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FROM THE EDITOR

# Presenteeism and Wellbeing: Two Keys to Unlocking the Full Human Capital Value of Employee Health

This expanded issue of the *Journal of Health & Productivity* includes two very different articles about two very different concepts that have one very big thing in common – a vital part in understanding and demonstrating the full value of employee health as a human capital asset.

*Health and Productivity Management Strategy Concept Paper: A Proposed Equation for Presenteeism* by a multidisciplinary team from Saudi Aramco uses a six-year study of that company’s Wellcare Program – a systematic workplace wellness program – to measure cost avoidance through risk migration between program participants’ entry and exit points to posit an equation that translates those avoided costs into potential presenteeism savings.

Readers of the *JHP* will be familiar with the history of presenteeism – the calculated loss of productive capacity resulting from functional impairment related to chronic health problems – such as pain, depression or respiratory disorders. From nearly universal skepticism about the validity of self-reported information from psychometrically designed survey tools 15 years ago, we have moved to broader acceptance of such measures as a way of trying to capture what everyone knows intuitively is the large productivity loss in the workplace every day from a wide range of health-related issues.

Nonetheless, these measures based on self-reported information still are “soft” in the minds of more than a few corporate number-crunchers. The presenteeism equation presented in the article by Horseman, Al Dhubaib and colleagues is intended as a first step in improving the current methodology of measuring presenteeism, with more work to follow in testing the predictive value of this equation.

The article by Jones, Brown and Minami points the way to what the authors intend to be the next frontier of health and productivity – the emerging domain of “wellbeing.” In this article *Wellbeing: A Critical Health Domain* they focus on the positive side of mental health – the antipode of depression, anxiety, et. al. – and on concepts such as happiness and a sense of achievement.

Beginning with the WHO (World Health Organization) definition of “Health is a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity,” the authors recognize the need for a more actuarial approach to measure the range of wellbeing. This puts them in league with Horseman and colleagues in pushing measurement to give us a larger and “harder” sense of how much more effective and productive “healthier” people can be.

Their article presents a new research program designed to develop reliable tools for measuring wellbeing and distress, and better understanding how they relate to measures of workplace productivity. The productivity “downside” of depression and anxiety has been well established; this research program aims to investigate the “upside” of wellbeing as a predictor of better productivity.



Readers of the *JHP* will be familiar with the history of presenteeism – the calculated loss of productive capacity resulting from functional impairment related to chronic health problems – such as pain, depression or respiratory disorders.

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# Wellbeing: A Critical Health Domain

Ed Jones, Ph.D., Jeb Brown, Ph.D., Takuya Minami, Ph.D.

## ABSTRACT

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People worldwide are focused on health. Companies and countries are focused on health. In particular, mental illnesses have gained notoriety based on celebrity confessions, infamous murders, suicides, and drug overdoses. Depression has gained increasing attention in the past decade. The World Health Organization reports on its website that depression is the leading cause of disability worldwide, impacting more than 350 million people of all ages. Recently, however, a new concept focusing on the positive side of mental health is gaining attention. Unlike mental illnesses such as depression and anxiety, researchers have started focusing on concepts such as happiness and sense of achievement. The positive side of mental health is being termed as wellbeing.

### I. The Emergence of Wellbeing as a Key Health Concept

You might immediately wonder how wellbeing is defined. A journal dedicated to this concept, *International Journal of Wellbeing*, illustrates the lack of consensus even among researchers: “The question of how wellbeing should be defined (or spelt) still remains largely unresolved.”<sup>1</sup> However, three independent tributaries have come together in recent years to create this powerful current.

## INTRODUCTION

---

### **MORE THAN THE ABSENCE OF DISEASE**

Interestingly, the earliest expression of this concept dates back to 1946 with the founding of the World Health Organization. The preamble to its constitution includes this statement: “Health is a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity<sup>2</sup>”, WHO has not amended this definition of health and it remains as a broad conceptualization encompassing three dimensions of wellbeing.

One might wonder if the definition is so aspirational that only a few fortunate people ever achieve this state of mental health at any particular point in time. Clearly a somewhat more actuarial approach is needed to measure the range of wellbeing.

The important point is that wellbeing and illness are not simply two ends on the same spectrum. The idea is that we want more than the absence of illness or disease in our lives. We want something distinctly positive; the implication is that our societies should be structured to promote this state of being. While it is conceptually a powerful distinction, it must be acknowledged that it has yet to be demonstrated that the differentiation is of empirical importance.

This article presents a new research program intended to develop sophisticated tools for measurement of the constructs of wellbeing and distress, and to further understand how these constructs might also relate to various measures of workplace productivity. It has been well established that illnesses,

such as depression and anxiety, result in significantly reduced productivity in the workplace. This research program proposes to further this understanding by investigating the extent that measures of wellbeing might also prove to be powerful predictors of productivity.

### SUBJECTIVE WELLBEING OR HAPPINESS

There is a body of research in psychology that emerged largely in the 1970s focused on wellbeing. In the earlier years, psychologists often conceptualized wellbeing as synonymous with happiness. However, as Shigehiro Oishi states in his 2012 book, *The Psychological Wealth of Nations: Do Happy People Make a Happy Society*<sup>3</sup>, psychologists prefer the term wellbeing in order to differentiate it from the common conception of happiness as “a temporary mood state.” He summarizes the conclusions of this literature on the components of wellbeing in this way:

The cognitive component of subjective wellbeing is often represented by life satisfaction, or how well people think their lives are going. The affective component of subjective wellbeing is represented by positive and negative affect—how often people feel happiness, sadness, and other emotions in their daily lives.

Oishi also notes that psychologists agree on how to measure wellbeing, namely, through the use of self-report questionnaires. Of course, many such tools have been used through the years and there is no single questionnaire that is embraced by all psychologists.

In recent years, wellbeing has been embraced by public policy experts as an important health concept. For example, the Centers for Disease Control and Prevention have posted an article on their website at <http://www.cdc.gov/hrqol/wellbeing.htm> which asserts that wellbeing is an important measure for public health:

Wellbeing is associated with numerous health, job, family, and economically-related benefits. For example, higher levels of wellbeing are associated with decreased risk of disease, illness, and injury; better immune functioning; speedier recovery; and increased longevity. Individuals with high levels of wellbeing are more productive at work and are

more likely to contribute to their communities.

### THE GLOBAL PURSUIT OF HAPPINESS

Wellbeing as an idea has gained global momentum both as a research agenda and as a health improvement agenda. In order to understand the global and cultural dimensions of this health concept, it is best to start with the work of Ed Diener, the psychologist who has pioneered this research over the past three decades. He critiqued subjective wellbeing scales as far back as 1984<sup>4</sup>, and with William Tov, another significant thinker in this domain, analyzed the impact of culture on wellbeing. Tov and Diener argued that “some types of wellbeing, as well as their causes, are consistent across cultures, whereas there are also unique patterns of wellbeing in societies that are not compatible across cultures. Thus, wellbeing can be understood to some degree in universal terms, but must also be understood within the framework of each culture<sup>5</sup>”.

If there is any doubt that wellbeing has a global research base, then it is not necessary to look beyond the World Database of Happiness collected by Veenhoven<sup>6</sup> for wellbeing scores for over 160 societies based on survey studies from 1946 to the present. While this work may be faulted since many of the measures include only one item reflecting wellbeing, the enormity of the undertaking cannot be underestimated. Indeed, the work advances our understanding of the fact that “the ‘happiest’ nation in a cognitive sense may not necessarily be the happiest nation in terms of emotional experiences, and vice versa<sup>7</sup>”.

Global interest in wellbeing is evident from this research activity, but even more pervasive has been the expansion of employee assistance programs (EAP) around the world. EAPs began in North America in the 1970s and then expanded to the UK, Ireland, and Australia. The early discussion of global employee assistance outside these countries meant the provision of counseling and other support services almost exclusively for expatriates. However, in the past five to ten years, the focus has shifted dramatically to including local employees in much greater numbers. The challenge has been how to offer such services in a culturally sensitive way. In

many instances it is culturally insensitive to suggest that people need “assistance” or need to address “stress,” and so efforts to increase wellbeing and happiness have been found to be more resonant with cultural norms in many countries.

#### **PATHWAYS TO WELLBEING**

If we take the thinking of the WHO, research psychologists, and EAP clinicians as promoting the importance of wellbeing in complementary ways, we still have not answered the question of whether and how people can increase their wellbeing. Wellbeing is a construct comprised of different elements, as was described earlier in the work of researchers who identified life satisfaction and positive emotion as critical components. This has been a key focus of popular books published in the past few years by prominent researchers.

Tom Rath and Jim Harter published *Wellbeing: The Five Essential Elements in 2010*.<sup>8</sup> They offer a holistic view of what contributes to wellbeing over the course of a lifetime based on research completed at Gallup, Inc. Harter is the Chief Scientist for Workplace Management and Wellbeing at Gallup. They identify five universal elements comprising wellbeing: career wellbeing, social wellbeing, financial wellbeing, physical wellbeing, and community wellbeing. These straightforward areas of focus offer a practical roadmap for building wellbeing.

A more psychologically-based model is offered by Martin Seligman, Ph.D., who is the recognized leader for the past two decades in the research and theory of positive psychology. His 2011 book, *Flourish: A Visionary New Understanding of Happiness and Wellbeing*,<sup>9</sup> entails a major reformulation of positive psychology. He argues that “the topic of positive psychology is wellbeing” and furthermore, that “the gold standard for measuring wellbeing is flourishing”. He goes on to say that wellbeing is a construct with several measurable elements, “each a real thing, each contributing to wellbeing, but none defining wellbeing”.

Seligman offers five measurable elements of wellbeing, notably positive emotion (of which happiness and life satisfaction are all aspects), engagement, relationships, meaning, and achievement. These elements of

wellbeing that he identified overlap with those studied by other research psychologists, but extend beyond those as well. He has much to say about each of these areas, but perhaps more importantly, he has developed very specific techniques for helping people improve these elements of their lives, or in other terms, flourish. Specifically, he led the development of the Penn Resiliency Program as a means of teaching wellbeing in schools, and he developed Master Resilience Training with the U.S. Army.

As would be expected, Dr. Seligman has conducted research on the impact of his programs and the results are encouraging. However, it seems clear that there are many pathways to enhancing the components of wellbeing. People who complete a variety of psychotherapy and counseling services report improvement in positive emotion and relationships, and any number of interventions can help people achieve more. The thrust of Dr. Seligman’s work in positive psychology is that “positive mental health is not just the absence of mental illness,” and so “being in a state of mental health is not merely being disorder free; rather it is the presence of flourishing”. This certainly resonates with the constitution of the WHO, and it is a strong antidote to professionals who promote mental health services that focus exclusively on problems and disorders.

#### **II. THE MEASUREMENT OF WELLBEING**

One of the most critical yet unresolved issues is measuring wellbeing effectively, using reliable, valid, and preferably brief tools. Such an attempt by seven of the leading researchers in the wellbeing arena is illustrated in a 2009 article,<sup>10</sup> which offers two new measures that were tested with 689 college students. The new measures were an attempt to improve on the previous approaches to wellbeing. Notably, they separated the questionnaire into two scales: one to measure the construct of “Flourishing” and a second Scale of Positive and Negative Experience (SPANE). The 12-item SPANE scale includes six items to assess positive feelings and six items to assess negative feelings.

