

Determinants of Absenteeism According to Health Risk Appraisal Data

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Kinesiology)
in The University of Michigan
2013

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Acknowledgements

Primarily, I would like to thank my dissertation committee for all of their support and guidance during this project: I would like to express appreciation to Brenda Gillepsie who has encouraged me and helped from start to end. Thank you also to Kathryn Heinze and Gretchen Spreitzer for their time, engagement, and thoughtful feedback. I especially would like to thank Dee Edington, my advisor, for making this opportunity possible for me, for his unending guidance, wealth of insight and patience with me through this process.

I would also like to express appreciation to my husband who has encouraged me and believed in me when I did not believe in myself. Without his support and motivation, none of this would have been possible.

I would also like to acknowledge Andrew Scibelli and Katy Lovill for their assistance in data collection.

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Chapter 1

Introduction

Employee Health and Absenteeism

According to the Departments of Health and Human Services (DHHS), conditions associated with modifiable health risks are the leading cause of death and disability in the United States (Minino et al., 2010). Excessive body weight, lack of physical activity, poor eating habits and tobacco use are considered major causes of morbidity and premature death. Two-thirds of Americans are overweight or obese (Flegal et al., 2010). More than one-third of all adults do not meet recommendations for aerobic physical activity (CDC, 2008). Heart disease, diabetes, cancer and stroke account for 50% of all deaths and are largely associated with modifiable health behaviors (Minino et al., 2010). The implications of poor health for individuals include physical limitation, reduced quality of life, reduced wages and shortened life expectancy.

Beyond the societal perspective of concerning the implications of poor individual health, employers have a vested interest in promoting high levels of health and functioning in employees. Economically, employers bear the costs of poor health through increased healthcare costs, increased absenteeism and decreased productivity. Lost productivity time due to absenteeism and reduced performance for health related reasons cost U. S. employers an estimated \$226 billion dollars (Stewart et al., 2003). Other consequences of absenteeism include decreased morale and increased demands on remaining staff (Hackett, 1989). There are additional costs to be considered that are not

quantifiable such as the lost productivity for an entire team, the strain on remaining employees, and reduced productivity by replacing missing worker with one less experienced in that role (Steel, 2003). Therefore, poor employee health and absenteeism has direct implications for an organization's productivity and overall viability.

Health Risk Appraisals

Health Risk Appraisals (HRAs) have been the predominant instrument in identifying employee health risks and employee interest in programs. Health risk appraisals are self-administered questionnaires containing items related to demographics, biometrics, lifestyle and emotional status. Results of the 2004 National Worksite Health Promotion Survey indicated that 19.4% of worksites overall use HRAs. Among larger worksites (over 750 employees), 45.8% utilize HRAs (Linnan et al., 2008). Health risk appraisals serve multiple purposes. First, is to raise awareness among participants of their health risks. Second, is to supply the employer with decision support information for wellness programming based on prevalent health risks in the population. Third, is to track progress/changes of health risks over time for both individuals and employers. A major advantage of HRAs is that risks can be identified before increased health problems or health care costs occur (Edington et al., 1997, Gazmararian et al., 1991). While health risk information is useful in program planning, the data collected in these surveys have historically been under-utilized by focusing on health risks alone. Utilizing HRA data in new ways, such as structural equation modeling, might offer information that advances the field of health promotion and can be leveraged to improve policies and programs in supporting individual health.

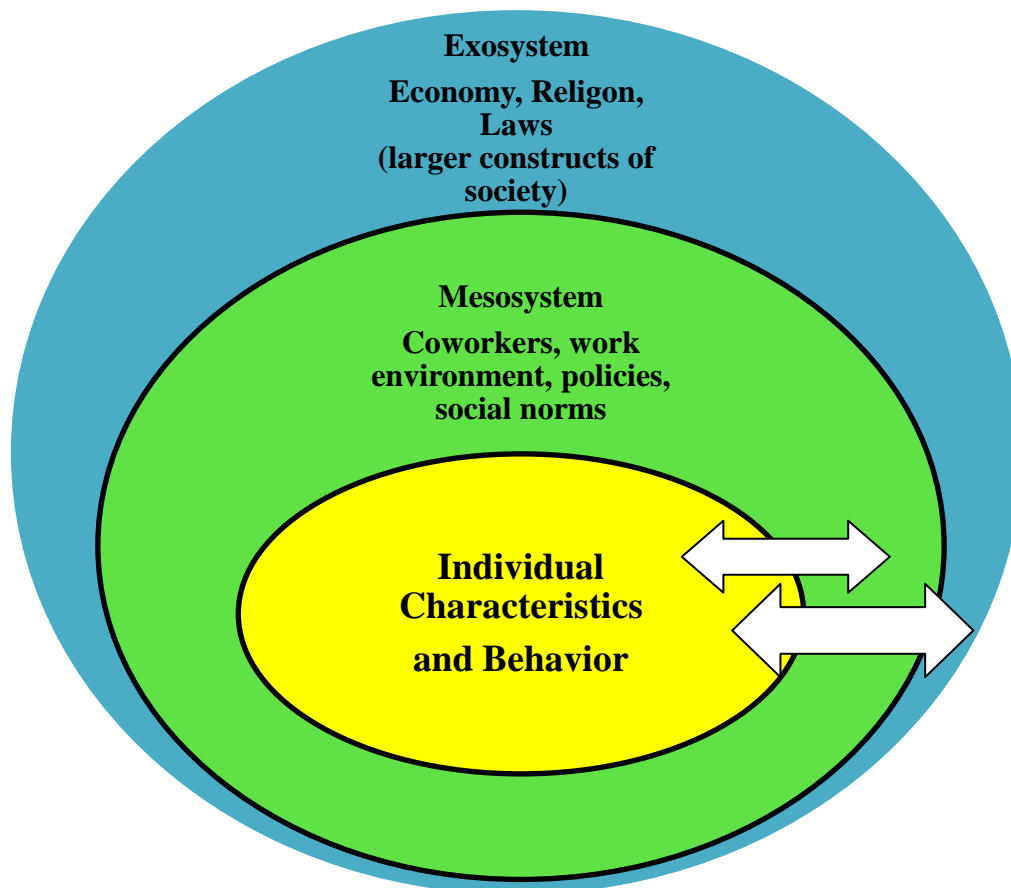
Specifically, the studies in this dissertation utilize the University of Michigan, Health Risk Appraisal (HRA). This HRA was originally developed by the Centers for Disease Control and Prevention/Carter Center and modified by the University of Michigan, Health Management Research Center (UM-HMRC). Reliability and validity studies have shown health risks as assessed by the HRA to be predictive of morbidity and mortality (Edington et al., 1997, Gazmararian et al., 1991). The UM-HRA is considered the “gold standard” since health risks identified by this tool have been validated against objective measures such as, medical costs, workers’ compensation, disability costs and productivity measures (Burton et al., 2005, Musich et al., 2001, Wright et al., 2002, Yen et al., 1991). The UM-HRA is well suited for this work due to its comprehensive nature and established validity.

Conceptual Framework

The perspective of this dissertation work is based in the social ecological model. As a general framework, the social ecological framework proposes that outcomes such as behavior, health and absence have multiple influences consisting of individual characteristics and environmental factors. The social ecological model in its current form is largely attributed to Urie Bronfenbrenner, who adapted the model from earlier researchers. The social ecological model defines three main levels of environmental influences that interact with individual characteristics. 1) The microsystem consists of immediate interpersonal interactions such as family, acquaintances and work groups. 2) The mesosystem refers to settings such as family, school and work. 3) The exosystem refers to the larger influence of economic forces, cultural beliefs and societal forces. As

outlined in Figure 1.1, there is a reciprocal nature to factors and processes. Therefore, in contrast to a unidirectional dynamic of A effecting B. The ecological model allows for the effect of A on B and also that B has an effect on A (Bronfenbrenner 1977). Factors within and between levels are in constant interaction with each other. Ecological models, as they have evolved in behavioral sciences and public health, focus on the interactions between individuals and their physical and sociocultural surroundings (i.e. environments). As mentioned, the ecological model suggests that individual behavior is affected by and also impacts the surrounding environment including social interactions (McLeroy et al., 1988).

Figure 1.1 Social Ecological Model



Within health promotion, the ecological model of influencing behavior has grown in popularity through the past decade. This concept of intervening at the worksite level has led to the rise in population-based wellness programs designed to improve health behaviors (e.g. discourage smoking, healthy eating, physical activity) in the whole employee population. The premise behind this population-based approach is to improve health by affecting the environment in which people work (Golaszewski et al., 2008). Research findings supporting the value of population-based interventions include reduced smoking rates/cigarette consumption following worksite smoking bans (Fichtenberg and Glantz, 2002), increased use of stairs following implementation of signage (Webb and Eves, 2007), and increased physical activity with specified walking paths (Napolitano et al., 2006). The target of the intervention is solely the worksite (i.e the environment) itself, rather than addressing individual behavior through targeted programs.

However, with the population-based approach to health promotion proponents have ignored individual characteristics. More recently, a study involving 13 population-based interventions showed minimal improvement in population risk levels (not statistically significant) and decreased absenteeism over two years. Interventions included no smoking policies, healthier food choices, walking paths, signs encouraging stair use, and on-site screenings for blood pressure. Interventions designed to be accessible to most employees without depending on timing, location or characteristics specific to the individual. Although encouraging, the results in health risk change were modest considering the number of programs implemented. One explanation for this was lack of consideration for characteristics at the individual level that influence individual behavior. A main issue was stress among employees. Stress may have directly influenced health

behaviors such as smoking and over-eating. Also, individuals reported reluctance for participating in programs due to lack of manager support and desiring to appear committed at work (Marzec et al., 2011). This example illustrates the importance of considering individual factors concurrent with population-based wellness interventions.

Population-based interventions represent an important transition in health promotion from focusing on individual behavior change to inclusion of the environment to affect change. However, the ecological framework considers both individual characteristics and the environment. Health promotion priorities have largely focused on either individual characteristics (behavior change/risk reduction) or the environmental interventions and not both simultaneously. An opportunity exists for examining individual characteristics or mechanisms related to an outcome of interest and then designing interventions at the environmental level for widespread impact. By examining determinants and mechanisms that are driving outcomes of interest, such as absenteeism, more effective policies and health promotion interventions can be designed.

Research from other disciplines offer examples where this strategy has been implemented successfully. Occupational rehabilitation research supports the inclusion of individual characteristics and environmental factors for health and positive work outcomes (Mayer et al., 1985, Mayer et al., 1987, Schonstein et al., 2003). For example, a literature review of 19 interventions that included both cognitive-behavior and physical therapy showed on average 45 fewer absent days/year related to back and neck pain. There was no evidence of an effect on absenteeism for standard care programs (physical therapy alone) (Schonstein et al., 2003). Other approaches that consider the specific work environment in the rehabilitation process also show improved work outcomes as

compared to standard physical therapy (Matheson et al., 1997). Models that include a social perspective indicate that workers' motivation within return to work programs is more strongly influenced by supervisor support, trust and respect than by personal and demographic factors (Baril et al., 2003). It is well-recognized in the occupational literature that more successful return to work interventions include both work conditions and individual factors (Durand et al., 2003). There is evidence that occupational rehabilitation interventions were improved greatly by adapting the social ecological model perspective for interventions. Therefore, a similar perspective may yield similar improvement for other health and work related outcomes, such as absenteeism.

Determinants of Absenteeism

Absenteeism represents an objective outcome measure related to employee health and a measure of lost productivity. Therefore, the value in studying absenteeism lies in reducing it for its own sake. Additionally, factors that reduce absenteeism improve health. Employers benefit directly from having healthy employees (less absenteeism), but also benefit by providing a more positive work atmosphere that is supportive of health in general. Currently, the majority of research examines associations of single factors, such as the existence of medical conditions or even a single condition in relation such as the common cold to absenteeism (Loeppke et al., 2009, Bramley et al., 2002). Other studies focus on psychosocial factors such as job satisfaction or stress in relation to absenteeism (Bakker et al., 2003, Peter and Siegrist, 1997, VanWormer et al., 2011). However, individuals' realities consist of multiple influences and multiple roles (work, family, personal/medical needs). Therefore, a potentially useful research and intervention

perspective involves an integrated model of multiple factors that contribute to absenteeism and indirectly health.

Definition of Absenteeism

For this work, absenteeism is defined as time away from work due to incidental reasons or health problems. In the literature, most studies concerned with employee health specify absence due to illness (Steele, 2003). However, recent work noted that employees use other forms of absence in lieu of sick time for health-related reasons (Spears et al., publish ahead of print). For the studies in this dissertation, absenteeism is restricted to absence due to personal illness where self-reported data is concerned. This is because the self-reported item specifies absence due to illness (Study 1 and Study 3). Study 2 only utilizes absence from company records and not self-reported data. For that work a broader definition of incidental, absence is used that encompasses more forms of absence. Among the study populations for this dissertation ~98% of utility provider employees used some form of incidental absence and 64.5% used illness time. For the financial services employees of Study 3, 58.1% reported any absence time in the past year due to illness. A key component of Study 1 and 2 is the confirmation of findings of self-reported absenteeism data with objective absenteeism data from company records. Self-reported data, though easier to obtain, has been criticized due to the potential for recall bias and underreporting response bias. Thus, the use of both types of absenteeism where possible is a strength of this work (Steel, 2003).

Study Purpose

The purpose of this project is to examine determinants of absenteeism identified in the literature and according to Health Risk Appraisal information. The studies also examine interrelationships between factors. Main determinants of absenteeism are examined over time to assess if changes in these factors result in changes in absenteeism. Absenteeism is used as the outcome metric, due to its quantifiable nature and established links to individual health. Although factors related to increased absenteeism are identified, the perspective of the study is of improving individual health. In the context of the social ecological framework, there are reciprocal interactions between individual characteristics and the larger social and physical environment. Knowledge of individual characteristics should be useful for improving wellness interventions and affecting policies and procedures for organization. Therefore, the three studies will:

Study 1 examines individual factors according to HRA data as determinants of absenteeism. Both self-reported absenteeism and absenteeism from administrative records were incorporated into the study.

Study 2 assesses changes in absenteeism in relation to changes in the main determinants of absenteeism.

Study 3 extends findings of the first two studies by focusing on stress as a main determinant of absenteeism. The third study examines stress as a determinant of absenteeism, but also expands the work of the Study 1 and Study 2 by including caregiving as a potential predictor for stress and absenteeism. Also, the connection between stress and the presence of medical conditions is examined in more detail. In

terms of outcome measures, on-the- job productivity loss (presenteeism) is examined in addition to absenteeism. Presenteeism has been described as the “at work” correlate to absenteeism where one is at work but less productive due to health or emotional problems (Burton et al., 2005).

Summary

Absenteeism is a useful outcome to study as it is an objective, quantifiable measure associated with individual health. Absenteeism is also relevant to employers due to direct and indirect costs that impact an organization’s viability. Health Risk Appraisals (HRA) provide a useful source of data due to widespread and growing use among employers and health insurance providers. Since HRAs capture data on multiple aspects of aspects of health at the individual level, there is an opportunity to use the data to inform workplace policies and health promotion strategies. This differs from current approaches where either a) HRAs are used to identify individual characteristics that fit a specific program or b) environmental policies and interventions are put in place irregardless of individual characteristics.

Potential contributions of this work include: a) establishing additional value in HRA data in examining factors that contribute to health-related outcomes (e.g. absenteeism), b) supplementing extant research by quantifying relative contribution of factors related to absenteeism and c) informing health promotion practitioners and employers as to implications for policies and wellness program strategies.

References

- Bakker, A. B., Demerouti, E., de Boer, E. and Schaufeli, W. B. 2003. Job demands and job resources as predictors of absence duration and frequency. *J. Vocat. Behav.*, 62(2) 341-356. <Go to ISI>://WOS:000182138100009
- Baril, R., Clarke, J., M. Friesen, Stock, S., Cole, D., Bombardier, C., et al. 2003. Management of return-to-work programs for workers with musculoskeletal disorders: A qualitative study in three Canadian provinces. *Social Science & Medicine*, 57; 2101-2114.
- Bramley, Thomas J., Lerner, Debra and Sarnes, Matthew 2002. Productivity Losses Related to the Common Cold. *J Occup Environ Med*, 44(9) 822-829.
http://journals.lww.com/joem/Fulltext/2002/09000/Productivity_Losses_Related_to_the_Common_Cold.4.aspx
- Burton, Wayne N., McCallister, Katherine T., Chen, Chin-Yu and Edington, Dee W. 2005. The association of health status, worksite fitness center participation, and two measures of productivity. *J Occup Environ Med*, 47(4) 343-351.
- Centers for Disease Control 2008. Prevalence of self-reported physically active adults--United States 2007. *Morbidity and Mortality Weekly Report*, 57; 1297-1300.
<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5748a1.htm>
- Durand, M.J., Vachon, B., Loisel, P. and Berthelette, D. 2003. Constructing the program impact theory for an evidence-based work rehabilitation program for workers with low back pain. *Work*, 21(3) 233-242.
- Edington, Dee W., Yen, Louis T. and Witting, Pamela 1997. The financial impact of changes in personal health practices. *J Occup Environ Med.*, 39; 1037-1046.
- Fichtenberg, Caroline M. and Glantz, Stanton A. 2002. Effect of smoke-free workplaces on smoking behaviour: systematic review *British Medical Journal*, 325; (188)
<http://www.bmj.com/cgi/reprint/325/7357/188>
- Flegal, Katherine M., Carroll, Margaret D., Ogden, Cynthia L. and Curtin, Lester R. 2010. Prevalence and Trends in Obesity Among US Adults, 1999-2008. *JAMA*, 303(3) 235-241.
- Gazmararian, Julie A., Foxman, Betsy., Yen, Louis T., Morgenstern, Hal and Edington, Dee W. 1991. Comparing the predictive accuracy of health risk appraisal: the Centers for Disease Control verses Carter Center Program. *Ameri J Public Health*, 81(10) 1296-1301.
- Golaszewski, Thomas, Hoebbel, Cassandra, Crossley, Jonathon, Foley, Gabrielle and Dorn, Joan 2008. The reliability and validity of an organizational health culture audit. *Amer J Health Studies*, 23(3) 116-123.
- Hackett, R. D. 1989. Work attitudes and employee absenteeism: A synthesis of the literature. *J Occup Psych*, 62; 235-248.
- Linnan, Laura, Bowling, Mike, Childress, Jennifer, Lindsay, Garry, Blakey, Carter, Pronk, Stephanie, et al. 2008. Results of the 2004 national worksite health promotion survey. *Amer J Public Health*, 98(8) 1503-1509.
- Loeppeke, Ronald, Taitel, Michael, Haufle, Vince, Parry, Thomas, Kessler, Ronald C. and Jinnett, Kimberly 2009. Health and productivity as a business strategy: A multiemployer study. *J Occup Environ Med*, 51(4) 411-428.

- Marzec, Mary, Golaszewski, Thomas, Musich, Shirley, Powers, Patricia E., Shewry, Sandra and Edington, Dee W. 2011. Effects of Environmentally-Focused Interventions on Health Risks and Absenteeism. *International J of Workplace Health Management* 4(3) 200-215.
- Matheson, L.N., Isernhagen, S.J. and Hart, D.L. 1997. A client-centered ecological approach. *Work*, 8; 225-225.
- Mayer, T.G., Gatchel, R.J., Kishino, N.D., Keeley, J., P. Capra, Mayer, H., et al. 1985. Objective assessment of spine function following industrial injury: A prospective study with comparison group and one-year follow-up. *Spine*, 10; 482-493.
- Mayer, T.G., Gatchel, R.J., Mayer, H., Kishino, N.D., Keeley, J. and Mooney, V. 1987. A prospective two-year study of functional restoration in industrial low back injury: An objective assessment procedure. *JAMA*, 258; 1763-1767.
- McLeroy, Kenneth R., Bibeau, Daniel, Steckler, Alan and Glanz, Karen 1988. An ecological perspective on health promotion programs. *Health Education Quarterly*, 14(4) 351-377.
- Minino, Arialdi M., Xu, Jiaquan and Kochanek, Kenneth K. 2010. National vital statistics report--Deaths: preliminary data for 2008 59(2)
http://www.cdc.gov/nchs/data/nvsr/nvsr59/nvsr59_02.pdf
- Musich, Shirley, Napier, Deborah and Edington, Dee W. 2001. The association of health risks with workers' compensation costs. *J Occup Environ Med*, 43(6) 534-41.
- Napolitano, Melissa A., Lerch, Heather, Papandonatos, George and Marcus, Bess H. 2006. Worksite and communications-based promotion of a local walking path *Journal of community health*, 31(4) 326-342.
<http://www.springerlink.com/content/0k35v45211002624/>
- Peter, Richard and Siegrist, Johannes 1997. Chronic work stress, sickness absence, and hypertension in middle managers: General or specific sociological explanations? *Social Science & Medicine*, 45(7) 1111-1120.
<http://www.sciencedirect.com/science/article/pii/S0277953697000397>
- Schonstein, Eva, Kenny, D., Keating, J., Koes, B. and Herbert, R. D. 2003. Physical Conditioning Programs for Workers With Back and Neck Pain: A Cochrane Systematic Review. *Spine*, 28; (19) E391-E395.
http://journals.lww.com/spinejournal/Fulltext/2003/10010/Physical_Conditioning_Programs_for_Workers_With.22.aspx
- Spears, D. Ross, McNeil, Carrie, Warnock, Eli, Trapp, Jonathan, Oyinloye, Oluremi, Whitehurst, Vanessa, et al. publish ahead of print. Predicting Temporal Trends in Sickness Absence Rates for Civil Service Employees of a Federal Public Health Agency. *J Occup Environ Med*, 10.1097/JOM.0b013e3182717eb5.
http://journals.lww.com/joem/Fulltext/publishahead/Predicting_Temporal_Trends_in_Sickness_Absence.99356.aspx
- Steel, Robert P. 2003. Methodological and operational issues in the construction of absence variables. *Human Resource Management Review*, 13(2) 243-251.
<http://www.sciencedirect.com/science/article/pii/S1053482203000159>
- Stewart, Walter F., Ricci, Judith A., Chee, Elsbeth and Morganstein, David 2003. Lost Productive Work Time Costs From Health Conditions in the United States: Results From the American Productivity Audit. *J Occup Environ Med*, 45(12) 1234-1246.

http://journals.lww.com/joem/Fulltext/2003/12000/Lost_Productive_Work_Time_Costs_From_Health.4.aspx

VanWormer, Jeffrey J., Fyfe-Johnson, Amber L., Boucher, Jackie L., Johnson, Pamela Jo, Britt, Heather R., Thygeson, N. Marcus, et al. 2011. Stress and Workplace Productivity Loss in the Heart of New Ulm Project. *J Occup Environ Med*, 53(10) 1106-1109 10.1097/JOM.0b013e318229ab18.

http://journals.lww.com/joem/Fulltext/2011/10000/Stress_and_Workplace_Productivity_Loss_in_the.3.aspx

Webb, Oliver J. and Eves, Frank F. 2007. Effects of environmental changes in a stair climbing intervention: generalization to stair descent *Amer J Health Promot*, 22(1) 38-44.

Wright, Douglas, Beard, Marshall and Edington, Dee W. 2002. Association of health risks with the cost of time away from work. *J Occup Environ Med*, 44(12) 1126-34.

Yen, Louis T., Edington, D. and Witting, P. 1991. Associations between health risk appraisal scores and employee medical claims costs in a manufacturing company. *Amer J Health Promot*, 6; 46-54.

Chapter 2

Examining Individual Factors according to Health Risk Appraisal Data as Determinants of Absenteeism among US Utility Employees

Introduction

Lost productivity time due to absenteeism and reduced performance for health related reasons cost U. S. employers an estimated \$226 billion dollars (Stewart et al., 2003). Increased absenteeism, in terms of hours away from work, is also a tangible measure related to both physical and mental health. Most physical health conditions are associated with increased absenteeism (Collins et al., 2005, Kessler et al., 2001, Wang et al., 2003). Furthermore, increased absenteeism also occurs with emotional health issues, such as depression, anxiety and stress (Braunstein et al., 2001, Burton et al., 2004, Cohen et al., 2007, Goetzel et al., 2009). Therefore, by assessing and intervening with factors related to absenteeism, employers are likely to improve the overall health of employees as well. Other consequences of absenteeism include decreased morale and increased demands on remaining staff (Hackett, 1989). There are additional costs to be considered that are not quantifiable such as the lost productivity for an entire team, strain on remaining employees, and reduced productivity by replacing missing worker with one less experienced in that role (Steel, 2003). Therefore, poor employee health and absenteeism have direct implications for an organization's productivity and overall viability.

Since individuals' realities consist of multiple influences (work, family, personal/medical needs), a potentially useful research and intervention perspective involves modeling multiple factors associated with absenteeism. This study examines pathways by which individual factors are related to absenteeism. Individual factors are considered to be those specific to the individual in contrast to studies that investigate factors specific to the organization (work environment, bureaucracy and supportive culture) as determinants of absenteeism (Howard and Cordes, 2010, Karasek, 1990, Ose, 2005, Shapiro and Stiglitz, 1984, Way and MacNeil, 2006). Beyond demographics including job classification, medical condition burden, stress, job satisfaction and physical activity were considered in the model. Self-reported and objective absenteeism were modeled separately as outcome measures. By investigating how factors are related to absenteeism and to each other, workplace policies and wellness programs may be improved to positively impact such outcomes and employee health.

Theoretical Basis for the Path Analysis Model

Model formation was based on evidence from the literature. Variables of interest included medical condition burden, job satisfaction and stress as determinants of absenteeism. Evidence of a link between physical activity levels and reductions in absenteeism exists in the literature (Ludovic van Amelsvoort et al., 2006, Taimela et al., 2008). Among randomized controlled trials, as compared to observational studies, evidence is positive, but less conclusive (Osilla et al., 2012, Proper et al., 2002). Information on the modality by which physical activity may impact absenteeism would

be useful in setting expectations for absenteeism as an objective outcome for physical-activity-related programs.

Multimorbidity (Medical Condition Burden)

A large body of evidence exists linking most health conditions to increased absenteeism. Approximately, 10% of working individuals reported absence from work at least one day within timeframe of the past two weeks due to health conditions (Stewart et al., 2003). Multimorbidity is the presence of multiple chronic medical conditions. In a large multi-employer study by Loeppke et al., for most medical conditions having a single condition was not associated with increased absenteeism as compared to not having the condition (Loeppke et al., 2009). Exceptions were coronary heart disease and cancer. However, 62% of individuals with a medical condition also had at least one other condition. Absenteeism increased as the number of co-morbidities increased (Loeppke et al., 2009). Since most affected individuals appear to have multiple conditions, considering conditions in isolation may be of limited applicable value. An opportunity exists to consider the number medical conditions as a reflection of disease burden and evaluate how this relates to absenteeism. Other studies have assessed multimorbidity by summing number of conditions (Franche et al., 2011, John et al., 2003). For this study, we created a medical condition burden index (MCBI) which was calculated by summing the number of self-reported medical conditions according to HRA responses. The MCBI was included in the model as a measure of medical condition burden.

