

**MULTIGENERATIONAL PSYCHOMETRIC EVALUATION OF HEALTH PROMOTION
PRACTICES TO IDENTIFY DETERMINANTS FOR SUSTAINING WORKLIFE
EXPECTANCY IN AGING POPULATION**

By

Vatsalya Vatsalya

Submitted to the

Faculty of the College of Arts and Sciences

of American University

in Partial Fulfillment of

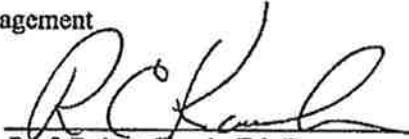
the Requirements for the Degree of

Masters of Science

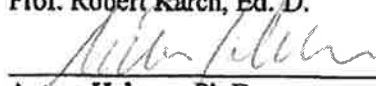
In

Health Promotion Management

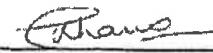
Chair:



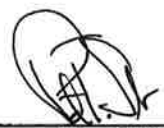
Prof. Robert Karch, Ed. D.



Antero Heloma, Ph.D.



Gulshan L. Khanna, Ph.D.



Dean of the College of Arts and Sciences



Date

2013

American University

Washington, D.C. 20016

© COPYRIGHT

by

Vatsalya Vatsalya

2013

ALL RIGHTS RESERVED

MULTIGENERATIONAL PSYCHOMETRIC EVALUATION OF HEALTH PROMOTION
PRACTICES TO IDENTIFY DETERMINANTS FOR SUSTAINING WORKLIFE
EXPECTANCY IN AGING POPULATION

BY

Vatsalya Vatsalya

ABSTRACT

Growth of older population in United States requires multi-generational evaluation to characterize health indices for sustaining workability. The objective of this study was to assess the available health promoting practices that are being used by the working population to sustain their workability and also to identify additional health promoting practices that can be used as markers to sustain workability.

Forty (40) non-treatment seeking, non-diagnosed otherwise healthy working population residing within United States with minimum age of 22 years up to 75 years were included in this study. Research data was collected as responses to two paper based questionnaires - the Customized Employee Biographical Questionnaire (EBQ) and Occupational Health Surveillance Questionnaire (OHRQ). Processed data was tabulated for the parameters with age-groups distribution as 22-31, 32-41, 42-51, 52-61 and 62+ groups and statistically analyzed.

Length of working showed significant Between-Subjects effects with hours of physical training at moderate levels, though this effect increased when age was included as a covariate, which demonstrates that continuous physical training is important for all age-groups to sustain workability. Education and level of training strongly associated with hours of training as measure interactions with age as a covariate as well.

The analysis of the data gathered for this investigation identified that workability was strongly associated with hours of physical training and is a significant marker for sustaining

workability. Further investigation of measures in larger working population who use their work-life in an attempt to stay healthy and fit could potentially reveal significant associations that could extend workability as well as enhance work productivity in such areas as performance, presenteeism, and job satisfaction.

ACKNOWLEDGMENTS

I would like to acknowledge my wife, Dr. Shweta Srivastava and my son Hirsch Vagish for their support and patience towards my effort to complete this research project and would like to dedicate this work to them. I am obliged to the wisdom that I received from my parents, to seek knowledge. Lastly though not the least, I am thankful to the research committee members Dr. Antero Heloma, Dr. Gulshan Khanna and specially Dr. Robert Karch; for their guidance and comments that has assisted me in bringing this study concept up to its current level of a scholastic work. My special regards goes to Dr. Karch for his research mentorship and guidance throughout the project and providing me with the insights of conducting human research investigations. I also would like to extend my gratitude to the faculty and staff of the School of Education, Teaching, and Health at the College of Arts and Sciences at American University, Washington DC for their support.

TABLE OF CONTENTS

ABSTRACT	ii
ACKNOWLEDGMENTS	iv
LIST OF TABLES	vii
LIST OF ILLUSTRATIONS	viii
CHAPTER 1 THE PROBLEM AND ITS SETTING	1
Introduction.....	1
Statement of the Problem.....	2
Hypothesis Rationale	3
The Hypotheses.....	3
The Sub-Problems.....	3
Hypothesis Objectives	3
The Definition of Terms	4
Abbreviations	4
Scope of the Study	4
Limitations of the Study.....	4
Delimitations.....	5
The Assumptions	5
The Study Organization	5
CHAPTER 2 REVIEW OF THE LITERATURE	6
Present Global Health Concerns and Prolonged Work-Life Expectancy	6
Implications and Scope of Work-life Expectancy in US Context	7
Direction of Strategic Evaluation towards Appropriating Planning	9
CHAPTER 3 RESEARCH METHODOLOGY	12

Identification and Validation of the Questionnaire Forms	12
Study Population.....	12
Procurement Process (Inclusion and Exclusionary Criteria)	13
Procedures.....	13
Validation of Data and Quality Assurance and Quality Control	14
Treatment of the Data	14
Programming the Data	16
Analyzing the Data and Statistical Rationale.....	16
Benefits and Risks/Discomforts.....	17
CHAPTER 4 ANALYSIS OF THE DATA AND DISCUSSION	19
CHAPTER 5 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	34
APPENDIX A: CONSENT FORM: MULTIGENERATIONAL PSYCHOMETRIC EVALUATION OF HEALTH PROMOTION PRACTICES TO IDENTIFY DETERMINANTS FOR SUSTAINING WORKLIFE EXPECTANCY IN AGING POPULATION	40
APPENDIX B: EMPLOYEE BIOGRAPHICAL QUESTIONNAIRE FOR PROTOCOL: MULTIGENERATIONAL PSYCHOMETRIC EVALUATION OF HEALTH PROMOTION PRACTICES TO IDENTIFY DETERMINANTS FOR SUSTAINING WORKLIFE EXPECTANCY IN AGING POPULATION	42
APPENDIX C: OCCUPATIONAL HEALTH SURVEILLANCE QUESTIONNAIRE FOR PROTOCOL: MULTIGENERATIONAL PSYCHOMETRIC EVALUATION OF HEALTH PROMOTION PRACTICES TO IDENTIFY DETERMINANTS FOR SUSTAINING WORKLIFE EXPECTANCY IN AGING POPULATION.....	44

LIST OF TABLES

Table

1.	Demographical Distribution of the Study Sample.....	20
2.	Association of Length of Working with Hours of Training and Age.....	21
3.	Education Level and Age Association with the Duration of Working.....	23
4.	Reverse Association between Duration of Training and Weight Increases.....	24
5.	Association of Weight Increases, BMI and Shifts of Work.....	26
6.	Progressive Increase in Association of Measures across the Ages.....	32

LIST OF ILLUSTRATIONS

Figure

1.	Distribution of Health Determinants among Various Age Groups.....	22
2.	Length of Working versus Work Shifts and Sports Type measures.....	27
3.	Traits of Health Determinant Measures among Various Age-groups Group.....	29
4.	Differences in the Health Measures in Various Age-Groups compared from the Youngest.....	31

CHAPTER 1

THE PROBLEM AND ITS SETTING

Introduction

The reality of the ever increasing age of the workforce populations of United States and the corresponding increase in the costs of various health care services, has caused considerable introspection for not only employers but also, and perhaps even more so, for individuals still in the workforce as they contemplate their remaining years of employment. One result of this introspection is that an increasing number of workers, during their middle age years, are planning various work-life scenarios for their remaining years of work as well as their a post-retirement period. In addition, one increasingly more common outcome has led people to extend their work-life for additional years more than they had previously anticipated. However, in doing so, many people who choose, or out of necessity must, continue working longer than they had anticipated have adopted various health promoting activities as resources to maintain their work-ability in an attempt to delay if not avoid complications due their extended work schedule. Thus, an investigation of the prevailing rational for such actions as well as the type and effect of selected health promoting activities in which a population chooses to engage in an effort to maintain workability, can provide meaningful insight as to the development of long term work behavior and sustained work-ability.

While the topic of sustained work-ability is relatively new in the United States, various European and Asian regions, namely Scandinavian and South-East Asian countries, respectively have been successful in introducing and studying such measures for many years. More specifically, they have been using an array of evaluations that incorporate measures of work-ability indexes to develop and implement various health promotion practices most appropriate for their various working population groups. The indexes are designed in relation to health status,

job requirements, social and psychological factors and provide comparisons between various occupational groups based on data obtained from the evaluations. One of its main objectives of this research study was to understand work-ability subjectively in order to better customize the practice by focusing on the individual's needs. However, the process of conceptualizing and then constructing such comprehensive indicators for use in a work-ability index in US has been rather limited. Currently the accomplishments of the few health promotion practices already under use are being studied in middle and older range working groups at various agency-based (namely Department of Defense and Labor) and academic institutions to understand the levels and proficiency of outcomes from extending workability in various constructs. More specifically, different evaluations targeting socio-demographic, health conditions (both psychological and physiological) and current health promotion practices are being investigated to stratify the course of work-ability and associated health promotion requirements in the regional US environment. It is anticipated that findings from these studies will be used to further the understanding of the corresponding health behaviors as well as to better identify, define, and prescribe, if not require, the most appropriate health promotion practices. Such practices could then be institutionalized to prolong work-ability.

Statement of the Problem

The problem of this study was four-fold: first, to identify the health and lifestyle measures that could assist the working US population in various age-groups to sustain their workability; second, to identify, secure, and obtain the necessary data from the study participants; third, to determine and characterize the association among the measures that interplay with and among the measures; and lastly, to develop a set of recommendations for planning and sustaining workability, as well as recommendations for further study of this topic.

Hypothesis Rationale

The rationale advanced for this study was that by assessing the health promoting practices that are being used by the working population to sustain their workability, this study would aid in developing appropriate guideline to incorporate such practices in current and future workplace settings so as to assist workers in continuing their workability for their desired duration.

The Hypotheses

The first hypothesis was that with respect to the study participants, on the subjects assessed, there would be no significant differences among the responses from the questionnaires and association towards work sustainability. The second hypothesis was that there would be statistically no significant interaction between the measures.