This is a worthwhile effort to refine a measurement approach, but the authors in this case were constrained by a relatively small sample size of college students. This sample



was too small and heterogeneous to permit a thorough investigation of the underlying psychometric constructs. In other words, in what ways does a measure of “Flourishing” converge or diverge from measures of positive or negative feelings/experiences? Are these in fact real and separate measurement constructs, or are the correlations among these items so high that they are best treated as a single construct?

Fortunately, over the course of several decades similar measures have been used for psychotherapy outcome research with hundreds of thousands of adults with diverse backgrounds. To take advantage of this rich source of data, the Institute for Health and Productivity Management has developed a global program focused on wellbeing in collaboration with Jeb Brown, Ph.D., Center for Clinical Informatics, and Takuya Minami, Ph.D., University of Massachusetts Boston.

Drs. Brown and Minami maintain a large database known as the ACORN data repository. ACORN is an acronym standing for A Collaborative Outcomes Resource Network. The repository contains data collected by thousands of mental health practitioners using a variety of questionnaires. The repository is one of the largest databases of its kind in the world, containing over 1.5 million records of completed questionnaires.

Under this new initiative, Drs. Brown and Minami are pursuing a research program that includes highly sophisticated measures of wellbeing. At the core of this program is a self-report questionnaire of wellbeing which not only builds on prior wellbeing research, but also takes advantage of a large database of well-validated questionnaires used in the measurement of outcomes for psychological distress and substance abuse treatment.

The new Wellbeing Questionnaire will enable employers (including both private and public employers) to assess the state of wellbeing of their workforce, identify sub-populations needing further attention, and implement a range of interventions recommended based on the results, taking into consideration regional and cultural issues. Because of the sophisticated questionnaire development methodology, employers can be assured that the measure embodies exceptionally strong psychometric properties, while retaining the flexibility to adjust the measure to fit the

needs of specific cultures, language groups, or other populations of interest.

In reviewing the literature on existing wellbeing measures, it becomes readily apparent that the item content of these measures was chosen to fit the conceptual framework used to describe wellbeing. However, it is important to understand that using items with high face validity for the concept being measured does not necessarily translate into robust construct validity. Only when the items are subjected to extensive analyses employing large and diverse samples can validity be better understood.

Decades of research on treatment outcomes for depression, anxiety disorders, and related mental health problems can provide substantial guidance in this area. A number of highly reliable and valid questionnaires are in widespread use, providing a rich data set to explore the underlying psychometric constructs of the measure. When reviewing results from multiple factor analyses across many different outcome questionnaires, it becomes apparent that virtually all of the items are loading a common factor, generally referred to as “global distress.”<sup>11,12</sup> Questionnaires or subscales for depression, anxiety, social isolation/conflict, and impaired functioning/productivity do not emerge as discrete factors. The items from these various clinical domains all tend to correlate highly with the global factor, and so from a purely psychometric point of view, they all belong on a single scale.

While these outcome questionnaires tend to measure symptoms of mental illness (e.g., depression, anxiety) some items are worded in a positive manner. For example, “How often do you have a good level of energy,” and “How often do you have little or no energy,” are statements that function as essentially mirrors of one another. If they are scored so that a higher score always means more sadness/less happiness, then the results of the two items look virtually identical and load heavily on the global distress factor.

Other ACORN data repository examples of mirror items showing similar psychometric properties and strong loading on the global distress factor include: sadness/positive mood; problems with sleep/right amount of sleep; trouble trusting others/trust a friend; feel worthless/feel good about

yourself; and problem achieving goals/making progress towards goals.

If the positive feeling items and negative feeling items were truly measuring different constructs, then a factor analysis on a large heterogeneous sample would find separate factors for distress and wellbeing, with the two being largely uncorrelated. In the case of these examples, this is clearly not true. Whether a scale including these pairs of items is labeled Global Distress or Wellbeing makes no difference from a measurement point of view.

A large body of research has demonstrated a strong correlation between reduced workplace productivity and symptoms of depression, anxiety, and other aspects of global distress.<sup>13,14,15,16</sup> This in-and-of-itself might be an argument to include at least some items to measure these symptoms within a wellbeing questionnaire. It seems quite plausible that items inquiring positively about wellbeing would exhibit similar correlations to workplace productivity. This question, which has not in the past been fully investigated, is the primary undertaking of the current collaboration between IHPM and Center for Clinical Informatics.

Another consideration when evaluating questionnaire items is the ease by which they translate to different languages and cultures. Many of the items in the ACORN inventory have been translated into multiple languages, including Korean, Chinese, and Japanese. While most items translate without difficulty, some items prove more challenging due to cultural differences in definitions of socially defined concepts such as a successful life, virtue, and even happiness. As a rule, items inquiring about specific concrete symptoms (e.g., sleep, pain, anxiety, and depression) translate more readily. This is another reason that negative symptoms should be incorporated into a questionnaire that aims to be cross-culturally sound.

### III. IHPM WELLBEING QUESTIONNAIRE

The new IHPM Wellbeing Questionnaire was developed taking all of these considerations into account. The measure is designed to provide a brief but highly reliable and valid measure of quality of life and overall wellbeing. The Wellbeing Questionnaire is named as such because responses to its items

make sense to a layperson as reflecting a person's sense of wellbeing.

This questionnaire fills a gap in existing measures of wellbeing and symptoms in that it provides a balance of both positive and negative emotional states along with other indicators of quality of life, including workplace productivity. The large sample size used in the development of the questionnaire, along with the continued research program to collect a large and diverse normative sample, assures that the underlying measurement construct is well understood and consistent.

Items were selected based both on their known psychometric properties, as well as face validity, meaning that similar items appear on other recognized measures of Wellbeing and Global Distress. When possible, items were also selected based on known correlations to self-reported productivity in the workplace.

The Wellbeing Questionnaire was developed using data from the ACORN data repository, which includes questionnaires completed by over 300,000 adults receiving psychotherapy. A great advantage of this scale is that it is comprised of items reflecting both clinical symptoms and emotional wellbeing. The items have been well tested in both clinical samples (i.e., individuals seeking mental health services) and non-clinical samples drawn from the workplace and community. With the exception of four new items included in the questionnaire, the normative sample sizes for the ACORN items included in the questionnaire ranges from just over 600 records to well over 50,000 records (most common). In other words, the psychometric properties of almost all of the items in the new questionnaire are already well understood.

Due to the inclusion of items known to work well in clinical populations, the questionnaire is both a measure of overall wellbeing and a tool that can be readily utilized to identify individuals who are likely to benefit from therapy, EAP services, or other forms of increased psychological support. Individuals who receive the necessary psychological services are highly likely to report significant improvements in workplace productivity.

The Wellbeing Questionnaire consists of 21 items. Seventeen of the items have already been used in clinical settings, and

questionnaires based on these items have shown high reliability, validity, and sensitivity to change over time (as measured by repeated assessments during the course of therapy).

New normative data, separately from the thousands already collected, are currently being collected on all 21 items from workplace and community samples. At the time this article went to press (September 2013), the new normative sample size was 478 adults between the ages of 18 and 90, with 80 percent between 24 and 54. Eighty one percent were employed, eight percent unemployed, five percent homemakers, and five percent students. The sample size continues to increase rapidly.

The 21 items cover five main domains drawn from the literature on wellbeing and quality of life. These are: Flourishing; Mental/Physical Health; Life Satisfaction; Productivity; and Substance Abuse. The item analyses performed to date indicate that these domains are all highly correlated and can be probably be treated as part of a single Wellbeing/Quality of Life scale.

As sample sizes increase, further research may reveal a more complex factor structure. We will be able to conduct complex factor analyses on individual items across varied age groups, employment categories, gender, ethnic groups, etc. However, the fact that the scale is currently loading onto a single factor is consistent with the body of empirical literature in psychology.

The items on the questionnaire are presented in a well-tested format, known to produce results with excellent psychometric properties. The questionnaire utilizes a five-point Likert-type scale, in which respondents are asked to rate how often in the past two weeks they have had certain experiences. Possible responses are: Never; Rarely; Sometimes; Often; and Very Often. The scale is scored simply by adding the value associated with each response. The questionnaire is scored so that high scores represent higher levels of wellbeing/lower level of distress. Specifically, items reflecting positive states are scored as follows: Never = 0; Rarely = 1; Sometimes = 2; Often = 3; Very often = 4. Conversely, negative states are coded as follows: Never = 4; Rarely = 3; Sometimes = 2; Often = 1; Very often = 1.

The reliability of the full 21 items, as assessed by Cronbach's coefficient alpha, is .91. A coefficient alpha of  $>.90$  is considered excellent reliability, suitable for measurement of individuals.

The following list groups the items by domain/subscale, with the observed correlation between each domain and the common factor in parentheses after the domain name.

Items listed by domain (\*placed after items indicate this is one of the four new items):

How often in the last two weeks did you...

**Flourishing ( $r = .88$ )**

- Feel good/positive about yourself?
- Enjoy your leisure time? \*
- Have a good energy level?
- Enjoy spending time with family or friends?
- Enjoy your work and other activities of daily life? \*
- Have the right amount of sleep?

**Mental/Physical Health ( $r = .84$ )**

- Have physical pain or other health problems?
- Worry about a lot of things?
- Feel unhappy or sad?
- Feel nervous or anxious?
- Cut back on activities due to physical or emotional health problems?
- Feel hopeless about the future?
- Feel lonely?

**Quality of Life/Life Satisfaction ( $r = .84$ )**

- Feel fulfilled in life? \*
- Feel happy with your living situation?
- Feel fortunate about your social relationships? \*

**Productivity ( $r = .82$ )**

- Feel unmotivated to do anything?
- Feel unproductive at work or other daily activities?
- Have a hard time paying attention?
- Accomplish most of what you wanted to do?

**Substance Abuse ( $r = .28$ )**

- Have problems at work, school or home due use of drugs or alcohol?

The new Wellbeing Questionnaire is a reliable ( $r = .91$ ) and valid measure of

overall wellbeing, quality of life, and level of psychological distress. All items correlated highly with a common factor, and therefore the measure can be scored as a single scale.

However, subscales can be reported to assist with interpretation based on the needs of the end user. For example, for clinicians working in an EAP setting, the different domains may be useful in planning treatment with their clients.

In clinical settings, reliability of similar Wellbeing/Global Distress questionnaires with at least ten items from the ACORN repository (including items from this new scale) have consistently revealed reliability of .85 or higher (Cronbach's alpha; sample size >300,000 adults). This means briefer versions of the questionnaire may be possible while still retaining high levels of reliability and validity.

Concurrent validity, as measured by correlations between the items in the ACORN repository and other widely used measures such as the PHQ-9 (depression), Beck Depression Inventory, Beck Anxiety Inventory, Outcome Questionnaire-45, and Outcome Rating Scale, is also very strong. Coefficients of correlation (Pearson's *r*) fall in a narrow range around .80. This is further evidence that all of these measures share a common factor.

Careful item selection, based on the psychometric properties of each item, will result in questionnaires with outstanding psychometric performance, well suited for the measurement task in target populations. Criteria for psychometric performance include:

- Reliability of .9 or higher, as measured by Cronbach's coefficient alpha.
- Differential validity: ability to differentiate between different target populations, such as individuals receiving mental health services and individuals in the community who have never sought services
- Construct validity: items are good representations of the underlying construct.
- Concurrent validity: high correlation with other measures assessing the same underlying construct.