Hypothesis 1: Medical condition burden as measured according the MCBI will be positively related to absenteeism.

Stress

Substantial literature exists that defines areas of the workplace that are potential sources of psychological distress. Main areas include excessive workload, interpersonal relationships, lack of task control, role ambiguity, unfair management practices, family and job conflicts, training/career development issues, and poor organizational climate (lack of management commitment to core values, conflicting communication styles, etc.) (Collins and Gibbs, 2003, Darr and Johns, 2008, Evans et al., 2010, Way and MacNeil, 2006).

The inclination for individuals to avoid overwhelming/unpleasant situations is one dynamic that implicates stress as a source of absenteeism. In a study utilizing self-reported data of 250 worksites, Jacobson et al. found perceived stress to be associated with absenteeism independent of other confounders (age, gender, education, smoking, alcohol consumption, blood pressure, cholesterol, body mass index, and physical activity) (Jacobson et al., 1996). A Belgian study examined work related stress and found factors that predicted absence were low job control (odds ratio 1.4) and high over-commitment (odds ratio 2.4) for more than 5 days absence per year (Godin and Kittel, 2004). Further evidence on the relationship between workplace stress and absenteeism comes from a focus group style study of nurses across ten Canadian acute care hospitals. Leading causes cited for absenteeism were excessive workload, understaffing, mental/psychosocial health (Shamian et al., 2003). Besides avoidance behavior, workplace stress may lead to absenteeism due to increased health problems including anxiety, depression (Tennant, 2001), cardiovascular disease (Searle, 2008), gastrointestinal disorders (Chrousos, 2009) and others (Thoits, 2010). For example, one meta-analysis estimated an approximate 50% increase in cardiovascular disease risk

associated with high levels of work stress (Kivimaki et al., 2006). Thus, we also postulate that stress may be positively related to the MCBI.

Hypothesis 2: Stress, as measured on the HRA, will be a) positively related to absenteeism and b) positively related to the MCBI.

Job Satisfaction

Studies investigating associations between job satisfaction measures and absenteeism have shown mixed results. Common assumptions posit that higher job satisfaction is associated with lower absenteeism. Correlates of job satisfaction include appropriate work demands, input as to work expectations, higher organizational engagement, and positive attitude toward job and organization. All of these would predict lower exhibition of withdrawal behavior such as absenteeism. In fact, many studies have shown weak correlations between job satisfaction and absenteeism. Hackett found a relatively small mean correlation of $r = -0.23$ between general job satisfaction and time lost measures of absence (Hackett, 1989). Harrison and Martocchio reported that corresponding correlations for job involvement (extent to which an individual identifies psychologically with their job) are even lower with $r = -0.14$ (Harrison and Martocchio, 1998). More recently, Wegge et al. found similar results with weak correlation between job satisfaction and absence duration ($r = -0.11$) and for job satisfaction and absence frequency ($r = 0.02$). However, the authors noted significant interaction effects between job involvement and job satisfaction. Among those with low job satisfaction, high job involvement predicted higher absence. Among those with high job satisfaction, there was no association between job involvement and absenteeism (Wegge et al., 2007). Since the

HRA assesses general job satisfaction, this variable is more likely to be associated with stress than absenteeism.

Hypothesis 3: a) Direct relationship between job satisfaction and absenteeism is not expected. b) Job satisfaction is expected to be negatively associated with stress.

Physical Activity

Physical activity has been associated with better health status (Warburton et al., 2006) and improved mood (Fox, 1999, Paluska and Schwenk, 2000, Taylor, 2001). Physical activity is effective of prevention of many chronic conditions and for management of existing conditions ranging from cardiovascular disease to rheumatoid arthritis (Oguma and Shinoda-Tagawa, 2004, Prohaska et al., 2006, Pronk et al., 2004). For mental health, physical activity has been recommended for treatment of clinical mental disorders and sub-clinical symptoms of anxiety depression and stress (Fox, 1999, Paluska and Schwenk, 2000, Taylor, 2001). Therefore, it is expected that physical activity should be inversely related to both MCBI and stress.

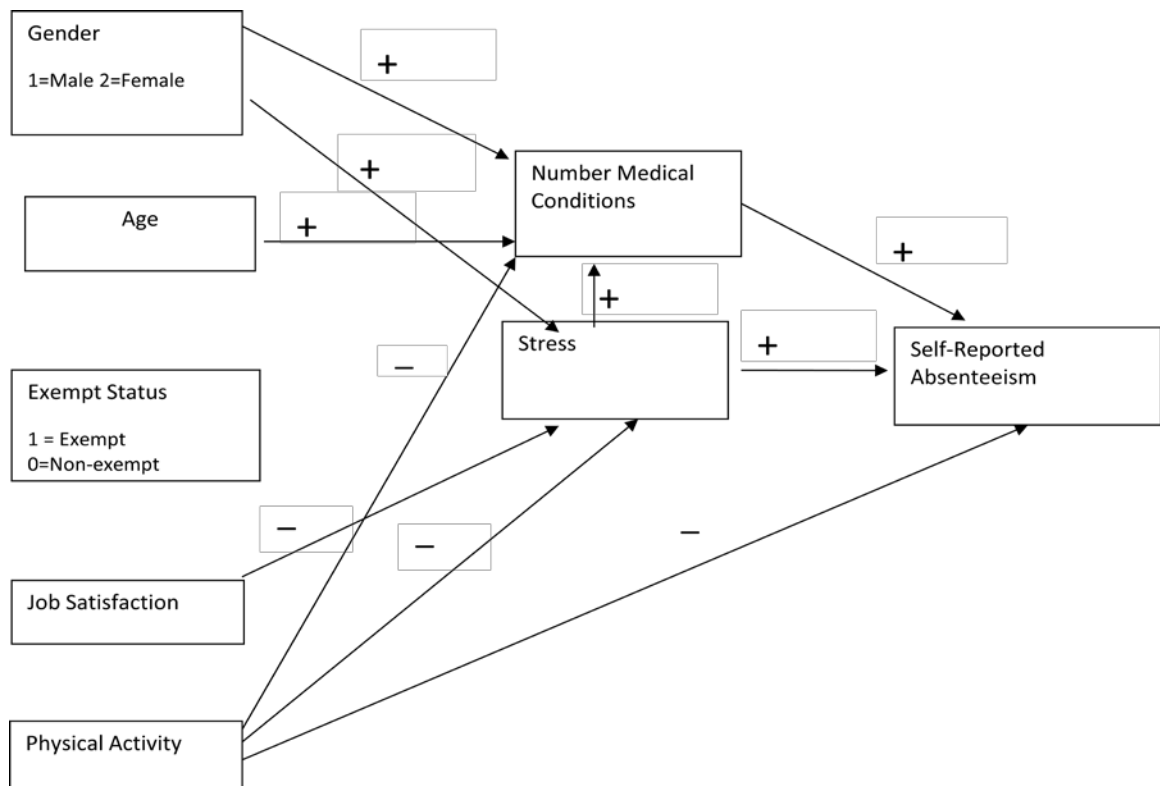
Research is mostly supportive of reduced absenteeism in association with physical activity. One study compared absence time over the past year for individuals reporting leisure time physical activity two or more times a week to those reporting one or fewer episodes of physical activity per week. Absence was measured using both self-reported and employer records. On average, physically active employees had fewer absent days per year (physically active 14.8 days vs. physically inactive 19.5 days). Adjustments for age, gender and educational level did not change the relationships (Ludovic van Amelsvoort et al., 2006). Another observational study followed 125 individuals after

participation in 12-week physical activity rehabilitation program for low back pain. Average time from program completion to follow-up was 14 months, ranging from 2-30 months. Outcome measures were recurrence of back pain and absenteeism due to back pain. The authors utilized hazard functions and found exercisers less likely to have either recurrent back pain (Kaplan-Maier test statistic 2.2; $p = 0.003$) or absenteeism due to low back pain (test statistic 2.6; $p = 0.009$) (Taimela et al., 2000). These studies offer supportive evidence for physical activity and reduced absenteeism.

Hypothesis 4: a) Physical activity is expected to be inversely related to MCBI, stress and absenteeism.

Figure 2.1 illustrates the hypothesized model

Figure 2.1. Hypothesized Model of Individual Factors and Self-Reported Absenteeism



Methods

This study uses the University of Michigan Health Risk Appraisal. This HRA is a modified version of the *Healthier People, Version 4.0* originally developed by the Centers for Disease Control and Prevention, Carter Center. This HRA measures 15 health factors, including alcohol use, blood pressure, body weight, total cholesterol, cigarette smoking, health perception, health age index, illness days, life dissatisfaction, job dissatisfaction, presence of major medical conditions, physical inactivity, safety belt use, stress, and use of drugs/medication to relax. The definition of high risk status for each health risk factor has been reported previously (Wright et al., 2004). Health risks identified by this tool have been validated against objective measures including, medical costs, workers' compensation costs, disability costs and worker productivity measures (Musich et al., 2001, Wright et al., 2002, Yen et al., 1991, Burton et al., 2005). Furthermore, as health risks change (either increasing or decreasing), there is an associated change in healthcare costs (Edington, 2001, Musich et al., 2000). The University of Michigan HRA has been validated against several objective measures and has been the basis of multiple peer-reviewed publications.

This study included some items that are also identified as health risks (physical inactivity, stress, job satisfaction). However, health risks are dichotomous variables with established cutoffs such that an individual either has the risk or does not have it. To more fully utilize the information, we used the question items with the full range of answer choices. Stress was determined from responses to: "During the past year, how much effect has stress had on your health?" Using a four-point ordinal scale – A Lot, Some, Hardly Any, None. Job satisfaction was assessed by: "Would you agree you are satisfied

with your job?” Agree Strongly, Agree, Disagree, Strongly Disagree. The item for self-reported absenteeism was “In the past year, how many days of work have you missed due to personal illness?” 0, 1-2 days, 3-5 days, 6-10 days, 11-15 days, 16 days or more. This item was coded as 1-6. The objective absenteeism from administrative records was grouped into the same categories and also coded as 1-6. The MCBI was based on the number of self-reported medical conditions from the HRA. All HRA questions used in this study and the 20 medical conditions that comprised the MCBI are itemized in Table 2.1.

Table 2.1 Health Risk Appraisal Items

	Health Risk Appraisal Question	Answer Choices
Stress	During the past year, how much effect has stress had on your health?	a) A lot b) Some c) Hardly any d) None
Job Satisfaction	Would you agree you are satisfied with your job?	a) Agree strongly b) Agree c) Disagree d) Disagree strongly
Physical Activity	In the average week, how many times do you engage in physical activity (exercise or work which is hard enough to make you breathe heavily and make your heart beat faster) and is done for at least 20 minutes?	a) Less than 1 time/week b) 1 or 2 times/week c) 3 times/week d) 4 or more times/week
Self-Reported Absenteeism	In the past year, how many days of work have you missed due to personal illness?"	a) 0 b) 1-2 days c) 3-5 days d) 6-10 days e) 11-15 days f) 16 days or more
	Medical Condition Burden Index (MCBI) Items	
	Do you have ..?(Items are listed vertically on questionnaire):	Multiple Part Answering Option
	allergies, arthritis, asthma, back pain, cancer, chronic bronchitis/emphysema, chronic pain, depression, diabetes, heart problems, heartburn/acid reflux, high blood pressure, high cholesterol, menopause, migraine headaches, osteoporosis, sleep disorder, stroke, thyroid disease, and "other"	a) Never b) In the Past c) Have Currently* If Have Currently a) Taking Medication* b) Under Medical Care*

*Considered as having the condition

Design

This is a cross-sectional study of 2010 HRA respondents from a U. S. utility corporation. There were 13,099 active employees at the time of the study. HRAs were completed on a voluntary basis by employees. Approval for this work was obtained from the University of Michigan Institutional Review Board (IRB) and consent was obtained from participants for use of the data in aggregate form.

Outcome Measures

Table 2.1 provides the specific HRA questions used in the development of our model. Antecedent and mediating variables considered in the model were derived directly from questions in the HRA. All variables (age, gender, medical condition burden index, stress, job satisfaction, and physical activity) were coded in the positive direction. The medical condition burden index (MCBI) consisted of having or being under medical care for any of 20 medical conditions listed on the HRA. The number of medical conditions reported was summed for each individual. The items included in the MCBI were allergies, arthritis, asthma, back pain, cancer, chronic bronchitis/emphysema, chronic pain, depression, diabetes, heart problems, heartburn/acid reflux, high blood pressure, high cholesterol, menopause, migraine headaches, osteoporosis, sleep disorder, stroke, thyroid disease, and an “other” option. Absenteeism was the outcome variable for the model. Both self-reported absenteeism and objective absenteeism from company administrative records were modeled. The objective data was converted from hours to days and grouped into similar categories as the self-reported data.

Objective Absenteeism: Hours of absence due to employee illness grouped into day categories (0 days-- < 8 hours; 1-2 days--8-20 hours; 3-5 days---21-50 hours; 6-10 days – 50-100 hours 11-15 days --101-150 hours; 16+ days—150 or more hours.

Control Variables: Age, and gender and exempt/non-exempt job classification were controlled for in the analysis.

Statistical Analysis

Demographics of the HRA participants were assessed and compared to non-HRA participants using t-tests for continuous variables and chi square tests for categorical variables. Statistical significance was set at $p < 0.05$ for comparisons of gender and age. Prior to creating the path analysis model, a preliminary analysis using Spearman correlation matrix identified potential pathways of relevant variables. T-tests, chi-square, and correlation analyses were performed with SAS 9.0. The path analyses were performed using AMOS software by SPSS (Chicago, IL). Model fit was based on chi square values with degree of freedom, goodness of fit index (GFI), comparative fit index (CFI), root mean square residual (RMR) values, root mean square of approximation (RMSEA), modification indices and importance of the variable to the model according to the pathway estimates. For the path analysis model, statistical significance level was set at $p < 0.05$. However, the sample size is large ($N > 200$) and the chi square statistic is sensitive to sample size. Thus, a significant chi square is typically not considered problematic in assessing structural models (Kline, 2011). Instead, RMSEA was considered as the best critical fit index because the sample size for this project is large. The sample size consideration is included in the RMSEA definition ($RMSEA = \sqrt{[(\text{chi square}/df - 1) / (N - 1)]}$).

Results

HRA Participants

Participants were employees from a major US based utility corporation. In 2010, there were 13,099 employees of the utility corporation company eligible for the HRA of whom 7,748 completed the HRA (participation rate: 59%). Demographic differences were noted between the HRA respondents and the non-HRA participants. The HRA participants had a greater proportion of females (30% vs.11%; $p < 0.01$). The HRA participants on average were younger than the non-participants (44.6 years old vs. 45.6 years old; $P < 0.01$). HRA participants were more likely to have exempt job classification (65% vs. 22%; $P < 0.01$). Demographics for the eligible employees, HRA participants and HRA non-participants are shown in Table 2.2.

Table 2.2 Population and Study Sample Demographics

	Eligible Employees	HRA Participants	HRA Non-Participants
N	13,099	7,748	5,351
Participation Rate		59%	
Gender			
Female	22.2%	30.2%*	10.5%*
Male	77.8%	69.8%	89.5%
Age			
19-24	2.8%	2.2%	3.6%
25-34	19.2%	20.4%	17.5%
35-44	20.9%	22.3%	18.8%
45-45	35.6%	35.7%	35.4%
55-64	20.3%	18.2%	23.3%
65+	1.3%	1.2%	1.5%
Average Age (mean ± std. dev.)	45.0 ± 11.1	44.6 ± 10.9*	45.6 ± 11.4*
Percent Exempt	47.3%	65.1%*	21.6%*

*statistically significant difference between HRA participants and non-participants (P < 0.05)

Descriptive statistics

The ranges, means and standard deviations for all study variables are shown for the HRA respondents in Table 2.3. The MCBI had a potential range from 0 to 20. In the

actual data, the score ranged from 0-11. The MCBI mean and standard deviation values were 1.2 ± 1.4 .

Table 2.3 Descriptive Statistics and Correlations for Main Study Variables

Variable	Range	Mean \pm Std. Dev.	1	2	4	5	6	7
1. Medical Condition Burden Index (MCBI)	1-11	1.2 \pm 1.4	1					
2. Stress Affecting Health	1-4	2.2 \pm 0.8	.27	1				
4. Job Satisfaction	1-4	3.2 \pm 0.6	-.11	-.25	1			
5. Physical Activity	1-4	2.8 \pm 1.0	-.18	-.19	.12	1		
6. Self- Reported Absent Days	1-6	1.8 \pm 1.0	.17	.16	-.09	-.07	1	
7. Objective Absent Days (from personnel)	1-6	1.9 \pm 1.1	.12	.08	-.06	-.03	.44	1

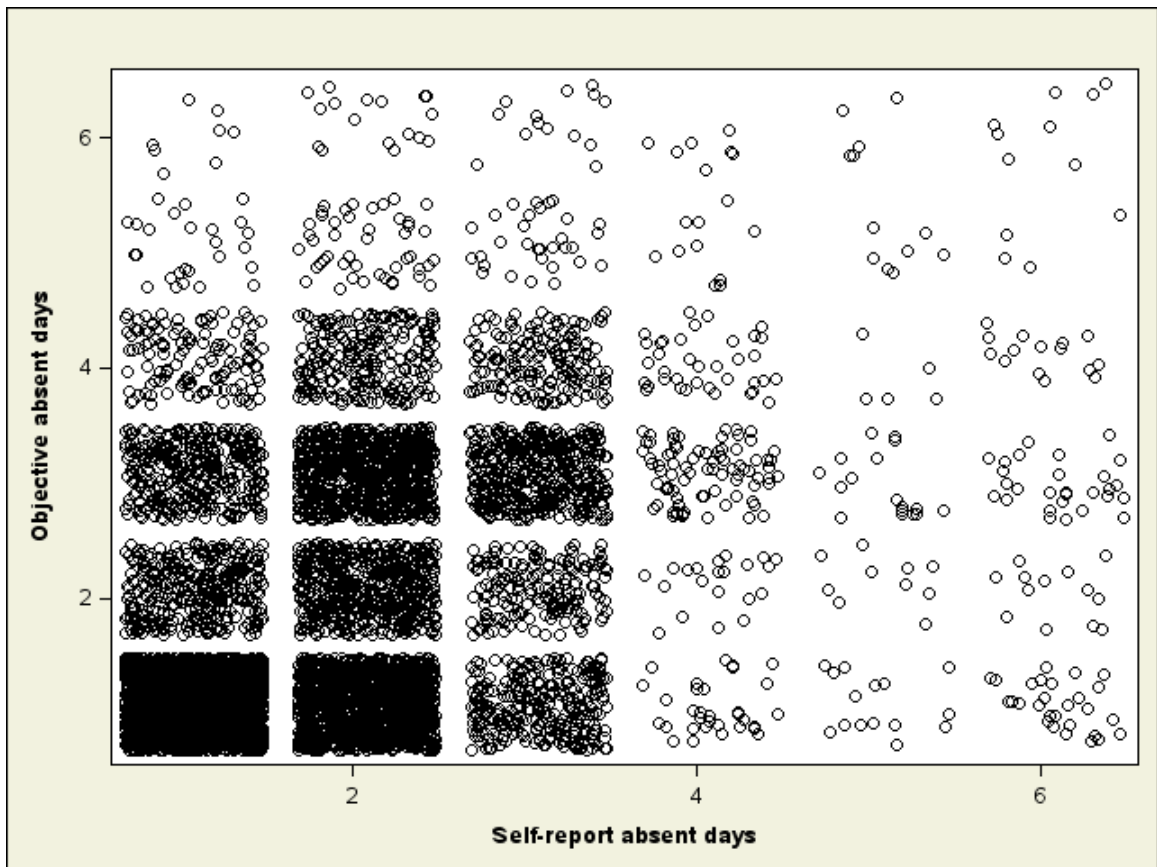
$P < 0.01$ for all correlation coefficients

Self-Reported vs. Objective Absenteeism

In order to compare the results using self-reported absenteeism and objective data, absenteeism from personnel records were grouped into the same categories as the self-reported data. Both measures of absenteeism had a range of 1-6 representing days per year absent due to illness. Zero days absent was coded as 1, 1-2 days coded as 2; 3-5 days coded as 3, 6-10 days coded as 4; 11-15 days coded as 5 and 16 or more days was coded as 6. The correlation between the two measures of absenteeism was 0.44 (Table 2.3). Figure 2.2 shows a scatterplot of the two measures. To prevent over plotting of the data, “jittering” was performed such that random values between [-0.4, +0.4] were added to the data values. After rounding this did not impact the original values. On average self-

reported absent days were lower than the objective absence (after grouping into similar categories) at 1.83 and 1.91 respectively ($P < 0.01$). Separate path analysis models were performed with the same endogenous variables and different forms of absenteeism as the outcome variables (self-reported and objective absenteeism).

Figure 2.2 Jittered Scatterplot of Self-reported Absent Days vs. Objective Absent Days



Preliminary Analysis for Model Development

The model was developed using HRA data from employees of a US utility company. For this group 58% of individuals reported more than one medical condition.

Thirty five percent of HRA participants reported stress affecting their health “some” or “a lot”.

Correlations

Correlation analysis was utilized to explore associations between variables for building the structural equation model (see Table 2.3). Stress was negatively correlated with job satisfaction, such that higher stress was associated with lower job satisfaction ($r_s = -.25$; $P < .001$). Stress was positively correlated with self-reported absence ($r_s = .16$; $p < .001$). This supports direct paths between the stress variable and job satisfaction and between stress and self-reported absenteeism. For MCBI, the strongest correlations were with stress affecting health ($r_s = .27$; $P < .001$) and self-reported absence ($r_s = .17$; $P < .001$). This suggests direct relationships between MCBI and those variables. Physical activity was negatively correlated with MCBI ($r_s = -0.18$; $P < 0.01$) and stress affecting health ($r_s = -0.19$; $P < 0.01$). Physical activity did not correlated strongly with either self-reported or objective absence ($r_s = -0.07$ and $r_s = -0.03$ respectively). Thus, direct paths between physical activity and MCBI and between physical activity and stress affecting health were supported by this preliminary analysis. Evidence is much weaker for a direct relationship between physical activity and absenteeism.

Multiple Regression

Multivariate regression was used to attain more information about the variables in terms of predicting absenteeism. All regression coefficients were statistically significant except physical activity (See Table 2.4).

Table 2.4 Multiple Regression of Self-reported Absenteeism on Demographic and Study Variables

N = 7,748	Regression Estimate	Standard Error	95% Confidence Interval	Standardized Estimate
Age (5 yr categories)	-0.06**	0.02	(-0.07, -0.05)	-0.14
Gender	0.27**	0.02	(0.22, 0.32)	0.12
Exempt/Non-exempt Job Status	-0.54	0.03	(-0.59,-0.48)	-0.22
Job Satisfaction	-0.06*	0.02	(-0.1, -0.02)	-0.03
Medical Condition Burden Index (MCBI)	0.13**	0.01	(0.11, 0.14)	0.18
Stress Affecting Health	0.19**	0.02	(0.16, 0.22)	0.15
Physical Activity	0.006	0.01	(-0.009, 0.007)	0.005

*P < 0.05 **P < 0.001

Path Analysis Model

Unstandardized coefficients, standardized coefficients, standard errors and p-values for the path coefficients for both the model with self-reported absenteeism and objective absenteeism are shown in Table 2.5. Unstandardized coefficients indicate the association between variables in units according to the variables.. Standardized coefficients are equalized to amount of change per one standard deviation and are independent of units or scales specific to each variable. Therefore, standardized coefficients are typically used when showing relative influence of variables within the model (Kline, 2011). All path coefficients discussed in the text and shown in Figure 2.2 are standardized values.

Self-Reported Absenteeism

Figure 2.2 illustrates the structural equation model with self-reported absenteeism from the HRA as the outcome variable. The model fit statistics indicated a good fit between the model and data (chi-square = 23.0 degrees of freedom= 4, GFI = 0.99, CFI=.995, RMR = 0.009 and RMSEA = 0.025). In support of hypothesis 1, higher MCBI was associated with greater absenteeism ($\beta = 0.19$). The specific interpretation is that with one standard deviation change in MCBI, absenteeism is expected to increase 0.19 standard deviation after adjusting for other factors and intercorrelations in the model. In support of hypothesis 2, stress was positively associated with absenteeism ($\beta = 0.11$). Similarly a change of one standard deviation in stress would expect to result in 0.11 standard deviation change in absenteeism. For the second part of hypothesis 2, stress influenced the MCBI with higher stress being associated with greater number of medical conditions ($\beta = 0.26$). To check directionality of the relationship, we reversed the pathway such that medical conditions were influencing stress. Results indicated a poorer fit between the model and the data. Those model fit statistics were chi-square = 100 degrees of freedom= 4, GFI = 0.97, CFI=.976, RMR = 0.018 and RMSEA = 0.056). For job satisfaction (hypothesis 3), as expected, there was not strong evidence for a direct association between job satisfaction and absenteeism, ($\beta = -0.05$; $P = 0.06$). The second part of hypothesis 3 was supported since job satisfaction and stress were related ($\beta = -0.24$). For hypothesis 4, physical activity was protective of stress ($\beta = -0.15$) and MCBI ($\beta = -0.11$). The relationship between physical activity and absenteeism was not statistically significant ($\beta = -0.03$; $P = 0.10$). Other findings were that both stress and the MCBI were moderated by gender (woman with greater stress on average and higher

MCBI). Job satisfaction was negatively associated with stress ($\beta = -0.24$). Also, age inversely affected absenteeism ($\beta = -0.12$) such that older individuals had lower absenteeism on average.