The Sub-Problems

The sub-problems for this study were: (1) to identify and secure the participants of this study and obtain valid responses to the instrumentations used in this study, (2) to complete quality assurance of the data and statistically analyze the data to compare the findings with respect to the age-groups differences.

Hypothesis Objectives

(1) To Identify both the health promoting measures as determinants, which can be used by a working population to sustain workability and the characterization of health promoting practices that can be used to sustain workability,

(2) To develop appropriate guideline for the utilization of such practices for a working population according to the individual based criteria for best achieving a desirable working timeframe.

The Definition of Terms

Health Determinants: are the measures of health indices that incorporate social and economic environment; physical environment; and the person's individual characteristics and behaviors.

Work Sustainability: is an employment incentive issue that includes engagement, education and learning, communication and strategies for employees to continue to work quantitatively and qualitatively with optimal involvement.

Abbreviations

This study has used various health measures and demographic markers for data collection, storage, analysis, and presentation of data and findings. All abbreviated forms and markers used in this study are identified and defined in the Methodology section of this thesis.

Scope of the Study

This research was conducted in the greater Washington DC area and was open to all sexes and ages (21 to 75) who were employed full-time. Responses from 40 subjects were used in the analysis, which was well within scope of the statistical power. This study was conducted using the research protocol approved by American University Institutional Review Board to conduct research with human subject involvement.

Limitations of the Study

This Study was limited to the 40 subjects who were US residents, who were drawn from greater Washington DC area. However, with the scope of large investigation support including funding and strength of research staff, replication of this research study could very conveniently accommodate a larger number of subjects from other regions.

Delimitations

This study did not attempt to evaluate the level of workplace performance for participants involved in this study. This study also did not exclusively use performance or job type of the participants as criteria of study.

The Assumptions

It was assumed that participants involved in this study providing truthful and accurate responses to the research questionnaires used in this study.

The Study Organization

This study was organized as follows: Chapter II was devoted to reviewing the literature associated with the nature of the study and was subdivided into “Present Global Health Concerns and Prolonged Work-Life Expectancy”, “Implications and Scope of Work-Life Expectancy in US context”, and “Direction for Strategic Evaluation towards Appropriating Planning”; Chapter III was devoted to the process that was used for data collection and analysis and was subdivided into “Identification and Validation of the Questionnaire Forms”, “Study Population”, “Procurement Process (Inclusion and Exclusionary Criteria)”, “Procedures”, “Validation of Data and Quality Assurance and Quality Control”, “Treatment of the Data”, “Programming the Data”, “Analyzing the Data and Statistical Rationale”, “Benefits and Risks/Discomforts”; Chapter IV was devoted to the presentation and analyses of the data collected for this study, and discussion, and was subdivided into “Statistical Treatment”, “Socio-Demographical Illustration of the Study Population”, “Interaction of Measures with Length of Working across the Age Groups”, and “Variability Characterization of Measures across Age Cohorts”; and Chapter V presents the inferences from the results of the study, study conclusions, and recommendations for future research.

CHAPTER 2

REVIEW OF THE LITERATURE

Present Global Health Concerns and Prolonged Work-Life Expectancy

Over the past decade the dual impact of an aging population and rising health care costs have been adversely influencing the national economies of countries worldwide. Globally countries are attempting to find solutions to deal with their healthcare associated financial crisis and minimize if not avoid over-burdening their citizens with various economic reforms and taxations (1). Further compounding the ramifications of this crisis is the fact that while the relative age of the working population in all developed countries has been trending upward while at the same time global competitive dynamics have created the expectation, if not necessity, that aging employees perform better both qualitatively and quantitatively. This dilemma is further compounded by the fact that aged and retired workers often need and seek access to robust and costly healthcare services as a result of years of chronic lifestyle linked health risk behaviors or geriatric ailments (2).

Today, variable working paradigms, such as lifestyle management programs designed to reduce health-risk behavior, workplace health and safety requirements and the costs of health care services, have motivated employees during their early to middle age, to plan for their current and extended years in the workplace as well as their senior post-retirement years (3). However, there remains, in both developed and developing countries many unhealthy workplace settings that are adversely affecting the health status and work performance of employees which in turn negatively impacts work sustainability and overall quality of life. Thus, to minimize disability, planning for responsible behavior and awareness about a sustainable lifestyle and the evolution of self-liability is essential (4). People selecting to work longer will require

incorporating various resources to stay healthy and minimize disability. This would aid in continuing to work with desirable outcomes and avoiding complications due to extended work schedule with the ever increasing, pace, stress, and sophistication of workplace settings (5). The need to understand the concepts of work-life expectancy therefore becomes very important to evaluate measures of work sustainability.

The work-life expectancy at a certain age is the average number of years that a person in a given cohort will spend either working or actively looking for work during the remainder of one's life (6). Markov assumption (7) has been used to better understand the work-life relationship, and states that the probability of a person to remain active the following year depends only on whether one was active or inactive in the present year. Even if the person has 20 previous years as an active member of the labor force, one's chances of being inactive next year are the same as someone, who had been in and out of the labor force 10 times in the same period (8). Therefore, the possibility of a person to remain in the labor force can be an outcome of a combination of necessities and abilities (9). Given the state of current social and economic conditions, there is an increasing trend for workers to extend retirement plans and restructure post-retirement plans. Specifically, this growing age group might need to make informed decisions for working longer than anticipated to accommodate already anticipated financial goals (10). Additional concern among older workers could be a greater need for improvement in terms of training and health conditions comparing with the younger working population (11).

Implications and Scope of Work-life Expectancy in US Context

Continuous growth among the older group adults, apprehensions of financial planning and independence have become concerning gerontology issues. Increasing costs of health care services in United States has started to raise concerns in the working class and has lead to an ever

increasing exploration of new approaches in an effort to sustain and meet the goals for prolonging workability and productivity. Older Americans, the most rapidly growing age group, are the least physically active and generate the highest health care expenditures (12). In the next 20 years, United States will experience a major demographic shift as the largest birth cohort grows older (13). The emerging impacts of present economy with the inflation of healthcare costs, for the elderly will not be avoidable, therefore significant policy development and their planned implementation in a timely manner are quickly becoming necessary process for individuals and agencies. Historical information about retirement rates can be used to project the long-term trend in retirement. The average retirement age is the youngest age at which at least half of population has left the labor force. There has already been some historical variation in the trending of the age of retirement in that during the early 1990s there was a strong trend toward earlier male (majority of US workforce) retirement but that trend has ceased by late 1990s (14). It is clear, that anticipating, monitoring, and responding to both increased or decreased changes in the work-life sustainability of employees is not only very important but also has critical implications for such social programs as Medicare and Social Security. Further, such changes could also translate into reduced long-term care and health management of the elderly, technological support for management of medical care, a more active involvement of geriatric work force, and development of viable strategies to pay for escalating medical care costs (15).

However all these programs and their applicability require inputs to ascertain the extent and quantification of various measures that could relate to the needs of the elderly for maintaining their healthy status as well as financial independence. Thus, there is a clear need for the characterization of work sustainability indices in US context and an evaluation of health promotion practices related to work-life expectancy and sustainability. More specifically,

applicable programs need to be developed for the working population to extend and improve their work-life. Such developments could lead to a deeper understanding of the level of severity of the current problem and assist in generating appropriate strategies.

Direction of Strategic Evaluation towards Appropriating Planning

Longitudinal investigations to evaluate health promotion practices with the intent of extending and improving work sustainability with multigenerational employees have been helpful for the working population to adhere to intelligent health enhancing and work-life sustaining programs. However, in the US, there has been very little research with respect to present health practices and planning with the anticipation of prolonging the work life for a working population with aging concerns. Clearly if undertaken, such studies could potentially provide information about the choices and availability of appropriate health promotion practices as well as to how various working populations can utilize this information to incorporate recommendations for sustaining workability at older age. Further standard questionnaires and surveys (namely biographical, occupational health surveys, economic expectancy questionnaire) that incorporate mental and physical assessments and financial independence plans can be administered congruently. Moreover, such tools could be useful to identify significant correlates of health promotion practices with indices of sustainability of work (16, 17). Two such tools that have been used for this purpose are the Employee Biographical Questionnaire (EBQ) and Occupational Health Surveillance Questionnaire (OHRQ). Such assessment should be implemented on various age-group working population to expand the evaluation with age-cohort perspective. Involving such age-group populations, data collection and accuracy of evaluations would play a highly valuable role in demographical and longitudinal studies. Research questions directed towards the assessment of performance of the health advancing techniques that adult

and a senior-adult population have utilized or would use to enhance work-life sustainability would be important in providing an essential frame work of individual health. Further, an investigation of resources, which people use to stay healthy and fit, would be able to reflect significance for expectancy of responsible behavior and longevity. Such study paradigms could lay the necessary groundwork by identifying a set of markers for health promotion practices. And finally, the results from investigating the health and fitness practices and programs used by a working population can also be evaluated on the basis of outcomes related to work life sustainability and not only on achieving general healthy status.

Targeting various age-groups with psychometric evaluation designed to explain health promotion factors for sustaining work-life expectancy in aging population provides opportunities to evaluate multigenerational differences. These factors could be used as determinants for further constructing recommendations for various growing age groups for selection of available options to sustain workability. Ultimately, health practices could be evaluated by younger working class as a tool to enhance working abilities in terms of health condition to projected workability at comparatively older age. Study outcome could be used by the employers to structure incentive based responsible health behavior development among employees through incentivizing individualized health promotion programs. At the same time it may essentially serve the employees as well by providing tools tailored to their efforts towards maintaining optimal health for sustaining workability (18). Such broad spectrum studies could also be able to identify predictability of appropriate health promoting practices and vitality of translational planning strategies. Outcome of investigations to measure health indices for sustaining workability could potentially provide information of successful methodologies used by various working classes in different age groups to develop and maintain their health status for maintaining their work

performance for a desirable time-frame in old age. Such investigations could further information regarding the choices, various sub - populations characterizations and recommendations of health profiling and modeling that could be used for developing intelligent health deigns and predictable planning approaches.