### SCORING INSTRUCTIONS

The Wellbeing Scale is scored as the mean of

the non-missing items on that scale. Each Item is scored on a five-point scale ranging from 0 to 4, with higher numbers indicative of a higher frequency of well-being/happiness/life satisfaction and lower frequency of symptoms and negative experiences. Since the scale score is derived by averaging the individual item scores, the full scale and all subscales range from 0 to 4, with 4 reflecting the highest level of wellbeing.

### INTERPRETING SCORES

#### WELLBEING

Wellbeing scores, with a possible range of 0 to 4, are divided into three severity ranges for ease of interpretation.

High wellbeing/normal levels of distress (score range 2.5 to 4):

Approximately 25 percent of an outpatient mental health sample will score in this range at intake. Likewise, approximately 75 percent of a community sample not receiving mental health services will fall in this range.

Low wellbeing/moderate distress (1.5 to 2.4): Approximately 50 percent of an outpatient mental health sample will score in this range at intake, while approximately 20 percent of a community sample will fall in this range.

Very low wellbeing/severe distress (0 to 1.4): Approximately 25 percent of an outpatient mental health sample will score in this range at intake, with fewer than five percent of a community sample in this range.

#### SUBSTANCE ABUSE

The vast majority of people (90 percent) in the community sample scored 4 on this item, while among those receiving psychotherapy >65 percent score 4 on this scale at intake. A score of 2 or lower on this item is clear evidence of a self-reported substance abuse problem.

#### ONGOING RESEARCH AND DEVELOPMENT

The IHPM Wellbeing Questionnaire is a new measure in the sense that these exact 21 items have never been administered together in a single questionnaire. While the overall psychometric properties of the measure is easy to estimate based on the known properties of each item, for the purpose of methodological rigor, IHPM has implemented an ongoing process of research and development

to field test the questionnaire as a whole.

Field testing is proceeding rapidly, and the complete results of these field trials will be presented in a forthcoming article. Continued evaluation of the questionnaire using factor analysis and other methods will further probe the nature of the constructs measured. This work will also permit development of briefer versions of the questionnaire to be used with targeted populations for specific measurement purposes.

It should also be noted that as we continue to accumulate data from different language/cultural groups, it may prove necessary to refine or add items to reflect knowledge gained from cross-cultural comparisons. Continued testing and re-evaluation in real world environments assures that the questionnaire continues to perform as designed.

Most of the questionnaires used among researchers are intended to remain fixed in their item content. This posits a significant issue, as it cannot be tailored to meet the measurement needs of different customers and populations of interest. Ultimately, copyrighted and fixed questionnaires cannot prove as versatile as alternative versions of the IHPM Wellbeing Questionnaire, tailored to specific measurement needs.

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# Health and Productivity Management Strategy Concept Paper: A Proposed Equation for Presenteeism

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**KEYWORDS** Health and Productivity Management (HPM), organizational dimensions, health risk migration, health status, cost avoidance, presenteeism equation®, worksite wellness program.

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## ABSTRACT

**OBJECTIVE:** This paper consists of measuring the impact of the Saudi Aramco Wellcare Program (SAWP) by looking at entry and exit point of participants in the program over a six-year duration and proposes a presenteeism equation® based on this methodology.

**METHODOLOGY:** The SAWP is a systematic corporate healthy human capital investment program delivers online and on-site health improvement and injury prevention resources. Based upon two wellcare cohort studies (n = 1,157) from 2005 to 2011, and (n = 6,366) from 2007 to 2009 investigating the effect the workplace wellness program has in: cost avoidance through disease prevention, reduction of health risks, such as body mass index (BMI), blood pressure (BP), and body fat percentage physical activity levels, stress, smoking, low back pain demonstrated through markov modeling and applying the Health Enhancement Research Organization (HERO) and Mercer Study.

**RESULTS:** Risk migration through cost avoidance equates to a total of 8.9 million dollars. To date, the program has demonstrated a statistically significant positive impact on workforce biometric health behaviors, performance, and improved work factors. These factors are the foundation of the presenteeism equation®. Presenteeism potential savings/year is 3.4 million dollars, which over six years equates to 20.4 million dollars.

**CONCLUSIONS:** The presenteeism equation® is the first step in expanding and improving the current methodology of measuring presenteeism, which today is a series of self-reported questionnaires. Future studies will examine the dynamics of risk migration, and test the predictive value of this equation, in addition to further support the econometric robustness.

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## INTRODUCTION

The Saudi Aramco Wellness Program (SAWP) was founded in 2005, and has grown tremendously to deliver online and on-site health improvement and injury prevention resources and activities company-wide. SAWP offers a variety of physical activity classes, lifestyle wellness coaching courses, health screening clinics, healthy lifestyle modification classes, and injury prevention programs. “Wellness on Wheels” (WOW) clinics ensure that employees in remote locations, such as oil rigs and offshore

facilities, can also take part in wellness activities and health screenings (Horseman et al, 2010; Horseman et al, 2012). The SAWP aligns with industry best practice (Chapman, 2005; Sullivan, 2004) on how to develop a healthy and productive workforce, utilizing virtual and on-site wellness programming. This program promotes a culture of health and wellness throughout the company infrastructure, connected through a technological champion network, ensuring wellness is part of everyday work practice (Horseman, 2012;

Horseman, 2013). Over the years a systematic approach to program design is based upon four key organizational dimensions (Horseman, 2010). These include process, design, policy and culture, seen in figure 1.

### ORGANIZATIONAL DIMENSIONS OF THE SAUDI ARAMCO WELLCARE PROGRAM

**Process:** Onsite and virtual healthy human capital investment process-initiated in 2005

**Design:** Wellness Program Group and multi business line certified champions.

**Policy:** Stand-alone wellness policy for the company GI 150.011.

**Culture of Health:** Community of Practice (CoP) creating and sustaining daily wellcare practices. Within a corporate/work culture sustained through champions across all business lines.

Figure 1: Application of the systems thinking and wellness (Horseman, 2010)

The SAWP, has evolved into a service line called wellcare is founded on the Health and Productivity Management (HPM) model. This model demonstrates the link between management science and medical science and is regarded by experts (Chapman, 2005; Sullivan, 2005; Aldana, 2004; Edington and Burton, 2003) as the gold standard and best practice model. A critical success factor of HPM is the pillar of gaining senior management support. In fact the CEO and President of Saudi Aramco, Mr. Khalid Al Falih, who not only walks and talks wellness, but also challenges us to all realize our inner potential and transform from within. As the company embarks on the Accelerated Transformation Program (ATP) Corporate Strategy for 2020, it is apparent that Saudi Aramco is not only the leader in the Oil and Gas Industry, but also a leader in wellness for their workforce. The below quote supports the work that Saudi Aramco has contributed to the World Economic Forum - workplace wellness alliance:

### METHODOLOGY

This paper introduces the concept of developing a proposed differential equation based on the cohort research methodology (Horseman, et al 2012) through investigating the impact that a workforce wellness program has on factors of: health risk migration

FIGURE 1: Application of systems thinking and wellness (Horseman, 2010)

**Process:** Onsite and virtual healthy human capital investment process initiated in 2005.

**Design:** Wellness Program Group and multi-business line certified champions.

**Policy:** Stand-alone wellness policy for the company GI 150.011

**Culture of Health:** Community of Practice (CoP) creating and sustaining daily wellcare practices. Within a corporate/work culture sustained through champions across all business lines.

*“Today preventing disease is more achievable than ever and our workforce is better educated than ever, yet we remain burdened by preventable disease with the productivity and potential of companies being undermined by the reduced physical capacity of their workforces.*

*At Saudi Aramco, health is a partnership and we encourage our employees to join us in learning about making the right health and wellness choices which will provide the company with a happier, healthier and more fulfilled workforce and our people with the tools to last them and their families a lifetime. Our involvement in the Workplace Wellness Alliance is a part of our commitment to addressing the underlying lifestyle factors that lead to chronic disease. We are proud to have contributed to the growing body of knowledge that will help us tackle these important issues.”*

- Mr. Khalid Al Falih, President and CEO, 2013, Davos.

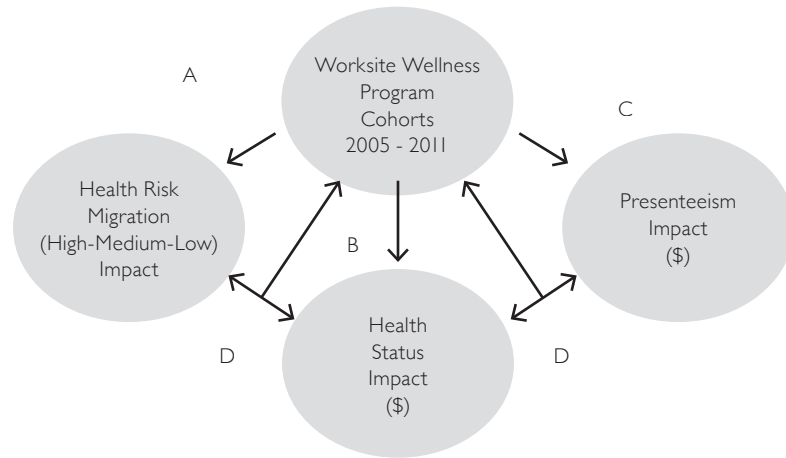
(A), health status (B), and presenteeism (C), as seen in the research map figure 2. A generic research map of the variables describes this clearly:

Figure 2: Relationship between variables

This paper explores the relationship (D) that exists between each factor and the possible synergistic outcome that this manifests. The next chapter will describe the background to the figure 2 research map, and figure 1 organizational dimensions.

This program is integrated into the operational, tactical and strategic levels of the company. Through the application of the organizational dimensions of: process, design, policy and culture, wellness is part of daily work practice (Horseman, 2013). The SAWP has undergone a lean six sigma evaluation, which has led to the current success of transitioning from a program group to a service line for the organization (Horseman

Figure 2: Relationship Between Variables Research Map



et al, 2012). The methodology of this research is based upon the two wellcare cohort studies (n = 1,157) from 2005 to 2011, and (n = 6,366) from 2007 to 2009 investigated the effect the workplace wellness program has in: cost avoidance in disease prevention, in cost avoidance, reduction of health risks, such as body mass index (BMI), blood pressure (BP), and body fat percentage physical activity levels, stress, smoking, low back pain demonstrated through Markov modeling (p < 0.001) (Horseman, et al 2012). In addition to the cost avoidance and physiological improvements, preliminary survey findings indicate that well employees have improved work factors, such as job satisfaction, manage stress more effectively, improved work engagement, and productivity (Horseman, 2013).

**RESULTS**

To date, the program has demonstrated a statistically significant positive impact on workforce biometric health behaviors, performance, and improved work factors. The current methodology of measuring the impact of presenteeism are self-reported questionnaires (Lerner,2012; Kessler, Barber, Beck, and Bergland, 2003; Koopman, Pelletier, Murray, Sharmila, Berger and Turpin, 2002) with some reporting a Cronbach alpha score of > 0.5. In addition, a recent qualitative study (Burgess, 2012) of a random selection of 150 subjects from a

total of 4,560, measuring the impact of the program based on behavior, culture and engagement demonstrated that the likelihood of employees transferring the wellness practices to their families was 66 percent either strongly agreed or agreed (see table 1).