Table 2.5 Path Estimates for Final Model using Self-reported and Objective Absenteeism as Outcome Measures*

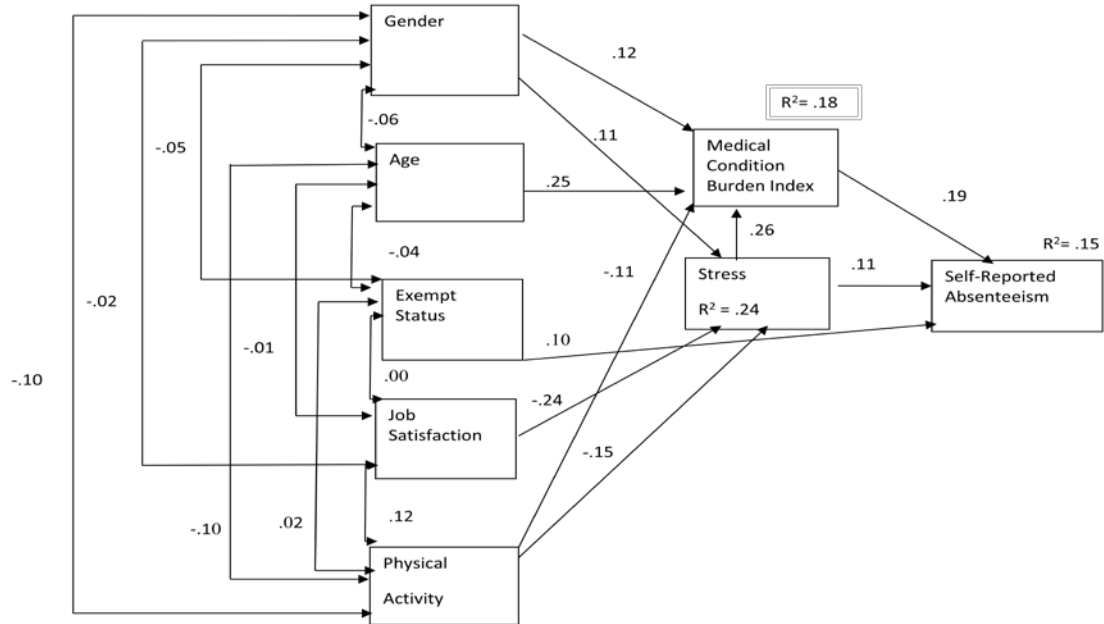
			Estimate		Standardized		Std. Error.		P-value	
			Self-report	Objective	Self-report	Objective	Self-report	Objective	Self-report	Objective
Gender	→	Stress	.21	<i>.21</i>	.11	<i>.11</i>	.02	<i>.02</i>	***	***
Job Satisfaction	→	Stress	-.35	<i>-.35</i>	-.24	<i>-.24</i>	.02	<i>.02</i>	***	***
Physical activity	→	Stress	-.13	<i>-.13</i>	-.15	<i>-.15</i>	-.01	<i>.01</i>	***	***
Gender	→	MCBI	.37	<i>.37</i>	.12	<i>.12</i>	.03	<i>.03</i>	***	***
Age	→	MCBI	.16	<i>.16</i>	.25	<i>.25</i>	.01	<i>.01</i>	***	***
Stress	→	MCBI	.44	<i>.44</i>	.26	<i>.26</i>	.02	<i>.02</i>	***	***
Physical Activity	→	MCBI	-.16	<i>-.16</i>	-.11	<i>-.11</i>	.02	<i>.02</i>	***	***
Exempt/Non-Exempt	→	MCBI	-.21	<i>-.21</i>	-.07	<i>-.07</i>	.03	<i>.03</i>	***	***
Medical Condition Burden Index (MCBI)	→	Absent Days	.12	<i>.10</i>	.19	<i>.13</i>	.01	<i>.01</i>	***	***
Stress	→	Absent Days	.12	<i>.05</i>	.11	<i>.11</i>	.01	<i>.02</i>	***	<i>.002</i>
Gender	→	Absent Days	.22	<i>.32</i>	.10	<i>.09</i>	.02	<i>.02</i>	***	***
Age	→	Absent Days	-.05	<i>-.05</i>	-.12	<i>-.10</i>	.01	<i>.01</i>	***	***
Exempt/Non-Exempt	→	Absent Days	-.22	<i>-.53</i>	-.10	<i>-.22</i>	.02	<i>.03</i>	***	***
Job Satisfaction	→	Absent Days	-.08	<i>-.07</i>	-.05	<i>-.04</i>	.02	<i>.02</i>	0.06	<i>0.07</i>

* Statistics for self-reported absence on left in bold; Statistics for objective absenteeism from personnel on right in italics.

***p < 0.001

Note: Values for statistics concerning HRA variables are the same for both self-reported and objective absenteeism.

Figure 2.3 Final Structural Equation Model Showing Standardized Coefficients for Individual Factors and Self-reported Absenteeism



The following relationships were considered in the model and the chi square was reduced to 10. However, the regression coefficients were low. Therefore, they were not retained in the final model. The deleted relationships were a) age and stress, ($\beta = 0.02$), b) exempt status and stress, ($\beta = 0.03$), c) job satisfaction and number of medical conditions, ($\beta = -0.02$), d) physical activity and absent days, ($\beta = -.03$).

Objective Absenteeism

In order to confirm the findings we also modeled objective absenteeism obtained from personnel records. Table 2.5 shows the standardized and unstandardized coefficients along with standard errors and p values. The model fit statistics indicated a good fit between the hypothesized model and data (chi-square = 16 degrees of freedom= 4, GFI =

0.99, CFI=.997, RMR = 0.008 and RMSEA = 0.020). As with the self-reported data, objective absenteeism was directly influenced by MCBI, stress gender and age. Positive associations were seen for MCBI ($\beta = 0.13$) and stress ($\beta = 0.11$). Since the same HRA data were used, the path coefficients between HRA variables (MCBI, stress, job satisfaction and physical activity) are the same as with self-reported absenteeism. Those relationships and corresponding coefficients are shown in Table 2.5, but would be redundant to list here. One main difference noted between the models was that exempt/non-exempt status was a stronger predictor for absenteeism using objective data ($\beta = -0.53$; $P < 0.01$) as compared to the model using self-reported absenteeism ($\beta = -0.10$; $P < 0.01$). For both models absenteeism tended to be lower for individuals with exempt status. The overall R-squared value for the model using objective absenteeism was 0.08. In summary, the same pathways seen with self-reported absenteeism were confirmed using objective absenteeism from personnel records.

Discussion

This study was conducted using HRA data and path analysis modeling to identify determinants of absenteeism and examine their interrelationships. The study sample was employees of a US utility provider that participated in the HRA in 2010. Both self-reported absenteeism from the HRA and objective absenteeism from administrative records were modeled as outcome variables. Similar results for the path analysis were seen using both self-reported and objective absenteeism in terms of items that directly influenced absenteeism and relationships between items. Control variables included in the analysis included age, gender and job classification (exempt/non-exempt). These were

not main objects of the hypotheses, however it was noted that female gender was positively associated with absenteeism ($\beta = 0.10$; $P < 0.01$) and age was inversely associated with absenteeism ($\beta = -0.12$; $P < 0.01$). This is consistent with previous work that reported similar findings in terms of gender, age and absenteeism (Yen et al., 1992).

Preliminary analysis of the data showed a high prevalence of individuals reporting more than one medical condition (58%) and that having multiple medical conditions correlated with greater absenteeism. This is similar to findings of Loeppke et al. who noted 62% of individuals had more than one medical condition (Loeppke et al., 2009). For purposes of this study, a medical condition burden index (MCBI) was created by summing the number of medical conditions reported on the HRA. Such a measure was proposed as a possibility by Loeppke et al. who observed that absenteeism was highly correlated with number of co-morbidities more so than to existence of an individual conditions (Loeppke et al., 2009). Our study corroborates these findings and the MCBI was positively associated with absenteeism. The other direct determinant of absenteeism was stress. The prevalence of stress was significant with 34.5% of participants reported stress that affected their health “some” or “a lot”. This underscores the importance for organizations to consider stress as a priority in employee health efforts.

In terms of interrelationships with other variables, the MCBI was directly impacted by age and gender with older individuals and women tending to have higher MCBI values. Stress also impacted the MCBI with those reporting higher stress tending to have higher MCBI values. Reversing the relationship to investigate if number of medical conditions impacted stress was not supported by the model. Thus, stress appears to influence physical health and may exacerbate medical conditions. The finding that

stress potentially exacerbates medical conditions is supported by other research. A study of industrial employees indicated that employees with high job strain, (combination of high demands at work and low job control), had a 2.2-fold cardiovascular mortality risk compared with their co-workers with low job strain after adjusting for age, gender and behavioral risk factors (Kivimäki et al., 2002). In a case control-crossover study, Moller et al. found that workplace events, characterized by high demands, competition, or conflict, were significantly associated with the onset of myocardial infarction (odds ratio: 6.0) (Möller et al., 2005). Studies have shown glucose control in diabetics to be negatively impacted by stress (Dutour et al., 1996). Since stress impacted both absenteeism directly and the MCBI, there is an opportunity that addressing stress via interventions could positively impact absenteeism directly and indirectly by improving physical health. Stress was influenced by gender with women tending to report higher stress. However, there was not a statistically significant impact of age on stress.

Job satisfaction was supported as being negatively correlated with stress, such that in general, higher job satisfaction correlated to lower stress. There was no a statistically significant association between job satisfaction and absenteeism. This is consistent with other research that has shown minimal direct association between job satisfaction and absenteeism. Others have found job satisfaction to be associated with absenteeism as a moderator for stress. For example, a study among telecom managers and executives showed work engagement being inversely related to absenteeism. Characteristics of burnout were directly related to increased absenteeism (Schaufeli and Bakker, 2004). Job dissatisfaction and on-job-stress has been show to result in symptoms of exhaustion, depression, cynicism, and reduced performance (Schaufeli and Bakker, 2004, Bakker and

Demerouti, 2007, Cartwright and Holmes, 2006, Christensen et al., 2005, Darr and Johns, 2008). A limitation of general job satisfaction as in our measure may encompass many other factors related to job situations, such as workload, role clarity and social support and therefore simply be too broad to show connection to absenteeism.

Physical activity was included in the model as several studies indicate that physical activity is associated with better health (Fox, 1999, Paluska and Schwenk, 2000, Taylor, 2001, Warburton et al., 2006, Goldberg and King, 2007, Hu et al., 2000, Laaksonen et al., 2002, Oguma and Shinoda-Tagawa, 2004, Pronk et al., 2004). There are studies indicating that lower absenteeism is found among those that are physically active (Ludovic van Amelsvoort et al., 2006, Proper et al., 2002). In our study, there was no evidence for a direct association between self-reported physical activity and absenteeism. However, physical activity mediated both stress and the MCBI. Therefore, physical activity may impact absenteeism indirectly by affecting both emotional and physical health. This is important because health promotion practitioners often seek to evaluate wellness programs solely on the impact on quantitative outcomes such as absenteeism and health care costs. While such objective outcomes are important, our findings indicate that qualitative outcomes such as reduced stress and improved physical health may be more direct outcomes related to physical activity.

These findings also indicate that interventions that encourage physical activity in order to impact productivity outcomes such as absenteeism may not be effective unless stress is also addressed. Given the relative importance of stress as a determinant of absenteeism, policy implications are for organizations to gauge stress among employees,

address stress management through interventions, make adjustment in staffing and examine applicable organizational policies in order to reduce stress.

Limitations

Model results for the self-reported absenteeism were confirmed using objective absenteeism. However, the direct correlation between these two variables was modest ($r = 0.44$). One source of variability stems from the conversion of hours to days where half days in the personnel measure of absenteeism would be included in the day count. For the self-reported measure, participants are asked, “how many days missed due to personal illness” So conceivably partial days are not included in the self-report measure. Another source of variability between the two measures is also likely in asking participants to recall absence over the past year.

Secondly, the amount of variability in absenteeism explained by the models was quite low. The R-squared value for self-reported absenteeism was 0.15 and 0.08 for objective absenteeism (Figure 2.2). It is likely that other factors such as absence policies and organizational characteristics also influence absenteeism. The objective of this study was to investigate individual characteristics and their relationships to each other and to absenteeism, rather than attempt to capture all factors relating to absenteeism. Within that scope, these findings are still useful to inform policies and set expectations for absenteeism as an outcome measure.

Although, these findings are limited to employees of a US utility provider, it is likely that other populations will yield similar results since our model was based on

literature support. However, more research will need to be done in other employee populations such as manufacturing or those with differing age/gender distributions.

Conclusions

For improved employee health and productivity, organizations would be well served by placing stress management as a top priority for wellness program and policy focus. Higher stress was directly associated with both medical condition burden and absenteeism. Physical activity was not directly associated with absenteeism, but with stress and medical condition burden. This underscores the importance of physical activity for both mental and physical health. However, in setting expectations for evaluating physical-activity-oriented programs, changes in stress levels and physical health may be more immediate measurable outcomes of physical activity programs than absenteeism.

References

- Bakker, Arnold B. and Demerouti, Evangelia 2007. The jobs demands-resources model: state of the art *J Management Psych*, 22(3) 309-328.
- Braunstein, Alexandra, Hirschland, David, Edington, Dee W. and McDonald, Timothy 2001. Internal Associations among Health-risk Factors and Risk Prevalence. *Amer J Health Behavior*, 25(4) 407-417. <http://www.atypon-link.com/PNG/doi/abs/10.5555/ajhb.2001.25.4.407>
- Burton, Wayne N., Chen, Chin-Yu, Conti, Daniel J., Schultz, Alyssa B., Pransky, Glenn and Edington, Dee W. 2005. The association of health risks with on-the-job productivity. *J Occup Environ Med*, 47(8) 769-777.
- Burton, Wayne N., Pransky, Glenn, Conti, Daniel J., Chen, Chin-Yu and Edington, Dee W. 2004. The association of medical conditions and presenteeism. *J Occup Environ Med*, 46(6 suppl.) S38-S45.
- Cartwright, Susan and Holmes, Nicola 2006. The meaning of work: The challenge of regaining employee engagement and reducing cynicism *Human Resource Management Review*, 16(2) 199-208.
- Christensen, Karl Bang, Nielsen, Martin L., Rugulies, Reiner, Smith-Hansen, Lars and Kristensen, Tage S. 2005. Workplace Levels of Psychosocial Factors as Prospective Predictors of Registered Sickness Absence. *J Occup Environ Med*, 47(9) 933-940.
http://journals.lww.com/joem/Fulltext/2005/09000/Workplace_Levels_of_Psychosocial_Factors_as.8.aspx
- Chrousos, George P. 2009. Stress and disorders of the stress system. *Nat Rev Endocrinol*, 5(7) 374-381. <http://dx.doi.org/10.1038/nrendo.2009.106>
- Cohen, Sheldon, Janicki-Deverts, Denise and Miller, Gregory E. 2007. Psychological Stress and Disease. *JAMA*, 298(14) 1685-1687. <http://jama.ama-assn.org/content/298/14/1685.short>
- Collins, James J., Baase, Catherine M., Sharda, Claire E., Ozminkowski, Ronald J., Nicholson, Sean, Billotti, Gary M., et al. 2005. The Assessment of Chronic Health Conditions on Work Performance, Absence, and Total Economic Impact for Employers. *J Occup Environ Med*, 47(6) 547-557
10.1097/01.jom.0000166864.58664.29.
http://journals.lww.com/joem/Fulltext/2005/06000/The_Assessment_of_Chronic_Health_Conditions_on.5.aspx
- Collins, PA and Gibbs, AC 2003. Stress in police officers: a study of the origins, prevalence and severity of stress-related symptoms within a county police force. *Occup Med (Lond)*, 53(4) 256 - 64.
- Darr, Wendy and Johns, Gary 2008. Work strain, health, and absenteeism: A meta-analysis. *J Occup Health Psych*, 13(4) 293-318.
<http://search.ebscohost.com/login.aspx?direct=true&db=pdh&AN=ocp-13-4-293&site=ehost-live>
- Dutour, A., Boiteau, V., Dadoun, F., Feissel, A., Atlan, C. and Oliver, C. 1996. Hormonal response to stress in brittle diabetes. *Psychoneuroendocrinology*, 21(6) 525-543.
<http://www.sciencedirect.com/science/article/pii/S0306453096000145>

- Edington, Dee W. 2001. Emerging research: a view from one research center. *Amer J Health Promot*, 15(5) 341-9.
- Evans, Gary W., Becker, Franklin D., Zahn, Alicia, Bilotta, Elena and Keesee, Alyssa M. 2010. Capturing the Ecology of Workplace Stress With Cumulative Risk Assessment. *Environment and Behavior*, <http://eab.sagepub.com/content/early/2010/12/02/0013916510389981.full.pdf+html>
- Fox, Kenneth R 1999. The influence of physical activity on mental well-being. *Public Health Nutrition*, 2(Supplement 3a) 411-418. <http://dx.doi.org/10.1017/S1368980099000567>
- Franche, Renée-Louise, Murray, Eleanor, Ibrahim, Selahadin, Smith, Peter, Carnide, Nancy, Côté, Pierre, et al. 2011. Examining the Impact of Worker and Workplace Factors on Prolonged Work Absences Among Canadian Nurses. *J Occup Environ Med*, 53(8) 919-927 10.1097/JOM.0b013e3182255dea. http://journals.lww.com/joem/Fulltext/2011/08000/Examining_the_Impact_of_Worker_and_Workplace.14.aspx
- Godin, Isabelle and Kittel, France 2004. Differential economic stability and psychosocial stress at work: associations with psychosomatic complaints and absenteeism. *Social Science & Medicine*, 58(8) 1543-1553. <http://www.sciencedirect.com/science/article/pii/S0277953603003459>
- Goetzel, Ron, Carla, Ginger Smith, Wang, Shaohung, Kelly, Emily, Mauceri, Edward, Columbus, Daniel, et al. 2009. The relationship between modifiable health risk factors and medical expenditures, absenteeism, short-term disability, and presenteeism among employees at Novartis. *J Occup Environ Med*, 51 487-499.
- Goldberg, Jennifer H. and King, Abby C. 2007. Physical activity and weight management across the lifespan. *Annual Review of Public Health*, 28145-170.
- Hackett, R. D. 1989. Work attitudes and employee absenteeism: A synthesis of the literature. *J Occup Psych*, 6(2) 235-248.
- Harrison, D. A. and Martocchio, J. J. 1998. Time for absenteeism: A 20-year review of origins, offshoots and outcomes. *Journal of Management*, 2(4) 305-350.
- Howard, Larry and Cordes, Cynthia 2010. Flight from Unfairness: Effects of Perceived Injustice on Emotional Exhaustion and Employee Withdrawal. *Journal of Business and Psychology*, 25(3) 409-428. <http://dx.doi.org/10.1007/s10869-010-9158-5>
- Hu, Frank B., Stampfer, Meir J., Colditz, Graham A., Ascherio, Alberto, Rexrode, Kathryn M., Willett, Walter C., et al. 2000. Physical activity and risk of stroke in women. *JAMA*, 283 (22) 2961-2967.
- Jacobson, Bert H., Aldana, Steven G., Goetzel, Ron Z. and Vardell, K. D. 1996. The relationship between perceived stress and self-reported illness-related absenteeism *American Journal of Health Promotion*, 11(1) 54-61.
- John, Robert, Kerby, Dave S. and Hagan Hennessy, Catherine 2003. Patterns and Impact of Comorbidity and Multimorbidity Among Community-Resident American Indian Elders. *The Gerontologist*, 43(5) 649-660. <http://gerontologist.oxfordjournals.org/content/43/5/649.abstract>
- Karasek, Robert 1990. Lower health risk with increased job control among white collar workers. *J Org Behav*, 11(3) 171-185.

- Kessler, Ronald C., Greenberg, Paul E., Mickelson, Kristin D., Meneades, Laurie M. and Wang, Philip S. 2001. The Effects of Chronic Medical Conditions on Work Loss and Work Cutback. *J Occup Environ Med*, 43(3) 218-225.
http://journals.lww.com/joem/Fulltext/2001/03000/The_Effects_of_Chronic_Medical_Conditions_on_Work.9.aspx
- Kivimäki, Mika , Virtanen, Marianna, Elovainio, Marko, Kouvonen, Anne, Vaananen, Ari and Vahtera, Jussi 2006. Work stress in the etiology of coronary heart disease-a meta-analysis. *Scandinavian Journal of Work Environment and Health*, 32(6) 431-442.
- Kivimäki, Mika, Leino-Arjas, Päivi, Luukkonen, Ritva, Riihimäi, Hilikka, Vahtera, Jussi and Kirjonen, Juhani 2002. Work stress and risk of cardiovascular mortality: prospective cohort study of industrial employees. *BMJ*, 325, 857
<http://www.bmj.com/content/325/7369/857.abstract>
- Kline, Rex B. 2011. *Principles and Practice of Structural Equation Modeling*, New York, New York, Guilford Press.
- Laaksonen, David E., Lakka, Hanna-Maaria, Salonen, Jukka T., Niskanen, Leo K., Rauramaa, Rainer and Lakka, Timo A. 2002. Low Levels of leisure-time physical activity and cardiorespiratory fitness predict development of the metabolic syndrome. *Diabetes Care*, 25(9) 1612-1618.
- Loeppke, Ronald, Taitel, Michael, Haufle, Vince, Parry, Thomas, Kessler, Ronald C. and Jinnett, Kimberly 2009. Health and productivity as a business strategy: A multiemployer study. *J Occup Environ Med*, 51(4) 411-428.
- Ludovic van Amelsvoort, Spijt, Mark, Swaen, Gerard and Kant, Ijmert 2006. Leisure time physical activity and sickness absenteeism; a prospective study. *Occup Med* 56 210-212.
- Möller, Jette, Theorell, Töres, de Faire, Ulf, Ahlbom, Anders and Hallqvist, Johan 2005. Work related stressful life events and the risk of myocardial infarction. Case-control and case-crossover analyses within the Stockholm heart epidemiology programme (SHEEP). *Journal of Epidemiology and Community Health*, 59(1) 23-30. <http://jech.bmj.com/content/59/1/23.abstract>
- Musich, Shirley, Adams, Laura and Edington, Dee W. 2000. Effectiveness of health promotion programs in moderating medical costs in the USA. *Health Promotion International*, 15(1) 5-15.
- Musich, Shirley, Napier, Deborah and Edington, Dee W. 2001. The association of health risks with workers' compensation costs. *J Occup Environ Med*, 43(6) 534-41.
- Oguma, Y. and Shinoda-Tagawa, T. 2004. Physical activity decreases cardiovascular disease risk in women: review and meta-analysis. *Amer J Prev Med*, 26 407-418.
- Ose, Solveig Osborg 2005. Working conditions, compensation and absenteeism. *J Health Econ* 24 161-188.
- Osilla, Karen Chan, Busum, Kristin Van, Schnye, Christopher, Larkin, Jody Wozar, Eibner, Christine and Mattke, Soeren 2012. Systematic review of the impact of worksite wellness programs. *Am J Manag Care*, 18(2) e68-e81.
<http://www.ajmc.com/articles/Systematic-Review-of-the-Impact-of-Worksite-Wellness-Programs>
- Paluska, Scott A. and Schwenk, Thomas L. 2000. Physical Activity and Mental Health: Current Concepts. *Sports Medicine*, 29(3) 167-180.

- http://adisonline.com/sportsmedicine/Fulltext/2000/29030/Physical_Activity_and_Mental_Health_Current.3.aspx
- Prohaska, Thomas, Belansky, Elaine, Belza, Basia, Buchner, David, Marshall, Victor, McTigue, Kathleen, et al. 2006. Physical activity, public health and aging: critical issues and research priorities. *Journal of Gerontology*, 61B; (5) S267-S273.
- Pronk, Nicolaas P., Martinson, Brian, Kessler, Ronald C., Beck, Arne L., Simon, Gregory E. and Wang, Philip 2004. The Association Between Work Performance and Physical Activity, Cardiorespiratory Fitness, and Obesity. *J Occup Environ Med*, 46(1) 19-25.
http://journals.lww.com/joem/Fulltext/2004/01000/The_Association_Between_Work_Performance_and.5.aspx
- Proper, Karin I, Staal, Bart J, Hildebrandt, Vincent H, Beek, Allard J van der and Mechelen, Willem van 2002. Effectiveness of physical activity programs at worksites with respect to work-related outcomes. *Scand J Work Environ Health* 28(2) 75-84.
- Schaufeli, Wilmar B. and Bakker, Arnold B. 2004. Job demands, job resources, and their relationship with burnout and engagement: a multi-sample study. *J Org Behav*, 25(3) 293-293-315.
<http://search.proquest.com/docview/224901572?accountid=14667>
- Searle, Ben J. 2008. Does Personal Initiative training work as a stress management intervention? *J Occup Health Psychology* 13(3) 259-270.
- Shamian, Judith, O'Brian-Pallas, Linda, Thomson, Donna, Alksnis, Chris and Kerr, Micheal 2003. Nurse Absenteeism, Stress and Workplace Injury: What are the Contributing Factors and What Can/Should Be Done About It? *International Journal of Sociology and Social Policy*, 23(8/9) 81-103.
- Shapiro, C. and Stiglitz, J. 1984. Equilibrium unemployment as a worker discipline device. *The American Economic Review*, 74(3) 433-444.
- Steel, Robert P. 2003. Methodological and operational issues in the construction of absence variables. *Human Resource Management Review*, 13(2) 243-251.
<http://www.sciencedirect.com/science/article/pii/S1053482203000159>
- Stewart, Walter F., Ricci, Judith A., Chee, Elsbeth and Morganstein, David 2003. Lost Productive Work Time Costs From Health Conditions in the United States: Results From the American Productivity Audit. *J Occup Environ Med*, 45(12) 1234-1246.
http://journals.lww.com/joem/Fulltext/2003/12000/Lost_Productive_Work_Time_Costs_From_Health.4.aspx
- Taimela, S, Malmivaara, A, Justén, S, Läärä, E, Sintonen, H, Tiekso, J, et al. 2008. The effectiveness of two occupational health intervention programmes in reducing sickness absence among employees at risk. Two randomised controlled trials. *Occup Environ Med*, 65(4) 236-241.
<http://oem.bmj.com/content/65/4/236.abstract>
- Taimela, Simo, Diederich, Carlo, Hubsch, Marc and Heinrich, Michel 2000. The Role of Physical Exercise and Inactivity in Pain Recurrence and Absenteeism From Work After Active Outpatient Rehabilitation for Recurrent or Chronic Low Back Pain: A Follow-Up Study. *Spine*, 25(14) 1809-1816.
- Taylor, A. H. 2001. Physical activity, anxiety, and stress. Routledge.