CHAPTER 3

RESEARCH METHODOLOGY

Primary research set-up was located at the Health Promotion Management Department, SETH at American University, where the study methodologies were developed and guided accordingly for analysis. Technical and information based resources from the American University Library and Health Promotion Management Department administration were also used to support various aspects of the study paradigm.

Identification and Validation of the Questionnaire Forms

The data that was collected for this study were obtained using the Employee Biographical questionnaire (EBQ, GRC 453 [Sep. 02]) and the Occupational Health Surveillance Questionnaire (OHSQ, GC-5197 Rev. [June 04]). These two validated (both for validity and reliability) questionnaires (Appendix B, C) having been established and used in research for the past several years and have been used extensively in present day investigation for evaluating medium to large scale socio-economic and health measure based survey studies.

Study Population

The 40 participants that were included in this study were identified as non-treatment seeking, non-diagnosed otherwise healthy working population residing within United States with minimum age of 22 years up to 75 years. The specific inclusion and exclusion criteria are listed in a following section. This study was designed to evaluate health promotion practices that adhere with age, biographic, education, gender and work activities (mental and physical) associated with workability. Children were not included, primarily because the study proposed involves employment specific age gradient parameters not applicable for a younger population.

Primary screening for legitimacy and consent of the individuals in the study was obtained at the time of data collections.

Procurement Process (Inclusion and Exclusionary Criteria)

This study was designed to evaluate the efficacy of extending workability through the use of health promotion practices. Accordingly, this study was conducted in 40 healthy working adults recruited and randomly selected through word of mouth in the greater Washington DC area. The study was open to all racial and ethnic groups, and as was anticipated, the target enrollment of participants reflected a balanced racial/ethnic distribution. Subjects with diagnosed medical condition requiring long term treatment; terminally ill; physically/mentally challenged; addiction issues were excluded based on their response for their own health assessment during their consent. No specific outreach programs were used or needed for recruitment as the enrollment opportunities were robust enough to allow potential participants to participate if they met the enrollment eligibility criteria.

Procedures

Proper guidelines were followed to seek agreeability to collect data from the participants with gaining assent. Research data were collected as responses to a paper based questionnaire system using Customized Employee Biographical Questionnaire (EBQ) and Occupational Health Surveillance Questionnaire (OHRQ). Biographic assessments (Appendix B and C), usage of health associated activities assessment, outcome based attribute for selecting health status and practices for work sustainability (16, 17) were collected for study objectives. Questionnaire sections with personal identification and medical information were omitted (blackened) before being provided to the participants so that no personal/medical data would be collected. More

specifically, OHSQ-CG; Page 1: name, home address was not asked. Other omissions: "Potential Hazards"; and "Protective Equipment Worn". In page 1, column 6 for work activities, type of work (mental, physical and mental and physical were asked); and shift of work schedule was asked (as morning, evening and night). Part II of page 2, and Page 3 were not included in the data collection. In the section "Hobbies and active sports", total time of exercise and type of physical activity based on strength was asked (light, medium, heavy and none). In the "Work related experience", availability type of food choice (as vegetarian, and all); and BMI range were asked (as BMI in underweight, normal, overweight, obese). EBQ; Page 1: portions of "Return to" (Public Information office, mail stop, Educational Services office, Mail stop, Org. Code, Employee name, Present home address, NASA, Glenn [twice]) section; portions of "Personal data" (Spouse name, Children [name and ages], parents' name and address, last permanent address and its periods, last employer before NASA), and Military service were not asked. Page 2: information only from research fields was collected.

Validation of Data and Quality Assurance and Quality Control

Data was validated to recognize the differences with "Auditing and Validation" application available in the MS Excel 2010. Repeat entry of data was performed and all differences were identified with the raw data to errors and corrected. Quality control was performed using standard research practice protocol for proofreading questionnaire responses.

Treatment of the Data

Data was coded for statistical analysis and was accessible only to the investigator. The following coding format was used: "Sex" was coded as 1 for female and 2 for males; "Age" was as a numerical value in years as was used as is in the analysis. "Working Shift" (WS) was

categorized as 1 for morning shift, 2 for evening and 3 for night shifts. “Length of Working” (LOW) and “Education” were reported in years and were used as is later on during the evaluation. “Type of Work” (TOW) was classified as 1 for mental, 2 for physical, 3 for both mental and physical involvement during the professional work. “Level of Training (Sports Type, LOT)” was classified as 1 for light, 2 for medium, 3 for heavy and 0 for no physical training. “Hours of Training” (HOT) was again in numerical (Hours) for physical exercise therefore was not coded as well. “Marital Status” (MS) was numbered as 1 for married and 2 for single/divorced/widowed.; “Food Choices” (FC) as 1 for choice of every kind of food items and 2 for vegan only. “BMI” was numbered as 1 for normal, 2 for overweight and 3 for obese, whereas “Weight Increased” (WI) was scored 1 for yes and 2 for no response. No individual data was used for analysis outcomes and only group data analysis outcomes were determined. Since the BMI data was collected in such a way to eliminate any potential of judgmental notions towards the subjects, in place of exact BMIs, the categories of BMI ranges 1 as normal, 2 as overweight and 3 as obese were collected. Statistical outcomes were used as predictors for identifying appropriateness for health promoting practices with age groups, type of work. In addition the outcomes were used to develop recommendations for further study.

The actual data was kept confidential even though no subject identification criteria were utilized in the entire data collecting processes. The data was used by the principal Investigator (PI) of the study and the faculty advisor associated with this study. As stated earlier, paper based questionnaire were used and then ultimately converted into an electronic numerical status for analysis. All paper based data were saved in the jurisdiction of the investigators’ accessibility till the study objectives were accomplished and thereafter were appropriately disposed based on the IRB guidelines. Only electronic data was used for analysis and evaluation for the study purpose.

Programming the Data

The gathered data was compiled in the statistical charts and quantification of data for the parameters was performed in MS excel application. Age-groups were distributed as 22-31, 32-41, 42-51, 52-61 and 62+ groups. The raw data for various measures (from OHSQ and EBQ) were used to develop statistical evaluations in relevance to the specificity of health associated promotion practices as covariates of age groups. This data set was used to develop graphs and tables and was transposed in the statistical programming. SPSS IBM version 19.0 was the choice as the statistical vehicle, since this study showed compatibility for critical analytical skills and support for more accurate and insightful decision-making for social and demographic data structure, which SPSS is designed as a statistical application.

Analyzing the Data and Statistical Rationale

General Linear modeling was conducted using Multivariate ANOVA (MANOVA) and Univariate ANOVA (UANOVA); and Linear Regression statistical tools were used; for measure characterization, evaluations and their interactions. Length of working was introduced as a dependent measure in the UANOVA instrumentation and its variance was compared with other measures to identify their effects as independent variable. MANOVA statistical instrumentation was used to estimate the association of measures across the age groups that could show their translation and promise in a larger population. Selected measures as covariates and between the subject factors were introduced in this analysis to estimate the differences. Characteristics from the collected data were utilized to identify the common health approaches for the specific age groups. Secondary analysis was conducted to see the association among the differences and percentage differences among the measures with age-groups using repeated ANOVA. Estimation

of scope of workability, evaluation and involvement of significant relationship of health promotion practice and estimation of efficiency and productivity of health promotion practice for extending workability were the major factors that were studied in relations to the efficacy and applicability of health promotion practices.

Power analysis was designed to accommodate between group designs with a total of 40 subjects balanced on order of age-groups. For objective 1, health promoting practices as determinants were evaluated using two-tailed comparison at probability level of .05 with an adequate power to detect large effect size (Cohen's $F = 0.45$). It was also hypothesized to identify most effective determinants that were standardized at an adequate power (.80) to detect large effect sizes (F) of 0.45 for dependent measure (in this case, length of working) at the $p < .05$ level, for which 34 subjects were minimally required at a $\sigma = 1$, with True $|\mu - \mu_0| = 0.5$. For this, general linear modeling was adequate with application of covariance analysis that could have included application of ANOVA; Multiple, Univariate and Repetitive analysis of variance and multiple regressions with measures with the point of interests as age groups. To evaluate multiple correlations with the dependent and independent variables, R-square evaluations were also conducted.

Benefits and Risks/Discomforts

Benefits: There were no direct health benefits for the participants participating in the studies proposed in this project. Compensation: All participants volunteered for the study without any monetary compensation for their time.

Potential Risks (and strategies for protections against these risks): (1) potential risk of breach of confidentiality and privacy of the participant as in any study. Confidentiality was carefully maintained. All participants were assigned a code number and analytical databases use

only that number for identification. All documents were stored in locked filing cabinets.

Research data was stored in an electronic database, which was accessible only by the investigators and was protected by a system of passwords. Overall, the risks of participation were minimal and every precaution and protective measure was included on to minimize any risks.

Benefit to risk ratio of the proposed studies was favorable. (2) Assent processes: The study protocols and informed assent form were approved by the Institutional Review Board of the American University prior to the start of the studies. The informed assent form (Appendix A) was discussed with the participants and all questions were addressed before the participant agrees (initial the assent form). Assent was obtained by the principal investigator.

CHAPTER 4

ANALYSIS OF THE DATA AND DISCUSSION

Statistical Treatment

Data from this study was analyzed with the SPSS statistical instrument and there were no limitations found in the analysis structure or performance. Evaluation of the demographic and other socio-economic data was evaluated first. The following analysis demonstrates interaction and association of length of working that was measured with other collected measures; and age and sex were used as covariates and were also tested for their value as between the subjects' factors. Inter-measure associations were also evaluated to compare their coherences and if multiple measures work together and what would be the characteristics with multiple measures affecting to the length of working. In the following analysis, first the analysis for the association of length of working with other measures and multiple measure effects with and without covariate involvement has been reported and thereafter inter-measure associations have been evaluated.