**DISTRIBUTION OF DEMOGRAPHIC VARIABLES AMONGST WELLNESS PARTICIPANTS**

Building on the work of well reputed experts and researchers whom have discovered the link between wellness and cost avoidance (Baiker et al, 2010; Aldana, 2001; Aldana et al, 2004; Chapman, 2005b; Goetzel et al, 2002), health risk migration and health status improvement, (Edington & Burton, 2003; Edington, 2001; Goetzel et al , 2004; Burton et al ; 1999; Reidel & Baase, 2001) and most recently presenteeism – ROI (Boles et al 2004; Aldana et al, 2004; Hemp, 2004; Berry et al, 2010; Chapman, 2005c; Sullivan, 2005). In addition to improved work factors, that has demonstrated improved employee engagement (Dornan, 2010; World Economic Forum, 2008) to the company (66% agreed or strongly agreed). The associations demonstrated that if the participant was aware of (p = 0.001\*\*\*), and linked to a wellness champion (p = 0.000\*\*\*), in the workplace this was more likely to assist in active participation of wellness practices. Conversely, if the employee did not have a wellness champion in their workplace this led



Table 1: Distribution Data of the Population

Demographic Variables	N = 150	
	No.	%
1. Age in years		
a) 20 – 29 yrs	31	20.7
b) 30 – 39 yrs	40	26.7
c) 40 – 49 yrs	37	24.7
d) More than 50 yrs	42	28.0
2. Gender		
a) Male	110	73.3
b) Female	40	26.7
3. Nationality		
a) Saudi	80	53.3
b) US/Canadian	25	16.6
c) UK/Europe	19	12.6
d) Other Arabs	5	3.3
e) Asians	21	14
4. Year joining the wellness program		
a) 2010	83	55.3
b) 2011	35	23.3
c) 2012	32	21.3
5. Company do more engaged		
a) Strongly Agree	47	31.3
b) Agree	52	34.7
c) Undecided	20	13.3
d) Disagree	10	6.7
e) Strongly disagree	3	2.0
Not Answer	18	12.0
6. Know about the wellness champions		
a) Yes	90	60.0
b) No	60	40.0

Table 2: Health Improvements to Participation in the Wellness Program

SA	Agree	Undecided	Disagree	SDA	No Response	Mean	S.D.
11 (7.3)	33 (22.0)	31 (20.7)	3 (2.0)	1 (0.7)	71 (47.3)	3.63	0.82
9 (6.0)	33 (22.0)	32 (21.3)	3 (2.0)	1 (0.7)	72 (48.0)	3.59	0.80
12 (8.0)	26 (17.3)	34 (22.7)	5 (3.3)	1 (0.7)	72 (48.0)	3.55	0.88
24 (16.0)	39 (26.0)	16 (10.7)	1 (0.7)	-	70 (46.7)	4.07	0.74
15 (10.0)	42 (28.0)	20 (13.3)	2 (1.3)	1 (0.7)	70 (46.7)	3.85	0.79
13 (8.7)	42 (28.0)	23 (15.3)	2 (1.3)	-	70 (46.7)	3.82	0.72
7 (4.7)	15 (10.0)	30 (20.0)	8 (5.3)	4 (2.7)	86 (57.3)	3.20	1.01
27 (18.0)	40 (26.7)	13 (8.7)	1 (0.7)	-	69 (46.0)	1.15	0.73
13 (8.7)	31 (20.7)	24 (16.0)	10 (6.7)	2 (1.3)	70 (46.7)	3.54	0.99
14 (9.3)	39 (26.0)	17 (11.3)	7 (4.7)	-	73 (48.7)	3.78	0.85
16 (10.7)	52 (34.7)	11 (7.3)	2 (1.3)	-	69 (46.0)	4.01	0.66
27 (18.0)	50 (33.3)	7 (4.7)	-	-	66 (44.0)	4.24	0.59
20 (13.3)	50 (33.3)	10 (6.7)	4 (2.7)	1 (0.7)	65 (43.3)	3.99	0.81

Table 3: Distribution of Healthy Behaviors brought Home to the Family due to Participation in the Wellness Program

SA	Agree	Undecided	Disagree	SDA	No Response	Mean	S.D.
21 (14.0)	52 (34.7)	7 (4.7)	2 (1.3)	-	68 (45.3)	4.12	0.66
11 (7.3)	16 (10.7)	31 (20.7)	2 (1.3)	5 (3.3)	85 (56.7)	3.40	1.06
20 (13.3)	52 (34.7)	9 (6.0)	3 (2.0)	-	66 (44.0)	4.06	0.70
30 (20.0)	45 (30.0)	6 (4.0)	2 (1.3)	-	67 (44.7)	4.24	0.69
19 (12.7)	47 (31.3)	15 (10.0)	3 (2.0)	-	66 (44.0)	3.98	0.74

Table 4: Association Between Active Participation in the Wellness Program (Q10) and Demographic Variables

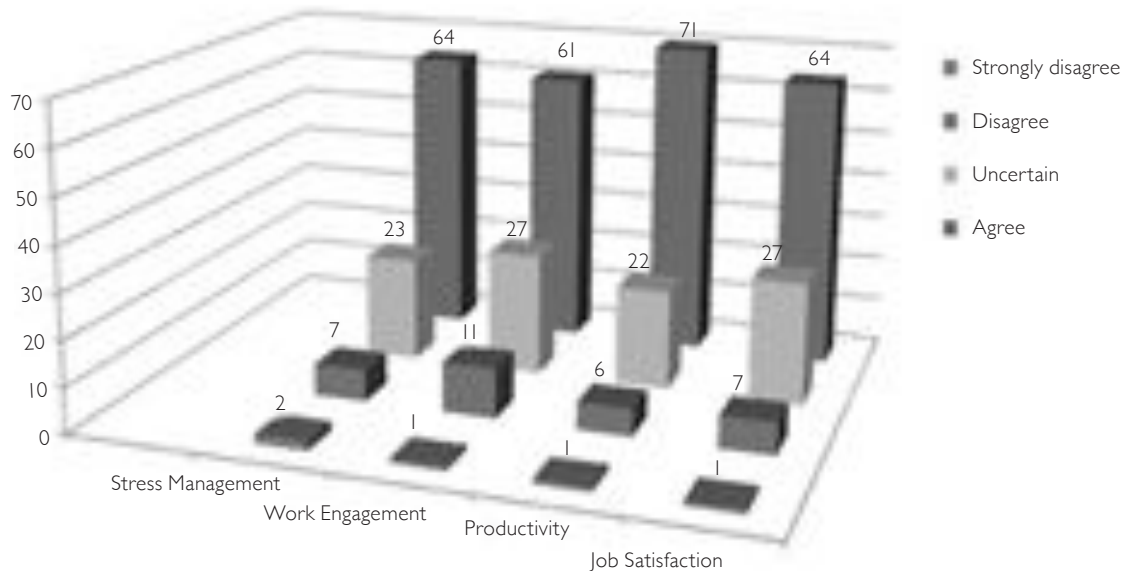
Demographic Variable	Overall Score			F - Test Value and P - Value
	Number	Mean	S.D.	
1. Age in Years				F = 1.620 P = 0.187 (N.S)
a) 20-29 years	31	0.35	0.48	
b) 30-39 years	40	0.58	0.50	
c) 40 – 49 years	37	0.51	0.51	
d) 50 year & above	42	0.60	0.50	
2. Gender				F = 7.332 P = 0.008**
a) Male	110	0.45	0.50	
b) Female	40	0.70	0.46	
3. Nationality				F = 2.95 P = 0.022*
a) Saudi	80	0.41	0.49	
b) US/Canadian	25	0.76	0.43	
c) UK/Europe	19	0.58	0.50	
d) Other Arabs	5	0.80	0.44	
e) Asians	21	0.52	0.51	
4. Year of Joining the Wellness Program.				F = 2.108 P = 0.125 (N.S)
a) 2010	83	0.45	0.50	
b) 2011	35	0.63	0.49	
c) 2012	32	0.59	0.49	
5. Aware of Wellness Champion				F = 12.380 P = 0.001***
a) Yes	90	0.63	0.48	
b) No	60	0.35	0.48	
6. Champion in Department				F = 8.590 P = 0.000 ***
a) Yes	52	0.73	0.44	
b) Unsure	67	0.36	0.48	
c) No	31	0.52	0.50	

Note: \*P<0.05, \*\*P<0.01, \*\*\*P<0.001: Level of Significance; N.S. – Not Significant

to reasons of nonparticipation (p = 0.004\*\*). This strongly supports the corporate culture of the wellness champion model. In relation to health improvements, the more employees actively participate the greater their health

improvements (p = 0.000\*\*) (see table 2). As seen in graph 1, preliminary survey findings indicate that 64 percent of well employees report have improved work factors, such as job satisfaction, 64 percent report that they

## QUALITY OF WORK LIFE FACTORS



The graph demonstrates the effect of the worksite wellness program on quality of work life factors such as stress management, engagement, productivity and job satisfaction (n = 1,157)

manage stress more effectively, 61% report improved work engagement, and 71 percent report improved productivity (Horseman, 2013).

In addition to these recent qualitative findings, a longitudinal cohort study (n = 6,366) was conducted as a “Physical Performance and Health Study” between 2007 and 2009 with the Wellness Program Group. The study involved collecting data through a health risk appraisal (HRA) and physical performance tests with a wellness program. In addition to another longer cohort (n = 1,157) of employees enrolled a corporate wellness program from 2005 to 2011, seen in table 5.

These emerging results support much of what the current literature states, that workplace wellness programs improve workforce health factors, work performance, job satisfaction, work engagement, reduce stress. In addition such programs reduce health costs, reduce presenteeism, and decrease absenteeism. All of these factors have been researched and proven, however what would happen if based on a specific research methodology a differential equation could accurately predict what a workforce would cost a company in relation to presenteeism costs overtime? This paper sets out to answer this equation based

upon the current search map – addressing the (D) relationship between variables.