- Tennant, Christopher 2001. Work-related stress and depressive disorders. *J Psychosomatic Res*, 51(5) 697-704.
<http://www.sciencedirect.com/science/article/pii/S0022399901002550>
- Thoits, Peggy A. 2010. Stress and Health. *Journal of Health and Social Behavior*, 51(1 suppl) S41-S53. http://hsb.sagepub.com/content/51/1_suppl/S41.abstract
- Wang, Philip S., Beck, Arne, Berglund, Patricia, Leutzinger, Joseph A., Pronk, Nico, Richling, Dennis, et al. 2003. Chronic Medical Conditions and Work Performance in the Health and Work Performance Questionnaire Calibration Surveys. *J Occup Environ Med*, 45(12) 1303-1311.
- Warburton, Darren E.R., Nicol, Crystal Whitney and Bredin, Shannon S.D. 2006. Health benefits of physical activity: the evidence. *Canadian Medical Association Journal*, 174(6) 801-809. <http://www.cmaj.ca/content/174/6/801.abstract>
- Way, Mary and MacNeil, Melanie 2006. Organizational Characteristics And Their Effect on Health. *Nursing Economics*, 24(2) 67-76, 55.
<http://search.proquest.com/docview/236936503?accountid=14667>
- Wegge, Jurgen, Schmidt, Klaus-Helmut, Parkes, Carole and Dick, Rolf van 2007. 'Taking a sickie': Job satisfaction and job involvement as interactive predictors of absenteeism in a public organization. *J Occup Org Psych* 80 77-89.
- Wright, Douglas, Adams, Laura, Beard, Marshall J., Burton, Wayne N., Hirschland, David, McDonald, Timothy, et al. 2004. Comparing Excess Costs Across Multiple Corporate Populations. *J Occup and Environ Med*, 46(9) 937-945.
- Wright, Douglas, Beard, Marshall and Edington, Dee W. 2002. Association of health risks with the cost of time away from work. *J Occup Environ Med*, 44(12) 1126-34.
- Yen, Louis, Edington, Dee W. and Witting, Pamela 1992. Prediction of prospective medical claims and absenteeism costs for 1284 hourly workers from a manufacturing company. *J Occup Med*, 34(4) 428-435.
- Yen, Louis T., Edington, D. and Witting, P. 1991. Associations between health risk appraisal scores and employee medical claims costs in a manufacturing company. *Amer J Health Prom*, 6 46-54.

Chapter 3

Impact of Changes in Medical Condition Burden Index and Stress on Absenteeism among Employees of a US Utility Provider

Introduction

Employers have a vested interest in decreasing absenteeism and improving health of employees. One study estimates lost productivity time due to absenteeism and reduced performance for health related reasons cost US employers an estimated \$226 billion dollars (Stewart et al., 2003). Several studies link increased absenteeism to poor health and other health risks such as stress and physical inactivity (Carr et al., 2007, Cooper and Dewe, 2008, Wright et al., 2002, Merrill et al., publish ahead of print). While employee health can be difficult to measure, absenteeism represents an objective outcome measure related to employee health and a measure of lost productivity. Therefore, the value in studying absenteeism is two-fold. First, there is potential for economic benefit for the organization by delineating ways to reduce absenteeism. Second, factors reduce absenteeism are likely to improve employee health. Currently, the majority of research is cross-sectional and does not examine determinants over time (Beemsterboer et al., 2009). Many studies show that individuals with medical conditions, stress and other indicators of poor health have increased absenteeism (Boles et al., 2004, Collins et al., 2005, Cooper and Dewe, 2008, Darr and Johns, 2008). However, studies have not followed individuals to see changes in these factors also result in changes in absenteeism.

In terms of patterns of absenteeism over time, a temporal study examined absenteeism among US federal workers over a 10-year period. The study noted consistent seasonal peaks for the Spring and Fall that were consistent with flu and allergy outbreaks. Knowledge of seasonal variations in absenteeism can help organizations plan for staffing shortages during the year. The authors also noted that absenteeism due to illness decreased during the end of the year holiday season, suggesting that individuals used other forms of absence time in lieu of sick time. (Spears et al., published ahead of print). This longitudinal study did not follow specific determinants of absenteeism.

Most studies concerning medical conditions and absenteeism either focus on a single condition of interest in relation to absenteeism as an outcome measure or assess multiple health conditions showing rates of absenteeism in relation to them. Either approach has limitations. The single medical condition approach is specific to that condition. Studies that assess multiple conditions do not account for individuals having multiple conditions. Therefore, individuals are considered in multiple categories. For example, absenteeism associated with an individual that has arthritis and heart disease is applied toward both conditions. In this study, prevalence and retention for individual medical conditions are provided, but the main variable of interest is medical condition burden in the form of number of medical conditions.

Multimorbidity or the existence of multiple medical conditions is important to consider since individuals with one medical condition often have other co-existing conditions (Burton et al., 2004) and absenteeism tends to increase with number of conditions. Loepke et al. reported multimorbidity or the presence of multiple medical conditions to be 62% in a multi-employer study over 30,000 employed individuals. This

study also indicated that for most conditions having a single conditions was not associated with increased absenteeism. Exceptions were cancer and coronary heart disease. Co-morbidities did have significant effects on absenteeism and at-work productivity loss (presenteeism) (Loeppke et al., 2009). Using multimorbidity or number of medical conditions as a measure of disease burden has been used by other studies (Franche et al., 2011, John et al., 2003, Van den Akker et al., 1998). Considering disease burden according to number of medical conditions has the advantage of discrete categorization of individuals.

In addition to physical health, emotional health has been linked to absenteeism. Several studies implicate stress from various sources as a determinant of increased absenteeism Workplace situations can cause stress in the form of excessive workload, interpersonal relationships, lack of task control, role ambiguity, unfair management practices, training/career development issues, and poor organizational climate (lack of management commitment to core values, conflicting communication styles, etc.) (Collins and Gibbs, 2003, Darr and Johns, 2008, De Boer et al., 2002, Evans et al., 2010, Rothmann et al., 2005, Virtanen et al., 2007, Way and MacNeil, 2006). Although all the organizational and social factors that contribute to stress are beyond the scope of this paper, perceived stress has been associated with absenteeism independent of other confounders (age, gender, education, smoking, alcohol consumption, blood pressure, cholesterol, body mass index, and physical activity) (Jacobson et al., 1996). Low job control and high over-commitment in particular are dynamics that contribute to stress and absenteeism (Godin and Kittel, 2004). Further evidence on the relationship between workplace stress and absenteeism comes from a focus group style study of nurses across

ten Canadian acute care hospitals. Leading causes cited for absenteeism were excessive workload, understaffing, mental/psychosocial health (Shamian et al., 2003).

A second factor that implicates stress as a determinant of absenteeism is that stress can have physical health consequences. Stress can negatively impact the immune system (Cohen et al., 1991). Consequentially, individuals may be more susceptible to illness. Stress can also exacerbate existing medical conditions such as high blood pressure, heart conditions and diabetes (Surwit et al., 1992, Möller et al., 2005, Kivimaki et al., 2006, Lepore et al., 2006). Thus, stress may be linked to increased absenteeism due to its deleterious effects on physical health.

A cross-sectional analysis of predictors of absenteeism identified both medical condition burden and stress as a direct predictors of absenteeism (Marzec et al., in press). The main objective of this current study is to examine how increases or decreases in medical condition burden and stress impact absenteeism from 2009 to 2010. Medical condition burden or MCBI which was calculated by summing the number of self-reported medical conditions according to Health Risk Appraisal (HRA) information. Stress was assessed according to individuals reporting stress that affected their health. Prevalence of the medical conditions that comprise the medical condition burden index (MCBI) is also provided along with percent of individuals reporting each condition for both years. Prevalence of stress is also provided for each year as reference along with amount of turnover or percent of individuals reporting stress in both years. According to the main objective, information from this study should be useful to show if changes in the medical condition burden index and stress result in changes in absenteeism over a one year period.

Methods

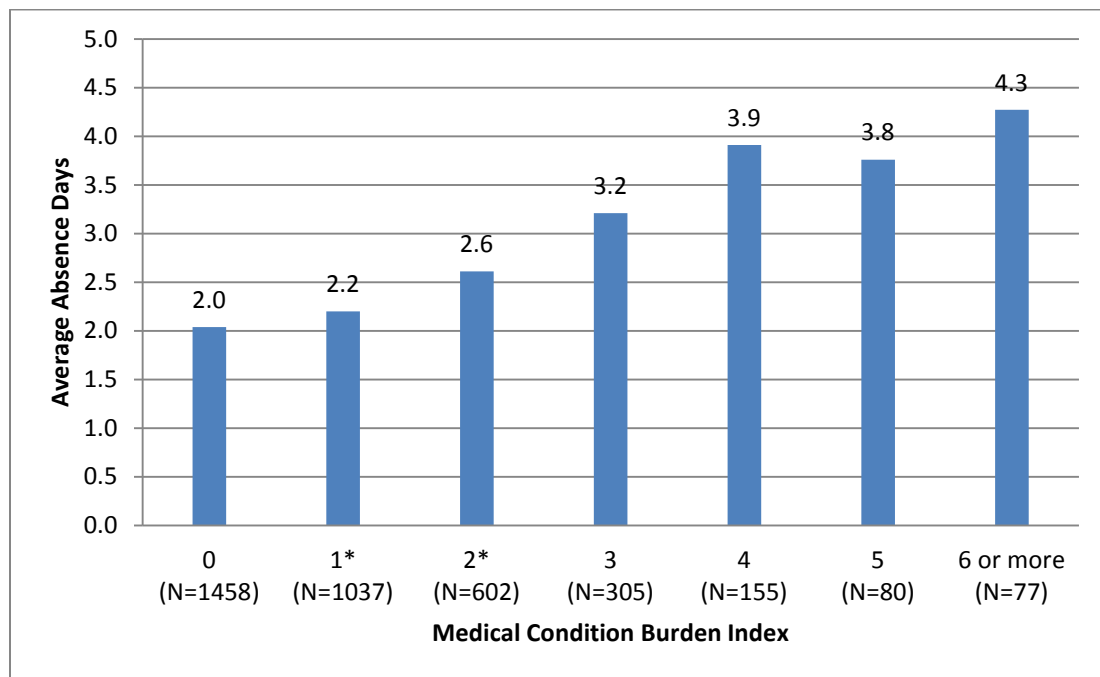
This study uses the University of Michigan Health Risk Appraisal. This HRA is a modified version of the *Healthier People, Version 4.0* originally developed by the Centers for Disease Control and Prevention, Carter Center. This HRA measures 15 health risk factors that have been defined in previous publications.(Wright et al., 2004) Health risks identified by this tool have been assessed against objective measures including, medical costs, workers' compensation costs, disability costs and worker productivity measures including absenteeism (Yen et al., 1991, Wright et al., 2002, Musich et al., 2001, Burton et al., 2005). Furthermore, as health risks change (either increasing or decreasing), there is an associated change in healthcare costs.(Musich et al., 2000, Edington, 2001). The University of Michigan HRA has the advantage of having been validated against several objective measures and has been the basis of multiple peer-reviewed publications.

As mentioned, previous work identified stress and medical condition burden index (MCBI--number of self-reported current medical conditions) as direct determinants of absenteeism (Marzec et al., in press). Therefore, this study investigates changes in these two variables in relation to changes in absenteeism from administrative records. The MCBI was constructed based on the number of self-reported medical conditions from the HRA. Prevalence for each condition for both years was calculated. Amount of retention for each condition was also assessed according to the percent of individuals reported having the condition in 2009 that also had the condition in 2010.

In order to assess the impact on absenteeism associated with increases or decreases in study variables, the MCBI and stress were categorized as low and high. Low

MCBI was defined as reporting 0 or 1 current self-reported medical conditions and high was defined as 2 or more medical conditions. This cut point was identified according to preliminary analysis that showed absence rates were similar for individuals with zero or one medical condition and significantly greater for those with two or more medical conditions. Figure 3.1 shows the distribution of average absence days/year by MCBI score using 2009 HRA and absenteeism data. The pattern was similar for 2010 (data not shown). Others have also reported that increased absenteeism occurs with two or more medical conditions (Loeppke et al., 2009). From 2009 to 2010, we assessed change in absenteeism associated with change in MCBI low versus high category.

Figure 3.1 Average Number Absence Days by Self-Reported Medical Conditions



* $P < 0.05$ for average absence days comparing MCBI =1 and MCBI =2, supporting the cut point between low (0-1) and high (2+) MCBI categories.

Stress was determined from responses to: “During the past year, how much effect has stress had on your health?” Using a four-point ordinal scale – A Lot, Some, Hardly Any, None. The low category for this variable was “Hardly Any” or “None” for stress affecting health and the high category was “Some” or “A Lot” of stress that affects one’s health.

Absenteeism was obtained from administrative records. For this analysis, absenteeism included hours of work missed due to illness, vacation, holiday, family illness or “other” paid and “other” not paid. Categories beyond personal illness were included since it is possible that those taking absence for reasons related to stress may use vacation or other forms of absence. Also research indicates individuals use other forms of absence in lieu of sick time (Spears et al., published ahead of print). Hours were converted to days assuming an eight-hour workday. Categories of absenteeism not included in this analysis are short-term disability, absence due to Family and Medical Leave Act (FMLA), or absence due to jury duty, disciplinary action, or “no report” absence.

Exclusion criteria:

Two exclusion criteria were applied 1) one individual self-reported having all of medical conditions 2) five individuals with > 1,000 hours of absence were identified as outliers (six times the interquartile range).

Design

This is a longitudinal, observational study of 2009 and 2010 HRA respondents from a US utility provider. Approval for this work was obtained from the University of Michigan Institutional Review Board (IRB) and consent was obtained from participants for use of their data in aggregate reporting.

Population and Study Sample

Utility company employees, age 19 and older who participated in the Health Risk Appraisal (HRA) in 2009 and 2010 (N=3,711). Participation rate was 33%. Individuals completing only one HRA in either year were considered non-participants for the purposes of the study.

Statistical Analysis

Statistical analysis was done using SAS 9.2 (Cary, North Carolina). Chi-square tests were used for categorical variables and paired T-tests used for repeated measures of continuous variables. Bonneferoni correction was used to account for multiple comparisons. Wilcoxon rank sum tests instead of paired t-tests were used for absenteeism due to its non-normal distribution.

Results

HRA Participants

Participants were individuals that were employed at a US utility corporation in 2009 and 2010. There were 11,344 employees of the utility company employed both years, of whom 3,711 completed the HRA both years (participation rate: 33%). Demographics for the eligible employees, HRA participants and HRA non-participants are shown in Table 3.1. Differences were noted between the HRA participants and non-participants. The HRA participants were on average younger (44.4 years old vs. 45.3 years old; $P < .01$), had a greater proportion of females (35% vs. 15%; $P < .01$) and were more likely to be of exempt job classification (66% vs. 36%; $P < 0.01$).

Table 3.1 Demographic Characteristics of Eligible Employees and HRA Participants

	2009 and 2010 Employees	2009 and 2010 HRA Participants	HRA Non-Participants
N	11,344	3,711	7,633
Gender			
Female	21.9%	35.3%*	15.4%*
Male	78.1%	64.7%	84.6%
Age			
19-24	3.0%	2.4%	3.2%
25-34	18.0%	20.0%	17.0%
35-44	20.8%	22.0%	20.2%
45-54	38.1%	37.8%	38.3%
55-64	19.1%	16.6%	20.3%
65+	1.2%	1.2%	1.0%
Average Age	45.0 ±10.8	44.4± 10.6*	45.3 ±10.8
Employee Group			
Exempt	45.7%	66.1%*	35.8%*
Non-Exempt	24.4%	31.6%	20.9%

* statistically significant differences between eligible employees and HRA participants at P <0.05

Self-Reported Medical Condition and Stress Prevalence

Since the MCBI was comprised of number of medical conditions, the prevalence for each condition is reported on Table 3.2. The five most prevalent conditions were allergies (2009: 25%; 2010: 23%), back pain (14%, 12%) high blood pressure (13%, 12%), high cholesterol (12%, 14%) and heart burn/acid reflux (9%, 8%). For the 20 conditions, prevalence was below 10% for 16 of them. Among all conditions, only the 2.1 percentage point decrease in allergies and the 3.1 percentage point increase in menopause

(among women only) were statistically significant. The percentage of those reporting a condition in 2009 that also reported having the condition in 2010 is also shown.

Although, the overall prevalence for most conditions did not change, less than 75% of individuals reported having the condition in both years for all but three conditions (menopause, thyroid disease, and diabetes).

For stress, the prevalence of those reporting that stress affected their health “some” or “a lot” was 40.2% in 2009 and 33.8% in 2010 with a 6.4 percentage point decrease between the years. Stress decreased, but was still greater in prevalence than any medical condition. Additionally, 57.8% of individuals reporting high stress in 2009 also reported high stress for 2010.

Table 3.2 Self-Reported Medical Condition and Stress Prevalence

HRA Participants (N = 3,711)	2009	2010	Percentage Point Change	Percent with Condition Both Years
Allergies	25.0%	22.9%	-2.1%*	69.3%
Back Pain	14.1%	12.3%	-1.8%	50.7%
High Blood Pressure	12.8%	12.3%	-0.5%	69.5%
High Cholesterol	11.8%	13.9%	2.1%	54.6%
Heart Burn/ Acid Reflux	9.4%	8.3%	-1.1%	51.6%
Arthritis	8.4%	7.5%	-0.9%	61.7%
Migraines	6.3%	5.3%	-1.0%	61.1%
Menopause [†]	17.6%	20.7%	3.1%*	76.1%
Sleep Disorder	5.6%	4.6%	-1.0%	50.0%
Thyroid Disorder	4.3%	4.5%	0.2%	86.3%
Chronic Pain	3.8%	3.0%	-0.8%	45.0%
Other Condition	3.8%	3.9%	0.0%	46.5%
Diabetes	3.7%	3.9%	0.2%	89.9%
Depression	3.4%	2.8%	-0.6%	37.8%
Asthma	3.2%	3.2%	0.1%	70.1%
Heart Disease	2.2%	1.9%	-0.3%	58.5%
Osteoporosis	1.2%	1.2%	0.0%	54.5%
Chronic Bronchitis/Emphysema	0.4%	0.4%	0.0%	35.7%
Cancer	0.3%	0.5%	0.1%	41.7%
Stroke	0.0%	0.0%	0.0%	0%
Number Medical Conditions (MCBI)	1.26	1.20	0.06*	N/A
Stress (some or a lot)	40.2%	33.8%	-.6.4%*	57.8%

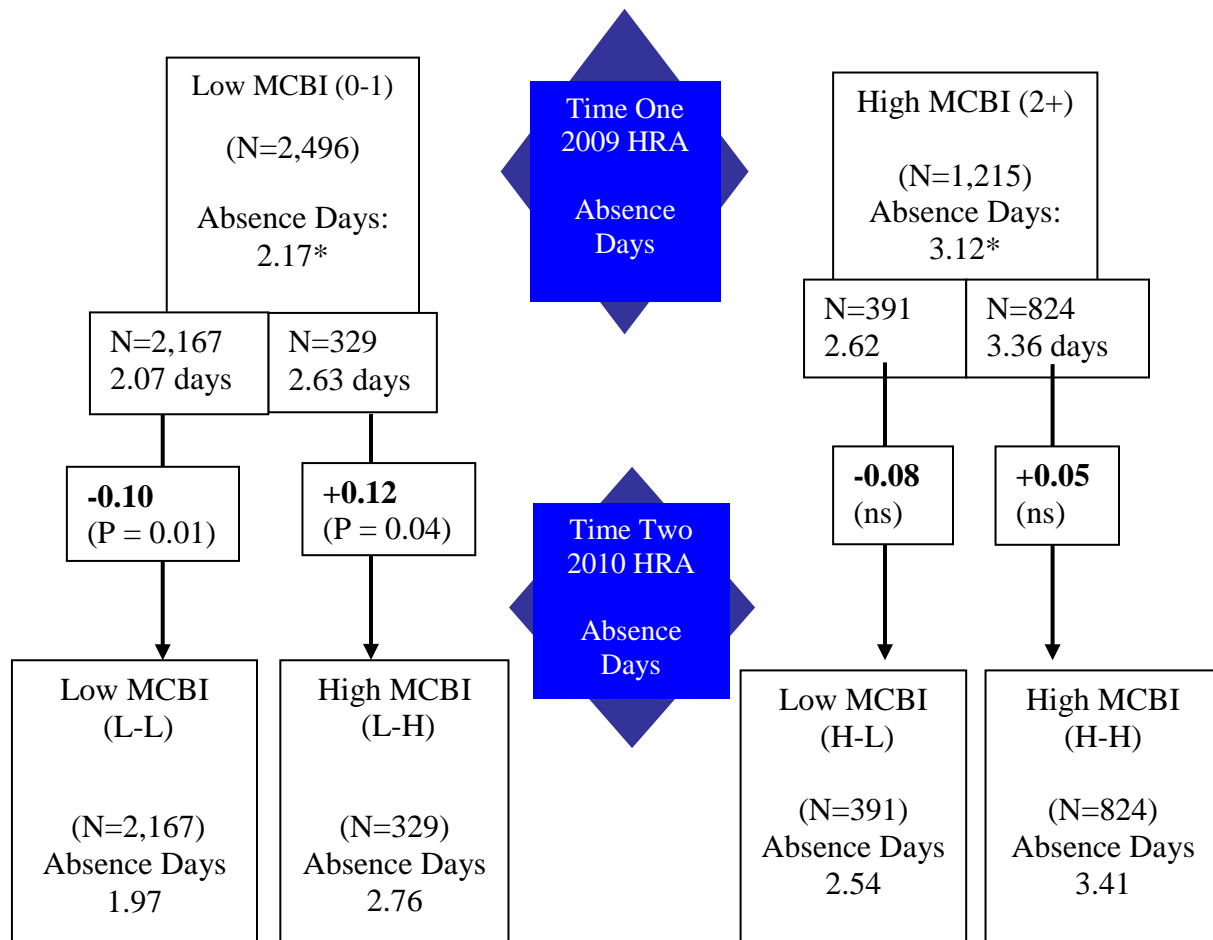
*P < 0.003 (Bonferroni correction for multiple comparisons)

[†] Menopause prevalence in females only

Change in MCBI and Change in Absenteeism

For 2009 (time 1), absence days was higher for those in the high category for MCBI as compared to the low category (low: 2.17 days/year vs high 3.12 days/year $P < 0.001$). As a determinant of absenteeism it was expected that if MCBI decreased then absenteeism would also decrease. Using low (0-1 MCBI) and high (2+ MCBI) categories, Figure 3.2 shows average absence days/year for MCBI category transitions (L-L, L-H, H-L and H-H). Comparisons were made at the individual level, not the group level, therefore Figure 3.2 shows the absence days at time 1 for the whole group and by whether they stayed in same category or changed category. For example, those that transitioned from low to high MCBI had greater absence days at time 1 than those that stayed in the low category. So, this difference in absenteeism within the low category at time 1 was accounted for in the analysis. Absence days decreased for those that remained in the low MCBI category (-0.10 days/year $P = 0.01$) and increased for those that transitioned from low to high MCBI (+0.12 days/year; $P = 0.04$). For those in the high category at time 1, the change in absenteeism was in the expected direction. However, the changes in absenteeism for those that transitioned from high to low or for those that remained in the high category were not statistically significant.

Figure 3.2 Changes in Medical Condition Burden Index and Changes in Absenteeism per Year



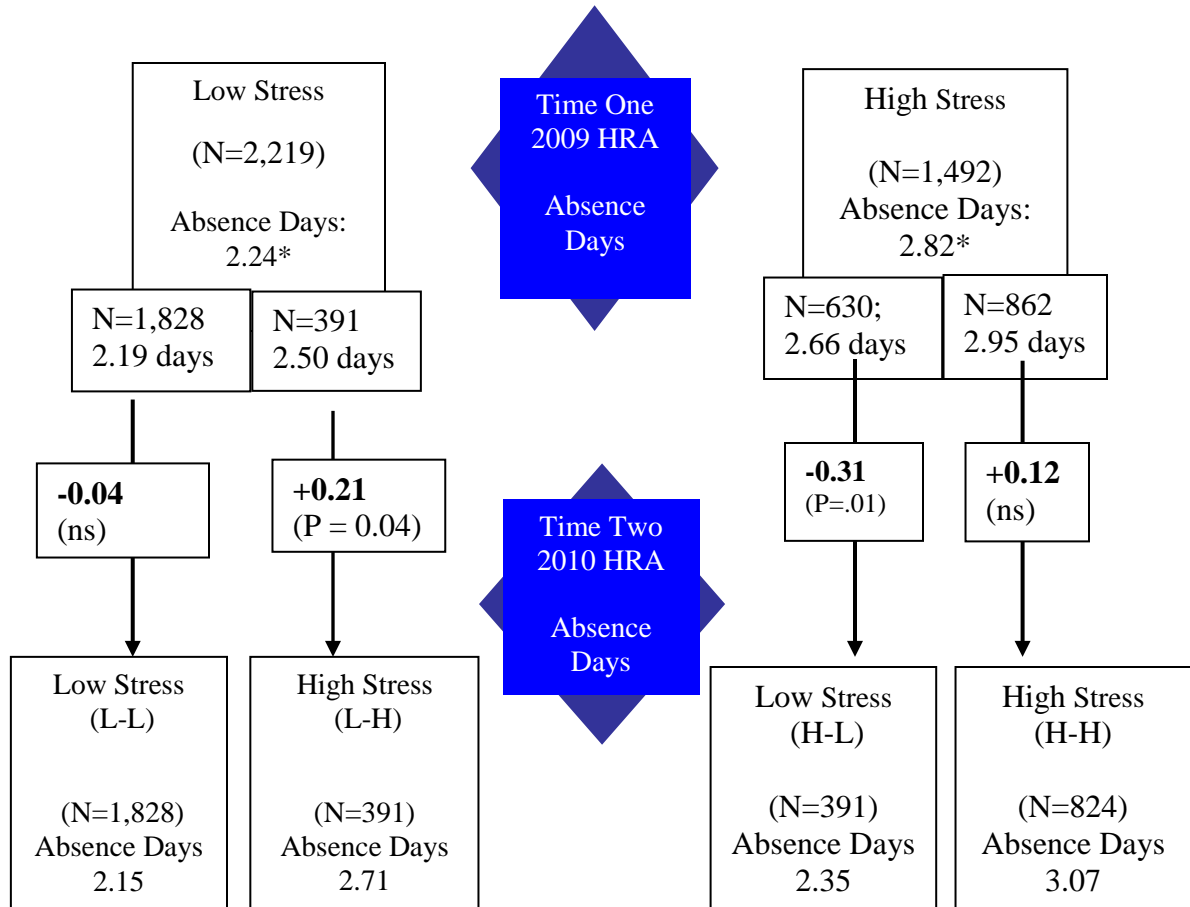
*statistically significant difference for absence days for low MCBI and high MCBI at time one (P < 0.01)

ns = not statistically significant

Change in Stress and Change in Absenteeism

Similar to MCBI, absence days were greater for those with high stress as compared to low stress at time 1 (low stress: 2.24 days/year vs high stress 2.82 days/year $P < 0.01$). Change in stress was associated with change in absence days. For those that moved from low stress to high stress absenteeism increased by 0.21 days/year; $P = 0.04$) Unlike MCBI, for those that moved from high to low stress absenteeism decreased by 0.31 days/year; $P = 0.01$). For those that remained in low or high categories for stress absenteeism decreased or increased respectively, but the differences in absenteeism were not statistically significant.