Socio-Demographical Illustrations of the Study Population

The sample population used in this study was equally distributed among the parameters of age groups; males and females showed almost equal distribution in the measure values depicted in Table 1. Mean age differences between males and females in each group were contiguous; and more subjects in the oldest age group reported more number of years of education than subjects from other groups apart from the 32-41 yrs. age group. Interestingly, in the 32-41 age groups; both BMI and WI were better controlled than any other group, which shows reverse directional trends. WI was present in each group therefore each group was influenced by the weight gain regardless. Largest WI was observed in 42-51 yrs. age group

population, which also showed not only the highest BMI levels but also the lowest level of “Education” as well. BMI showed similar values in youngest (22-31 yrs.) and two oldest groups (52-61 and 62+ yrs.).

Interaction of Measures with Length of Working
across the Age Groups

Length of working progressively increases with age. Using linear Regression, LOW showed significant Between-Subjects effects with duration of physical exercise, HOT (Fig. 1); $R^2 = 0.120$, $F(1, 38) = 5.190$ at $p = 0.028$ though this effect seized up, when age was weighed in the least squares regression, $R^2 = 0.124$, $F(1, 38) = 5.397$ at $p = 0.026$. To further characterize the role of age, when both age and HOT were run as independent measures of predictability for LOW as described in Table 2, a strong significant association was observed, $R^2 = 0.832$, at $p = 0.00$, which demonstrates that continuous physical training is becomes stronger when age is taken into account in all age-groups to continue working.

Table 1
Demographical Distribution of the Study Sample

Age Groups (years)	22-31 gr.	32-41 gr.	42-51 gr.	52-61 gr.	62+
# Females (Mean Age)	4 (25.5)	3 (36.0)	5 (46.2)	3 (54.3)	5 (65.8)
# Males (Mean Age)	4 (27.0)	5 (35.4)	3 (46.0)	5 (55)	3 (67)
BMI	1.6 ± 0.5	1.4 ± 0.5	2.1 ± 0.6	1.6 ± 0.7	1.6 ± 0.5
Weight Increased	1.4 ± 0.5	1.4 ± 0.5	1.8 ± 0.5	1.5 ± 0.5	1.6 ± 0.5
Education	15.3 ± 3.2	17.1 ± 3.1	15.3 ± 3.5	16 ± 2.1	16.5 ± 4.6

Note: Mean values are depicted with standard deviations.

Age was also reflective of having significant association with HOT in the regression model with HOT as a dependent measure, deriving the analysis at, $R^2 = 0.083$, $F(1, 38) = 4.536$ at $p \leq 0.040$. This analysis also showed direction of the association, and age with LOW could be supported in this analysis using linear regression to have positive association, $B = 0.924$, whereas HOT with age showed negative association, $B = -0.058$ (Fig. 1), which could mean that employees may need constant though less demanding training when they have worked for longer time and could probably imply adaptability. At the same time, HOT is very closely associated with the duration of work therefore demonstrates the value of its coherence with age as the power of analysis becomes stronger.

Table 2
Association of Length of Working with Hours of Training and Age

Variables Entered/Removed ^a			
Model	Variables Entered	Variables Removed	Method
1	Age, HrsTraining ^b	.	Enter
a. Dependent Variable: Lengthofworking			
b. All requested variables entered.			

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.912 ^a	.832	.823	6.155
a. Predictors: (Constant), Age, HrsTraining				

Variance models and regression were conducted to evaluate significance of association between the length of working and with other measures in this population. LOW could only show trends of significant Between-Subjects effects with level of training (or sports type), LOT, $R^2 = 0.267$, $F(3, 36) = 4.361$ at $p = 0.010$; though when weighed with age, Between-Subjects

effects became stronger, $R^2 = 0.872$, $F(4, 35) = 3.858$ at $p = 0.017$ (Fig. 2). It also implies that the level of training may not have strong association (albeit significant) with duration of work, thereby supposing that kind of training is important though when age is included in this analysis the association becomes strong, which was also evident in the analysis with the previous HOT analysis previously. When tested with the regression model, robust predictability was observed. LOT as a predictor of LOW (as a dependent variable) showed lower association $R^2 = 0.266$, $F(1, 38) = 2.885$ at a trend level of significance, $p = 0.098$ though when age was weighed in the least square analysis in the same model, even though the predictability lowered, $R^2 = 0.126$, $F(1, 38) = 5.462$ at $p = 0.025$, which could support the fact that the type of exercise could primarily predict an association as individual based interaction with the measures.

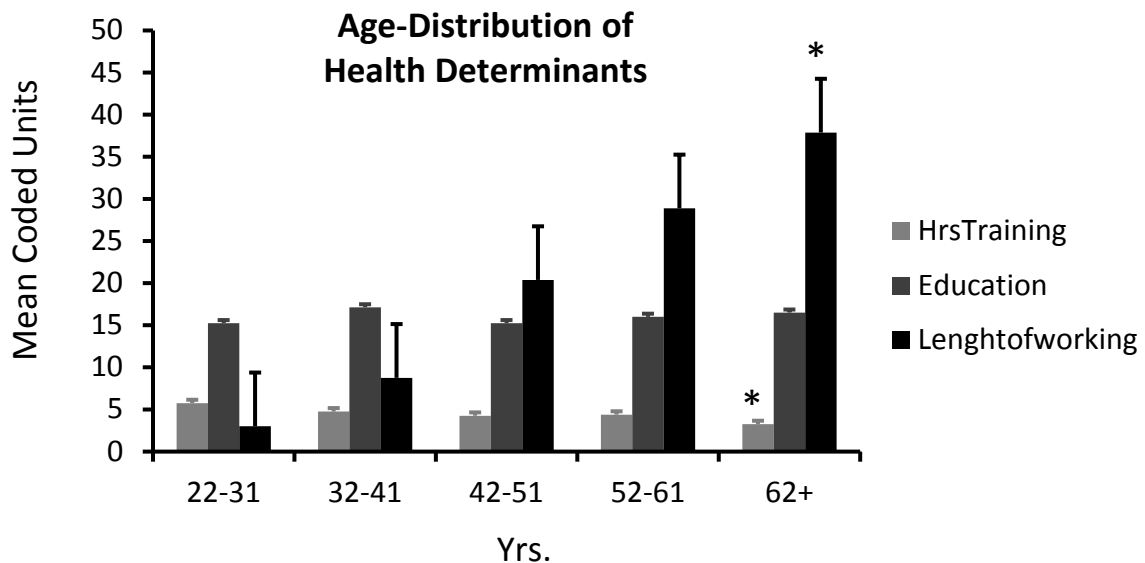


Figure 1. Distribution of Health Determinants among Various Age Groups. *Robust association, $p = 0.028$ between Hours of Training and Length of Working measures.

LOW showed only trends of Between-Subjects association (with UANOVA) with Education, $R^2 = 0.395$, $F(1, 38) = 1.894$ at $p = 0.088$ though when age was included in the

analysis as a covariate, then robust association at significant levels were determined, $R^2 = 0.931$, $F(1, 38) = 4.128$ at $p = 0.001$, which reinforces again that age and education together have a more meaningful impact on how long people work though independently may not further the characterization.

Table 3
Education Level and Age Association with the Duration of Working

Parameter Estimates									
Dependent Variable: Lenghtofworking									
Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared	Noncent. Parameter	Observed Power ^b
					Lower Bound	Upper Bound			
Intercept	-29.134	5.962	-4.886	.000	-41.347	-16.921	.460	4.886	.997
Age	.853	.058	14.755	.000	.734	.971	.886	14.755	1.000
[Education=8.0]	5.551	6.759	.821	.418	-8.294	19.396	.024	.821	.125
[Education=10.0]	21.264	6.418	3.313	.003	8.116	34.411	.282	3.313	.892
[Education=12.0]	18.198	4.968	3.663	.001	8.021	28.375	.324	3.663	.942
[Education=14.0]	13.368	5.426	2.464	.020	2.253	24.482	.178	2.464	.662
[Education=16.0]	7.876	4.844	1.626	.115	-2.047	17.799	.086	1.626	.349
[Education=17.0]	3.846	6.723	.572	.572	-9.926	17.618	.012	.572	.086
[Education=18.0]	9.075	5.053	1.796	.083	-1.276	19.425	.103	1.796	.411
[Education=19.0]	4.435	6.657	.666	.511	-9.202	18.072	.016	.666	.099
[Education=22.0]	8.880	5.589	1.589	.123	-2.568	20.329	.083	1.589	.335
[Education=23.0]	2.435	6.657	.366	.717	-11.202	16.072	.005	.366	.064
[Education=24.0]	0 ^a	.	.	.	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

b. Computed using alpha = .05

To understand the precise role of level of Education, parameter estimates test were conducted in this model as mentioned in Table 3 as well and it could show that number of years anything between 10 and 14 is the most important range of Education that could actually be highly associated with the length of working in this sample. Sex as a covariate could not play a significant role in determining variability in association due to its statistically small subset in each group and when included in the analysis, diverted the association at non-significant levels.

LOW did not show any association using linear regression analysis with SW, $R^2 = 0.048$, $F(1, 38) = 1.934$ at $p = 0.172$; as well as with TOW, $R^2 = 0.047$, $F(1, 38) = 1.934$ at $p = 0.181$, which translates into LOW being independent of the type of work people do or the time of work

that people choose to perform for their employment. Though while evaluating the Between-Subjects effects (UANOVA), parameter estimates could show trends of association between LOW and morning shift, B (Unstandardized coefficient) = 11.312 at $p = 0.064$; and more meaningful association with the evening shifts, B = 18.071 at $p = 0.026$. No relationship or main effects could be established for association with MS; BMI and FC with or without age as a covariate for each.

Table 4
Reverse Association between Duration of Training and Weight Increases

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.333 ^a	.111	.088	2.466

a. Predictors: (Constant), HasWeightIncreasedwithWork

ANOVA ^a					
Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	28.887	1	28.887	4.750	.036 ^b
Residual	231.088	38	6.081		
Total	259.975	39			

a. Dependent Variable: HrsTraining

b. Predictors: (Constant), HasWeightIncreasedwithWork

Coefficients ^a					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	7.070	1.253		5.643	.000
HasWeightIncreasedwithWork	-1.702	.781	-.333	-2.179	.036

a. Dependent Variable: HrsTraining

All of the independent measures were also investigated using MANOVA, Regression and UANOVA modeling for determining the association patterns and their robustness with other measures. There was gradual lowering of HOT with the increasing order of the age group (as

discussed and described about linearity in the result section of LOW), with more number of hours of training performed by the youngest (5.8 ± 3.4) and least by the eldest groups (3.3 ± 2.6) (Fig. 1). When HOT was evaluated as a predictor for WI in a linear regression model, there was small significant association, $R^2 = 0.111$, $F(1, 38) = 4.750$ at $p = 0.036$ with WI though it clearly shows negative direction in the association which is also an indication of that increases in weight and the duration of physical training could balance each other out described in Table 4.