The research methodology of the cohort studies have led to the significant contributions in the factors in the development of the presenteeism equation<sup>®</sup>. These variables are represented in the figure 2, research map. The authors’ compiled both cohort studies together for the cost avoidance equation (B), in figure 1. The next step is to evaluate the relative health risk transitions (A), in figure 2, which quantifies the health risk migrations, from high, to medium to low categories. This step is to ascertain the healthcare costs saved due to the reduced relative risks and disease prevention. This cost avoidance was calculated by the transitions of risks and identifying out of each risk the actual costs as estimated based upon reducing the risk increase from low risk (0 to 2 health risks) to medium risk (2 to 3 health risks) and from medium risk to high risk (4+ health risks). The application of the markov model was inspired by the well-known gurus in the risk migration field Edington and Burton (2003). The cost avoidance data is based on the excess risk premium cost data applied in health insurance. Insurance premium data

Table 5: Comparative Data Between the Pretest and Post Test of the Workplace Wellness Program

Variables	Pre Test (n = 1,157)		Post Test (n = 1,157)	
	No.	%	No.	%
a. BMI				
1. Low	11	1.0	13	1.1
2. Normal	355	30.7	374	32.3
3. Over weight	486	42.0	535	46.2
4. Obese	283	24.5	223	19.3
5. Severely Obese	22	1.9	12	1.0
b. BMR				
1. Warning	8	0.8	12	1.2
2. Low Energy	84	8.5	89	9.0
3. Below Average	220	22.2	233	23.6
4. Average energy	374	37.8	371	37.5
5. High Energy	302	30.5	284	28.7
6. Extreme Energy	0	0.0	0	0.0
c. FAT				
1. Essential Fat	1	0.1	2	0.2
2. Athlete Level	40	4.7	46	5.4
3. Optimal Level	221	26.2	220	26.0
4. Moderate Excess of fat	477	56.4	469	55.5
5. Maximum excess of fat	106	12.5	108	12.8
d. BLOOD PRESSURE				
1. Low BP	88	9.2	109	11.4
2. Normal BP	589	61.5	736	76.9
3. High BP	280	29.3	112	11.7
e. Active Level				
1. Standard	1,125	97.3	1,118	96.6
2. Athletic	26	2.2	34	2.9

Table 6: Normative variables of Pretest and Post Test – Statistically Significant Findings Post Intervention

Variables	Mean Value		P - values
	Pretest	Post Test	
Weight	80.07	77.91	P = 0.000***
BMI	27.52	26.91	P = 0.000***
BMR	1,995.17	1,785.83	P = 0.000***
Fat %	25.88	25.51	P = 0.002**
Fat Mass	21.31	20.81	P = 0.002**
FFM Kg	58.56	57.74	P = 0.000***
Systolic BP	130.12	124.17	P = 0.000***
Diastolic BP	77.29	74.88	P = 0.001***

Note: \*\* - P<0.01, \*\*\* - P<0.001 Level of Significance, N.S. – Not Significant

are available through the Mercer Employer Health Surveys. The econometric assumptions are that health costs associated with health risk factors would experience the

same rates of increase that all costs encounter. That for each “high risk” employee migrating to “low risk” status the most recent value in the premium data table is the estimated expense based on U.S. national data. How the excess premium data is applied to health and productivity research is that if researchers know the numbers of individuals/population group that have reduced health risks and which health risk factor is reduced the actual cost avoidance in health claims costs can be estimated. This work is founded from the Health Enhancement Research Organization (HERO) study, which facilitated the creation of a large retrospective multi-employer wellness research database (Goetzel et al, 1998).

The critical research imperative of the database was the ability to examine the impact of risk factors, risk factor combinations and risk factor change on individual medical expenditures. The database consists of 47,500 employee entries and the methodology involved connecting the health risk appraisal data set with medical claims data set along the eligibility data set. The merging of these data sets yielded 113,963 person years’ experience. To demonstrate the value of this HERO database the previous largest research database of its kind is the Control Data – Milliman Robertson database, which includes 13,000 study subjects and provides approximately 40,000 person years’ experience.

In figures 3 and 4 the two cohorts demonstrate risk factors, medical claim cost, risk migration, medical cost avoidance.

Figures 5 and 6 demonstrate the migration of risks. A shifting from high, to medium, to low risks categories of the two cohort groups total workforce population,(n = 7,523).

Having established a greater understanding and the methodology involved in calculating the (A) relationship of the research map as seen in figure 2. The next step is calculate the total medical cost avoidance (B). Understanding the total medical cost avoidance \$8,874,277 dollars (the total of figure 3 and 4 combined) for a total of 7,523 employees (combining both cohorts 1157 + 6366) figure 5 and 6, provides an opportunity to apply the productivity loss costs (Edington, 2009) as a ratio per 1,000 FTE as seen in figure 7.

Figure 3: Hero Cost Avoidance Data

Calculations					
Risk Factor	Medical Claim Cost	Risk Migration (#'s)	Medical Cost Avoidance (n = 1,157)	Total \$'s Saved Risk Factor (6.4%)	Grand Total
BMI >30* >25*	\$1,616	100 70	\$161,600 \$113,120	\$274,720 (\$17,581)	\$292,301
Blood Pressure HTN	\$950	168	\$159,600	\$159,600 (\$10,214)	\$169,814
Musculoskeletal Low Back Pain* Shoulder Pain*	\$2,533 \$1,870	90 58	\$227,970 \$108,460	\$336,430 (\$21,531)	\$357,961
Physical Activity*	\$961	1,118	\$1,074,398	\$1,074,398 (\$68,761)	\$1,143,129
Stress*	\$1,718	833	\$1,431,162	\$1,431,162 (\$91,594)	\$1,522,756
					<b>\$3,485,961</b>

P <0.001 Level of Significance, Chapman 2010 - Updated HERO Study

Reference & notes: Tsai, A.G., et al. Direct Medical Cost of Obesity in the USA Obesity Reviews, online January 6, 2009.

HERO Study: Goetzel et al (2006). Mercer Employer Health Surveys, available for purchase <http://www.mercer.com> - updated HERO

Excess Risk Premium Cost Data: 2009 mercer percent Growth = 6.4% Econtech - Medibank Study 2009

Figure 4: Hero Cost Avoidance Data

Calculations					
Risk Factor	Medical Claim Cost	Risk Migration (#'s)	Medical Cost Avoidance (n = 6,366)	Total \$'s Saved Risk Factor (6.4%)	Grand Total
BMI >25	\$1,616	825	\$1,333,200	\$1,333,200 (\$85,325)	\$1,418,525
Blood Pressure Pre HTN HTN	\$876 \$950	254 509	\$222,504 \$483,550	\$706,054 (\$45,187)	\$751,241
Physical Activity	\$961	1,814	\$1,743,254	\$1,743,254 (\$111,568)	\$1,854,822
Tobacco	\$965	63	\$60,795	\$60,795 (\$3,890)	\$64,685
Low Back Pain	\$2,533	482	\$1,220,906	\$1,220,906 (\$78,137)	\$1,299,043
					<b>\$5,388,316</b>

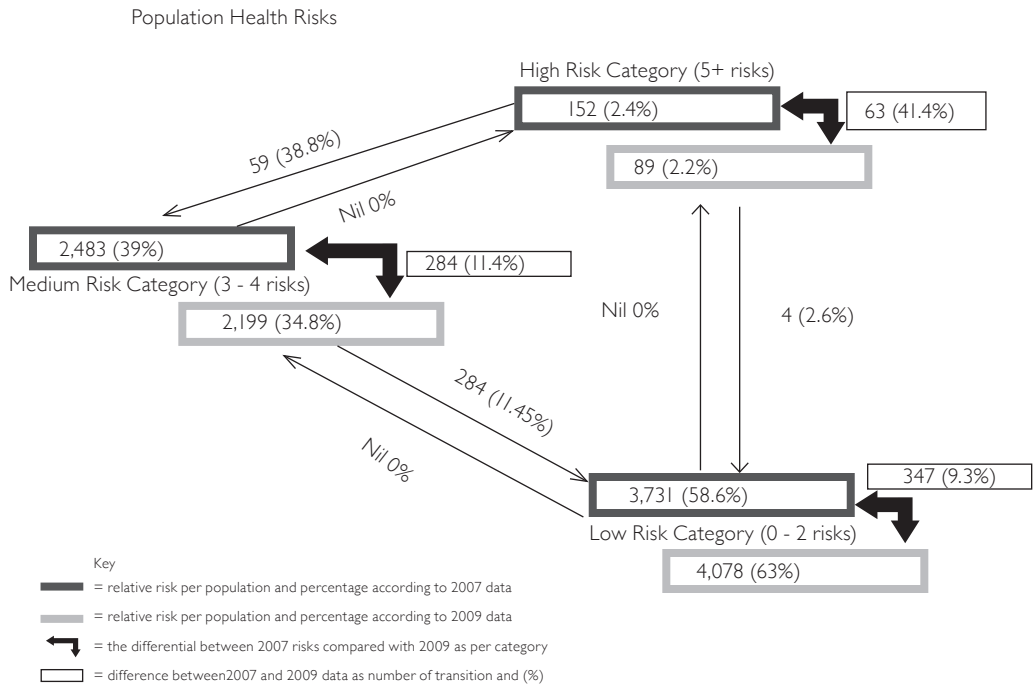
P <0.001 Level of Significance, Chapman 2010 - Updated HERO Study

Reference & notes: Tsai, A.G., et al. Direct Medical Cost of Obesity in the USA Obesity Reviews, online January 6, 2009.

HERO Study: Goetzel et al (2006). Mercer Employer Health Surveys, available for purchase <http://www.mercer.com> - updated HERO

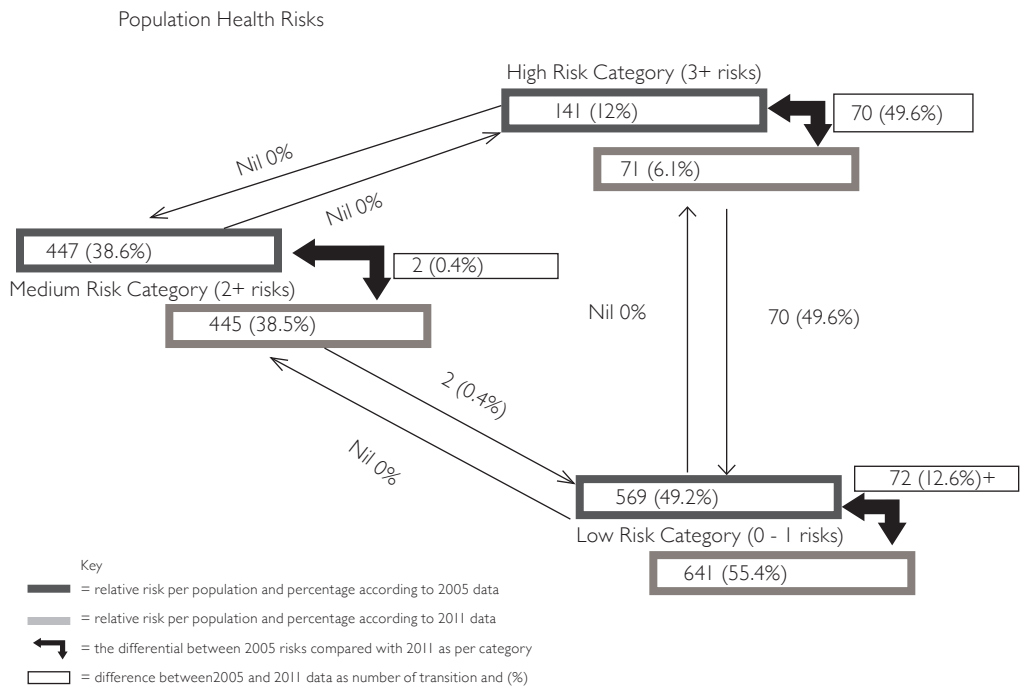
Excess Risk Premium Cost Data: 2009 mercer percent Growth = 6.4%

Figure 5: Population Health Risk Migrations: Markov Modeling



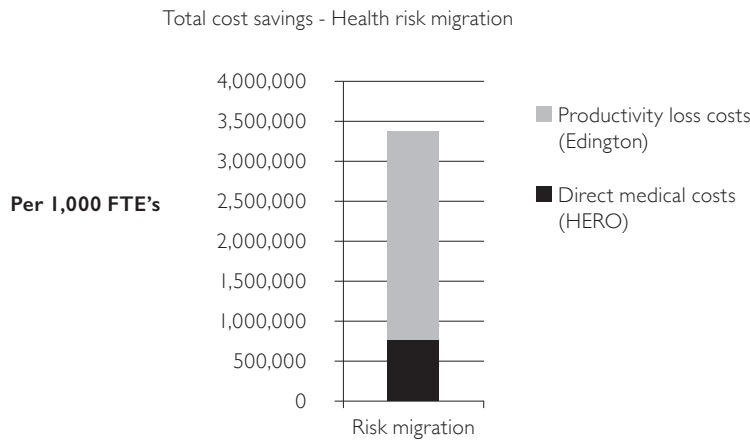
Health risks migration - reduction of relative risks from 2007 to 2009, of a population group of 6,366  
Modified from Edington (2009), AJHP 15 95:341 - 349, 2001

Figure 6: Population Health Risk Migrations: Markov Modeling



Health risks migration - reduction of relative risks from 2005 to 2011, of a population group of 1,157  
Edington (2009)

Figure 7: Calculating the productivity lost due to poor health as factored for 1,000 FTEs.