Figure 3.3 Changes in Stress and Changes in Absenteeism Days per Year



ns = not statistically significant

*statistically significant difference for absence days for low stress and high stress at time one (P < 0.01)

Discussion

Previous research has indicated the presence of medical conditions and stress are determinants of increased absenteeism (Marzec et al., in press). Using a sample of

employees from a US utility provider, we investigated changes in absence relative to changes in medical condition burden index (MCBI) and stress. Self-reported measures were used for both MCBI and stress. Absence days/year were calculated from the company's administrative records. The primary objective of this study was to examine the impact of changes in the MCBI and stress on absenteeism.

Since the MCBI was constructed as number of self-reported medical conditions, prevalence for each medical condition was also reported. Most prevalent self-reported medical conditions were allergies, back pain, high blood pressure and high cholesterol which is similar to other work reporting results from this HRA (Burton et al., 2004). The prevalence for most conditions were similar for both years. Exceptions were allergies (-2.1 percentage points) and menopause (+ 3.1 percentage points). Menopause was calculated according to females only. For each condition, we reported the amount of retention as the percent of individuals reporting the condition in 2009 that also reported having the condition for 2010. Retention ranged from 36% for chronic bronchitis/emphysema to 90% for diabetes. This indicates that although prevalence may be consistent over time it does not necessarily represent the same individuals. Conditions with the highest retention were diabetes (90% had condition both years), thyroid disorder (86%) and menopause (76%). The wide variance in retention, despite almost no change in prevalence for medical conditions underscores the value of tracking individuals over time.

Additionally, most conditions have relatively low prevalence. Only allergies had a prevalence greater than 15% (25% and 23% for 2009 and 2010 respectively). Therefore, using an index measure such as the MCBI may be useful for measuring overall physical

health in populations as opposed to looking at individual conditions. Such a measure of multimorbidity is more common in research concerning geriatric populations (Marengoni et al., 2009, Marengoni et al., 2008, Min et al., 2007, Lee et al., 2009), but is applicable of populations of any age (Franche et al., 2011, John et al., 2003, Van den Akker et al., 1998). A similar strategy of assessing number of conditions vs. specific ones has long been widely adopted for measuring health risk factors where individuals are categorized according to number of risks rather than tracking specific risks (Edington, 2001). Additionally, the MCBI avoids including individuals in multiple categories, as is typically done with studies that report absenteeism and multiple medical conditions (Collins et al., 2005, Wang et al., 2003). Due to low prevalence of most medical conditions, very large sample sizes are needed to assess absenteeism and medical conditions individually (Loeppke et al., 2009).

In this study 40.2% of individuals reported stress that affected their health “a lot” or “some” (high stress) for 2009 and 33.8% reported high stress for 2010. Additionally, 58.7% of those with high stress in 2009 also reported high stress in 2010. For either year, stress had a higher prevalence than any medical condition and the majority reported high stress for both years. The relatively high prevalence of stress is not surprising. A National Institute of Occupational Safety and Health (NIOSH) report that compiled data from multiple sources noted that that 40% of US workers classified their job as “very or extremely stressful”. The same report noted 26% of workers “often or very often being burned out or stressed by their work” (Sauter et al., 1999). Another study reported 34% of individuals reporting their work as “often” or “always” stressful (Waters et al., 2007). These studies are specific to job stress, whereas our stress measure was more general.

For both MCBI and stress low levels were associated with lower absenteeism as compared to those in the high category. For change in absenteeism in relation to change in MCBI and stress, consistent patterns were observed. Individuals with low MCBI that remained in the low category had decreased average absenteeism as did those that moved from high to low for MCBI. For those moved from high to low or remained high, changes in average absenteeism were in the expected direction but not statistically significant. For stress, average absenteeism increased for those that transitioned from low stress to high stress (+0.21 days/year; $P = 0.04$). Those that transitioned from high to low showed decreased absenteeism (-0.31 days/year; $P = 0.01$). According to these findings, MCBI and stress are determinants of absenteeism such that changes in these factors also result in changes in absenteeism. Interventions that improve physical health and reduce stress can be expected to have some impact on absenteeism. However, results from stress reduction efforts may manifest as having a greater impact on absenteeism than efforts that result in changes in medical conditions. An explanation for this may be that stress may be reflective of factors that influence work attendance such as workplace factors or family-work conflict that can be completely resolved. On the other hand, chronic physical health problems may need to be managed over time rather than be resolved. These findings are consistent with others that have noted once individuals attain disease states, reduction in outcome measures do not immediately follow improvements in health status (Musich et al., 2003). A study of short term disability and medical costs associated with having metabolic syndrome or not over time showed decreases in medical costs over a one year period, but short term disability costs did not decrease until the second year (Schultz and Edington, 2009).

Limitations

While this study has strengths in that individuals and factors associated with absenteeism were followed over time, there are limitations that should be noted. These findings are limited to employees of a US utility provider. The specific results can not necessarily be applied to other populations. It is likely that other populations will yield similar patterns of increases or decreases in absenteeism in relation to these measures of medical condition burden and stress. However, more research will need to be done in other employee populations such as manufacturing or those with differing age/gender distributions.

The MCBI used in this study was based on self-report of medical conditions. In a non-anonymous format such as the HRA reporting of medical conditions may be subject to intentional and non-intentional reporting bias. Rank order according to prevalence of conditions was consistent to that reported in other studies (Burton et al., 2004), suggesting that any reporting bias did not influence overall results. The proportion of individuals reporting a medical condition for both years was reported as “retention”. This measure may be susceptible to reporting bias. However, retention for each condition in addition to prevalence for the medical conditions was provided as background information for the reader and neither were main objectives of this study. Therefore, those with specific interests in this area have the opportunity to pursue validation of these measures to a greater extent. Another limitation of the study is self-report of medical conditions as compared to obtaining such information from claims data. However, self-reported information has the advantage of not relying on inference of billing coding. An

individual with multiple conditions may not be accurately represented according to the coding system. Since we were interested in overall medical condition burden and not a specific medical condition, relying on claims data may have resulted in an artificially low estimate of medical condition burden. Finally, the MCBI was calculated as a simple summation measure of number of medical conditions. While this method has been used by others, it does not account for the complex morphology of disease manifestation whereby conditions often coexist or are causally related. Such limitations have been outlined by others, who noted that the complexity of the measure for multimorbidity should be related to the question at hand (Van den Akker et al., 2001). Our interest did not revolve around any specific medical condition, but rather the general burden of number of medical conditions, thus the adoption of a broad, unweighted measure.

Conclusions

Changes in both MCBI and stress appeared to impact absenteeism. For medical conditions especially, improvements in this factor may not translate to statistically significant changes absenteeism over a one-year period. Stress showed more immediate impact with statistically significant differences in absenteeism for either those that increased stress (low to high transition) or those that decreased stress (high to low transition). Statistically significant changes in absenteeism were not seen for reductions in MCBI within this time period. Such information is valuable in setting expectations and priorities for those designing interventions and considering absenteeism as an outcome measure.

References

- Beemsterboer, Willibrord, Stewart, Roy, Groothoff, Johan and Nijhuis, Frans 2009. A literature review on sick leave determinants (1984-2009). *Int J Occup Med and Environ Health* 22(2) 169-179.
- Boles, Myde, Pelletier, Barbara and Lynch, Wendy 2004. The Relationship Between Health Risks and Work Productivity. *J Occup Environ Med*, 46(7) 737-745. http://journals.lww.com/joem/Fulltext/2004/07000/The_Relationship_Between_Health_Risks_and_Work.18.aspx
- Burton, Wayne N., Chen, Chin-Yu, Conti, Daniel J., Schultz, Alyssa B., Pransky, Glenn and Edington, Dee W. 2005. The association of health risks with on-the-job productivity. *J Occup Environ Med*, 47(8) 769-777.
- Burton, Wayne N., Pransky, Glenn, Conti, Daniel J., Chen, Chin-Yu and Edington, Dee W. 2004. The association of medical conditions and presenteeism. *J Occup Environ Med*, 46(6 suppl.) S38-S45.
- Carr, Deborah, Friedman, Michael A. and Jaffe, Karen 2007. Understanding the relationship between obesity and positive and negative affect: The role of psychosocial mechanisms. *Body Image*, 4(2) 165-177. <http://www.sciencedirect.com/science/article/pii/S1740144507000344>
- Cohen, Sheldon, Tyrrell, David A.J. and Smith, Andrew P. 1991. Psychological Stress and Susceptibility to the Common Cold. *New Engl J Med*, 325(9) 606-612. <http://www.nejm.org/doi/full/10.1056/NEJM199108293250903>
- Collins, James J., Baase, Catherine M., Sharda, Claire E., Ozminkowski, Ronald J., Nicholson, Sean, Billotti, Gary M., et al. 2005. The Assessment of Chronic Health Conditions on Work Performance, Absence, and Total Economic Impact for Employers. *J Occup Environ Med*, 47(6) 547-557
10.1097/01.jom.0000166864.58664.29.
http://journals.lww.com/joem/Fulltext/2005/06000/The_Assessment_of_Chronic_Health_Conditions_on.5.aspx
- Collins, PA and Gibbs, AC 2003. Stress in police officers: a study of the origins, prevalence and severity of stress-related symptoms within a county police force. *Occup Med (Lond)*, 53(4) 256 - 64.
- Cooper, Cary and Dewe, Philip 2008. Well-being—absenteeism, presenteeism, costs and challenges. *Occupational Medicine*, 58(8) 522-524. <http://occm.oxfordjournals.org/content/58/8/522.short>
- Darr, Wendy and Johns, Gary 2008. Work strain, health, and absenteeism: A meta-analysis. *J Occup Health Psych*, 13(4) 293-318. <http://search.ebscohost.com/login.aspx?direct=true&db=pdh&AN=ocp-13-4-293&site=ehost-live>
- De Boer, Elpine M., Bakker, Arnold B., Syroit, Jef E. and Schaufeli, Wilmar B. 2002. Unfairness at work as a predictor of absenteeism. *Journal of Org Behav*, 23(2) 181-197. <http://search.proquest.com/docview/224867921?accountid=14667>
- Edington, Dee W. 2001. Emerging research: a view from one research center. *Amer J Health Promot*, 15(5) 341-9.

- Evans, Gary W., Becker, Franklin D., Zahn, Alicia, Bilotta, Elena and Keesee, Alyssa M. 2010. Capturing the Ecology of Workplace Stress With Cumulative Risk Assessment. *Environment and Behavior*, <http://eab.sagepub.com/content/early/2010/12/02/0013916510389981.full.pdf+html>
- Franche, Renée-Louise, Murray, Eleanor, Ibrahim, Selahadin, Smith, Peter, Carnide, Nancy, Côté, Pierre, et al. 2011. Examining the Impact of Worker and Workplace Factors on Prolonged Work Absences Among Canadian Nurses. *J Occup Environ Med*, 53(8) 919-927 10.1097/JOM.0b013e3182255dea. http://journals.lww.com/joem/Fulltext/2011/08000/Examining_the_Impact_of_Worker_and_Workplace.14.aspx
- Godin, Isabelle and Kittel, France 2004. Differential economic stability and psychosocial stress at work: associations with psychosomatic complaints and absenteeism. *Social Science & Medicine*, 58(8) 1543-1553. <http://www.sciencedirect.com/science/article/pii/S0277953603003459>
- Jacobson, Bert H., Aldana, Steven G., Goetzel, Ron Z. and Vardell, K. D. 1996. The relationship between perceived stress and self-reported illness-related absenteeism *Amer J Health Prom*, 11(1) 54-61.
- John, Robert, Kerby, Dave S. and Hagan Hennessy, Catherine 2003. Patterns and Impact of Comorbidity and Multimorbidity Among Community-Resident American Indian Elders. *The Gerontologist*, 43(5) 649-660. <http://gerontologist.oxfordjournals.org/content/43/5/649.abstract>
- Kivimaki, Mika , Virtanen, Marianna, Elovainio, Marko, Kouvonen, Anne, Vaananen, Ari and Vahtera, Jussi 2006. Work stress in the etiology of coronary heart disease-a meta-analysis. *Scandinavian Journal of Work Environment and Health*, 32(6) 431-442.
- Lee, Pearl G., Cigolle, Christine and Blaum, Caroline 2009. The Co-Occurrence of Chronic Diseases and Geriatric Syndromes: The Health and Retirement Study. *J Amer Geriatrics Society*, 57(3) 511-516. <http://dx.doi.org/10.1111/j.1532-5415.2008.02150.x>
- Lepore, S. J., Revenson, T. A. and Weinberger, S. L. 2006. Effects of social stressors on cardiovascular reactivity in black and white women. *Ann Behav Med*, 31 120-127. http://dx.doi.org/10.1207/s15324796abm3102_3
- Loeppke, Ronald, Taitel, Michael, Haufle, Vince, Parry, Thomas, Kessler, Ronald C. and Jinnett, Kimberly 2009. Health and productivity as a business strategy: A multiemployer study. *J Occup Environ Med*, 51(4) 411-428.
- Marengoni, Alessandra, Rizzuto, Debora, Wang, Hui-Xin, Winblad, Bengt and Fratiglioni, Laura 2009. Patterns of Chronic Multimorbidity in the Elderly Population. *J Amer Geriatrics Society*, 57(2) 225-230. <http://dx.doi.org/10.1111/j.1532-5415.2008.02109.x>
- Marengoni, Alessandra, Winblad, Bengt, Karp, Anita and Fratiglioni, Laura 2008. Prevalence of Chronic Diseases and Multimorbidity Among the Elderly Population in Sweden. *Amer J Public Health*, 98(7) 1198-1200. <http://dx.doi.org/10.2105/AJPH.2007.121137>

- Marzec, Mary L., Scibelli, Andrew F. and Edington, Dee W. Examining Individual Factors according to Health Risk Appraisal Data as Determinants of Absenteeism among US Utility Employees. in press *J Occup Environ Med*.
- Merrill, Ray M., Aldana, Steven G., Pope, James E., Anderson, David R., Coberley, Carter R., Grossmeier, Jessica J., et al. in press. Self-Rated Job Performance and Absenteeism According to Employee Engagement, Health Behaviors, and Physical Health. *J Occup Environ Med*, Publish Ahead of Print 10.1097/JOM.0b013e31827b73af. http://journals.lww.com/joem/Fulltext/publishahead/Self_Rated_Job_Performance_and_Absenteeism.99341.aspx
- Min, Lillian C., Wenger, Neil S., Fung, Constance, Chang, John T., Ganz, David A., Higashi, Takahiro, et al. 2007. Multimorbidity is Associated With Better Quality of Care Among Vulnerable Elders. *Medical Care*, 45(6) 480-488 10.1097/MLR.0b013e318030ff9. http://journals.lww.com/medicalcare/Fulltext/2007/06000/Multimorbidity_is_Associated_With_Better_Quality.2.aspx
- Möller, Jette, Theorell, Töres, de Faire, Ulf, Ahlbom, Anders and Hallqvist, Johan 2005. Work related stressful life events and the risk of myocardial infarction. Case-control and case-crossover analyses within the Stockholm heart epidemiology programme (SHEEP). *Journal of Epidemiology and Community Health*, 59(1) 23-30. <http://jech.bmj.com/content/59/1/23.abstract>
- Musich, Shirley, Adams, Laura and Edington, Dee W. 2000. Effectiveness of health promotion programs in moderating medical costs in the USA. *Health Promotion International*, 15(1) 5-15.
- Musich, Shirley, Faruzzi, Stephanie, Lu, Chifung, McDonald, Timothy, Hirschland, David and Edington, Dee 2003. Patterns of medical charges after quitting smoking among those with or without arthritis, allergies or back pain. *Amer J Health Promot*, 18(2) 133-142.
- Musich, Shirley, Napier, Deborah and Edington, Dee W. 2001. The association of health risks with workers' compensation costs. *J Occup Environ Med*, 43(6) 534-41.
- Rothmann, S., Steyn, L.J. and Mostert, K. 2005. Job stress, sense of coherence and work wellness in an electricity supply organisation. *S. Afr. J. Business Management*, 36(1) 55-63.
- Sauter, Steven, Murphy, Lawrence, Colligan, Michael, Swanson, Naomi, Joseph Hurrell, Jr. , Frederick Scharf, Jr, et al. 1999. Stress at work. *Departments of Health and Human Services, National Institute of Occupational Safety and Health*, Publication No. 99-101
- Schultz, Alyssa B. and Edington, Dee W. 2009. The Association Between Changes in Metabolic Syndrome and Changes in Cost in a Workplace Population. *J Occup Environ Med*, 51(7) 771-779 10.1097/JOM.0b013e3181a88da5. http://journals.lww.com/joem/Fulltext/2009/07000/The_Association_Between_Changes_in_Metabolic.3.aspx
- Shamian, Judith, O'Brian-Pallas, Linda, Thomson, Donna, Alksnis, Chris and Kerr, Micheal 2003. Nurse Absenteeism, Stress and Workplace Injury: What are the Contributing Factors and What Can/Should Be Done About It? *International Journal of Sociology and Social Policy*, 23(8/9) 81-103.

- Spears, D. Ross, McNeil, Carrie, Warnock, Eli, Trapp, Jonathan, Oyinloye, Oluremi, Whitehurst, Vanessa, et al. in press. Predicting Temporal Trends in Sickness Absence Rates for Civil Service Employees of a Federal Public Health Agency. *J Occup Environ Med*, Publish Ahead of Print 10.1097/JOM.0b013e3182717eb5. http://journals.lww.com/joem/Fulltext/publishahead/Predicting_Temporal_Trends_in_Sickness_Absence.99356.aspx
- Stewart, Walter F., Ricci, Judith A., Chee, Elsbeth and Morganstein, David 2003. Lost Productive Work Time Costs From Health Conditions in the United States: Results From the American Productivity Audit. *J Occup Environ Med*, 45(12) 1234-1246. http://journals.lww.com/joem/Fulltext/2003/12000/Lost_Productive_Work_Time_Costs_From_Health.4.aspx
- Surwit, Richard S, Schneider, Mark S and Feinglos, Mark N 1992. Stress and Diabetes Mellitus. *Diabetes Care*, 15(10) 1413-1422. <http://care.diabetesjournals.org/content/15/10/1413.abstract>
- Van den Akker, Marjan, Buntinx, Frank, Metsemakers, Job F. M., Roos, Sjef and Knottnerus, J. André 1998. Multimorbidity in General Practice: Prevalence, Incidence, and Determinants of Co-Occurring Chronic and Recurrent Diseases. *Journal of Clinical Epidemiology*, 51(5) 367-375. <http://www.sciencedirect.com/science/article/pii/S0895435697003065>
- Van den Akker, Marjan, Buntinx, Frank, Roos, Sjef and Knottnerus, J. André 2001. Problems in determining occurrence rates of multimorbidity. *Journal of Clinical Epidemiology*, 54(7) 675-679. <http://www.sciencedirect.com/science/article/pii/S0895435600003589>
- Virtanen, M, Vahtera, J, Pentti, J, Honkonen, T, Elovainio, M and Kivimaki, M 2007. Job strain and psychologic distress influence on sickness absence among Finnish employees. *Am J Prev Med*, 33(3) 182 - 7.
- Wang, Philip S., Beck, Arne, Berglund, Patricia, Leutzinger, Joseph A., Pronk, Nico, Richling, Dennis, et al. 2003. Chronic Medical Conditions and Work Performance in the Health and Work Performance Questionnaire Calibration Surveys. *J Occup Environ Med*, 45(12) 1303-1311.
- Waters, Thomas R., Dick, Robert B., Davis-Barkley, Joi and Krieg, Edward F. 2007. A Cross-Sectional Study of Risk Factors for Musculoskeletal Symptoms in the Workplace Using Data From the General Social Survey (GSS). *J Occup Environ Med*, 49(2) 172-184 10.1097/JOM.0b013e3180322559. http://journals.lww.com/joem/Fulltext/2007/02000/A_Cross_Sectional_Study_of_Risk_Factors_for.7.aspx
- Way, Mary and MacNeil, Melanie 2006. Organizational Characteristics And Their Effect on Health. *Nursing Economics*, 24(2) 67-77,. <http://search.proquest.com/docview/236936503?accountid=14667>
- Wright, Douglas, Adams, Laura, Beard, Marshall J., Burton, Wayne N., Hirschland, David, McDonald, Timothy, et al. 2004. Comparing Excess Costs Across Multiple Corporate Populations. *J Occup Environ Med*, 46(9) 937-945.
- Wright, Douglas, Beard, Marshall and Edington, Dee W. 2002. Association of health risks with the cost of time away from work. *J Occup Environ Med*, 44(12) 1126-34.

Yen, Louis T., Edington, D. and Witting, P. 1991. Associations between health risk appraisal scores and employee medical claims costs in a manufacturing company. *AmerJ Health Prom*, 6, 46-54.

Chapter 4

Prevalence of Stress and its Relationship to Medical Conditions, Absenteeism and Presenteeism among Employees of a US Financial Services Company

Introduction

Chronic stress, such as that faced by individuals overwhelmed by competing priorities, has been identified as having negatively impacting health and functioning (Thoits, 2010). Stress is associated with health problems including gastrointestinal disorders (Chrousos, 2009), chronic pain, anxiety and depression (Tennant, 2001), cardiovascular disease (Searle, 2008), and other health problems (Thoits, 2010).

A British study reported that stress, depression or anxiety accounted for 13.8 million days lost or 46% of all reported illnesses. Stress and related conditions were the largest contributor for absences attributable to work-related illness (Cooper and Dewe, 2008). Procedural injustice, low job control, excessive physical or mental demands are examples of stress-related factors associated with increased absenteeism (De Boer et al., 2002, Bakker et al., 2003, Darr and Johns, 2008, Rauhala et al., 2007, Williams et al., 2007).

In previous work concerning employees of a utility provider, stress contributed to medical condition burden and absenteeism (Marzec et al., in press-b). This current study involves employees of a financial services organization and expands on those findings to explore which medical conditions are associated with increased stress. Similar to the

previous work this study also utilizes path analysis to assess stress in relationship to absenteeism and other factors such as job satisfaction and physical activity.

In addition to absenteeism, on-the-job productivity loss, also known as presenteeism, has also been considered by researchers in association with stress. Presenteeism is defined as being at work, but having reduced productivity or ability to perform on the job. Stress has also been implicated as a contributor for presenteeism. One study showed presenteeism among stressed individuals to be five times greater than for non-stressed employees after controlling for age, gender and other lifestyle factors (VanWormer et al., 2011). Another study also showed lower performance for those reporting their job stressful (Oberlechner and Nimgade, 2005). Negative impacts on productivity outcomes associated with stress may be due the deleterious physiological effects of stress on health and negative cognitive dynamics of situations perceived to be overwhelming.

Despite the well-established connection between work, stress and health, most worksite wellness programs tend to focus on weight loss, physical activity, nutrition, and/or tobacco cessation issues, with limited direct attention paid to stress management (Aldana et al., 2005). Information on stress prevalence, comorbidities related to stress and productivity outcomes is important to inform workplace policies and wellness program strategies. Identifying predictors of stress would also help inform strategies to reduce stress.

The objective of this study is to add to extant research on stress in terms of prevalence, relationships between stress and medical conditions, predictors of stress and

implications for absenteeism and presenteeism as productivity measures. The prevalence of stress is examined both cross-sectionally for 2012 and longitudinally from 2007 to 2012. Self-reported data for medical conditions was used to examine relationships between stress and medical conditions. Separate analysis of healthcare costs and stress is also included for reference. The study population is employees of a US financial services company that specializes in investments. The data for this study was from the University of Michigan, Health Risk Appraisal (HRA). Health Risk Appraisals are self-administered questionnaires designed to assess multiple to assess several facets of health and includes items addressing behavioral, emotional and physiological measures. As such, it is well suited for this type of exploratory analysis investigating predictors of stress. Path analysis was used to identify predictors of stress and the impact of stress on productivity measures (absenteeism and on-the-job productivity loss, i.e. presenteeism). Implications for workplace policies and wellness program interventions are discussed.

Theoretical Basis for Predictors of Stress

Path analysis model formation was based on previous work (Marzec et al., in press-a) and evidence from the literature. Variables of interest include feeling anxious, job satisfaction, physical activity and caregiving as predictors of stress that affects one's health. Outcome variables in the model are absenteeism and presenteeism.

Feeling Anxious

A study on predictors of behavior change intention also showed different dynamics between feeling anxious and stress affecting health (Marzec et al., in press-b). The item "feeling tense, anxious or depressed" appeared to represent a transient condition, whereas stress affecting health appeared to represent long-term stress.

However, the potential for “feeling anxious” as a predictor of stress that affects one’s health was not previously explored and is considered in this study.

Hypothesis 1: a) Feeling anxious is expected to be positively related to stress affecting health. b) stress affecting health may also impact feeling anxious (reverse path).

Job Satisfaction

The literature indicates mixed findings for the relationship between job satisfaction and stress. The majority of research indicates an inverse relationship between job satisfaction and stress, such that higher job satisfaction is indicative of lower stress. Correlates of job satisfaction include appropriate work demands (Bakker and Demerouti, 2007), input as to work expectations (Karasek, 1990), higher organizational engagement (Wegge et al., 2007), and positive attitude toward job and organization (Avey et al., 2006). All of these would predict lower stress.

Conversely, there are studies that show higher job satisfaction to be associated with higher stress. One study of a “high performance organization” showed increased job satisfaction and increased work stress after organizational restructuring. The restructuring resulted in positive impacts on job characteristics and increased output demands that increased stress (Kashefi, 2009). Other studies of professionals similarly show concurrent high job satisfaction and high stress. One study of pharmacists indicated pharmacists were generally satisfied with their occupation. Stress from short staffing practices and the need to constantly development professionally to maintain competence was also noted (Lapane and Hughes, 2006). A study of 111 neonatologists found that 60% reported their

work to be moderately or severely stressful. Twenty percent suffered a stress related illness with the past 5 years. However only 17% reported being moderately or very dissatisfied with their occupation (Clarke et al., 1984). Thus, among specific professions job satisfaction and stress do not appear to be exclusive of each other.

Hypothesis 2: a) Job satisfaction is expected to be negatively associated with stress. b) Stress may also impact job satisfaction, thus both directions of influence will be considered.

Physical Activity

Physical activity has been associated with better health status (Warburton et al., 2006) and improved mood (Fox, 1999). Evidence of a link between physical activity levels and reductions in stress exists in the literature.(Herman et al., 2006, Ludovic van Amelsvoort et al., 2006). Physical activity has been recommended for treatment of clinical mental disorders and sub-clinical symptoms of anxiety, depression and stress (Paluska and Schwenk, 2000, Taylor, 2001). Previous work also showed physical activity to be negatively correlated with stress that affects one's health. Higher physical activity correlated with lower stress (Marzec et al., in press-a). Therefore, it is expected that both vigorous and light physical activity should be inversely related to stress.

Hypothesis 3: Physical activity is expected to be inversely related to stress.

