate soon. They are

Linda Tello	Graduated
Andre Spalding	Graduated
Mark Young	PhD Candidate
Darik Smart	Graduated
Robert Deitz	Expected Dec. graduation
Nader Ayoub	Graduated
Michael Smith	Graduated
Matt Kalasky	Graduated
Shameera Dean	Expected Dec. graduation
Vanessa McConville	Continuing

Cost Sharing

The University of Miami is cost sharing tuition support of fellowship students in the Occupational Safety and Health training program. The University provides support equivalent to 75% of the total amount of tuition required. This has been in excess of $30,000 each year of the NIOSH grant program funding. The University is also cost sharing faculty time of those teaching in the program.

DISTINGTIVE CORE PROGRAMCONTRIBUTIONS

Conceptual Framework

The focus of the training program is on occupational ergonomics and safety. Students are given in-depth education and training in occupational health and safety problems and methodologies for prevention and intervention. Emphasis is given to traditional and automated work environments and to special populations. This is accomplished using an interdisciplinary approach based on integrated knowledge of engineering, ergonomics and the medical and health related sciences.

The conceptual model for the program is based on a systems approach to studying work and working environments. The systems approach views work in terms of the human/work interactions and thus focuses on all of the system components, the worker, the environment, and the job, with respect to improving working conditions. In addition, this approach examines the worker and working environment in relation to societal issues including economic, social, legal and moral factors. Thus, students are versed in engineering and ergonomic solutions to health and safety problems, as well as administrative issues such as workers' compensation, insurance, rehabilitation, and legal requirements. Emphasis is given to primary measures of prevention: engineering design of industrial facilities and jobs to reduce stresses and prevent accidents; secondary measures of prevention: post injury rehabilitation where the goal is thorough restoration of functional ability and immediate return to work; and tertiary measures of prevention: reengineering of the work environment to accommodate the effective solution. It is recognized that in spite of engineering controls, work injuries may occur and therefore, an overall prevention strategy including rehabilitation and return to gainful employment needs to be adopted to maximize humanitarian and economic gains.

Program Structure

The program consists of 36 semester credit hours leading to a Master of Science degree with concentration in Occupational Ergonomics and Safety. The degree is offered by the Department of Industrial Engineering, University of Miami. The program involves 33 hours of course work and 3 hours of an internship/project in an industrial or health related facility. The course

work includes laboratory experience and emphasis is given to applied problems. For example, in the basic Ergonomics course (IEN 557), students have laboratories related to anthropometry and workplace design, task analysis, etc. The course on Special Populations entail supervised practicum in the Comprehensive Pain and Rehabilitation Center (CPRC).

Each student is required to complete an internship. This will consist of the development and implementation of a project in an industrial or health care facility. The students must conceptualize the project, conduct the project and prepare a final report of masters' level quality. The project must be related to occupational ergonomics and safety and involve identifying a real-world problem and introducing proposed solutions. Students work with faculty advisors during the course of their internship and the faculty members guide them with respect to project topics and methodologies. The program faculty are actively involved in research and are well published in their areas of expertise.

The students' course work is usually spread over 2 academic years and 1 summer month. Students take 9 credits for four semesters. They conduct the three-hour internship in the intervening summer and complete the project in the second year. The course structure is as follows:

CORE COURSES

IEN 351	Industrial Safety Engineering
IEN 551	Accident Prevention Systems
IEN 557	Ergonomics and Human Factors Engineering
IEN 558	Industrial Hygiene I
IEN 559	Industrial Hygiene II
IEN 651	System Safety Engineering
IEN 657	Ergonomics and Occupational Biomechanics
IEN 658	Ergonomics and Special Populations
IEN 612	Design of Experiments
EPH 521	Fundamentals of Epidemiology
IEN 694	Master's Project (Internship)

ELECTIVES

Suggested List of Electives:

IEN 656	Human Information Processing and System Design
IEN 660	Human Factors in the Management of Technology
IEN 659	Work Physiology
EPH 541	Integrated Aspects of Environmental Health
MAS 606	Non Parametric Statistics
PSY 632	Multiple Regression and Multivariate Statistics
PSY 634	Program Evaluation
IEN 572	Management of Technology
MGT 650	Essentials of Management: Voice of the Business
MGT 651	Behavioral and Organizational Systems
MGT 602	Human Resource Management

(**Note:** All courses are 3 credit hours unless otherwise indicated.)