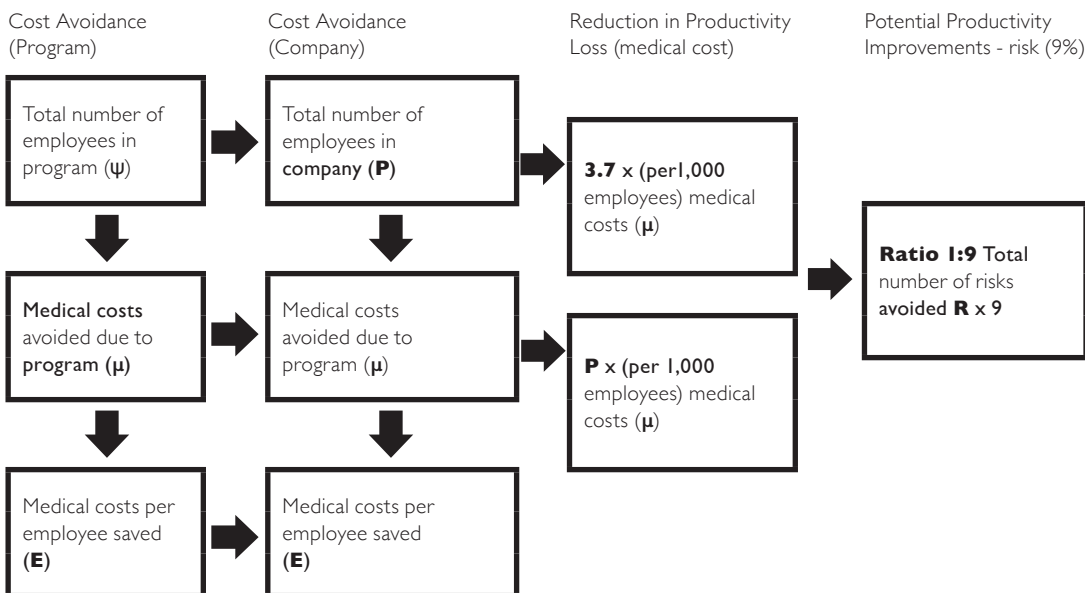


This was in fact the turning point of the research. Based upon this research and the econometric assumptions mentioned above the authors proposes a new equation for companies to assist in calculating reduced presenteeism within organizations, as seen in figure 8 below.

The equation derived below is applicable if the total population  $\psi$ , total risk avoidance  $R$ , medical costs avoided from the HERO

database  $\mu$  are known in alignment with Edington's (2009) econometric assumptions (Figure 7). This normalized equation is seen presented below so that organizations could calculate annual reduced presenteeism due to an onsite wellness intervention for their respective organizations. Through applying factor analysis the following steps outline the methodology of the presenteeism algorithm, as seen in figure 8. This is an

Figure 8: An Econometrically Sound Algorithm for Presenteeism



Program Presenteeism Equation® (based upon the econometric assumptions)

Figure 9: Four Steps in Developing the Presenteeism Equation® Based upon the Figure 2 Research Map

Step 1: Normalization of the two cohort data  
 Step 2: Calculate the average risks avoided per employee per year  
 Step 3: Calculate average medical costs avoided per year (direct)  
 Step 4: Calculate indirect costs avoided per year (indirect)

Step 1: Normalization of the two cohort data populations

**Population 1:**

$$\frac{\Delta P_H \cdot R_H + \Delta P_M \cdot R_M + \Delta P_L \cdot R_L}{\Delta t} \quad (\text{Equation 1})$$

Where  $\Delta t$  is the number of years between the start and end of the study,  $R_L$ ,  $R_M$ , and  $R_H$ , are the average number of risks associated with the low, medium and high risk populations respectively, and  $\Delta P_L$ ,  $\Delta P_M$ , and  $\Delta P_H$  are the percent of population migrations occurring in the low, medium, and high risk categories respectively.

$$\frac{[2.4-2.2] \cdot R_H + [39.0-34.8] \cdot R_M + [58.6-63.0] \cdot R_L}{2} \quad (\text{Equation 2})$$

$$.1 \times 5 + 2.1 \times 3.5 + (-2.2) \times 1 \quad (\text{Equation 3})$$

**Population 2:**

$$\frac{\Delta P_H \cdot R_H + \Delta P_M \cdot R_M + \Delta P_L \cdot R_L}{\Delta t} \quad (\text{Equation 4})$$

$$\frac{[12.0-6.1] \cdot R_H + [38.6-38.5] \cdot R_M + [49.2-55.4] \cdot R_L}{6} \quad (\text{Equation 5})$$

$$1.0 \times 5 + 0.0 \times 3.5 + (-1.0) \times 1 \quad (\text{Equation 6})$$

Step 2: Calculate the average number of risks avoided per year

Average the data from both population data to obtain  $\alpha$ , the average number of risks avoided per employee per year.

$$\alpha = .5 + 7.4 + (-2.2) = 5.7\% \quad (\text{Equation 8})$$

$$\alpha = 1.0 \times 5 + 0.0 \times 3.5 + (-1.0) = 4.0\% \quad (\text{Equation 9})$$

$$\frac{\alpha = 5.7\% + 4.0\% = 4.85}{2} \quad (\text{Equation 10})$$

This means that as a result of the SAWP, each employee impacted by the program has a 4.85% reduced chance of having 1 risk per year. With the above information and assuming  $\psi$  number of employees impacted by the SAWP, the average number of risks avoided per year  $\Delta \Gamma$  is:

$$\Delta \Gamma = \alpha \times \psi \quad (\text{Equation 11})$$

$$\Delta \Gamma = .0485 \times 10,000 = 485 \quad (\text{Equation 12})$$

attempt to assist other researchers apply the same methodology. These steps are highlighted above in figure 9.

**DISCUSSION**

This paper consisted of identifying the existence of an impact induced by the SAWP



Step 3: Calculate average medical costs avoided per year (direct)

The average medical cost avoided per year  $\Delta C$  as a result of the SAWP is determined by Equation 13 where the average medical cost per risk  $\mu$  is \$1,503 (see second column – tables 1 and 2).

$$\Delta C = \Gamma \chi \mu \quad (\text{Equation 13})$$

$$\Delta C = 485 \times 1503 = \$728,955 \quad (\text{Equation 14})$$

Step 4: Calculate indirect costs avoided per year (indirect)

Adding the ratio \$3.7 indirect costs saved for every \$1 of direct costs amounts to a total of \$4.7 saved for every \$1 of direct costs avoided. The average total costs saved per year  $\Delta C$ :

$$\Delta C = \Delta C + 3.7\Delta C = 4.7\Delta C \quad (\text{Equation 15})$$

$$\Delta C = 4.7 \times 728.955 \times 10^3 = \$3.425 \text{ Million} \quad (\text{Equation 16})$$

Proposed Presenteeism Equation®

The above values were obtained assuming linearity of population migrations and extension of man power, however, they hold no predictive power. Based on the above calculations, a presenteeism equation® may be developed using differential equations. The authors will expand upon the proposed Equations 17 and 18 in the future to identify the nonlinear dynamics of incurred costs (C) and cost avoidance ( $\frac{dC}{dt}$ ) due to medical risks.

$$C = 4.7 \times \mu \times \psi \times \{P_L R_L + P_M R_M + P_H R_H\} \quad (\text{Equation 17})$$

$$\frac{dC}{dt} = 4.7 \times \mu \times \psi \times \left\{ \frac{dP_L}{dt} R_L + \frac{dP_M}{dt} R_M + \frac{dP_H}{dt} R_H \right\} \quad (\text{Equation 18})$$

by looking at entry and exit point of participants in the program over a six-year duration and propose a presenteeism equation® based on this methodology. Most companies are relying on self-reported questionnaires as a method to calculate presenteeism. Instead, breaking away from the collective mold, this research has emerged with a novel approach towards addressing the significant cost burden of presenteeism that inflicts most companies today. This equation is the first step in expanding and improving the current methodology of measuring presenteeism. It is well documented that self-reported questionnaires are always subject to reliability issues over significant time.

The implications of this research are two-fold. Firstly it presents novel approach in addressing the health risk migration of a given population overtime through applying differential equations and econometrics in the evaluation of workforce health status, cost avoidance, and presenteeism. Furthermore, this enables researchers to truly quantify the cost poor workforce health has on a company. This equation is based on the assumption that risk migration, cost avoidance (HERO study) is known of a given population over a specific time. It aligns with the cohort studies and the research methodology applied to a given population. In this paper the presenteeism equation® was

applied to calculate the health risk migration effect (representing A, in figure 1 research map), current cost avoidance of health risk migration (representing B, in figure 1 research map) induced by a worksite wellness program's positive impact on productivity and reduction poor health (representing C, in figure 1 research map). The outcome is represented as a total presenteeism potential saving of \$3.4 M per year and a total of \$20.4 total presenteeism potential cost avoidance. This work will assist other researchers and business leaders to calculate the current risk migrations, cost avoidance, and presenteeism of a workforce over time, as aligned with the figure 1 research map, suggesting that the relationship between the variables (A-C) will be strengthened by further research to validate (D) and improve the robustness of the relationships and model.

The authors' future objective is to provide a business solution to maximization of productivity, risk avoidance, and cost avoidance. The second phase will examine the dynamics of risk migration induced by the SAWP

and finding a model to both extrapolate backwards in time and predict maximum capacity in the future. The future research goals are to develop a predictive model measuring the impact of the worksite wellness program in relation to workforce risk migration, health status and presenteeism, so as to support the development of a robust equation for presenteeism. This contribution to the field of health and productivity studies could be enhanced and improved upon by other researchers as an exciting and forward thinking direction in this emerging field.

**ACKNOWLEDGEMENTS:** The authors would like to appreciate Dr. Wojbor Woyczynski from Case Western Reserve University for his guidance and review of the statistical methods used, and Information Technology Future Center (ITFC) at Saudi Aramco for supporting this research pilot. The Saudi Aramco management in providing the support and belief in the authors to conduct such emerging research work.