Caregiving

Studies have indicated deleterious impact of care giving on life satisfaction, stress, and individual health. Burton et al. studied financial services employees and found caregivers

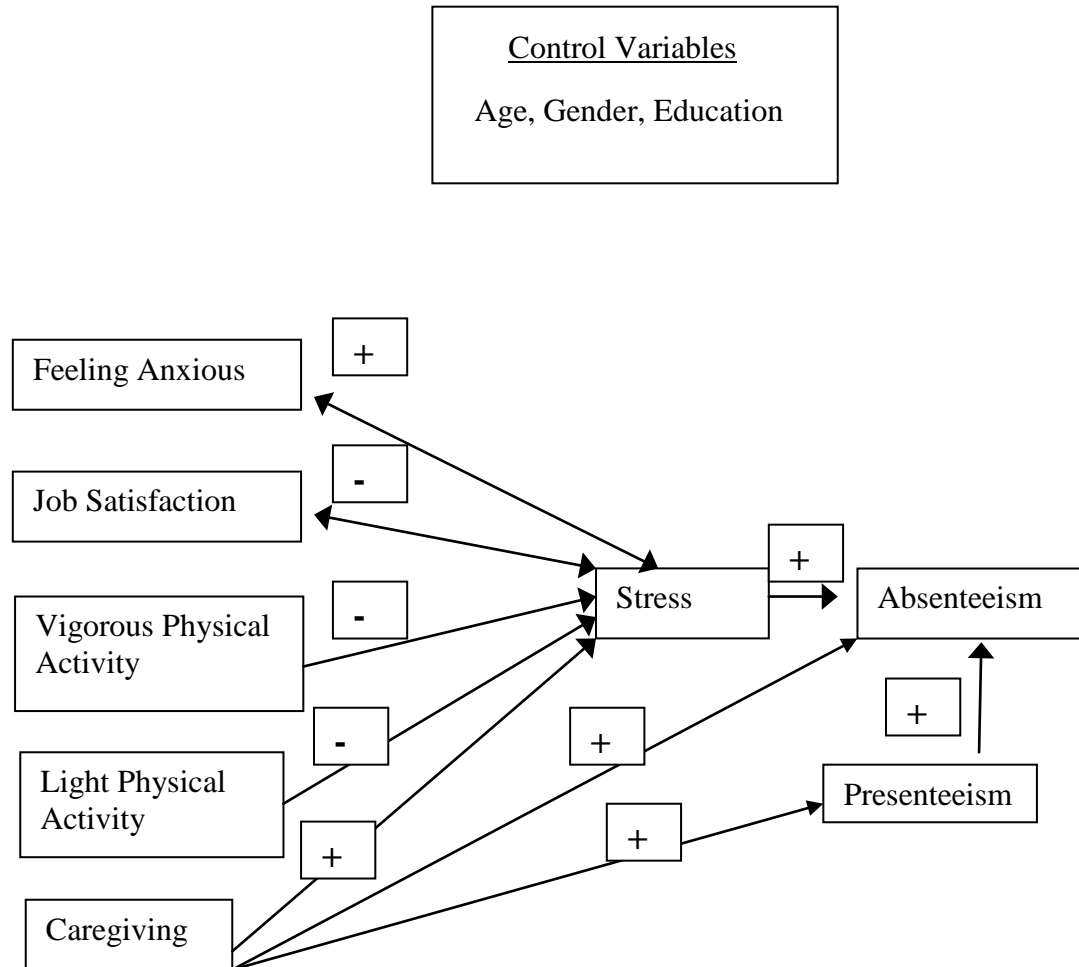
to have significantly higher rates of reporting depression, anxiety, sleep problems, stress, smoking and physical inactivity compared to non-care givers. Caregivers also reported higher rates of work limitations in terms of time management, performing physical tasks, ability to concentrate and engage with others. Unfortunately, absenteeism was not an outcome measure of this study (Burton et al., 2004a).

In terms of caregiving and work behaviors, the literature largely distinguishes two dynamics. First is family-work conflict (FWC) where family interferes with work. Second is work-family conflict (WFC) where work interferes with family. In terms of absenteeism, studies utilizing cross-sectional data showed FWC (family interference with work) to be correlated with absenteeism, but WFC typically is not correlated with increased absenteeism (Boyar et al., 2005, Gignac, 1996, Johns, 2011). It follows that individuals who report work commitment interfered with family would not have increased absence. However, a Dutch study found increased likelihood of absence regardless of the direction of family-work conflict (Jansen et al., 2006).

Hypothesis 4: a) Caregiving is expected to be directly related to stress. b) Caregiving may also be directly related to absenteeism and presenteeism

Figure 4.1 shows the hypothesized mode including potential predictors of stress and absenteeism and presenteeism as outcomes impacted by stress.

Figure 4.1 Hypothesized Model for Predictors of Stress and Productivity



Methods

Design

This is an observational study with cross-sectional and longitudinal components. The eligible population was 2012 active employees of a US financial services organization (N = 1,233). Data includes HRA data from 2007 to 2012 and healthcare costs (medical and

pharmacy costs combined) from 2007 to 2011. Approval for this work was obtained from the University of Michigan Institutional Review Board (IRB) and consent was obtained from participants for use of their data in aggregate form for research.

Measures

Stress

The main focus is on “stress that affects one’s health” as a measure of perception of enduring stress. This appears to represent long-term stress and has shown to be related to absenteeism as a productivity measure in previous work that was done in a sample of employees of a utility organization (Marzec et al., in press-a). A second measure of stress in terms of “feeling anxious, tense or depressed” was also included as a potential predictor for long term stress.

Previous research concerning the UM-HRA included the defined risk of stress as one of 15 risks that are predictive of healthcare costs (Yen et al., 1991), productivity (Burton et al., 2005a, Wright et al., 2002) and other employer costs (Musich et al., 2001). The stress risk is a weighted index and includes several components (personal loss, marital status, amount of sleep, perception of physical health, job satisfaction, life satisfaction and social ties). For the purpose of path analysis, the “risk” of stress has two disadvantages. Since it is comprised of multiple components, there is a disadvantage of losing the connection with the principle component(s) responsible for the score (Diamantopoulos and Winklhofer, 2001). Second, the risk of stress is dichotomous and lacks granularity that is preferred for path analysis (Kline, 2011). Thus, “stress that affects one’s health” is presented in this study as the principle measure of stress instead of “feeling anxious” or the previously established health risk of stress.

Other factors include caregiving, physical activity and job satisfaction. Caregiving was assessed according to whether an individual took time from work in the past two weeks to care for a child, adult or elder. General job satisfaction was assessed. Two measures of physical activity were included which consisted of vigorous physical activity and an item for more moderate physical activity such as brisk walking. All items from the HRA used as study variables are shown in Table 4.1.

Table 4.1 Health Risk Appraisal Items

Variable	Range	Health Risk Appraisal Question	Answer Choices
Stress Affecting Health	1-4	During the past year, how much effect has stress had on your health?	a) None b) Hardly Any c) Some d) A lot
Feeling Anxious	1-4	How often do you feel tense, anxious, or depressed?	a) Never b) Rarely c) Sometimes d) Often
Job Satisfaction	1-4	Would you agree you are satisfied with your job?	a) Disagree strongly b) Disagree c) Agree d) Agree strongly
Caregiving Child/Parent and Elder combined for this measure	0/1	How many hours did you take off work over the past two weeks to take care of sick children, parents or other relatives (This might include taking children to doctor's appointments, staying home with a sick child or parent or calling doctors or health insurance companies.)	a) 0 b) 1-4 hours c) 5-8 hours d) 9-16 hours e) 17 hours or more
Vigorous Physical Activity	1-4	In the average week, how many times do you engage in physical activity (exercise or work which is hard enough to make you breathe heavily and make your heart beat faster) and is done for at least 20 minutes?	a) Less than 1 time/week b) 1 or 2 times/week c) 3 times/week d) 4 or more times/week
Light Physical Activity	1-6	How many days per week do you get 30 minutes or more (for at least 10 minutes at a time) of light to moderate physical activity? Examples include walking, mowing (push mower), or slow cycling.	a) None b) 1 day c) 2 days d) 3-4 days e) 5-6 days f) 7 days
Absenteeism	1-6	In the past year, how many days of work have you missed due to personal illness?	a) 0 b) 1-2 days c) 3-5 days d) 6-10 days e) 11-15 days f) 16 days or more

Productivity Measures

Absenteeism and presenteeism as measures of productivity were assessed as outcome variables according to stress. Absenteeism was assessed according to self-report of days of work missed in the past year due to personal illness. The specific item is listed on Table 4.1. Presenteeism was defined as being at work, but having less than optimal productivity due to physical or emotional problems. A subset of the Work Limitations Questionnaire (WLQ) was included on the HRA in order to assess the health-related impact on work productivity (Lerner et al., 2001). Eight questions (2 from each WLQ work domain) were selected from the original WLQ questions. The eight-item subset of questions have been used in previous studies and were validated against actual productivity among financial services employees (Burton et al., 2004a, Burton et al., 2005a, Burton et al., 2005b, Burton et al., 2004b). These questions assessed the percentage of time at work that a physical or emotional problem interfered with work according to specific domains. The domains were: 1) time management (working the required number of hours, starting work on time); 2) physical work (repeating the same hand motions, using work equipment); 3) mental/interpersonal activities (concentration, teamwork); and 4) output demand (completing the require amount of work, working to your capability). Based on the previous two weeks of work, employees rated any impairment on a five-point scale with options of “none of the time (0%)”, “some of the time”, “half of the time (50%)”, “most of the time”, and “all of the time (100%)”. The responses for each domain were averaged and the domains were then averaged for a single score of presenteeism. Table 4.2 shows the eight items that comprised the presenteeism score.

Table 4.2 Presenteeism Items from the Work Limitations Questionnaire (WLQ)

Presenteeism	In the past 2 weeks, how much of the time did your physical health or emotional problems make it difficult for you to do the following?	All of the time (100%) Most of the time Half of the time (50%) Some of the time None of the time (0%)
	Work the required number of hours	
	Start on your job as soon as you arrived at work	
	Repeat the same hand motions over and over again while working	
	Use your equipment (i.e., phone, pen, keyboard, computer)	
	Concentrate on your work	
	Help other people to get work done	
	Do the required amount of work	
	Feel you have done what you are capable of doing	

Stress Prevalence and Stress in Relationship to Medical Conditions

As mentioned, this study focuses on stress that affects one’s health. Having stress was defined as reporting “some or a lot” for stress affecting health. Not having stress was defined as reporting “rarely” or “never” for stress affecting health. Prevalence of stress and trends over time were calculated for the overall sample and by gender.

Current medical conditions according to self-report of 19 medical conditions were assessed according to the odds currently having a medical condition for those with stress as compared to those without stress. Control variables were age, gender, education status, and body mass index (BMI). Household income was unavailable, thus education was used as a proxy for socioeconomic status (Braveman et al., 2005). Since excess bodyweight can be an independent risk factor for disease, BMI was also included as a

control variable (Alley and Chang, 2007, Edington and Schultz, 2009, Flegal et al., 2007, Fontaine et al., 2003).

Predictors of Stress and Productivity Measures as Outcomes

Path analysis was used to assess predictors for stress. Age gender and education status were controlled for. Variables were feeling anxious, job satisfaction, vigorous and light physical activity and caregiving as predictors of stress. Both absenteeism and presenteeism were modeled as outcome measures.

Population and Study Sample

The eligible population was active employees of a US financial services organization during 2012 (N = 1,233). The study samples were those who participated in the Health Risk Appraisal (HRA) in 2012 (N = 1,139) for longitudinal analysis we analyzed a subset that participated in the HRA from 2007 to 2012 (N = 873). Healthcare costs included years 2007-2011, since 2012 claims were not available at the time of this study. Participation rate for 2012 was 92%. The participation rate for all years 2007-2012 was 71% of the eligible population. Individuals that did not complete an HRA in 2012 were considered non-participants for the purposes of the study (N = 94; 8%).

Statistical Analysis

Demographics of the HRA respondents were assessed and compared to non-HRA respondents using t-tests for continuous variables and chi square tests for categorical variables.

For stress and medical conditions, odds ratios for medical conditions based on stress status were calculated according to multivariate logistic regression controlling for age, gender education status and BMI. Statistical significance was set at $p < 0.05$.

Path analysis identified predictors and productivity outcomes related to stress. Preliminary analysis with Spearman correlation matrix was used to identify potential pathways of relevant variables. Path analysis model fit was based on chi square values with degree of freedom, goodness of fit index (GFI), comparative fit index (CFI), root mean square residual (RMR) values, root mean square of approximation (RMSEA), modification indices and importance of the variable to the model according to the pathway estimates. Covariance relationships for exogenous variables were included in the model in order to account for them. They are not shown for lack of direct relevance to the study. For the path analysis model, statistical significance level was set at $P < 0.05$. However, the sample size is large ($N > 200$) and the chi square statistic is sensitive to sample size. Thus, a significant chi square is typically not considered problematic (Kline, 2011). Instead, RMSEA was considered as the best critical fit index because the sample size is large and the RMSEA directly accounts for sample size within its formula. Theoretical appropriateness of relationships, significance of path estimates and model fit were all considered as criteria.

T-tests, chi-square, logistic regression and correlation analyses were performed with SAS 9.0. (SAS Institute Inc., Cary, NC). The path analysis modeling was performed using AMOS 20.0 (SPSS, Chicago, IL).

Results

Out of the 2012 active employees (N =1,233), 92% participated in the Health Risk Appraisal in 2012 (N = 1,139). The 2012 HRA participants were 56.4% male with an average age of 43.5 years and were similar to the HRA non participants for both age and gender.

In order to investigate trends over time for stress there is analysis on a subgroup of 873 employees that participated in the HRA for all six years from 2007-2012. These individuals were 53.3% male and had an average age of 45.1 years. Table 4.3 shows demographic information for the eligible employees, the study groups and the HRA non-participants.

Table 4.3 Eligible Employees and HRA Participant Demographics

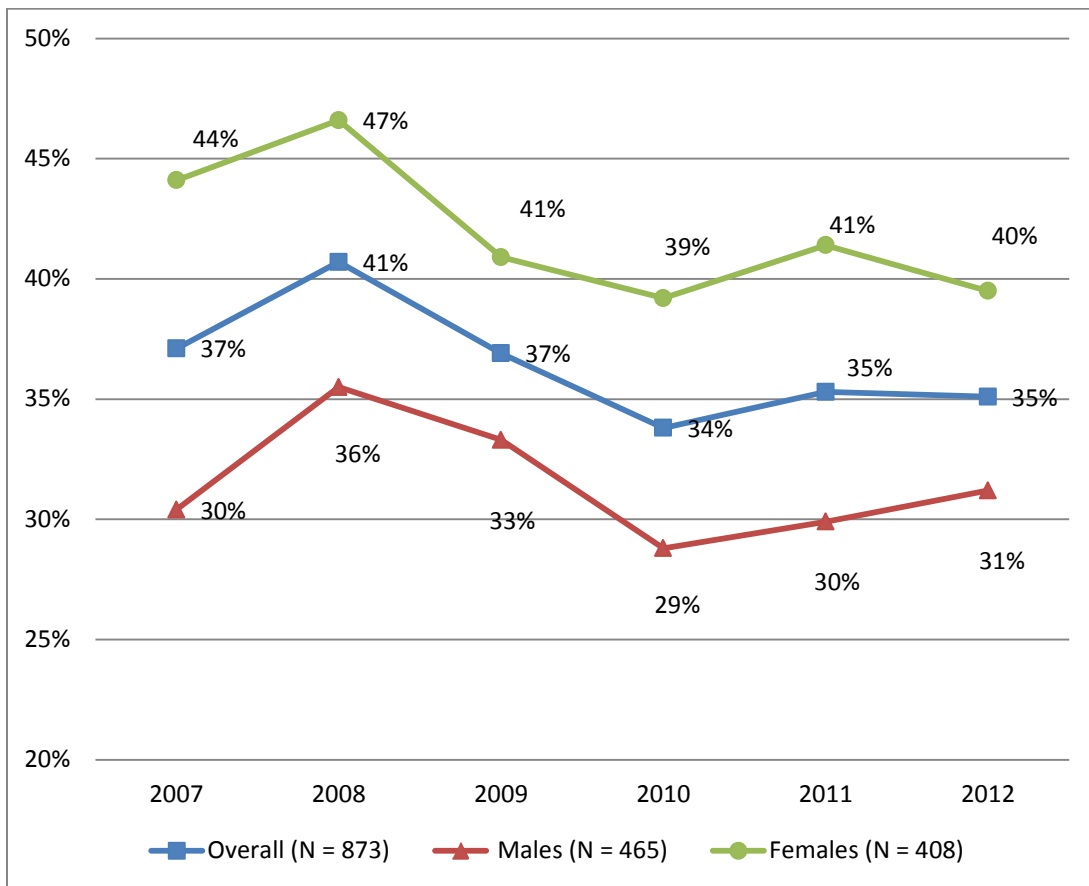
	Eligible Employees	2012 HRA Participants	2012 HRA Non-Participants	2007-2012 HRA Participants
N	1,233	1,139	94	873
Participation Rate		92%	8%	71%
Gender				
Male	57.7%	56.4%	60.6%	53.3%
Female	43.3%	43.6%	39.4%	46.7%
Age				
19-24	1.9%	1.5%	6.4%	0%
25-34	18.3%	18.1%	20.2%	12.7%
35-44	34.5%	35.1%	26.6%	36.4%
45-45	33.3%	33.6%	29.8%	37.5%
55-64	10.3%	10.2%	11.7%	11.7%
65+	1.8%	1.5%	5.3%	1.7%
Average Age (Mean ± Std. Dev.)	43.4 ± 9.8	43.5 ± 9.5	43.2 ± 12.0	45.1 ± 8.6
Percent Exempt	72.60%	72.80%	70.20%	76.1%
Job Status (% Full-time)	98.1%	98.7%	91.5%	98.7%

Prevalence and Trends over Time for Stress

For 2012 HRA participants (N = 1,139), 34.9% reported having stress that affected their health “some” or “a lot”. Prevalence was higher within females with 39.6% reporting stress as compared to 31.3% for the male HRA participants (P < 0.01).

For trends over time among the 873 participants that completed the HRA for all years 2007 to 2012, prevalence ranged from 33.8% to 40.7% with 2008 being higher than 2010, 2011 and 2012 ($P = 0.02$) and similar to 2007 and 2009 ($P = 0.10$). Women consistently showed higher prevalence of stress than men and increased stress in 2008 was consistent between males and females. Figure 4.2 shows the trend for stress prevalence from 2007 to 2012 for the overall sample and by gender.

Figure 4.2 Trends in Stress over Time and by Gender



Demographics and Control Variables according to Stress

Using 2012 HRA participants, demographic and control variable statistics are shown in Table 4.4. Groups were defined as those with stress that affected their health (“some” or

“a lot”) and those without stress affecting their health (“none” or “rarely”). Those with stress were more likely to be female and more likely to have a college degree. Average BMI was higher for those with stress as compared to those without stress. Age and race were similar between the groups.

Table 4.4 Demographics and Control Variables according to Stress

	Without Stress Affecting Health (N = 741)	With Stress Affecting Health (N = 398)	P-value*
Percent Male	59.5%	49.5%**	0.004
Average Age	43.5 years	42.8 years	0.244
Education			
Some college or less	18.8%	12.6%	0.007
College graduate or more	81.2% %	87.4%**	-----
Body Mass index	26.2	26.9	0.046
Percent Caucasian	88.7	89.7%	0.594

*t-test for age and body mass index; Chi-square test for gender, % Caucasian, and education;

**Statistically significant difference at $P < 0.05$

Medical Conditions and Stress

Medical condition prevalence was investigated according to having stress that affects one’s health (see Table 4.5). Also shown are the odds ratios (OR) for reporting having a medical condition for those with stress compared to those without stress after adjusting for age, gender and education. Of the 19 medical conditions assessed, adjusted odds ratios were significant for 10 medical conditions. Individuals with stress affecting their health were most likely to report depression (OR: 5.54), sleep disorder (OR: 3.43),

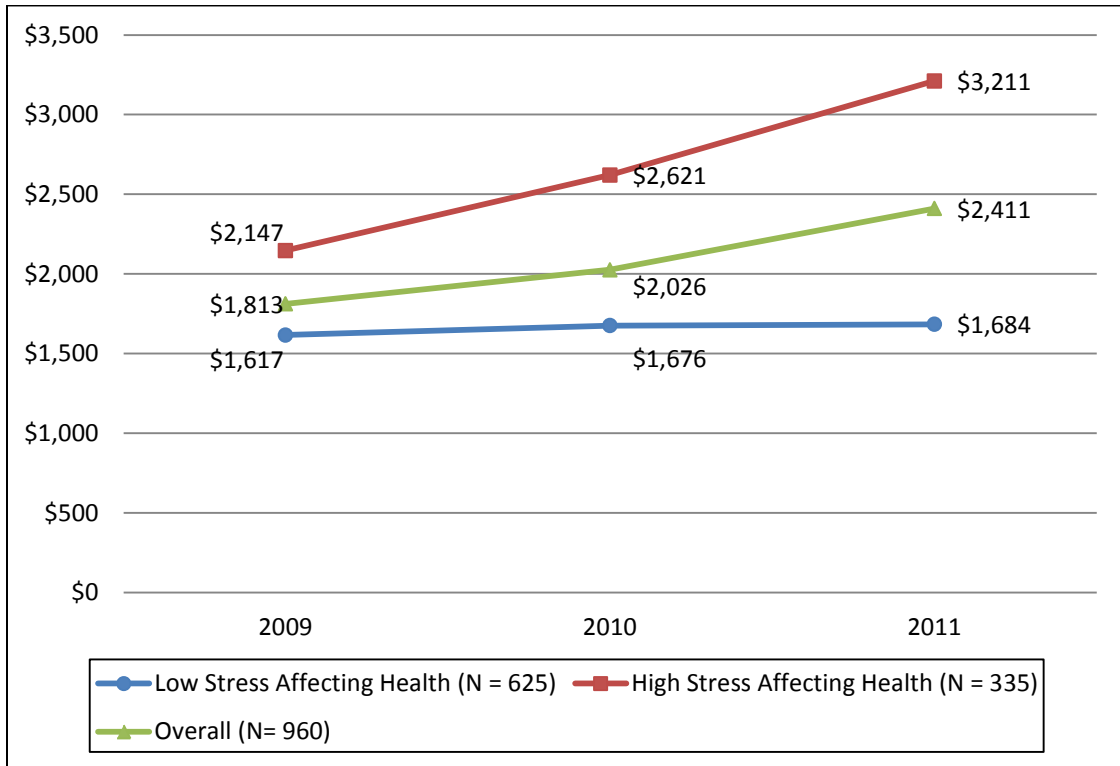
migraine headaches (OR 3.06) and chronic pain (OR: 2.58). On average the number of medical conditions for those with stress was greater than for those without stress (2.09 as compared to 1.38 respectively; $P < 0.001$). Conditions without increased odds according to having stress were allergies, asthma, cancer, chronic bronchitis/emphysema, heart problems, high cholesterol, osteoporosis, stroke and thyroid disorder. Consistent with stress being associated with medical conditions, stress was also associated with increased healthcare costs (combined medical and pharmacy claims) as shown in Figure 4.3.

Table 4.5 Comorbidities According to Self-Report of Medical Conditions

Medical Condition	Without Stress Affecting Health (N = 741)	With Stress Affecting Health (N = 398)	Adjusted Odd Ratio	95% Confidence Interval
Allergies	37.92%	43.47%	1.24	(0.97, 1.59)
Asthma	4.99%	3.52%	0.71	(0.38, 1.33)
Arthritis	6.61%	11.06%	2.08*	(1.32, 3.27)
Back Pain	10.26%	19.35%	2.18*	(1.55, 3.10)
Cancer	1.08%	1.26%	1.12	(0.36, 3.49)
Chronic Bronchitis/Emphysema	0.27%	0.50%	2.32	(0.31, 17.50)
Chronic Pain	3.10%	7.29%	2.58*	(1.46, 4.58)
Depression	2.43%	12.31%	5.54*	3.15, 9.76)
Diabetes	2.16%	4.52%	2.46*	(1.22, 4.96)
Heart Problems	1.21%	1.26%	1.21	(0.40, 3.68)
Heartburn or Acid Reflux	9.72%	16.08%	1.88*	(1.30, 2.71)
High Cholesterol	22.40%	24.87%	1.29	0.96, 1.74)
Migraine Headaches	3.51%	10.80%	3.06*	(1.83, 5.12)
Osteoporosis	1.08%	1.01%	0.93	(0.25, 3.48)
Stroke	0.40%	1.3%	2.74	(0.65, 11.62)
Other	3.64%	7.5%	2.02*	(1.18, 3.46)
High Blood Pressure	11.74%	16.3%	1.79*	(1.24, 2.59)
Thyroid Disease	4.18%	6.8%	1.50	(0.87, 2.61)
Sleep Disorder	3.37%	10.1%	3.43*	(2.03, 5.79)
Average Number of Medical Conditions	1.38	2.09	P < 0.001	N/A

*Odds ratios greater than 1 at P < 0.05 after adjusted for age, gender, education and BMI

Figure 4.3 2009-2011 Healthcare Cost Trends according to Stress Status*



*based on stress status for 2011; adjusted for age, gender, education and BMI

Predictors of Stress and Productivity Outcomes

Descriptive Statistics and Preliminary Analysis for Model Development

The ranges, means and standard deviations for variables included in the structural equation model are shown in Table 4.6. The average for stress was 2.2, which corresponded closest to “hardly any” for the overall sample. Average absenteeism was 0.8 or about 1 day absent in the past year due to personal illness. Average score for vigorous physical activity was 2.9 or approximately 3 days per week. The average score for light activity was 3.8 or approximately to 3-4 days per week.

Table 4.6 Descriptive Statistics and Correlations for Path Analysis Variables

HRA Participants (N = 1,139)										
Variable	Range	Mean ± Std. Dev.	1	2	3	4	5	6	7	8
1. Stress Affecting Health	1-4	2.2 ± 0.8	1							
2. Feeling Anxious	1-4	2.4 ± 0.7	.54	1						
3. Job Satisfaction	1-4	3.2 ± 0.6	-.25	-.30	1					
4. Vigorous Physical Activity	1-4	2.9 ± 1.0	-.17	-.21	.08	1				
5. Light Physical Activity	1-6	3.8 ± 1.3	-.13	-.14	.10	0.67	1			
6. Caregiving	0 or 1	0.12 ± 0.3	-.06 P=0.03	.05 P=0.1	-.04 P = .15	-.08	-.03 P=.30	1		
7. Presenteeism	0-4	0.22 ± 0.66	.13	.10	-.06 P = .04	-.03	-.01 P=.69	.10	1	
8. Absenteeism	1-6	1.8 ± 0.8	.24	.13	-.16	-.07	-.05 P=.04	.08 P=.01	.10	1

P < 0.01 for all correlation coefficients unless otherwise stated

Correlations

Correlation analysis was utilized to explore associations between variables for building the path analysis model (see Table 4.6). For stress, high correlation was noted between “stress affecting health” and “feeling anxious” ($r_s = .54$; $p < .001$). Stress was negatively correlated with job satisfaction, such that higher stress was associated with lower job satisfaction ($r_s = -.25$; $P < .001$). Both vigorous and light physical activity was negatively correlated with stress ($r_s = -.17$; $P < 0.01$ and $r_s = -.13$; $P < 0.01$ respectively). Vigorous or light physical activity did not correlate strongly with absenteeism ($r_s = -.07$; $P < 0.01$) and $r_s = -.05$; $P = 0.04$ respectively). Thus, direct paths

between physical activity and stress are supported. There is not evidence for direct paths between physical activity and absenteeism. Caregiving was not strongly correlated with stress or absenteeism. The correlations do support a direct path between caregiving and presenteeism ($r_s = .10$; $p < .01$). Stress was positively correlated with absenteeism ($r_s = .24$; $p < .01$).