When evaluated with “Education”, HOT showed moderate level of association, $R^2 = 0.205$, $F(1, 38) = 9.794$ at $p = 0.003$. There was also trivial significant association with LOT at $R^2 = 0.175$, $F(1, 38) = 8.050$ at $p = 0.007$. As predictable, it showed negative directional association, $B = -1.702$. This finding shows that even though LOW is closely related to few significant measures, many health measures are also interlinked; and demonstrate variability in association and strength of relationship among themselves. They may not have any direct causation with the duration of working though they certainly have a role in shaping the measures, which directly influence how long people could sustain their workability.

HOT was not associated with WS (Shifts of Work) showing low level of association, $R^2 = 0.095$ at non-significant levels, $F(1, 38) = 0.346$, $p = 0.560$; as well as with TOW (Type of Work), $R^2 = 0.061$, $F(1, 38) = 2.469$, $p = 0.124$, when linear regression model was used to analyze the association. This provides a very clear indication that choices people make to perform physical exercise are irrelevant of the type of work people indulge in or when they work. Thus, strongly advocating for the idea of appropriating time for doing physical training, would be supportive for increasing workability. Similarly with the same regression modeling, HOT could not be associated with the marital status (MS) as well, at non-significant $R^2 = 0.186$, $F(1, 38) = 0.250$, $p = 0.250$; and what people choose to eat, FC at $R^2 = 0.128$, $F(1, 38) = 0.628$,

$p = 0.433$. It also could not be established to have association with BMI, $R^2 = 0.020$, $F(1, 38) = 0.786$, $p = 0.381$. How people choose to work around with their time for

Table 5
Association of Weight Increases, BMI and Shifts of Work

Correlations		HasWeightIncreasedwithWork	BMI	WorkShift
HasWeightIncreasedwithWork	Pearson Correlation	1	.809**	.420**
	Sig. (2-tailed)		.000	.007
	Sum of Squares and Cross-products	9.975	9.825	6.500
	Covariance	.256	.252	.167
	N	40	40	40
BMI	Pearson Correlation	.809**	1	.345*
	Sig. (2-tailed)	.000		.029
	Sum of Squares and Cross-products	9.825	14.775	6.500
	Covariance	.252	.379	.167
	N	40	40	40
WorkShift	Pearson Correlation	.420**	.345*	1
	Sig. (2-tailed)	.007	.029	
	Sum of Squares and Cross-products	6.500	6.500	24.000
	Covariance	.167	.167	.615
	N	40	40	40

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

physical exercise may not be dependent upon their marital status, of what they eat or concerns of their BMI in this data set, which also supports the concept that these measures regardless of being present or not, may not make differences in the approaches that people may need to evaluate for their training, which is more relevant to their LOW.

Various shifts of work (WS) showed interesting characteristics with the population in this study. Younger individuals tend to have more evening and night shifts of work (Mean value = 1.75 ± 1.0) with more variability as evident with the standard deviation, which gradually inclined towards morning shift progressively with the increase in the age-interval (Fig.4) of the study groups (mean value for 62+ group = 1.25 ± 0.5). Observing at the compact correlation as shown

in Table 5 for the measures WS with WI, and BMI, further characteristics (Fig. 3) could be established.

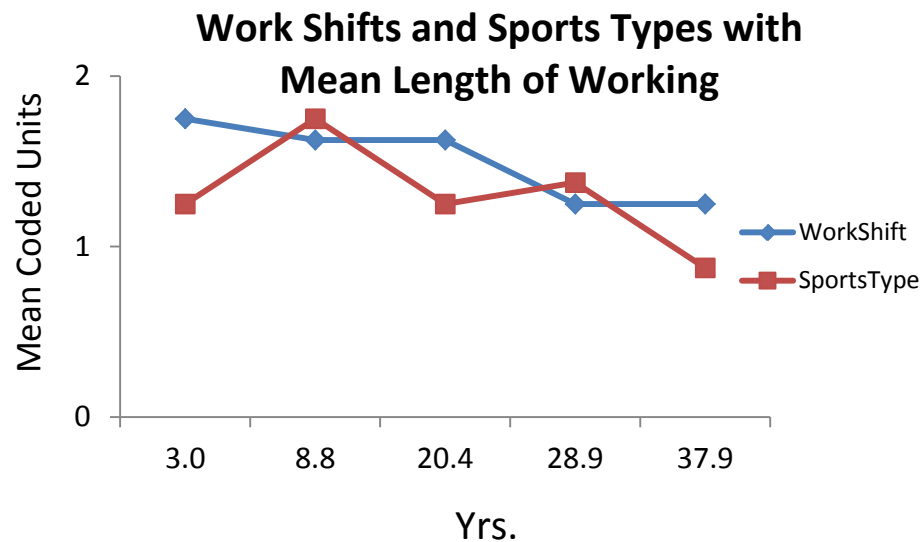


Figure 2. Length of Working versus Work Shifts and Sports Type measures. Both work shifts and level of training (or sports type) progressively get lowered with years of working demonstrating that trends for less physical work and more mental work options are used by the population when they are for a long time in the workforce and at the same time they start using non-extensive exercise planning.

WS showed predictability for WI (as a dependent variable) and moderate association at $R^2 = 0.420$, $F(1, 38) = 8.144$ at $p = 0.007$ with linear regression modeling. This association slightly reduced both in strength and significance when age weighed in the least square model, $R^2 = 0.148$, $F(1, 38) = 6.601$ at $p = 0.014$. This implies that the association between working shifts and increases in weight do not have any meaningful relationship, which with age becomes further irrelevant.

WS showed trend of association with HOT, discussed previously in the section for HOT analysis. When age was introduced as a covariate in the same analysis, $R^2 = 0.076$, $F(1, 38) = 3.111$, $p = 0.086$; both strength and significance of the association lowered still at the trend level

of significance. WS did not show association with TOW, Education, LOT, HOT, MS, with or without age as a covariate.

Type of Work (TOW) was observed to have more distribution of mental work in the youngest population (1.13 ± 0.4), which progressively gets distributed towards physical with elder age groups, maximizing in the 52-62 age group (2.1 ± 1.0). Though then it abruptly lowered in the eldest age group of 62+ years (1.5 ± 0.8) suggesting that mental and physical work for jobs was evenly distributed among the eldest population.

There was a small interaction between TOW and WI when sex was weighed for Least Square Regressions (LSR), $R^2 = 0.107$, $F(1, 38) = 4.545$ at $p = 0.040$ though this interaction becomes further weaker when sex was excluded, $R^2 = 0.094$, $F(1, 38) = 3.952$ at $p = 0.054$. Sex could be an important marker that changes the interaction to valuable association, which otherwise was not relevant. TOW was not associated with Education both while weighted by age and without; $R^2 = 0.062$, $F(1, 38) = 2.500$ at $p = 0.122$; $R^2 = 0.054$, $F(1, 38) = 2.174$, $p = 0.159$ respectively, in linear regression analysis. Also, it did not show any association with MS, LOT, BMI and FC as well regardless of including covariates as age or sex and without them.

Education showed cyclical characterization of number of years in the academic settings, with lowest in the youngest group (15.3 ± 3.2) and maximum in the subsequent group of 32-41 years group (17.1 ± 3.1) though the following group of 42-51 years, abruptly has lowest education years as much as that of the youngest group (15.3 ± 3.5) from where it progressively climbed through the further older groups. Education showed significant main effects with LOW and its significance with HOT as discussed in the HOT results section previously. Association with HOT became stronger and gained more power when sex was included in the analysis as weighted LSR, $R^2 = 0.239$, $F(1, 38) = 11.941$ at $p = 0.001$; and when age was weighed in as

well, $R^2 = 0.241$, $F(1, 38) = 13.394$ at $p = 0.001$. It only showed trends of association with TOW with sex weighted for LSR as illustrated in the TOW analysis section above. Education demonstrated only remote trends of association with MS with regression analysis, $R^2 = 0.081$, $F(1, 38) = 3.334$ at $p = 0.076$, though this association became significant with sex was weighed in

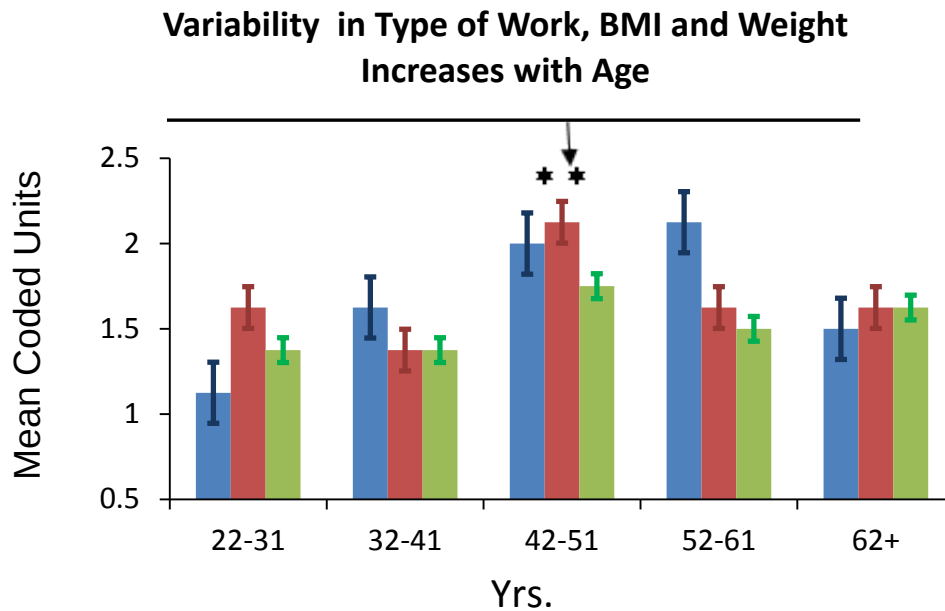


Figure 3. Traits of Health Determinant Measures among Various Age-Groups. Bar in blue is “Work Type”; in red is “BMI” and in green is “Weight Increased”. Last two measures are substantially higher in the 42-51 group, than any other group showing significant differences that might occur during this period of age.

using LSR, $R^2 = 0.099$, $F(1, 38) = 4.189$ at $p = 0.048$. This interaction when evaluated with age weighed in using LSR could show further strong association, $R^2 = 0.135$, $F(1, 38) = 5.911$ at $p = 0.020$. Education did not show any relationship and its significance with WS, LOT, FC, BMI and WI at all with or without any interaction with the covariates as age and sex.