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Differently from other chronic diseases, the incidence of chronic obstructive pulmonary disease (COPD) is increasing and the World Health Organisation (WHO) estimates that by 2020 it is going to become the third leading cause of death worldwide. In addition to its serious health burden, this disease has also a clear negative socio-economic impact: COPD is associated with high direct and indirect costs. This is why the European Parliament is active in addressing the causes of the COPD, for example in advocating for a new much more ambitious Tobacco Product Directive. We also had prioritized the lung diseases including COPD in the 7th Research Framework Program. We support also to have it as a priority in the new research program Horizon 2020.

By comparing patients employed with those “not in paid employment,” this independent patient-centric report shows the indirect costs of this disease, which are generally more complex to demonstrate given the difficulty in assessing the economic aspects of co-morbidity, reduced capacity at work, increased number of days off, sick leaves, premature retirement and mortality. The article illustrates that the real and perceived burden of COPD is lower in employed patients than in the case of those that are not in paid employment. The latter present higher incidence of co-morbidities, experience higher frequency of exacerbation and therefore require more hospitalisation compared to the former.

As a consequence, we believe that efforts should be made to minimise the impact of COPD and to help COPD patients to stay employed. Policy makers at the EU and national level should therefore promote flexible approaches that allow employers to maintain COPD patients in the work force. Implementation of COPD-related healthcare policies and adjustments to workplace strategies that accommodate patients’ needs while retaining employment and productivity would on the one hand promote early diagnosis to slow down the progression of the

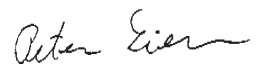
disease and on the other one improve the quality of life of COPD people.

This approach would be in line with the objectives of the European Year for Active Ageing and Solidarity between Generations 2012 and of the European Commission’s pilot project on the European Innovation Partnership (EIP) on Active and Healthy Ageing to have an employment rate of 75% for 20-64 year-old and to increase by two years the average healthy lifespan in the European Union (EU) by 2020. Indeed, though irreversible, COPD is both a preventable and treatable disease, making it imperative that it is recognised by us, policy makers, and marked as an issue that must be addressed.


Matthias Groote MEP and Chairman of the European Parliament Committee on the Environment, Public Health and Food Safety (ENVI)



Dr. Peter Liese MEP and Co-Coordinator of the EPP Group in the ENVI committee



Dr. Richard Seeber MEP and Co-Coordinator of the EPP Group in the ENVI committee



Dr. Antonia Parvanova MEP and member of the ENVI committee



# Real World Burden of COPD: Employed vs Not in Paid Employment Patients

Miguel Roman Rodriguez, Mark Small, Steve Fermer, James Bailey, Robert Wood, Antje –H. Fink-Wagner

## ABSTRACT

**AIM:** To describe the real and perceived burden of chronic obstructive pulmonary disease (COPD) regarding quality of life (QoL), exacerbations, use of health care resources, and loss of work productivity.

**METHODS:** Cross-sectional retrospective analysis of data collected in France, Germany, Italy, Spain, and United Kingdom by 189 primary care physicians and 168 pulmonologists, providing details on clinical symptoms and resource utilization in the past twelve months. Patients reported information through validated questionnaires reflecting QoL, health state, utility, dyspnea, (CAT, EQ-5D-3L, EQ5D VAS, mMRC), employment status, and impact on work. Inclusion criteria for patients were: age  $\geq 40$  years, history of smoking, and physician-confirmed diagnosis of COPD.

**RESULTS:** Data were collected from 1,823 patients (69 percent male, mean age:  $64.9 \pm 10.4$  years, mean time since COPD diagnosis 6.05 years). Patients were employed (38 percent), 'not in paid employment' (12 percent), retired (37 percent), not stated (13 percent). When comparing employed patients with those 'not in paid employment', the employed group had lower frequency of exacerbations ( $p < 0.0001$ ) and lower incidence of co-morbidities, including anxiety and depression, although 27.3 percent took up to 10 and more 'days off work' due to COPD; those 'not in paid employment' had poorer QoL and mMRC scores ( $p < 0.0001$ ).

**CONCLUSION:** The real and perceived burden of COPD is lower in employed patients than those 'not in paid employment'. It is postulated that by slowing the progression of COPD, additional benefits that lead to fewer exacerbations, lower burden on healthcare resources, and remaining in active employment could be achievable.

## KEY WORDS:

Chronic obstructive pulmonary disease, COPD; Employment; Exacerbations; Market research; Policy implications; Quality of life; Real World database evaluation; Socio-economic implications; Working population;

## INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is one of the world's most common non-communicable health problems, affecting almost 10 percent of all adults worldwide.<sup>1,2</sup> COPD is characterized by persistent airflow limitation, often accompanied by emphysema and chronic bronchitis that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles and gases.<sup>3</sup> In marked contrast to other chronic diseases, such as heart disease or stroke, the incidence of COPD is increasing

and by 2020, COPD is expected to become the third leading cause of death worldwide.<sup>4,5</sup> Contributing factors for COPD include tobacco consumption, environmental exposure to biomass, fuel smoke and other pollutants, as well as increase in the aging population.<sup>6</sup>

The average age at COPD diagnosis has been reported as 53 years in a US survey.<sup>7,8</sup> Worldwide, more than 50 percent of all patients diagnosed with COPD are 40 to 65 years old, and this applies to both men and women.<sup>9</sup> Thus unlike earlier beliefs, COPD

is no longer considered an old-age disease affecting mainly men, but rather it is being recognized as affecting younger people of both sexes, who are between 40 to 65 years-old and likely to be in the workforce.<sup>9-12</sup>

COPD is recognized as an important cause of general disability and is linked to other comorbidities that add to the large societal and economic burden associated with this disorder.<sup>6</sup> Several studies have shown that COPD is associated with high direct (primary) and indirect (secondary) costs. Direct costs arise mainly from the use of health services such as hospitalizations and medications. Indirect and societal costs are more difficult to assess because they involve factors such as related co-morbidities, reduced capacity for work, increased number of 'days off work', sick leave, psychological effects, premature retirement, and mortality. It is probably for these reasons that, in comparison to direct costs, only a few studies have evaluated indirect costs of COPD and the results obtained have varied widely.<sup>9,13-18</sup> We have found one study directly comparing the personal burden of COPD (expressed as QoL) in employed and unemployed patients with COPD.<sup>19</sup>

The purpose of the present paper is to present a retrospective analysis of a cross sectional real world dataset collected in five European countries from employed and those 'not in paid employment' patients with COPD and their treating physicians. The results represent the real and perceived aspects of COPD in the past twelve months and reflect QoL, health state, utility, dyspnea, exacerbations, use of health care resources and impact on loss of productivity through 'days off work' due to COPD.

## METHODS

### DATA COLLECTION

Data for this retrospective analysis are drawn from the Disease Specific Programme (DSP®), (Adelphi Real World Disease Specific Programs, Macclesfield, UK), a large cross-sectional, independent, multinational survey that captures real-world data from physicians and their presenting patients.<sup>20</sup> The DSP was not designed to test any set hypotheses or demonstrate cause and effect. The data reflect current clinical practice regardless of clinical guidelines, current

symptom prevalence and severity, physician and patient perception of their health state, and its impact on their daily living and working life. The data represent information that is available only to the physician or to the patient at the time of data collection. No tests or investigations were performed as part of this research.

Target physicians were identified by the local DSP fieldwork teams from public lists of healthcare professionals. They were checked for their eligibility to participate in the DSP in terms of specialty, location (Hospital or Office), whether they were personally responsible for treatment decisions and how many patients they see in a typical week (in total and with the relevant condition, in order to avoid physicians with an abnormal workload). Candidate respondents who meet these predefined eligibility criteria were invited to participate in the full programme. To avoid potential selection bias due to variable population densities in different geographic regions in a given county and appropriately an larger sample of physicians is identified in densely populated areas then in more sparsely populated areas, the aim was to obtain data rich samples from participating physicians as participation by physicians is voluntary, the programme criteria do not require patients samples to be representative of the population in terms of race, income, social class or age.

Physicians contributed on a volunteer basis and received payment for their participation. The data used for the analysis are based on patient record forms completed by physicians, and questionnaires completed by patients. Data collection was performed according to the European Pharmaceutical Market Research Association (EphMRA) code of conduct.<sup>21</sup> Each patient participated in the survey voluntarily and provided consent for de-identified and aggregated reporting of research findings, as required by the guidelines. DSP data were collected by local fieldwork partners and fully de-identified prior to receipt by Adelphi. *Therefore, ethics approval was not necessary* as this was a volunteer, non-invasive collection of data, later anonymized and presented as aggregated results.

### COUNTRIES INVOLVED AND TIME PERIOD FOR DATA COLLECTION

Physicians and patients were recruited in

France, Germany, Italy, Spain, and the United Kingdom (UK). Data was collected in each country for approximately twelve weeks between June and September 2011.

#### INCLUSION CRITERIA

To be eligible to participate in the data collection, physician had to have been qualified between  $\geq 6$  years and  $\leq 36$  years, and be responsible for treatment decisions for patients with respiratory disease. In addition they were required to manage three or more COPD patients each week with a diagnosis of airflow obstruction, COPD, emphysema and/or chronic bronchitis, who were 40 years and older with a history of smoking. Each of the participating physicians completed a detailed patient record form for the next six patients who consulted them and met the inclusion criteria. Therefore the study is representative of the consulting population rather than the COPD population as a whole. This sample takes on the properties of a 'random sample' because the physicians providing the information had no control over which of the eligible patients in their care would present in their clinic during the data collection period. Physicians provided information from patients' records for the past twelve months on demographics, disease history and diagnosis, severity of COPD, comorbidities, concomitant conditions, and healthcare resource utilized including hospitalizations and physician consultations. No tests or investigations were carried out as part of this research, and all responses were anonymized to preserve patient confidentiality. Participating physicians invited all consecutive patients for whom they completed a Patient Record Form, to complete a Patient Self Completion questionnaire.

No other patient selection criteria were applied. The determination of patient eligibility was made solely by the physician.

Using the patient self-completion questionnaire, information was collected regarding the COPD impact on lifestyle, information sources on COPD, general and COPD-related health status including the modified Medical Research Council Dyspnea Scale (mMRC) (specified below), and the impact of the disease on their ability to work, by asking how many days had been taken off work in the previous twelve

months due to their breathing condition, and employment status. Employment status was defined as one of either professional, managerial or technical, skilled non-manual, skilled manual, partly skilled, unskilled, or armed forces. 'Not in paid employment' was defined as student, unemployed, homemaker, or long term disability. Retired patients were included as a separate group based on patient response. A COPD exacerbation was defined as an increase in symptoms not brought under control by their rescue medication. This definition has consistencies and is in agreement with the definition in the current GOLD Strategy 2011.<sup>3</sup> Physicians were asked to ensure that all participating Patient Self Completion questionnaires were returned to the physician in a sealed envelope. All responses were anonymized to maintain patient confidentiality.