Path Analysis Model

Unstandardized coefficients, standardized coefficients, standard errors and p-values for the path coefficients including the control variables are shown in Table 4.7. Unstandardized coefficients indicate the association between variables in units according to the variables. Standardized coefficients are equalized to amount of change per one standard deviation. Therefore, standardized coefficients are typically used when showing relative influence of variables within the model (Kline, 2011). All path coefficients discussed in the text and shown in Figure 4.4 are standardized values.

Figure 4.4 illustrates the path analysis model with absenteeism and presenteeism as outcome variables. The model fit statistics indicated a good fit between the model and data (chi-square = 51.6 degrees of freedom= 17, GFI = 0.99, CFI=.977, RMR = 0.02 and RMSEA = 0.042). Consistent with hypothesis 1 “feeling anxious” was a predictor for stress ($\beta = 0.50$). However, the impact of stress on feeling anxious was not statistically significant. In support of hypothesis 2, job satisfaction was inversely associated with stress such that stress negatively impacted job satisfaction ($\beta = -0.55$). Conversely, high job satisfaction was associated with high stress ($\beta = 0.36$). Hypothesis 3 was not supported in this sample, although both forms of physical activity were inversely

associated with stress, the path coefficients were not statistically significant ($\beta = -.03$; $P = 0.27$ for vigorous physical activity and $\beta = -0.03$; $P = 0.44$ for light physical activity). Similarly the path coefficient between caregiving and stress was positive but not statistically significant ($\beta = 0.03$; $P = 0.16$). Part of hypothesis 4b was supported in that caregiving impacted presenteeism ($\beta = 0.10$), but not absenteeism ($\beta = 0.05$; $P = 0.08$). Stress was positively associated with absenteeism ($\beta = 0.24$) and presenteeism ($\beta = 0.12$).

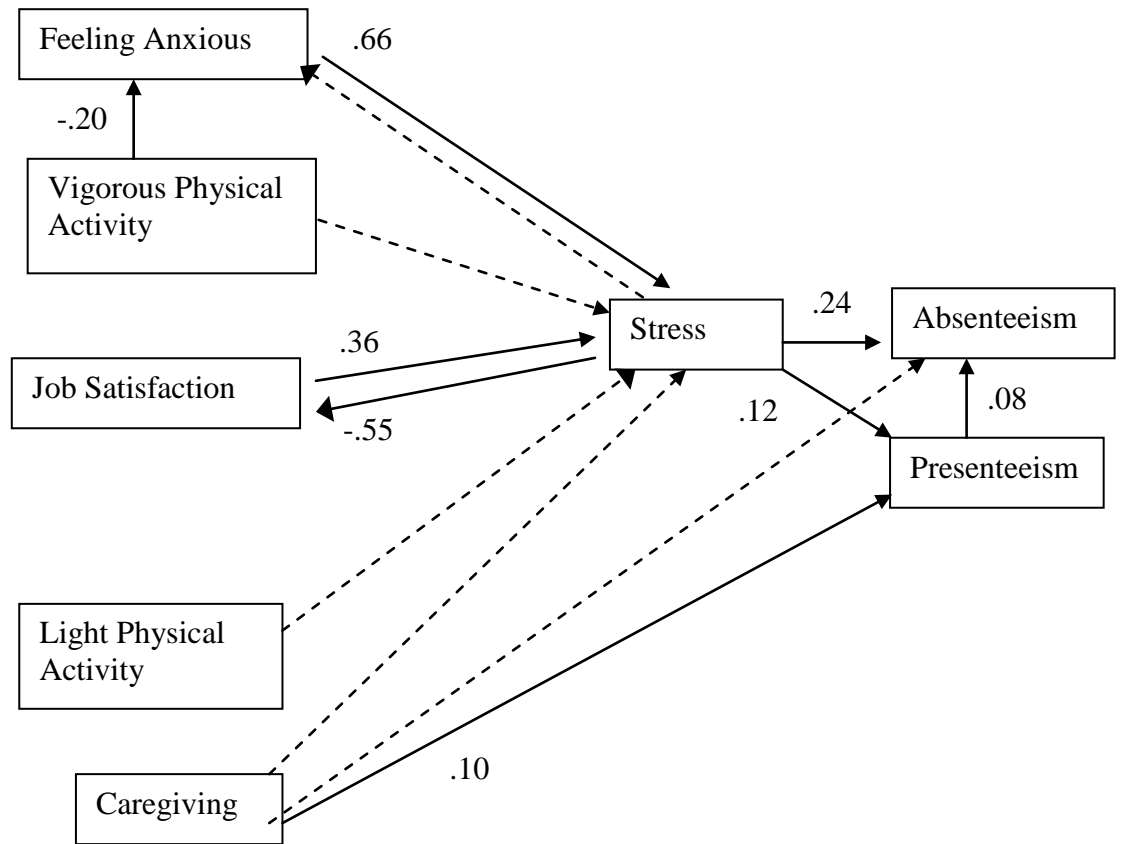
Although a relationship between feeling anxious and physical activity was not hypothesized, we modeled these relationships based on the correlation matrix ($r_s = -.21$, Table 4.6). Vigorous physical activity influenced feeling anxious such that more vigorous physical activity predicted lower levels of feeling anxious ($\beta = -0.20$). There was not evidence for a similar relationship for light physical activity. The additional path found to be relevant (Vigorous physical activity \Rightarrow Feeling anxious) is illustrated in Figure 4.4.

Table 4.7 Path Estimates for Final Model using Absenteeism and Presenteeism as Outcome Measures

			Path Estimate	Standardized Path Estimate	Std. Error	P-value
Gender	→	Stress	.20	.13	.05	***
Age (5 year categories)	→	Stress	.02	.05	.01	.09
Education	→	Stress	.05	.05	.03	.10
Feeling Anxious	→	Stress	.71	.66	.20	***
Stress	→	Feeling Anxious	-.02	-.03	.27	.93
Job Satisfaction	→	Stress	.49	.36	.19	.01
Stress	→	Job Satisfaction	-.41	-.55	.12	***
Vigorous Physical Activity	→	Stress	-.03	-.04	.03	.27
Vigorous Physical Activity	→	Feeling Anxious	-.14	-.20	.04	***
Light Physical Activity	→	Stress	-.02	-.03	.02	.44
Caregiving	→	Stress	.10	.03	.07	.16
Caregiving	→	Presenteeism	.19	.10	.06	.001
Caregiving	→	Absenteeism	.13	.05	.07	.08
Stress	→	Presenteeism	.10	.12	.02	***
Stress	→	Absenteeism	.25	.24	.03	***
Presenteeism	→	Absenteeism	.08	.06	.04	.04

***P < 0.001

Figure 4.4 Final Model for Predictors of Stress and Productivity



Note: Dashed lines indicate hypothesized paths that were not statistically significant

Discussion

This study was conducted using HRA data and path analysis to assess prevalence, trends, comorbidities, and predictors of stress. The study sample was employees of a US financial services company that participated in the HRA in 2012. Trends in stress over time were examined in a subsample of employees with HRA data from 2007 to 2012.

The prevalence of stress in 2012 was 34.9% and was higher among women (39.6%) than men (31.3%). Comparison with other studies is limited due to lack of consistent measures for stress in the literature. One study using the same measure also indicated an overall stress prevalence of 34.5% among employees of a US utility company (Marzec et al., in press-b). The National Institutes of Occupational Safety and Health (NIOSH) has reported that “high levels of emotional exhaustion at the end of the work day is the norm for 25% to 30% of the workforce” (Departments of Health and Human Services, 2002). Another study reported that 32% of financial traders “very high” or “extremely high” for overall work stress as measured indicating 6 or 7 on a 7 point Likert type scale. The authors also noted poorer physical health ratings and poorer job performance for stressed individuals as compared to those without stress (Oberlechner and Nimgade, 2005).

In terms of trends overtime, the prevalence of stress was consistent, generally ranging between 34% and 37%. Stress in 2008 was significantly higher at 40% than 2010-2012. The HRA was administered in from October-November and thus coincided with the financial crisis of 2008. The impact of this is likely reflected in the increased prevalence of stress (Krohn and Gruver, 2009).

Medical Conditions and Stress

There is substantial evidence that psychosocial stress affects the endocrine and immune system and enhance the likelihood of infection leading to health changes (Boscolo et al., 2008, Cohen et al., 2007). It is believed that stress exerts negative influences on the body by influencing control centers within the brain and the

sympathetic (SNS) and parasympathetic (PNS) branches of the autonomic nervous system. This leads to a feed-forward negative cascade of factors that contributes to disease over time (Chrousos, 2009, Cohen et al., 2001, Fisher et al., 2007, Folkman, 2011, Thoits, 2010).

In our study, those reporting stress had less favorable profiles in terms for most medical conditions and health care costs as compared to those without stress. Stressed individuals on average had more medical conditions as compared to those without stress after controlling for age, gender, education and BMI (1.38 vs. 2.09 respectively; $P < 0.001$). Individuals with stress had increased odds for 10 out of 19 self reported medical conditions and increased healthcare costs. Similarly, a Canadian study of self-reported medical conditions found increased odds for 8 of 10 medical conditions (Shields, 2004). In this study, conditions with the greatest odds ratios were depression (OR: 5.54), sleep disorder (OR: 3.43), migraine headaches (OR 3.06) and chronic pain (OR: 2.58). A study using national survey data of Canadian employed individuals ($N = 20,747$) reported individuals with “high day-to-day stress” were three times more likely to have depression than those without stress. The ratio was consistent for men and women (Shields, 2006). For sleep and stress a prospective study showed that individuals with work related stress were twice as likely to develop a sleep disorder such as insomnia within the following year (Linton, 2004). A Swedish study of 5,740 employed individuals also showed individuals with high job strain to be twice as likely to report “disturbed sleep (OR 2.15) (Åkerstedt et al., 2002). Others have noted stress to be associated with conditions such as anxiety, depression, sleep disorders, cardiovascular disease, diabetes, asthma and other conditions (Åkerstedt et al., 2002, Chen and Miller, 2007, Dutour et al., 1996, Eller et al.,

2009, Fisher et al., 2007, Kivimaki et al., 2006, Lloyd et al., 2005). Our findings are consistent with other literature indicating that stress contributes to physical illness as one of its tangible consequences.

Predictors and Productivity Outcomes

According to the path analysis results, feeling anxious was a predictor for stress. Stress was negatively associated with job satisfaction as the primary path of influence ($\beta = -0.55$), which is consistent with the majority of the literature. However, in this sample high job satisfaction was correlated with higher stress as well ($\beta = 0.36$). This apparent paradox is not commonly cited in the literature, but does have precedence. A study focusing on “Type A” personality types showed that individuals cited high stress concurrent with high job satisfaction. The study also noted this group was more likely to perceive situations as stressful than the comparison group of “Type B” individuals. Studies of pharmacists, medical doctors and other professional fields also report high stress concurrent with high job satisfaction (Clarke et al., 1984, Lapane and Hughes, 2006, Kashefi, 2009). Though only speculation is possible here, an indication that this dynamic may be relevant in this study is that individuals with stress were more likely to have a college degree than those without stress (87.4% vs. 81.2% respectively). Thus, these individuals may have stronger job commitment, responsibilities and more stress. Demerouti et al. found that more committed individuals are more likely to tolerate stressful work situations, but at some point this dynamic disintegrates as “burnout” sets in (Demerouti et al., 2001).

Generally, studies indicate that physical activity improve mood and decrease anxiety and stress (Fox, 1999, Paluska and Schwenk, 2000, Taylor, 2001) .Neither light/moderate physical activity nor vigorous physical activity were protective of stress in this sample. These findings differ from previous work showing physical activity to be inversely associated to stress (Marzec et al., in press-a, Marzec et al., in press-b). Additional modeling showed vigorous physical activity to be protective of feeling anxious ($\beta = -0.20$). Though more work is needed to investigate this phenomenon, it is possible in this population that feeling anxious represents a lower level of stress. More moderate stress may be remediated by interventions such as physical activity as compared to stress affecting health, which may represent a greater level or more persistent level of stress.

Caregiving was not a predictor for stress ($\beta = 0.03$: $P = 0.16$), but was associated with presenteeism ($\beta = 0.10$: $P = 0.001$). These results are similar to others that have noted presenteeism in association with caregiving (Burton et al., 2004a).

In terms of productivity outcomes and stress, stress impacted both absenteeism ($\beta = 0.25$) and presenteeism ($\beta = 0.10$). Caregiving was associated with presenteeism, but not absenteeism. This suggests stress had a greater impact on productivity overall than caregiving. These findings are consistent with previous work showing stress to be a predictor for absenteeism (Marzec et al., in press-a) and other studies showing stress to be related to both absenteeism and presenteeism (Darr and Johns, 2008, Jacobson et al., 1996). Similar to our study, VanWormer et al. showed stress as a main predictor of productivity loss (absenteeism and presenteeism combined). One point increase on the

stress scale accounted for a 17.6% increase in productivity loss (e.g.: 3.4% productivity loss to 4.0% productivity loss) (VanWormer et al., 2011).

One aspect of this study is that it utilizes a measure of stress anchored in the respondent's experience of having stress that impacts one's health. This implies both a severity and longitudinal quality of stress that is relevant to outcomes of interest for employers. Despite the overwhelming connection between stress and productivity loss (absenteeism and presenteeism), there is a paucity of research on the association between any measure of overall stress and overall workplace productivity loss. Instead, research has tended to be specialized, focusing on specific facets of stress, such as job strain, burnout, anxiety or depression (Ala-Mursula et al., 2005, Virtanen et al., 2007, Ybema et al., 2011, Hardy et al., 2003, Johnston et al., 2009). Furthermore, the assessment of stress is often specific to a scale or series of questions designed to assess specific facets of stress such as depression, anxiety, task overload or inter-relationships (Cohen et al., 1983, Evans et al., 2012, Lovibond and Lovibond, 1995). Incorporating multi-item stress scales into health assessment tools is challenging due to additional respondent burden. Additionally, combining a stress scale that was designed as a stand-alone tool into a health assessment tool may compromise the integrity of the scale (Groves et al., 2009). Therefore, research on prevalence of a general measure of stress allowing for comparisons across populations and studies would be a useful addition to the field.

Limitations

While this study has strengths in reporting prevalence of stress, predictors of stress and its impact on absenteeism and presenteeism as outcomes, there are several limitations that should be noted. These findings are limited to employees of a US

financial services employer. Over 80% of the sample had college degrees. Therefore, the specific results can not necessarily be applied to other populations. Since this study used a single measure of stress anchored in having a perceived impact on one's health. A useful next step for this line of research includes a multi-employer study reporting prevalence and trends in stress. This study showed that stress varied according to gender, additional work to identify differences in predictors of stress by gender could inform wellness program strategies. The findings presented in this study are cross-sectional, therefore causation can not be inferred. A useful follow-up study for this work would be to assess predictors of stress longitudinally to investigate if changes in these factors result in changes in stress.

Future Directions

Relevant to this work are the different dynamics of stress identified in the area of occupational stress. There is a distinction between positive and negative dynamics of stress (eustress and distress). Largely attributed to Hans Selye, eustress is represented by challenges, positive coping, attainment of new skills and competencies. Distress is the type of stress typically associated with impeded performance, reduced coping and negative health implications. Interestingly, these dynamics are independent of the stressor or identified demand and are determined by the perception of the individual not the stressor itself (Selye, 1964, Selye, 1974). According to LeFevre et al, a stressor can be characterized according factors such as: timing, if the demand is perceived as desirable/beneficial, or if the demand is self-imposed or externally imposed externally. For externally imposed demands, the source may be relevant as being from a friend, a manager, a policy, or an institutional norm, etc.) (LeFevre et al., 2003).

This study focused on the negative dynamic of stress (distress) assessed by individuals reporting stress that affected their health. The primary effect was that stress decreased job satisfaction. However, there was a secondary dynamic that those with higher job satisfaction also had increased stress. The challenge to the employer is to avoid “burnout” among highly engaged employees. The opportunity presented to the employer is in assisting employees to experience the stressors of the workplace as eustress. Cognitive behavior interventions may support employees in making positive interpretations of their environment. Examples of interventions include coaching or other personal development interventions. Second, when demand and resources can be modified to reduce stressors identified by employees as distress, then this should be addressed (Colligan and Higgins, 2006). Further work may include elucidating sources of job satisfaction and stress to elucidate specific interventions designed decrease the perception of distress and increase eustress among employees.

Also, in this study findings for physical activity were mixed since vigorous physical activity impacted feeling anxious but not stress. Physical activity is commonly believed to contribute to eustress (Selye, 1976, Shepard, 1983). Additional studies to illuminate the impact of physical activity on different types or levels of stress would be another future direction for to this work.

Conclusions

This study indicates that individuals reporting stress to the extent that it impacts their health is prevalent. Job dissatisfaction and feeling anxious were significantly related to stress. This should be of concern for employers since it is likely factors in the workplace are contributing to stress. Furthermore, stress has significant economic

implications for employers as it affects medical conditions and healthcare costs, absenteeism and presenteeism. In terms of specific strategies, physical activity interventions may be helpful for those reporting feeling anxious, but less so for those with stress impacting their health. For those with more significant stress, more comprehensive strategies should be enacted that includes physical activity and other life balance techniques. Since stress appears to contribute to multiple medical conditions, absenteeism and presenteeism, its remediation should be a priority for employers seeking to improve economic factors and improve employee health.

References

- Åkerstedt, T., Knutsson, A., Westerholm, P., Theorell, T., Alfredsson, L. and Kecklund, G. 2002. Sleep disturbances, work stress and work hours: A cross-sectional study. *Journal of Psychosomatic Research*, 53 (3) 741-748.
<http://www.sciencedirect.com/science/article/pii/S0022399902003331>
- Ala-Mursula, L, Vahtera, J, Linna, A, Pentti, J and Kivimaki, M 2005. Employee worktime control moderates the effects of job strain and effort-reward imbalance on sickness absence: the 10-town study. *J Epidemiol Community Health*, 59 (10) 851 - 7.
- Aldana, Steven G., Merrill, Ray M., Price, Kristine, Hardy, Aaron and Hager, Ron 2005. Financial impact of a comprehensive multisite workplace health promotion program. *Preventive Medicine*, 40 (2) 131-137.
<http://www.sciencedirect.com/science/article/pii/S0091743504002786>
- Alley, Dawn E. and Chang, Virginia W. 2007. The Changing Relationship of Obesity and Disability 1988-2004. *JAMA*, 298 (17) 2020-7.
- Avey, James B., Patera, Jaime L. and West, Bradley J. 2006. The Implications of Positive Psychological Capital on Employee Absenteeism. *Journal of Leadership & Organizational Studies*, 13 (2) 42-42-60.
<http://search.proquest.com/docview/203142590?accountid=14667>
- Bakker, A. B., Demerouti, E., de Boer, E. and Schaufeli, W. B. 2003. Job demands and job resources as predictors of absence duration and frequency. *J. Vocat. Behav.*, 62 (2) 341-356. <Go to ISI>://WOS:000182138100009
- Bakker, Arnold B. and Demerouti, Evangelia 2007. The Job Demands-Resources model: state of the art. *Journal of Managerial Psychology*, 22 (3) 309-309-328.
<http://search.proquest.com/docview/215868920?accountid=14667>
- Boscolo, Paolo, Youinou, Pierre, Theoharides, Theoharis C., Cerulli, G. and Conti, Pio 2008. Environmental and occupational stress and autoimmunity. *Autoimmunity Reviews*, 7 (4) 340-343.
<http://www.sciencedirect.com/science/article/pii/S156899720700211X>
- Boyar, Scott L., Jr, Carl P. Maertz and Pearson, Allison W. 2005. The effects of work-family conflict and family-work conflict on nonattendance behaviors. *Journal of Business Research* 58; 919-925.
- Braveman, Paula A., Cubbin, Catherine, Egerter, Susan, Chideya, Sekai, Marchi, Kristen S., Metzler, Marilyn, et al. 2005. Socioeconomic status in health research: One size does not fit all. *JAMA*, 294 (22) 2879-2888.
<http://dx.doi.org/10.1001/jama.294.22.2879>
- Burton, Wayne N., Chen, Chin-Yu, Conti, Daniel J., Pransky, Glenn and Edington, Dee 2004a. Care giving for ill dependents and its association with employee health risks and productivity. *J Occup Environ Med*, 46; 1048-1056.
- Burton, Wayne N., Chen, Chin-Yu, Conti, Daniel J., Schultz, Alyssa B., Pransky, Glenn and Edington, Dee W. 2005a. The association of health risks with on-the-job productivity. *J Occup Environ Med*, 47(8) 769-777.
- Burton, Wayne N., McCallister, Katherine T., Chen, Chin-Yu and Edington, Dee W. 2005b. The association of health status, worksite fitness center participation, and two measures of productivity. *J Occup Environ Med*, 47(4) 343-351.

- Burton, Wayne N., Pransky, Glenn, Conti, Daniel J., Chen, Chin-Yu and Edington, Dee W. 2004b. The association of medical conditions and presenteeism. *J Occup Environ Med*, 46(6 suppl.) S38-S45.
- Chen, Edith and Miller, Gregory E. 2007. Stress and inflammation in exacerbations of asthma. *Brain, Behavior, and Immunity*, 21(8) 993-999.
<http://www.sciencedirect.com/science/article/pii/S0889159107000761>
- Chrousos, George P. 2009. Stress and disorders of the stress system. *Nat Rev Endocrinol*, 5(7) 374-381. <http://dx.doi.org/10.1038/nrendo.2009.106>
- Clarke, Thomas A., Maniscalco, William M., Taylor-Brown, Susan, Roghmann, Klaus J., Shapiro, Donald L. and Hannon-Johnson, Catherine 1984. Job Satisfaction and Stress Among Neonatologists. *Pediatrics*, 74; 52-57.
- Cohen, S, Kamarck, T and Mermelstein, R. . 1983. A global measure of perceived stress. *J Health Soc Behav*, 24; 385-396.
- Cohen, Sheldon, Janicki-Deverts, Denise and Miller, Gregory E. 2007. Psychological Stress and Disease. *JAMA*, 298(14) 1685-1687. <http://jama.ama-assn.org/content/298/14/1685.short>
- Cohen, Sheldon, Miller, Gregory E. and Rabin, Bruce S. 2001. Psychological Stress and Antibody Response to Immunization: : A Critical Review of the Human Literature. *Psychosomatic Medicine*, 63(1) 7-18.
<http://www.psychosomaticmedicine.org/content/63/1/7.abstract>
- Colligan, Thomas W. and Higgins, Eileen M. 2006. Workplace Stress. *J Workplace Behavioral Health*, 21(2) 89-97. http://dx.doi.org/10.1300/J490v21n02_07
- Cooper, Cary and Dewe, Philip 2008. Well-being—absenteeism, presenteeism, costs and challenges. *Occupational Medicine*, 58(8) 522-524.
<http://occmed.oxfordjournals.org/content/58/8/522.short>
- Darr, Wendy and Johns, Gary 2008. Work strain, health, and absenteeism: A meta-analysis. *J Occup Health Psych*, 13(4) 293-318.
<http://search.ebscohost.com/login.aspx?direct=true&db=pdh&AN=ocp-13-4-293&site=ehost-live>
- De Boer, Elpine M., Bakker, Arnold B., Syroit, Jef E. and Schaufeli, Wilmar B. 2002. Unfairness at work as a predictor of absenteeism. *J Org Behav*, 23(2) 181-197.
<http://search.proquest.com/docview/224867921?accountid=14667>
- Demerouti, Evangelia, Bakker, Arnold B., Nachreiner, Friedhelm and Schaufeli, Wilmar B. 2001. The job demands-resources model of burnout. *Journal of Applied Psychology* 86(3) 499-512.
- Departments of Health and Human Services, National Institute of Occupational Safety and Health 2002. The changing organization of work and the safety and health of working people. *DHHS (NIOSH) Publication No. 2002-116*,
<http://www.cdc.gov/niosh/docs/2002-116/pdfs/2002-116.pdf>.
- Diamantopoulos, Adamantios and Winklhofer, Heidi M. 2001. Index construction with formative indicators: an alternative to scale development. *Journal of Marketing Research*, 38(2) 269-277.
- Dutour, A., Boiteau, V., Dadoun, F., Feissel, A., Atlan, C. and Oliver, C. 1996. Hormonal response to stress in brittle diabetes. *Psychoneuroendocrinology*, 21(6) 525-543.
<http://www.sciencedirect.com/science/article/pii/S0306453096000145>

- Edington, Dee W. and Schultz, Alyssa B. 2009. Obesity and its metabolic comorbidities in a worksite: prevalence and economic impact. *Journal of Health and Productivity*, 4(2) 9-14.
- Eller, Nanna H., Netterstrøm, Bo, Gyntelberg, Finn, Kristensen, Tage S., Nielsen, Finn, Steptoe, Andrew, et al. 2009. Work-Related Psychosocial Factors and the Development of Ischemic Heart Disease: A Systematic Review. *Cardiology in Review*, 17(2) 83-97 10.1097/CRD.0b013e318198c8e9.
http://journals.lww.com/cardiologyinreview/Fulltext/2009/04000/Work_Related_Psychosocial_Factors_and_the.6.aspx
- Evans, Gary W., Becker, Franklin D., Zahn, Alicia, Bilotta, Elena and Keesee, Alyssa M. 2012. Capturing the Ecology of Workplace Stress With Cumulative Risk Assessment. *Environment and Behavior*, 44(1) 136-154
<http://eab.sagepub.com/content/early/2010/12/02/0013916510389981.full.pdf+html>
- Fisher, Edwin B., Thorpe, Carolyn T., DeVellis, Brenda McEvoy and DeVellis, Robert F. 2007. Healthy Coping, Negative Emotions, and Diabetes Management. *The Diabetes Educator*, 33(6) 1080-1103.
<http://tde.sagepub.com/content/33/6/1080.abstract>
- Flegal, Katherine M., Graubard, Barry I., Williamson, David F. and Gail, Mitchell H. 2007. Cause-specific excess deaths associated with underweight, overweight and obesity. *JAMA*, 298(17) 2028-37.
- Folkman, Susan 2011. *The Oxford handbook of stress, health, and coping*, Oxford ; New York, Oxford University Press.
- Fontaine, Kevin R., Redden, David T., Wang, Chenxi, Westfall, Andrew O. and Allison, David B. 2003. Years of Life Lost Due to Obesity. *JAMA*, 289; 187-193.
- Fox, Kenneth R 1999. The influence of physical activity on mental well-being. *Public Health Nutrition*, 2(Supplement 3a) 411-418.
<http://dx.doi.org/10.1017/S1368980099000567>
- Gignac, Monique A. M. 1996. The impact of caregiving on employment: A mediational model of work-family conflict. Canadian Association on Gerontology = Association canadienne de g erontologie.
- Groves, Robert M, Kalton, Graham, Rao, J. N. K, Schwarz, Norbert and Skinner, Christopher (eds.) 2009. *Survey Methodology*, Hoboken, NJ: John Wiley & Sons.
- Hardy, Gillian E., Woods, David and Wall, Toby D. 2003. The impact of psychological distress on absence from work. *J Appl Psych*, 88(2) 306-314.
<http://search.ebscohost.com/login.aspx?direct=true&db=pdh&AN=2003-03332-014&site=ehost-liveg.hardy@sheffield.ac.uk>
- Herman, Christopher W., Musich, Shirley, Lu, Chifung, Young, Joyce M. and Edington, Dee W. 2006. Effectiveness of an incentive-based online physical activity intervention on employee health status *J Occup Environ Med*, 48(9) 889-895.
- Jacobson, Bert H., Aldana, Steven G., Goetzl, Ron Z. and Vardell, K. D. 1996. The relationship between perceived stress and self-reported illness-related absenteeism *American Journal of Health Promotion*, 11(1) 54-61.
- Jansen, N W H, Kant, IJ, van Amelsvoort, L G P M, Kristensen, T S, Swaen, G M H and Nijhuis, F J N 2006. Work-family conflict as a risk factor for sickness absence.