If a student is admitted with a previous record of having taken one of the program courses or its equivalent, he or she is advised to take a substitute course from a wide list of courses offered by the University of Miami, Department of Industrial Engineering, Epidemiology and Public Health or other departments. Examples of such courses are Advanced Epidemiology (EPH 641) or Environmental Health (EPH 541).

Faculty Commitment/Breadth

Dr. Tarek Khalil, Professor of Industrial Engineering and Director of the Ergonomics and Bioengineering Division at the School of Medicine's Comprehensive Pain and Rehabilitation Center directs the program. His experience includes serving as the Dean of the Graduate School of the University of Miami and as Chairman of the Department of Industrial Engineering. Dr. Khalil holds professorships in the Departments of Biomedical Engineering, Neurological Surgery and Epidemiology and Public Health. Dr. Khalil is involved in the review of the educational program, in teaching, in mentoring students, and as the program's liaison to industry and health care facilities for the internship program. He teaches Ergonomics, Industrial Hygiene and Safety courses.

Dr. Shihab Asfour, Professor and Chairman of Industrial Engineering acts as the general advisor for the students and is responsible for student admission. He also serves as a member of the teaching faculty and teaches the courses in Design of Experiments, Occupational Biomechanics, He also supervises student laboratory and internship experience.

Dr. Sara J. Czaja serves as a member of the program faculty. Dr. Czaja is a Professor in the Department of Psychiatry and Behavioral Medicine and in Industrial Engineering. She is the Director of the Miami Center in Human Factors and Aging Research. Dr. Czaja is involved in students' recruitment, advisement, coordination of the internship program and she supervises students' internship at the aging center. She is also teaching the Ergonomics and Human Factors Course and Human Information Processing Course.

Dr. Elsayed Abdel-Moty, Research Associate Professor of Industrial Engineering and Clinical Supervisor of the Comprehensive Pain and Rehabilitation Center serves as a member of the program faculty and supervises the student's orientation and internship in the clinical setting.

Dr. Joseph Sharit, Research Associate Professor of Industrial Engineering is nationally recognized for his work in human factors , safety and aging research. Dr Sharit teaches Systems Safety and Statistics and is involved in several interdisciplinary research projects with the Medical School.

The program, core faculty are complimented by the following members of the University of Miami faculty:

Hubert L. Rosomoff, M.D., D.Med.Sc., Professor and Chairman Emeritus of Neurological Surgery and Professor of Orthopedics and Rehabilitation at the University of Miami School of Medicine. He is founder of the Comprehensive Pain and Rehabilitation Center and is presently its Medical Director.

Carolee Devito, Ph.D., M.P.H., Associate Chair of the Department of Family Medicine and an Epidemiology and Public Health expert.

Laura Fleming, M.D., Assistant Professor of Occupational Medicine, University of Miami School of Medicine.
Joseph Signorile, Ph.D., Assistant Professor, Department of Exercise and Sports Science.

FACULTY AND THEIR AREA OF COMPETENCE

Core Faculty	Area of Competence
Khalil, Tarek M., Ph.D., P.E.	Ergonomics, Safety Engineering, Industrial Hygiene, Rehabilitation
Czaja, Sara Jane, Ph.D.	Ergonomics, Aging, Human Computer Interaction, Information Processing
Asfour, Shihab S., Ph.D.	Ergonomics, Biomechanics, Safety
Abdel-Moty, Elsayed M., Ph.D.	Ergonomics, Rehabilitation Engineering, Industrial Hygiene
Sharit, Joseph, Ph.D.	Human Factors, Systems Safety
Supporting Faculty	
Fleming, Lora, M.D., MPH	Occupational Medicine, Epidemiology
Rhodes, Milton, D.E.	Safety Engineering
Signorile, Joseph, Ph.D.	Work & Exercise Physiology
Rosomoff, Hubert L., M.D.	Rehabilitation, Neurosurgery
Devito, Carolee, Ph.D.	Public Health Services, Epidemiology

New additions to the program's Faculty include **Dr. M. W. Fahmy** who teaches in the area of Biomechanics and Ergonomics and **Dr. Mona Aboulseoud** who teaches in the area of Safety Engineering, accident prevention and statistics.