None of the mean BMI values in each age group were in the normal range. BMI also showed cyclical characterization of distribution in this study population. It was in the overweight category (for the youngest population, 22-31 years age group, which lowered in the

subsequent age group, increased mean values in the 42-51 age group; and then leveled off in the oldest two groups back at the approximate mean values of the youngest group (Fig. 3). BMI was most significantly alarming in the 42-51 age group and tallies with the highest WI in the same group and lowest Education and LOT. BMI was slightly associated with WS at significant levels, $R^2 = 0.119$, $F(1, 38) = 5.140$ at $p \leq 0.029$ (Fig. 3). It showed strong relationship with WI, $R^2 = 0.655$, $F(1, 38) = 72.137$ at $p = 0.000$, which is also highly observed and predictable in large population based studies in US; this association remained consistent with age or sex weighed in the regression analysis at $p = 0.000$. It did not show any association with the type of food choices, FC or any interaction with age and sex as covariates, that the population was selecting.

WI was observed in all the groups suggesting that WI was a widespread characteristic in all the groups. It remained consistent in the youngest two groups (1.35 ± 0.5 for each), though jumped to the highest in the 42 -51 age group (1.75 ± 0.5) before lowering down to the oldest two groups at (1.5 ± 0.5 and 1.6 ± 0.5 respectively for each). WI interaction and association analysis has been described beforehand with the evaluations of other measures above. It could not show any association with LOW or HOT and any interactions with or without inclusion of covariates for the same and may not be directly have any compounding effects on LOW or HOT directly. MS could be established as a potential measure to illustrate any association with workability or masked interaction otherwise in most of the analysis apart from some trends with Education as illustrated in the Education analysis section previously.

To evaluate the collective effects of factors, various combinations of measures were analyzed to understand the cumulative effects on the length of working. Education, HOT, TOW, and WS, with Age as a covariate; LOW showed significant association with all apart from TOW. When WI, BMI and FC were used to evaluate the cumulative effects, with Age as a covariate;

LOW showed only trends of association with FC and WI though did not show any significance with BMI.

Age could demonstrate to have a significant role in the interaction and association of measures with the workability in this statistical analysis. Sex could be intermittently established as a potential covariate to illustrate any masked interaction otherwise in most of the analysis. This could be because the subpopulations of sex in each group have other determinants, which traditionally are more proximally associated than other measures.

Variability Characterization of Measures across Age Cohorts

This analysis was conducted using RMANOVA (Repeated) and Regression statistical instrumentations to characterize the association of the measures across the age cohorts. There was progressive increase in the extent of association between the differences among the mean values of the measures with age in this study (Fig. 4). When the differences between the 62+ and

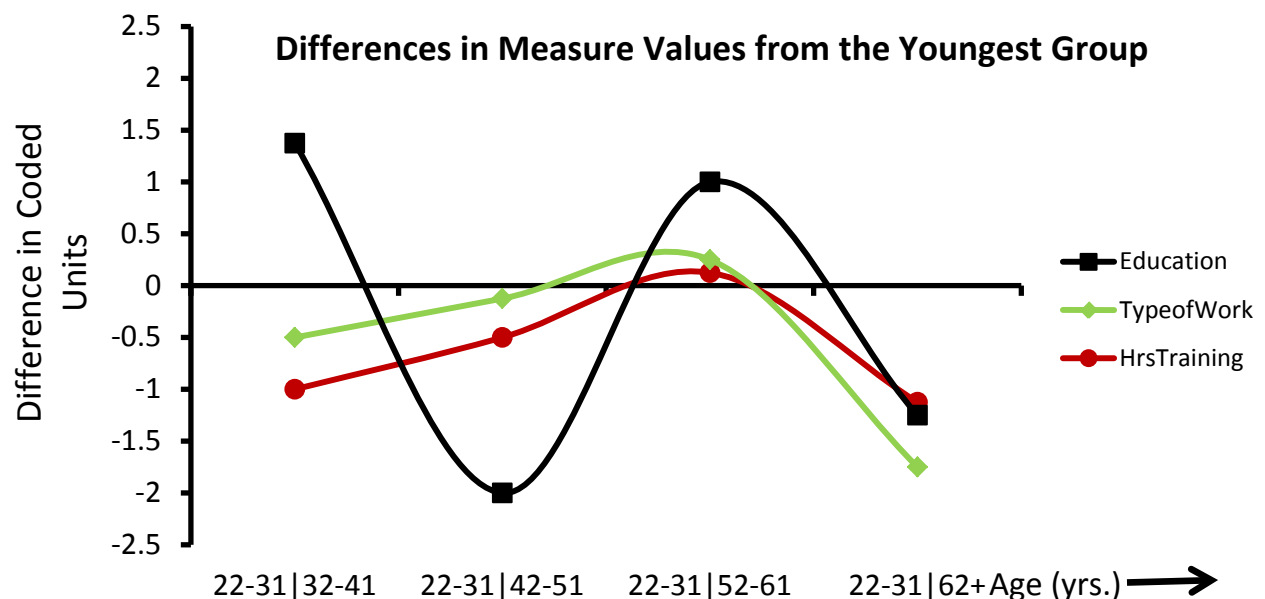


Figure 4. Differences in the Health Measures in Various Age-Groups compared from the Youngest Group.

52-61 was evaluated as dependent variables with the 42-51 and 52-61 age group measures with RMANOVA, no significant association was established though this evaluation demonstrated within-subjects effects when the difference in measure values between 22-31 and 32-41 yrs. age group was included as a covariate, $F(1, 9) = 12.731$ at robust significant level, $p = 0.006$. This suggests that the transition of age based changes even in consecutive groups could have early life implications, which could mean the differences in the 22-31 and 32-41 yr. age groups could direct the course of differences in the health measure differences in later part of life. Such interaction with covariate did not show any significance with the analysis using the differences among the measures between 31-41 and 42-51 yrs. age groups.

Table 6
Progressive Increase in Association of Measures across the Ages

Parameter Estimates										
Dependent Variable	Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared	Noncent. Parameter	Observed Power ^a
						Lower Bound	Upper Bound			
Gr62Plus	Intercept	.293	4.694	.062	.952	-10.325	10.911	.000	.062	.050
	Gr22_31	2.167	.498	4.353	.002	1.041	3.293	.678	4.353	.971
Gr52_61	Intercept	.441	3.443	.128	.901	-7.347	8.229	.002	.128	.052
	Gr22_31	1.821	.365	4.987	.001	.995	2.647	.734	4.987	.993
Gr42_51	Intercept	.349	2.371	.147	.886	-5.014	5.712	.002	.147	.052
	Gr22_31	1.559	.251	6.199	.000	.990	2.128	.810	6.199	1.000
Gr32_41	Intercept	-.133	.797	-.166	.872	-1.936	1.671	.003	.166	.053
	Gr22_31	1.301	.085	15.387	.000	1.110	1.493	.963	15.387	1.000

a. Computed using alpha = .05

Association of raw measures values across the age group 22-31 yrs. compared with that of 62+ showed strong association with linear regression model with “Enter” method, $R^2 = 0.678$, at significant power level, $p = 0.002$. Such association became stronger with progressively elder age groups when compared with the 62+ age group data; with 32-41 yrs. age group at $R^2 = 0.818$; with 42-51 age group at $R^2 = 0.974$; and with 52-61 yrs. age group at $R^2 = 0.995$, all at the

significance levels of $p \leq 0.01$ respectively (Table 6). This could demonstrate that with age, people show variability in their health measure values and that they could potentiate predictability of how the course and status of health measures in later part of life.

There were remote trends of Between-Subjects association effects with the mean value of the measures for 62+~group with other groups using MANOVA though no significant association could be established with the raw data with across the age cohort analysis. This could be attributed to the low subject population; and such studies when performed in large cohort studies show robust association across the population though this study could provide important information for possible direction of association of measures across the age cohorts from its analysis.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Several association based studies have broadly demonstrated a greater than expected interrelationship between work and chronic conditions and consequential morbidity (18). Moreover, loss of work ability and work life years could be much higher than anticipated in industrialized and economically transitioning regions, where proportionally more manpower is involved in work force (19). The US has been and for certain will be facing a simultaneous growth of both working as well as older retired population with preliminary status of the concern evident in the working population and it is becoming more and more factual that US economy and healthcare are facing giant responsibilities to cover the expenses that such population would incur (14, 15). This study provided information on how employees and employers both could be provided with evidence based measures that are valid and applicable markers for extending workability. These measures could also aid in the development of specific financial and healthcare policy changes in US so as to incorporate measures to support the aging population for their needs and financial independence (20).

Summary

In this study, LOW was found to have between the subjects significant association with HOT, which illustrates that LOW differentially is related to how people train themselves with age. Interaction between LOW and HOT with age as a covariate demonstrated stronger significant correlation, which illustrates that with age associated physical training becomes more relevant to continue to work as well. With age, HOT reduced, which also suggests that routine exercising is more important than the kind and length of the duration of exercise itself, this was evident in this analysis with the training duration evaluations as has been studied previously (21). Again, age when included increased the strength of the interaction of LOW with LOT. Similarly,

education was not associated with LOW though with age as a covariate, it showed very strong relationship. Age could be determined as a strong variable that plays a significant role in the interaction of duration of work with other measures. LOW could not be associated with other measures with this study and this could be attributed to the internal variability in the other measures that may not manifest those effects or interaction with how long individuals would work.