- Occup Environ Med*, 63(7) 488-494.
<http://oem.bmj.com/content/63/7/488.abstract>
- Johns, Gary 2011. Attendance dynamics at work: the antecedents and correlates of presenteeism, absenteeism and productivity loss. *Journal of Occup Health Psychology*, 16(4) 483-500.
- Johnston, Kenton, Westerfield, William, Momin, Soyal, Phillippi, Raymond and Naidoo, Allen 2009. The direct and indirect costs of employee depression, anxiety, and emotional disorders--an employer case study *J Occup Environ Med*, 51(5) 564-577.
- Karasek, Robert 1990. Lower health risk with increased job control among white collar workers. *J Org Behav*, 11(3) 171-185.
- Kashefi, Max 2009. Job Satisfaction and/or Job Stress: The Psychological Consequences of Working in 'High Performance Work Organizations'. *Current Sociology*, 57(6) 809-828. <http://csi.sagepub.com/content/57/6/809.abstract>
- Kivimaki, Mika , Virtanen, Marianna, Elovainio, Marko, Kouvonen, Anne, Vaananen, Ari and Vahtera, Jussi 2006. Work stress in the etiology of coronary heart disease-a meta-analysis. *Scandinavian Journal of Work Environment and Health*, 32(6) 431-442.
- Kline, Rex B. 2011. *Principles and Practice of Structural Equation Modeling*, New York, New York, Guilford Press.
- Krohn, Gregory A. and Gruver, William R. 2009. The Complexities of the Financial Turmoil of 2007 and 2008. *The Journal of Applied Business and Economics*, 9(4) 24-49.
<http://search.proquest.com.proxy.lib.umich.edu/docview/218705770?accountid=14667>
- Lapane, Kate L. and Hughes, Carmel M. 2006. Job satisfaction and stress among pharmacists in the long-term care sector. *The Consultant Pharmacist*, 21(4) 287-292.
- LeFevre, Mark, Matheny, Jonathan and Kolt, Gregory S. 2003. Eustress, distress, and interpretation in occupational stress *Journal of Managerial Psychology*, 18(7) 726-744.
- Lerner, Debra, Amick, Benjamin C., Rogers, William H., Malspeis, Susan, Bungay, Kathleen and Cynn, Diane 2001. The Work Limitations Questionnaire. *Medical Care*, 39(1) 72-85.
- Linton, Steven J. 2004. Does work stress predict insomnia? A prospective study. *British J Health Psych*, 9(2) 127-136. <http://dx.doi.org/10.1348/135910704773891005>
- Lloyd, Cathy, Smith, Julie and Weinger, Katie 2005. Stress and Diabetes: A Review of the Links. *Diabetes Spectrum*, 18(2) 121-127.
<http://spectrum.diabetesjournals.org/content/18/2/121.abstract>
- Lovibond, P.F. and Lovibond, S.H. 1995. The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, 33; 335-343.
- Ludovic van Amelsvoort, Spigt, Mark, Swaen, Gerard and Kant, Ijmert 2006. Leisure time physical activity and sickness absenteeism; a prospective study. *Occup Med* 56; 210-212.

- Marzec, Mary L., Scibelli, Andrew F. and Edington, Dee W. in press-a. Examining Individual Factors according to Health Risk Appraisal Data as Determinants of Absenteeism among US Utility Employees. *J Occup Environ Med*,
- Marzec, Mary L., Lee, Seung Pil, Cornwell, T. Bettina, Burton, Wayne N., McMullen, Judith and Edington, Dee W. in press-b. Predictors of Behavior Change Intention Using Health Risk Appraisal Data. *Amer J Health Behav*, 37(4) 478-490.
- Musich, Shirley, Napier, Deborah and Edington, Dee W. 2001. The association of health risks with workers' compensation costs. *J Occup Environ Med*, 43(6) 534-41.
- Oberlechner, Thomas and Nimgade, Ashok 2005. Work stress and performance among financial traders. *Stress and Health*, 21; 285-293
- Paluska, Scott A. and Schwenk, Thomas L. 2000. Physical Activity and Mental Health: Current Concepts. *Sports Medicine*, 29(3) 167-180.
http://adisonline.com/sportsmedicine/Fulltext/2000/29030/Physical_Activity_and_Mental_Health_Current.3.aspx
- Rauhala, A, Kivimaki, M, Fagerstrom, L, Elovainio, M, Virtanen, M and Vahtera, J 2007. What degree of work overload is likely to cause increased sickness absenteeism among nurses? Evidence from the RAFAELA patient classification system. *J Adv Nurs*, 57(3) 286 - 95.
- Searle, Ben J. 2008. Does Personal Initiative training work as a stress management intervention? *J Occup Health Psych*, 13(3) 259-270.
- Selye, H. 1964. *From dream to discovery*, New York, New York, McGraw Hill.
- Selye, H. 1974. *Stress without distress*, Philadelphia: J. B. Lippincott Co., J. B. Lippincott Co.
- Selye, H. 1976. Physical Activity and Stress. *McGill Journal of Education*, 11(1) 3-14.
- Shepard, R.J 1983. Physical activity and the healthy mind. *Can Med Assoc J.* , 128(5) 525-530.
- Shields, Margot 2004. Stress, health and the benefit of social support. *Health Reports (Statistics Canada, Catalogue 82-003)*, 15; (1) 9-38
<http://publications.gc.ca/collections/Collection-R/Statcan/82-003-XIE/0010382-003-XIE.pdf>.
- Shields, Margot 2006. Stress and depression in the employed population. *Health Reports* 17; (4) <http://www.statcan.gc.ca/ads-annonces/82-003-x/pdf/4194128-eng.pdf>.
- Taylor, A. H. 2001. Physical activity, anxiety, and stress. In: Biddle, S., Fox, K. R. & Boutcher, S. H. (eds.) *Physical activity and psychological well-being*. London: Routledge.
- Tennant, Christopher 2001. Work-related stress and depressive disorders. *Journal of Psychosomatic Research*, 51(5) 697-704.
<http://www.sciencedirect.com/science/article/pii/S0022399901002550>
- Thoits, Peggy A. 2010. Stress and Health. *Journal of Health and Social Behavior*, 51(1 suppl) S41-S53. http://hsb.sagepub.com/content/51/1_suppl/S41.abstract
- VanWormer, Jeffrey J., Fyfe-Johnson, Amber L., Boucher, Jackie L., Johnson, Pamela Jo, Britt, Heather R., Thygeson, N. Marcus, et al. 2011. Stress and Workplace Productivity Loss in the Heart of New Ulm Project. *J Occup Environ Med*, 53(10) 1106-1109 10.1097/JOM.0b013e318229ab18.
http://journals.lww.com/joem/Fulltext/2011/10000/Stress_and_Workplace_Productivity_Loss_in_the.3.aspx

- Virtanen, M, Vahtera, J, Pentti, J, Honkonen, T, Elovainio, M and Kivimaki, M 2007. Job strain and psychologic distress influence on sickness absence among Finnish employees. *Am J Prev Med*, 33(3) 182 - 7.
- Warburton, Darren E.R., Nicol, Crystal Whitney and Bredin, Shannon S.D. 2006. Health benefits of physical activity: the evidence. *Canadian Medical Association Journal*, 174(6) 801-809. <http://www.cmaj.ca/content/174/6/801.abstract>
- Wegge, Jurgen, Schmidt, Klaus-Helmut, Parkes, Carole and Dick, Rolf van 2007. 'Taking a sickie': Job satisfaction and job involvement as interactive predictors of absenteeism in a public organization. *J Occup Org Psych*, 80; 77-89.
- Williams, Eric S, Rondeau, Kent V, Xiao, Qian and Francescutti, Louis H 2007. Heavy physician workloads: impact on physician attitudes and outcomes. *Health Services Management Research*, 20(4) 261-269. <http://hsmr.rsmjournals.com/content/20/4/261.abstract>
- Wright, Douglas, Beard, Marshall and Edington, Dee W. 2002. Association of health risks with the cost of time away from work. *J Occup Environ Med*, 44(12) 1126-34.
- Ybema, Jan F., Evers, Marije S. and VanScheppingen, Arjella R. 2011. A Longitudinal Study on the Effects of Health Policy in Organizations on Job Satisfaction, Burnout, and Sickness Absence. *J Occup Environ Med*, 53(11) 1251–1257.
- Yen, Louis T., Edington, D. and Witting, P. 1991. Associations between health risk appraisal scores and employee medical claims costs in a manufacturing company. *Amer J Health Promot*, 6; 46-54.

Chapter 5

Determinants of Workplace Absenteeism According to HRA Data: Conclusions

The premise for the work within this dissertation was based in the social ecological framework which contends interactions between characteristics of individuals and the environment in which they function. Recent trends in worksite health promotion advocate structural changes in the workplace environment to encourage health behaviors. The broad context of this dissertation considers the alternative dynamic of investigating characteristics of individuals to inform workplace policies and wellness program strategies. More specifically, the studies evaluated factors from HRA data as to their relevance as determinants of absenteeism. Absenteeism was used as a measurable outcome measure that is also reflective of individual health. Main determinants of absenteeism were medical condition burden and stress. Additionally, higher stress was associated with greater medical condition burden. Policy and health promotion implications based on this are that employers should address stress as a distinct priority in addition to physical health in order to reduce absenteeism and improve health.

Empirical Findings

This dissertation explored determinants of absenteeism and the interrelationships of those factors according to HRA data. Samples from two employed populations were used. The first two studies were of utility provider employees and the third study was from employees of a financial services organization. **The first two studies indicated that medical condition burden and stress were determinants of absenteeism.** For the

first study, this pattern was examined using self-reported absence data and confirmed using absenteeism data from administrative records. Physical activity mediated both medical condition burden and stress, whereas job satisfaction only correlated with stress. Another important observation from Study 1 was that physical activity did not impact absenteeism directly, suggesting that wellness programs that focus in physical activity may not be successful in impacting productivity outcomes unless stress is also addressed.

These findings are consistent with others that have found medical condition burden measured as number of medical conditions to be associated with increased absenteeism (Collins et al., 2005, Loeppke et al., 2009, Wang et al., 2003). Loeppke et al. (2009) noted that 62% of participants in a multi-employer study had more than one medical condition. This is similar to our study where 58% had multiple health conditions. Loeppke et al. also noted a monotonic relationship between number of medical conditions and absenteeism which was similar to our results. **Study 2 indicated that if medical condition burden increased so does absenteeism. Unfortunately decreased medical condition burden did not result in statistically significant decreases in absenteeism.** This underscores the need for prevention of medical conditions. Treatment and remediation are necessary, but outcomes such as absenteeism may remain high despite remediation of medical conditions. Other studies have found similar patterns in studying changes in metabolic syndrome risks and changes in health care costs. Those increasing by 3 or more risks increased costs by an average of \$1348 those decreasing by the same amount decreased in costs by an average of \$437. Changes specific to absenteeism in relation to changes in health risks or factors have not previously been reported. Study 2 also underscores the importance of preventing and/or managing chronic

medical conditions and stress to prevent a worsening cascade in health and economic outcomes.

The findings that either medical conditions burden as a measure of physical health or stress are determinants of absenteeism is consistent with other studies. Others have found medical conditions to be related to productivity outcomes such as absenteeism (Collins et al., 2005, Loeppke et al., 2009, Wang et al., 2003, Yen et al., 1992). Similarly, stress has been associated with increased absenteeism (Darr and Johns, 2008, De Boer et al., 2002, Godin and Kittel, 2004, Peter and Siegrist, 1997). The additional contribution of this work is in showing that these factors concurrently impact absenteeism and they are related to other factors such as job satisfaction and physical activity.

All three studies showed that stress was a significant determinant of absenteeism both cross-sectionally (Study 1 and 3) and longitudinally (Study 2). In both employee samples ~35% of employees reported stress that affected their health “some” or “a lot”. Similar to our study, VanWormer et al. showed stress as a main predictor of productivity loss (absenteeism and presenteeism combined). One point increase on the stress scale accounted for a 17.6% increase in productivity loss (e.g.: 3.4% productivity loss to 4.0% productivity loss) (VanWormer et al., 2011).

Furthermore, Study 1 and 3 indicated that stress had significant and tangible impacts on physical health. **Given the prevalence and impact of stress on both physical health and absenteeism, these results show that stress should to be a priority for health promotion practitioners, occupational health specialists, and medical directors to consider for wellness program and policy implementation.**

The first study indicated that stress played a dual role by impacting absenteeism directly and also impacted medical conditions burden. The second study showed that changes in stress and medical conditions burden resulted in changes in absenteeism. However, changes in stress appeared to have greater impact on absenteeism than changes in medical condition burden within the one year timeframe. The first two studies indicated that stress may have a stronger role as a determinant of absenteeism than physical health (medical condition burden).

The third study extended findings of the previous studies. First, by using path analysis to examine predictors of stress and absenteeism in a population from a different employer sector and with a different demographic distribution. The third study was of financial services employees as compared to employees of a utility provider. The financial services sample had a higher percentage of females (44% as compared to 30%; $P < 0.01$) and was younger on average (43.5 years vs. 44.6 years $P < 0.01$). Additionally, caregiving was investigated as a predictor of stress and absenteeism. Third, presenteeism was included as an additional outcome variable to absenteeism. Fourth, the interrelationship between stress and medical conditions was examined in the third study in terms of odds of having a specific medical condition based on having stress after controlling for age, gender and education status.

There were some similarities and differences for predictors of stress between the different study populations. Job dissatisfaction was negatively associated with stress in both studies, suggesting that job-related stress may be a consistent factor across different groups. However, there was also a secondary dynamic where job satisfaction positively predicted stress in the financial services employees that was not relevant among the

employees of the utility organization. This indicates that dynamics for factors contributing to stress vary across employment sectors. As a company specializing in investments, the financial services employees were from a smaller more specialized organization as compared to the utility provider. For the financial services employees, over 80% had college degrees as compared to ~60% with college degrees among employees of the utility provider. Such differences in employee profiles are probably relevant to the noted differences in relationships between job satisfaction and stress. Other studies have noted conflicting relationships between job satisfaction and stress particularly among white collar or professional employees (Clarke et al., 1984, Kashefi, 2009, Lapane and Hughes, 2006). Physical activity was predictive of lower stress among utility employees, but was only associated with feeling anxious in the financial services group. Generally, studies indicate that physical activity improve mood and decrease anxiety and stress (Fox, 1999, Paluska and Schwenk, 2000, Taylor, 2001). The policy implications are that wellness programs that encourage physical activity are helpful, but programs and policies that address stress, especially work-related stress are also necessary to impact health and productivity outcomes.

. Both Study 1 and Study 3 showed that stress was related to increased medical conditions, both in number of medical conditions and for odds of having a specific medical condition. This was not a primary objective for Study 1. Nevertheless, the path analysis model showed stress to impact number of medical conditions. Reversing the direction of the relationship such that number of medical conditions impacted stress was not supported by the model. Study 3 further explored this dynamic and found that stressed individuals had more medical conditions as compared to those without stress

(1.38 vs. 2.09 respectively; $P < 0.001$). Odds of having a specific medical condition were increased for 10 of 19 conditions for those with stress after controlling for age, gender, education status and BMI. Similarly, a Canadian study of self-reported medical conditions found increased odds for 8 of 10 medical conditions (Shields, 2004). The findings from Study 3 support those in Study 1 that stress contributes to physical illness as one of its tangible consequences.

In summary, medical condition burden and stress were found to be direct determinants of absenteeism. Stress should be of greater concern given the evidence that it is correlated with increased medical conditions, increased absenteeism and presenteeism, and decreased job satisfaction. The promotion of physical activity may be helpful to improve stress for some individuals. Nevertheless, organizations interested in impacting economic outcomes and productivity should prioritize stress reduction on an equal or greater level than physical health or dietary interventions.

Methodological Contributions

From a methodological perspective, this work offers an additional use for HRA data. As the name implies, the predominant use for Health Risk Appraisals is to identify health risks both at the individual and population level. Since the HRA assesses multiple aspects of an individual's life and health behaviors, it is well-suited for path analysis. Path analysis differs from other modeling techniques because it indicates both strength and directionality of relationships between multiple predictors for a variable of interest. Direct and indirect effects are modeled and illustrated in a graphic form. The methodology is well established in the scientific field with specific criteria for model fit specifications. According to the current work, the use of path analysis has promise when

used in conjunction with HRA data in informing workplace policies and health promotion strategies. This methodology may also be useful for planning evaluation strategies for wellness programs. For example, the direct relationship for physical activity was with stress and not absenteeism. This dynamic should be considered in planning and evaluating wellness programs.

The use of a single item measure for stress that is anchored as “stress that impact one’s health” could be used by other researchers. This would allow for prevalence and trend comparisons for stress across populations. Beyond being a single item, this measure has other advantages. This measure does not refer to sensitive issues like depression or anxiety, therefore it should not be as prone to social desirability bias (Groves et al., 2009). This is especially important within the context of workplace health promotion since participants are employees. Also, this measure is likely to engage employer stakeholders. It is not an abstract scale. This measure is directly relevant to the health and productivity of employees since it is anchored as stress that impacts health, not just feeling stressed.

Limitations

In spite of insights gained from this work in terms of stress and medical conditions burden as primary determinants of absenteeism and their interrelationships with other factors, this work has several limitations that should be considered. First, it is likely that other factors such as absence policies and organizational characteristics also influence absenteeism. The objective of this work was to investigate individual characteristics and their relationships to each other and to absenteeism, rather than attempt to capture all factors relating to absenteeism. Within that scope, these findings

are still useful to inform policies and set expectations for absenteeism as an outcome measure.

A second limitation of this work is the use of secondary data. This work demonstrates an additional use of HRA data as a tool to provide insights for predictors of absenteeism. A potential application is to help inform wellness program strategies and workplace policies. The HRA data is useful as it provides information on several aspects of health and related factors. Unfortunately, it is limited in that areas are covered in a broad sense. For example, more specific information on sources of stress or job dissatisfaction would also be useful to inform wellness program strategies and workplace policies. A survey instrument designed specifically to assess each area of interest in detail would be ideal. Unfortunately, the cost of employee time, incentives, and management support of such a survey may limit ideal data collection.

Third, these findings are limited to employees of specific organizations (a US utility provider and a US financial services organization). Although the specific results cannot be generalized to other groups, there are themes such as the central role of stress in impacting health and productivity and the negative association between physical activity and stress variables (at some level of stress) that should be generalizable to other employed populations. More research will need to be done in other employer sectors to further delineate these findings.

Future directions

Future research in this area should attempt to replicate the findings of this dissertation among different employed populations with different demographic

distributions. Specifically, a multi-employer study on prevalence of perceived stress affecting one's health and trends over time in this measure would be a useful addition to the literature. Second, Study 1 and Study 3 studies showed different patterns for predictors of stress in the two populations studied. Continued research on predictors of stress would be useful empirically and to inform health promotion strategies. Third, our work showed that absenteeism was impacted by changes in medical condition burden and stress. The next valuable step would be to examine how physical health is impacted by changes in stress over time. Also, longitudinal studies on the impact of physical activity on stress (measured as perceived stress that impacts one's health) would be a valuable addition to the literature. This information would be useful to inform health promotion programs and workplace policies. In reference to the medical condition burden index (MCBI), absenteeism was averaged according to level of medical conditions burden. Additional work to investigate the variance of outcome measures (absenteeism or healthcare costs) within medical burden index levels would be a first step in validating this measure further.

Practical Applications

Findings from this work are directly applicable to the practice of worksite wellness promotion. According to this work, stress management should be prioritized at least equally along health-behavior related wellness programs (e.g. anti-smoking, physical activity, healthy eating). Ideally, companies should adopt a culture that discourages stress and encourages healthy stress management techniques. Continued efforts should be made to prevent medical conditions as compared to simply managing them in employee populations.

References

- Clarke, Thomas A., Maniscalco, William M., Taylor-Brown, Susan, Roghmann, Klaus J., Shapiro, Donald L. and Hannon-Johnson, Catherine 1984. Job Satisfaction and Stress Among Neonatologists. *Pediatrics*, 74; 52-57.
- Collins, James J., Baase, Catherine M., Sharda, Claire E., Ozminkowski, Ronald J., Nicholson, Sean, Billotti, Gary M., et al. 2005. The Assessment of Chronic Health Conditions on Work Performance, Absence, and Total Economic Impact for Employers. *J Occup Environ Med*, 47; (6) 547-557
10.1097/01.jom.0000166864.58664.29.
http://journals.lww.com/joem/Fulltext/2005/06000/The_Assessment_of_Chronic_Health_Conditions_on.5.aspx
- Darr, Wendy and Johns, Gary 2008. Work strain, health, and absenteeism: A meta-analysis. *Journal of Occupational Health Psychology*, 13(4) 293-318.
<http://search.ebscohost.com/login.aspx?direct=true&db=pdh&AN=ocp-13-4-293&site=ehost-live>
- De Boer, Elpine M., Bakker, Arnold B., Syroit, Jef E. and Schaufeli, Wilmar B. 2002. Unfairness at work as a predictor of absenteeism. *J Org Behav*, 23(2) 181-197.
<http://search.proquest.com/docview/224867921?accountid=14667>
- Fox, Kenneth R 1999. The influence of physical activity on mental well-being. *Public Health Nutrition*, 2(Supplement 3a) 411-418.
<http://dx.doi.org/10.1017/S1368980099000567>
- Godin, Isabelle and Kittel, France 2004. Differential economic stability and psychosocial stress at work: associations with psychosomatic complaints and absenteeism. *Social Science & Medicine*, 58(8) 1543-1553.
<http://www.sciencedirect.com/science/article/pii/S0277953603003459>
- Groves, Robert M, Kalton, Graham, Rao, J. N. K, Schwarz, Norbert and Skinner, Christopher (eds.) 2009. *Survey Methodology*, Hoboken, NJ: John Wiley & Sons.
- Kashefi, Max 2009. Job Satisfaction and/or Job Stress: The Psychological Consequences of Working in 'High Performance Work Organizations'. *Current Sociology*, 57 (6) 809-828. <http://csi.sagepub.com/content/57/6/809.abstract>
- Lapane, Kate L. and Hughes, Carmel M. 2006. Job satisfaction and stress among pharmacists in the long-term care sector. *The Consultant Pharmacist*, 21(4) 287-292.
- Loeppke, Ronald, Taitel, Michael, Haufle, Vince, Parry, Thomas, Kessler, Ronald C. and Jinnett, Kimberly 2009. Health and productivity as a business strategy: A multiemployer study. *JOccupEnvironMed*, 51(4) 411-428.
- Paluska, Scott A. and Schwenk, Thomas L. 2000. Physical Activity and Mental Health: Current Concepts. *Sports Medicine*, 29(3) 167-180.
http://adisonline.com/sportsmedicine/Fulltext/2000/29030/Physical_Activity_and_Mental_Health_Current.3.aspx
- Peter, Richard and Siegrist, Johannes 1997. Chronic work stress, sickness absence, and hypertension in middle managers: General or specific sociological explanations? *Social Science & Medicine*, 45(7) 1111-1120.
<http://www.sciencedirect.com/science/article/pii/S0277953697000397>

- Shields, Margot 2004. Stress, health and the benefit of social support. *Health Reports (Statistics Canada, Catalogue 82-003)*, 15(1) 9-38
<http://publications.gc.ca/collections/Collection-R/Statcan/82-003-XIE/0010382-003-XIE.pdf>.
- Taylor, A. H. 2001. Physical activity, anxiety, and stress. *In: Biddle, S., Fox, K. R. & Boutcher, S. H. (eds.) Physical activity and psychological well-being*. London: Routledge.
- VanWormer, Jeffrey J., Fyfe-Johnson, Amber L., Boucher, Jackie L., Johnson, Pamela Jo, Britt, Heather R., Thygeson, N. Marcus, et al. 2011. Stress and Workplace Productivity Loss in the Heart of New Ulm Project. *J Occup Environ Med*, 53(10) 1106-1109 10.1097/JOM.0b013e318229ab18.
http://journals.lww.com/joem/Fulltext/2011/10000/Stress_and_Workplace_Productivity_Loss_in_the.3.aspx
- Wang, Philip S., Beck, Arne, Berglund, Patricia, Leutzinger, Joseph A., Pronk, Nico, Richling, Dennis, et al. 2003. Chronic Medical Conditions and Work Performance in the Health and Work Performance Questionnaire Calibration Surveys. *J Occup Environ Med*, 45(12) 1303-1311.
- Yen, Louis, Edington, Dee W. and Witting, Pamela 1992. Prediction of prospective medical claims and absenteeism costs for 1284 hourly workers from a manufacturing company. *J Occup Med*, 34(4) 428-435.