Dr. Tarek Khalil taught the courses in Industrial Safety, Accident Prevention, Industrial Hygiene I, Industrial Hygiene II and Ergonomics and Special Populations. Dr. Shihab Asfour taught the

courses in Biomechanics and Design of Experiments. Dr. Sara Czaja taught the courses in Ergonomics and Human Factors and Human Computer Interaction.. Dr. Joseph Sharit taught the course in Systems Safety Engineering. Dr. M.W. Fahmy taught the course in Occupational Biomechanics. Dr. Mona Aboulseoud taught the courses in Accident Prevention and Industrial Safety. Dr. Laura Fleming taught the courses in Epidemiology and Environmental Health. Dr. E.A. Moty lectured in Ergonomics and Special Populations and supervised students' projects. Dr. Milton Rhodes taught courses in Industrial Safety and Accident Prevention.Other faculty members present seminars and are available to supervise internships and serve on the student's research advisory committees. Dr. Joseph Signorile lectured on Work Physiology.

Conclusions

The Occupational Safety and Health training program at the University of Miami has been effective in training men and women in areas vital to the implementation of the Occupational Safety and Health Act of 1970. NIOSH grant support was essential in the training of students in the concentration of Occupational Ergonomics and Safety.

The training program provided the impetus for faculty to develop new course material and be involved in research in areas related to safety, health and ergonomics. The program also helped foster interdisciplinary collaboration of faculty and students. The program has been highly successful and has had a strong influence in maintaining an effective educational program in occupational safety and health at the University of Miami.

Recent Faculty Publications

Since this is training and not a research program most faculty publications have been due to their involvement in many other research projects in their areas of expertise. The following is a sample of recent faculty publications related to the grant activities.

Tarek M. Khalil:

Abdel-Moty, E., Khalil, T., Steele-Rosomoff, R., Rosomoff, H., Asfour, SS. The Role of Ergonomics in the Prevention and Treatment of Myofascial Pain. In: Diagnosis and Comprehensive Treatment of Myofascial Pain: Handbook of Trigger Point Management, 2nd Edition. (E.S. Rachlin, T. Rachlin, Editors), 2001. In print.

Khalil, Tarek, Lefebvre, Louis, Mason, Robert, (Eds.) 2001. Management of Technology: The Key to Prosperity in the 3rd Millennium, Elsevier Science, Oxford, UK.

Abdel-Moty, E., Rosomoff, H.L., Steele-Rosomoff, R., Khalil, T., Sadek, S.S., Asfour, S., 2001. Motor Dysfunction Evaluation and Treatment in Chronic Back Pain Patients: A Multidisciplinary Approach. Proceedings of the International Conference on the Application of Human Performance in Heath & Disability, Cairo, Egypt, March 26-29, 2001. In print.

Khalil, Tarek, Management of Technology: The key to Global Competitiveness and Wealth Creation, McGraw Hill Book Co., New York, NY, 2000.
Khalil, T. et al." Postural Sway of Chronic Low Back Pain Patients and Comparison to Controls" Abstracts of the Annual Meeting of the International Society for the Study of the Lumbar Spine, June 1999.

Khalil, T. et al." Global Changes in the Automotive Industry" Proceedings of the 8th International Conference on Management of Technology, 1999.

Khalil, T. et al. (Eds.) Civilization, Modern Technology and Sustainable Development , Institute of National Planning Press, Cairo, Egypt, 1999.

Khalil, T. M. Management of Technology: Future Directions and Needs for the New Century, Report of NSF Workshop on Management of Technology and the paradigm shift in Education in response to the Technology Revolution, University of Miami, Coral Gables, Florida, 1999.