To understand the association between the measures that regulated length of working significantly, inter-variable analysis showed some interesting findings as well. Several variables showed association with each other. HOT was moderately associated with increase in weight, WI; Education; and LOT though it did not show any relationship with WS or TOW suggesting that how much people work out is irrelevant of the shift or kind of work that they involve in. Younger population showed more involvement in the non-traditional shift of work mostly in the evening or nights which was not as prominent with the older population. Shift of work and increases in weight were remotely associated. Type of work showed some interesting affinity to the younger population as well suggesting that the emerging employee population is leaning towards mental work that other work types in their jobs.

Education was moderately associated HOT and with sex as a covariate it showed further robust interaction suggesting that sex has a definitive role in the association of Education and HOT. BMI was a concerning issue with this data set as well and most of the information registered by the study population showed increased BMI with most alarming in the 42-51 age group. It showed strong association with increases in weight showing that regardless of age and sex of the individuals, BMI increase in each cohort is significantly associated with the pattern of the increase in weight.

Differences in the measure value in the early stages with the younger age cohorts showed stronger association, which was not evident in the differences in the older age groups. This findings supports the notion that differences early in life and career would make more impact regardless meaningful or otherwise as within subjects effects on the measures, which is directly associated with the individuals and may not be meaningful as a group outcome.

Association of measures across the youngest with the oldest groups also showed robust association with regression analysis. This association became consecutively stronger across the other group differences from the oldest with the increase in the age demonstrating that the transition of the measure values across the age cohorts is highly significant and valuable. The measures recorded with this population provided information for their differences with age and therefore could be used as valuable tools or markers for age cohort evaluation with such health and workability association studies.

Use of validated questionnaires and association based evaluation methodologies were incorporated in this investigation, which provide strong and advantageous results that could be replicated and modified conveniently with the use of questionnaires. Moreover, this also substantiated applicability to investigate larger population for similar study concepts. This finding shows that self-reported work ability is a feasible method to measure peoples' ability to remain an active part of the workforce. The estimated effect from work ability was substantial with association outcomes with individual measures and validated perceived associated measures of work ability and risk factors that are also related to it. Providing information to enhance the independent capacity of individuals and differentiation of promotional incentives based on profiling of individuals for healthcare programs serve the purpose of a common platform where both employees and employers (22) could use these findings to increase their aims for work

associated productivity in dual manner where both employees and employers can benefit together for shared goals.

Conclusions

With this study, present health practices and preferences associated with the expectation of prolonging the workability of the population in US could be identified. This study could provide preliminary information from the results that are relevant to extend workability, which various working factions of US population could use to extend workability; and how various working groups provide vital information to develop health planning that could be used for other age-based population groups (23). Physical exercise is encouraged in several work sites to improve the physical capacity of home care aides and prevent the early decline of their work ability (24). In jobs that are physically demanding, such as home care work, early prevention must start before the age-related deterioration of health and physical capacity (24), which is consistent with the results of this study where differences in the age groups were significantly associated and showed predictability for later years.

In the March 1981 report, published by Health and Human Services for the Congress that was presented from National Center of Health Statistics strongly supported increasing the retirement age with working population with the anticipation of increase in life longevity and that it should correspond with an increase of active life (25, 26). Further findings from the same report illustrated that the evidence did not support any claims that longer life is equivalent of longer years of good health and that the incidence of good health is not very convincing and there are no definitive resolution of this controversy. Education could really play its part in understanding the need to support health and evaluate doing physical exercises in present US context to support optimal health by preventing diseases and promoting health (27), which

supports the findings on education as a significant measure of health determinant in this investigation.

Many measures studied in this project showed interaction, which also shows that these measures may not directly influence a person for sustaining their work sustainability though their interaction strongly suggests that they regulate the major determinants. This supports the idea that workability could have a significant influence on where many other aspects of life may play a role as well but they may not confirm their direct consequences. This could as well be due to regional significances or a smaller participant pool but these interactions may show differences with a larger data-set with more accommodation of more diversified demographics.

Recommendations

Outcome of this study could further the understanding of measures and targeted implementation used by various working classes in different age groups to develop and maintain their health status for sustaining their workability for a desirable timeframe. The demographic shift of US aging population has significant implications that could be having its manifestation in the workplace and the risks associated with the aging process including physiological changes with aging, comorbidities and chronic diseases, and psychosocial factors as well as the impact those risks may have on work ability. Health promotion concepts for an aging working population could therefore include labor and employee profile, and targeted training programs (28). Sustaining workability for longer period and postponing retirement is now being studied at leading global research center on neurological disorders specially dementia and Alzheimer's disease and is a concerning issue for US as well since about 5 million individuals have Alzheimer's – 1 in 9 people aged 65 and over (29, 30). Recent studies provide evidence that working later in life could actually support and promote mental health, which also open the

possibilities for studies of prevention and promotion of health measures that could be used to prevent or delay the onset of such neurological conditions as well (31).

This study was conducted with a small population and even though the investigators invested in maintaining optimal diversity in subject participation; larger population, and larger studies with more assessment and follow-ups could provide much more information and in-depth findings, identifying their precise interactions. Though the study was constructed to achieve the statistical strength, which is demonstrated in the results, a larger study could have incorporated more measures and thereby more association and characterization of measures could have been anticipated, contingent to funding to support such kind of research scale. Including more participants could definitely further explained the details of the measure characteristics conducted as a national level investigation protocol. However, aim of this study was only to identify the health determinants that could be substantiated as measures of health promotion for sustaining workability in this sample, and study criteria and objectives were structured accordingly. The objectives of this study were very well defined and it could be evidently used as pilot investigations to initiate a larger study by providing preliminary findings and supportive information. This study ultimately broaden the scope of the choices, availability of appropriate health promotion practices and how various working population can utilize this information to incorporate appropriate health promotion practices for extending workability. Methodologies used in this investigation and associated findings out of this study could facilitate future studies with larger population thereby characterizing association of health and fitness measures more precisely. Future characterization of health measures with larger population would serve as a proactive approach with appropriate healthcare services modeling for US and other relevant populations at large to prolong workability.

APPENDIX A

CONSENT FORM: MULTIGENERATIONAL PSYCHOMETRIC EVALUATION OF HEALTH PROMOTION PRACTICES TO IDENTIFY DETERMINANTS FOR SUSTAINING WORKLIFE EXPECTANCY IN AGING POPULATION

Consent to Participate in Research

Identification of Investigators & Purpose of Study

You are being asked to participate in a research study conducted by V. Vatsalya and Dr. Karch from American University. The purpose of this study is to evaluate multigenerational Psychometric Approach of Health Promotion Practices to identify Determinants for Sustaining Work-life Expectancy in Aging Population. This study will contribute to the student's completion of his thesis towards his MS degree program.

Research Procedures

Should you decide to participate in this research study, you will be asked to complete the questionnaires and completion of the questionnaires would demonstrate your agreeability for your participation in the study. This study consists of a two questionnaires that will be administered to individual participants in Greater DC area (community, public places in DC, VA, and MD). You will be asked to provide answers to a series of questions related to assess the available health promoting practices. This study will help us determine what practices employers and employees can implement to help people remain in the workforce as long as they would like to. I would not audio/video tape any participants either for consent or questionnaires.

Time Required

Participation in this study will require 15-20 minutes of your time at a single session only.

Risks

The investigator does not perceive more than minimal risks from your involvement in this study.

Benefits

There are no direct benefits to the participants from the study. This study would aid in developing appropriate guideline to utilize such practices for the working population according to the individual based criteria for achieving desirable working timeframe.

Confidentiality

The results of this research will be presented at conferences. The results of this project will be coded in such a way that the respondent's identity will not be attached to the final form of this study. The researcher retains the right to use and publish non-identifiable data. While individual responses are confidential, aggregate data will be presented representing averages or

generalizations about the responses as a whole. All data will be stored in a secure location accessible only to the researcher. Upon completion of the study, all information that matches up individual respondents with their answers will be destroyed.

Participation & Withdrawal

Your participation is voluntary. You are free to choose not to participate. Should you choose to participate, you can withdraw at any time without consequences of any kind. You may also refuse to answer any individual question without consequences.

Questions about the Study

If you have questions or concerns during the time of your participation in this study, or after its completion or you would like to receive a copy of the final aggregate results of this study, please contact:

Vatsalya Vatsalya and/or Dr. Robert Karch

Department of Health promotion Management

220 McCabe Hall American University

Email: vv4238a@american.edu / rkarch@american.edu .

Telephone: (212)885-6285.

Questions about Your Rights as a Research Subject

Maria Ivancin

Chair, Institutional Review Board

American University

(202)885-2780

ivancin@american.edu

Matt Zembrzusi

IRB Coordinator

American University

(202)885-3447

irb@american.edu

Giving of Consent

I have read this consent form and I understand what is being requested of me as a participant in this study. I freely consent to participate. I have been given satisfactory answers to my questions. I am providing consent orally and completion of surveys would be confirmatory of giving of consent. I certify that I am at least 18 years of age.

Begin text or image here or delete appendix if it is not needed.