Rosomoff, RS, Rosomoff, HL, Abdel-Moty, E, Khalil, TM, Zaki, A, 1998. Stability of a Multidisciplinary Pain Center Outcome of 1619 Patients Over a 7-Year Period. Abstracts of the 17th Annual Scientific Meeting of the Americal Pain Society, San Diego, CA, November 5-8,

Shihab Asfour:

Asfour, S.S., Iakovou, E., Cortes, G.A., "A Synthesis of Quality Function Deployment & Robust Design and its Application in the Medical Device Industry", Journal of Quality Engineering 12, 1, 37-45, 1999-2000.

Smith, W., Besio, G., Tarjan, P., and Asfour, S.S., "Hemiplegia and Its Effect Upon Fractionated Premotor, Motor and Ankle Dorsiflexion Reaction Times", Accepted for Publication in Perceptual and Motor Skills Journal.

Asfour, S.S., Iakovou, E., Cortes, G.A., "A Synthesis of Quality Function Deployment & Robust Design and its Application in the Medical Device Industry", Journal of Quality Engineering 12, 1, 37-45, 1999-2000.
Ismail, A., and Asfour, S.S., "Discrete Wavelet Transform: A Tool in Smoothing Kinematic Data", Journal of Biomechanics, 32, 3, pp. 317-321, 1999.

Eldeeb, H., Asfour, S.S., Boubekri, N., "CT/MR Imaging : A Design Tool for Custom Orthosis." Disability and Rehabilation, Taylor and Francis Ltd., Vol. 22, Nos. 13,14,2000.

Abdallah, M.A., Asfour, S.S., Veziroglu, T.N., "Solar-Hydrogen Energy System for Egypt, "International Journal of Hydrogen Energy 24, 6, 505-518, 1999.

Ismail, A., and Asfour, S.S., "Discrete Wavelet Transform: A Tool in Smoothing Kinematic Data", Accepted for Publication in Journal of Biomechanics.

Ismail, A., and Asfour, S.S., "Continuous Wavelet Transform Application to EMG Signals During Human Gait", 32nd Asilomar Conference on Signals, Systems, and Computers. IEEE SP Society Pacific Grove, California, November 1-4, 1998.

Waly, S., Asfour, S.S., and Iridiastadi H., "Prediction of Thermal Stress in the Workplace with Natural Ventilation", Advances in Occupational Ergonomics and Safety II, B. Das and W. Karwowski (editors), Washington, DC, 1997.

Sara J. Czaja and Joseph Sharit

Czaja SJ., and Sharit J. , 1998. Ability-Performance relationships as a function of age and task experience for a data entry task. Journal of Experimental Psychology: Applied, 4(4), 332-351.

Czaja SJ, Sharit J., Nair S., and Rubert M. 1998. Understanding sources of user variability in computer-based data entry performance. Behavior and Information Technology, 17, 282-293.

Sharit J., Czaja SJ., Nair S., **Hoag DW.**, Leonard D. and Dielsen K. 1998. Subjective experiences of stress workload, and bodily discomfort as a function of age and type of computer work. Work and Stress, 12(2), 125-144.

Czaja SJ., Sharit J., Kline B., and Dielsen D. 1998. Age differences in attitudes towards computers: the influence of task characteristics. The Journals of Gerontoloty: Psychological Sciences and Social Sciences.

Sharit J. and Czaja SJ. 1999. Performance of a computer-based troubleshooting task in banking industry: Examining the effects of age, task experience, and cognitive abilities. Int. J. of Cognitive Ergonomics, 3(1), 1-22.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Memorandum

Date July 23, 2002

From Principal Engineer, OEP, NIOSH

Subject Final Progress Report for entry into NIOSHTIC2/NTIS for NIOSH Training Grant No. T01 CCT 410466

To Vern P. Anderson, Chief, IRB, EID (C-18)

The enclosed report has been received from the Program Director to document work performed during the specified grant project period. The following information applies to the designated Training Project Grant (TPG):

Title: Occupational Safety and Health Training

Project Director: Tarek M. Khalil, Ph.D.
University of Miami
Coral Gables, FL 33124

Grant No.: T01 CCT 410466

Project Period: 7/1/96 - 6/30/2001

Please place the report in DIDS and I also recommend it for entry into NIOSHTIC2 and submission to NTIS.

Thanks for your assistance.

John T. Talty, P.E., DEE

cc: S. Board/B. Kuchinski, OEP

Enclosure

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