APPENDIX B

EMPLOYEE BIOGRAPHICAL QUESTIONNAIRE FOR PROTOCOL: MULTI- GENERATIONAL PSYCHOMETRIC EVALUATION OF HEALTH PROMOTION PRACTICES TO IDENTIFY DETERMINANTS FOR SUSTAINING WORKLIFE EXPECTANCY IN AGING POPULATION

EMPLOYEE BIOGRAPHICAL QUESTIONNAIRE				DATE
Public Information Office		MAIL STOP		RETURN TO
EMPLOYEE (Name)		Educational Services Office		MAIL STOP
PRESENT HOME ADDRESS		PRESENT JOB TITLE		ORG. CODE
DATE JOINED		LOCATION (Other than Glenn)		POSITION ACCEPTED AT OTHER CENTER
NASA		GLENN		GLENN
PERSONAL DATA				
BIRTH PLACE		BIRTH DATE	MARITAL STATUS	SPOUSE'S NAME
			MARRIED	
			SINGLE	
CHILDREN (Name and ages)				
PARENTS' NAME AND ADDRESS				
YOUR "HOME TOWN"			PERIOD	
			FROM (year)	TO (year)
LAST PERMANENT ADDRESS				
LAST EMPLOYER BEFORE NASA (Name and location)				
MILITARY SERVICE (if applicable)				
BRANCH OF SERVICE		LIST CAMPAIGNS/MAJOR BATTLES IN WHICH YOU PARTICIPATED		
MEDALS AND CITATIONS			RANK AT DISCHARGE	
EDUCATION				
COLLEGE/UNIVERSITY (Name & address)	NO. YEARS ATTENDED	GRADUATED ("X" one) YES NO	YEAR GRADUATED	TYPE OF DEGREE/MAJOR SUBJECTS
LIST ANY TEACHING EXPERIENCE				

MISCELLANEOUS PERTINENT DATA	
RESEARCH FIELDS IN WHICH YOU	HAVE SPECIALIZED
	ARE CURRENTLY INVOLVED
	TECHNICAL PAPERS (Do not list, but give some indication of number and subject)
	AWARDS AND HONORS (List)
	SCIENTIFIC SOCIETIES, FRATERNITIES, SORORITIES (List)
HOBBIES (List)	IS THERE A PHOTOGRAPH OF YOU ON FILE IN THE PHOTO LAB?
	YES NO
LIST OTHER PERTINENT DATA YOU FEEL SHOULD BE COVERED	

APPENDIX C

OCCUPATIONAL HEALTH SURVEILLANCE QUESTIONNAIRE FOR PROTOCOL: MULTIGENERATIONAL PSYCHOMETRIC EVALUATION OF HEALTH PROMOTION PRACTICES TO IDENTIFY DETERMINANTS FOR SUSTAINING WORKLIFE EXPECTANCY IN AGING POPULATION

U.S. DEPARTMENT HOMELAND SECURITY U.S. COAST GUARD CG-6197 (Rev. 6-04)		OCCUPATIONAL HEALTH SURVEILLANCE QUESTIONNAIRE				DATE OF SUBMISSION		
NAME		RANK/RATE	HOME ADDRESS/MILITARY UNIT		SEX	DATE OF BIRTH	CURRENT JOB DESIGNATION	
PART I - OCCUPATIONAL HISTORY								
INSTRUCTIONS: Please complete the following work history; begin with your present job or military assignment, and list all jobs you have held.				Be as specific as possible; if you held more than one job with the same employer, list each job title and activity. Use additional sheets as needed.				
COMPANY OR MILITARY UNIT County and state where worked	DATES WORKED		FULL/PART TIME/JOB ORDER		JOB TITLE AND WORK ACTIVITIES	POTENTIAL HAZARDS EXPOSED TO		PROTECTIVE EQUIPMENT WORN Respirator, earplugs, etc.
	FROM MO/YR	TO MO/YR	FULL	PART		PHYSICAL Noise, vibration, etc.	CHEMICAL Fumes, gases, dusts, etc.	

PRIVACY ACT STATEMENT

Under Title 5 USC 552a(e)(3), the following information is provided to you when supplying personal information to the U.S. Coast Guard.

1. AUTHORITY WHICH AUTHORIZED THE SOLICITATION OF THE INFORMATION: Occupational Safety Act of 29 December 1970, P.L. 91-596, 91st Congress S-2193.
2. PRINCIPAL PURPOSE(S) FOR WHICH THE INFORMATION IS INTENDED TO BE USED: To collect and monitor occupational safety and health hazards exposures of Coast Guard civilian and military personnel.
3. THE ROUTINE USES WHICH MAY BE MADE OF THE INFORMATION: To provide health care to affected personnel and to establish a data base of information for the enhancement of the physical environment.
4. DISCLOSURE OF THE INFORMATION IS MANDATORY AND THE EFFECTS ON THE INDIVIDUALS, IF ANY, OF NOT PROVIDING ALL OR ANY PART OF THE REQUESTED INFORMATION: It could result in incomplete or insufficient health care for the individual(s) and could prevent the removal or correction of existing hazard, due to incomplete or inadequate information.

REFERENCES

- (1) World Bank. (January, 2012). Financial crisis, January 18, 2012. Article retrieved from: <http://www.worldbank.org/financialcrisis/bankinitiatives.htm>.
- (2) Vita, A. J., Terry, R. B., Hubert, H. B., Fries, J. F (1998). Aging, health risks, and cumulative disability. *N Engl J Med.* 338, 1035–104.
- (3) Majery, N., Duveau, A., Perleau, M., Touillaux, D. (October, 2007). Work ability index (WAI) in a population of 40+ in Luxemburg. Proceedings of the 3rd International Symposium on Work Ability, Hanoi, Vietnam.
- (4) Matsushita, S. (1996). Longevity, disease, and duration of disability. *Jap J Geria*, 33(12), 916-22.
- (5) Bryant, L., Altpeter, M., Whitelaw, N. (2006). Evaluation of health promotion programs for older adults: An introduction. *J App Geron*, 25(3), 197- 213.
- (6) Foster, E. M., Skoog, G. R. (2004). The Markov assumption of work-life expectancy. *J Foren Eco*, 17(2), 167-183.
- (7) Vigon, V. (2011). (Homogeneous) Markovian bridges. *Annales De l'Institut Henri*, 47(3), 875-916.
- (8) Goedhard, G. R., Goedhard, W. A. (October, 2007). Extending the working life? Proceedings of the 3rd International Symposium on Work Ability, Hanoi, Vietnam.
- (9) Ilmarinen, J. (2007). Towards a better and longer work life for older workers. *Fin Ins Occupat Heal*, Helsinki, Finland.
- (10) Maltby, T., Ilmarinen, J. (2006) Moving beyond the ‘cliff edge’? Age regulations and a sustainable future for employment in later life. *J Occup Med*, 56, 361-4.
- (11) Altpeter, M., Bryant, L., Schneider, E., Whitelaw, N. (2006) Evidence-based health practice: Knowing and using what works for older adults. *Home Health Care Services Quarterly*, 1/2, 1-11.
- (12) Manini, T. M., Pahor, M. (2009) Physical activity and maintaining physical function in older adults. *Bri J Spo Med*, 43(1), 28–31.
- (13) Gutheil, I. A. (1996) Introduction. The many faces of aging: challenges for the future. *Gerontologist*, 36(1), 13–14.

- (14) Burtless, G. T., Quinn, J. F. (2000) Retirement trends and policies to encourage work among older Americans. Paper for Annual Conference of the National Academy of Social Insurance, 26-27 January 2000, Washington DC, USA, 1-39.
- (15) Rice, D. P., Fineman, N. (2004) Economic implications of increased longevity in the United States. *Ann Rev Pub Heal*, 25, 457–73.
- (16) Nurminen, M.M., Heathcote, C.R., Davis, B.A. (2004) Estimating marginal cohort working life expectancies from sequential cross-sectional survey data. *J Off Stat*, 20(3), 495–517.
- (17) Nurminen, M.M., Heathcote, C.R., Davis, B.A. (2004) Estimating conditional working life expectancies from aggregate cohort data. *Int J Epidemiol*, 1(2).
- (18) Eskelinen, L., Kohvakka, A., Merisalo, T., Hurri, H., & Wägar, G. (1991). Relationship between the self-assessment and clinical assessment of health status and work ability. *ScanWork Envir Health*, 40-47.
- (19) Sell, L. (2009). Predicting long-term sickness absence and early retirement pension from self-reported work ability. *Intl Arch Occup Envir Health*, 82(9), 1133-1138.
- (20) Vatsalya, V., Karch, R. (2009, April). *Health promotion practices to extend workability in aging population*. Poster session 3.2.13 presented at 3rd Annual Health Disparity Conference, New Orleans, LA.
- (21) Haskell, W. L., Lee, I., Pate, R. R., Powell, K. E., Blair, S. N., Franklin, B. A., ... & Bauman, A. (2007). Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med. Sci. Sports Exer.*, 39(8), 1423.
- (22) Gustman, A.L., Steinmeier, T. L. (1994) Employer provided health insurance and retirement behavior (No. w4307). National Bureau of Economic Research.
- (23) Vatsalya, V., Karch, R. (2013). Evaluation of health determinants for sustaining workability in aging US workforce. *Adv Ag Res*, 2(3), 106-108.
- (24) Pohjonen, T., & Ranta, R. (2001). Effects of worksite physical exercise intervention on physical fitness, perceived health status, and work ability among home care workers: five-year follow-up. *Preven Med*, 32(6), 465-475.
- (25) Feldman, J. J. (1983). Work ability of the aged under conditions of improving mortality. *The Milbank Memorial Fund Quarterly. Heal Soc*, 430-444.
- (26) Verbrugge, L. M. (1984). Longer life but worsening health? Trends in health and mortality

of middle-aged and older persons. The Milbank Memorial Fund Quarterly. Heal Soc, 475-519.

- (27) Eng, T. R., Maxfield, A., Patrick, K., Deering, M. J., Ratzan, S. C., & Gustafson, D. H. (1998). Access to health information and support. JAMA, 280(15), 1371-1375.
- (28) Healy, M. L. (2001). Management strategies for an aging work force. AAOHN J, 49(11), 523.
- (29) Dufouil, C. (2013). Older age at retirement is associated with reduced risk of dementia. Press release at Annual Alzheimer's Association International Conference, 13-18 July 2013, Boston, USA.
- (30) Larson, E. B. (2008). Physical activity for older adults at risk for Alzheimer disease. JAMA, 300(9), 1077-1079.
- (31) Rolland, Y., Abellan van Kan, G., & Vellas, B. (2010). Healthy brain aging: role of exercise and physical activity. Clin Geriat Med, 26(1), 75-87.