Questionnaires reflecting QoL, health state, utility, and dyspnea (shortness of breath) in the past twelve months were completed by the patients. All QoL questionnaires are validated instruments, frequently used in other studies. As suggested by the GOLD Strategy last updated in 2011,<sup>3</sup> dyspnea was evaluated as the main COPD symptom, using the modified Medical Research Council (mMRC) Breathlessness Scale.<sup>22</sup> Further validated tools included the COPD Assessment Test (CAT) that measures the overall impact of COPD on the patient;<sup>23</sup> utility as defined by EQ5D-3L and EQ5D VAS scores that provide a measure of health for clinical and economic evaluation.<sup>24</sup>

#### STATISTICAL ANALYSIS

The data were derived from physician and patient-completed record forms. The population size is given for each individual analysis where appropriate and indicates the number of respondents (physician or patient) who provided responses relevant to that analysis.

Throughout this analysis, standard univariate tests were performed that involve the comparison of the same outcome between several patient groups. All analyses were performed using Stata 12.1. The test used depended on the type or distribution of the outcome variable: A t-test (ANOVA when more than two groups were compared) was performed when the outcome variable was numeric and did not violate the assumptions

Table I: Summary Characteristics (All patients)

Parameter/Patient Group	All	Not in Paid Employment <sup>1</sup>	Employed	Retired	p-values	
	Value	Value	Value	Value	Not in Paid Employment <sup>1</sup> vs Employed	Across 3 Groups
Number of patients (N)	1,823 (100)	221 (100)	694 (100)	678 (100)		
Men N (%)	1,257/1,820 (69.07)	83/221 (37.56)	528/693 (76.19)	491/677 (72.53)	<0.0001	<0.0001
Women N (%)	563/1,820 (30.93)	138/221 (62.44)	165/693 (23.81)	186/977 (27.47)		
Age years Mean + SD	64.91 + 10.36	61.74 + 10.63	59.37 + 9.65	71.05 + 7.40	0.0020	<0.0001
Age range years	40 - 94	40 - 93	40 - 87	49 - 94	0.022	<0.0001
40 - 50 years N (%)	170 (9.93)	31 (14.03)	123 (17.72)	3 (0.44)		
51 - 64 years N (%)	685 (37.58)	112 (50.68)	381 (54.90)	116 (17.11)		
65+ years N (%)	968 (53.10)	78 (35.29)	190 (27.38)	559 (82.45)		
Time since diagnosis of COPD years Mean + SD	6.05 + 5.81	5.82 + 6.60	4.47 + 4.50	7.59 + 6.27	0.034	<0.0001
Severity <sup>1</sup> of COPD						
Mild N (%)	501/1,823 (27.48)	55/221 (24.89)	245/694 (35.30)	149/678 (21.98)	<0.0001	<0.0001
Moderate N (%)	915/1,823 (50.19)	103/221 (46.61)	339/694 (48.85)	361/678 (53.24)		
Severe and very severe N (%) <sup>2</sup>	391/1,823 (21.45)	63/221 (28.51)	104/694 (14.99)	163/678 (24.04)		
Number of exacerbations suffered Mean + SD	1.15 + 1.80	1.47 + 2.30	0.83 + 1.48	1.35 + 1.77	<0.0001	<0.0001
40 - 50 years old	0.67 + 1.31	0.67 + 1.15	0.64 + 1.36	0	0.612	0.492
51 - 64 years old	0.97 + 1.71	1.54 + 1.99	0.72 + 1.42	1.13 + 2.21	<0.0001	<0.0001
65+ years old	1.36 + 1.90	1.67 + 2.90	1.17 + 1.61	1.40 + 1.67	0.501	0.083
Concomitant diseases						
None N (%)	233/1,823 (12.78)	27/221 (12.22)	137/694 (19.74)	50/678 (7.37)	0.015	<0.0001
Cardiovascular disease N (%)	1,271 (69.72)	136 (61.54)	419 (60.37)	545 (80.38)	0.633	<0.0001
Hypertention N (%)	1,024 (56.17)	100 (45.25)	347 (50.00)	441 (65.04)	0.276	<0.0001
Elevated cholesterol/hyperlipemia N (%)	550 (30.17)	56 (25.34)	165 (23.78)	254 (37.46)	0.587	<0.0001
Cardiac arrhythmias N (%)	175 (9.60)	16 (7.24)	51 (7.35)	83 (12.24)	1.0000	0.004
Diabetes N (%)	332 (18.21)	42 (19.00)	87 (12.54)	159 (23.45)	0.048	<0.0001
Obesity N (%)	219 (12.01)	32 (14.48)	65 (9.37)	87 (12.83)	0.082	0.062
Anxiety (N (%))	170 (9.33)	36 (16.29)	48 (6.92)	60 (8.85)	0.000	0.001
Depression N (%)	156 (8.56)	36 (16.29)	37 (5.33)	65 (9.59)	<0.0001	<0.0001

SD = Standard deviation; N=Number; NA=Not applicable

<sup>1</sup>Not in paid employment'= homemaker (N= 84, 38.01%), on long term disability (N=70, 31.67%), unemployed (N=65, 29.41%), student (N=2, 0.90%).

Employed: Skilled – non manual (N=164, 23.63%), Skilled – manual (N=163, 23.49%), Professional (N=123, 17.72%), Managerial or Technical (N=121, 17.44%), Partly skilled (N=62, 8.93%), Unskilled (N=52, 7.49%), Armed Forces (N=9, 1.30%).

<sup>1</sup>Information on severity of COPD was physician-assessed.

<sup>2</sup>For analytical purposes, data from patients with COPD assessed as severe (N=285, 15.63%) and very severe (N=106, 5.81%) were combined into one category.



Table 2: Patient Summary Characteristics: Age Groups (Employed)

Parameter/Patient Group	Employed			p-values
	40 - 50 years	50 - 64 years	65+ years	
	Value	Value	Value	Across 3 Groups
Number of patients (N)	123 (100)	381 (100)	190 (100)	
Men N (%)	88/123 (71.54)	278/381 (72.97)	162/190 (85.26)	0.003
Women N (%)	35/123 (28.46)	102/381 (26.77)	28/190 (14.74)	
Age years Mean + SD	46.53 + 2.83	57.20 + 3.69	72.05 + 5.50	<0.0001
Time since diagnosis of COPD years Mean + SD	2.71 + 2.68	3.62 + 3.60	7.39 + 5.65	<0.0001
Severity of COPD I				
Mild N (%)	60/123 (48.78)	146/381 (38.32)	39/190 (20.53)	<0.0001
Moderate N (%)	51/123 (41.46)	186/381 (48.82)	102/190 (53.68)	
Severe and very severe N (%) <sup>2</sup>	11/123 (8.94)	48/381 (12.60)	45/190 (23.68)	
Number of exacerbations suffered Mean + SD	0.64 + 1.36	0.72 + 1.42	1.17 + 1.61	0.000
Days off work				
None	66/123 (53.66)	193/381 (50.55)	55/190 (28.95)	0.000
1 - 5	22/123 (17.89)	49/381 (12.86)	3/190 (1.58)	
6 - 10	18/123 (14.63)	42/381 (11.02)	4/1090 (2.11)	
10+	13/123 (10.57)	36/381 (9.45)	2/190 (1.05)	
Data not provided by patients	4/123 (3.25)	61/381 (16.01)	126/190 (66.32)	
Concomitant diseases				
None N (%)	38/123 (30.89)	61/381 (19.42)	25/190 (13.16)	0.001
Cardiovascular disease N (%)	47 (38.21)	231 (60.63)	141 (74.21)	<0.0001
Hypertention N (%)	41 (33.33)	190 (49.87)	116 (61.05)	<0.0001
Elevated cholesterol/hyperlipemia N (%)	16 (13.01)	91 (23.88)	58 (30.53)	0.002
Cardiac arrhythmias N (%)	2 (1.63)	17 (4.46)	32 (16.84)	<0.0001
Diabetes N (%)	6 (4.88)	37 (9.71)	44 (23.16)	<0.0001
Obesity N (%)	12 (9.76)	32 (8.40)	20 (11.05)	0.668
Anxiety (N (%))	5 (4.07)	32 (8.04)	21 (11.05)	0.339
Depression N (%)	9 (7.32)	19 (4.99)	9 (4.74)	0.551

SD = Standard deviation; N=Number; NA=Not applicable; y = years

<sup>1</sup>Information on severity of COPD was physician-assessed.

<sup>2</sup>For analytical purposes, data from patients with COPD assessed as severe (N=78, 11.24%) and very severe (N=26, 3.75%) were combined into one category.

required for t-tests (i.e. the outcome variable followed a Gaussian distribution); Mann-Whitney tests (Kruskal-Wallis when more than two groups were compared) were performed when the outcome variable was

numeric and violated the assumptions required for a t-test (i.e. when the outcome variable followed a heavily skewed distribution or when the outcome variable was ordinal and categorical); A Fisher's exact test

Table 3: Patient Summary Characteristics: Age Groups ('Not in paid employment')

Parameter/Patient Group	Not in paid employment <sup>1</sup>			p-values
	40 - 50 years	50 - 64 years	65+ years	
	Value	Value	Value	Across 3 Groups
Number of patients (N)	31 (100)	112 (100)	78 (100)	
Men N (%)	12/31 (38.71)	44/112 (39.29)	27/78 (34.62)	0.799
Women N (%)	19/31 (61.29)	68/112 (60.71)	51/78 (65.38)	
Age years Mean ± SD	46.61 ± 3.16	57.86 ± 3.88	73.33 ± 6.86	<0.0001
Time since diagnosis of COPD years Mean ± SD	3.15 ± 3.29	4.99 ± 5.54	8.34 ± 8.30	0.000
Severity of COPD <sup>1</sup>				
Mild N (%)	10/31 (32.26)	25/112 (22.32)	20/78 (25.64)	0.044
Moderate N (%)	19/31 (61.29)	50/112 (44.64)	34/78 (43.59)	
Severe and very severe N (%) <sup>2</sup>	2/31 (6.45)	37/112 (33.04)	24/78 (30.77)	
Number of exacerbations suffered Mean ± SD	0.67 ± 1.15	1.54 ± 1.99	1.67 ± 2.90	0.046
Concomitant diseases				
None N (%)	6/31 (19.35)	12/112 (11.61)	8/75 (10.67)	0.442
Cardiovascular disease N (%)	10 (32.36)	73 (65.18)	53 (67.95)	0.001
Hypertension N (%)	6 (19.35)	50 (44.64)	44 (56.41)	0.001
Elevated cholesterol/hyperlipemia N (%)	4 (12.90)	29 (25.89)	23 (29.49)	0.152
Cardiac arrhythmias N (%)	0 (0.00)	10 (8.93)	6 (7.69)	0.2290
Diabetes N (%)	4 (12.90)	24 (21.43)	14 (17.95)	0.458
Obesity N (%)	4 (12.90)	17 (15.18)	11 (14.10)	0.901
Anxiety (N (%))	5 (16.13)	19 (16.96)	12 (15.38)	0.935
Depression N (%)	9 (29.03)	20 (17.86)	14 (17.95)	0.038

SD = Standard deviation; N=Number; NA=Not applicable; y = years

<sup>1</sup>Information on severity of COPD was physician-assessed.

<sup>2</sup>For analytical purposes, data from patients with COPD assessed as severe (N=42, 19.00%) and very severe (N=21, 9.50%) were combined into one category.

was performed when the outcome variable and the comparison variable were both binary categorical; A Chi-squared test was performed when the outcome variable or the comparison variable was categorical with more than two groups.

**RESULTS**

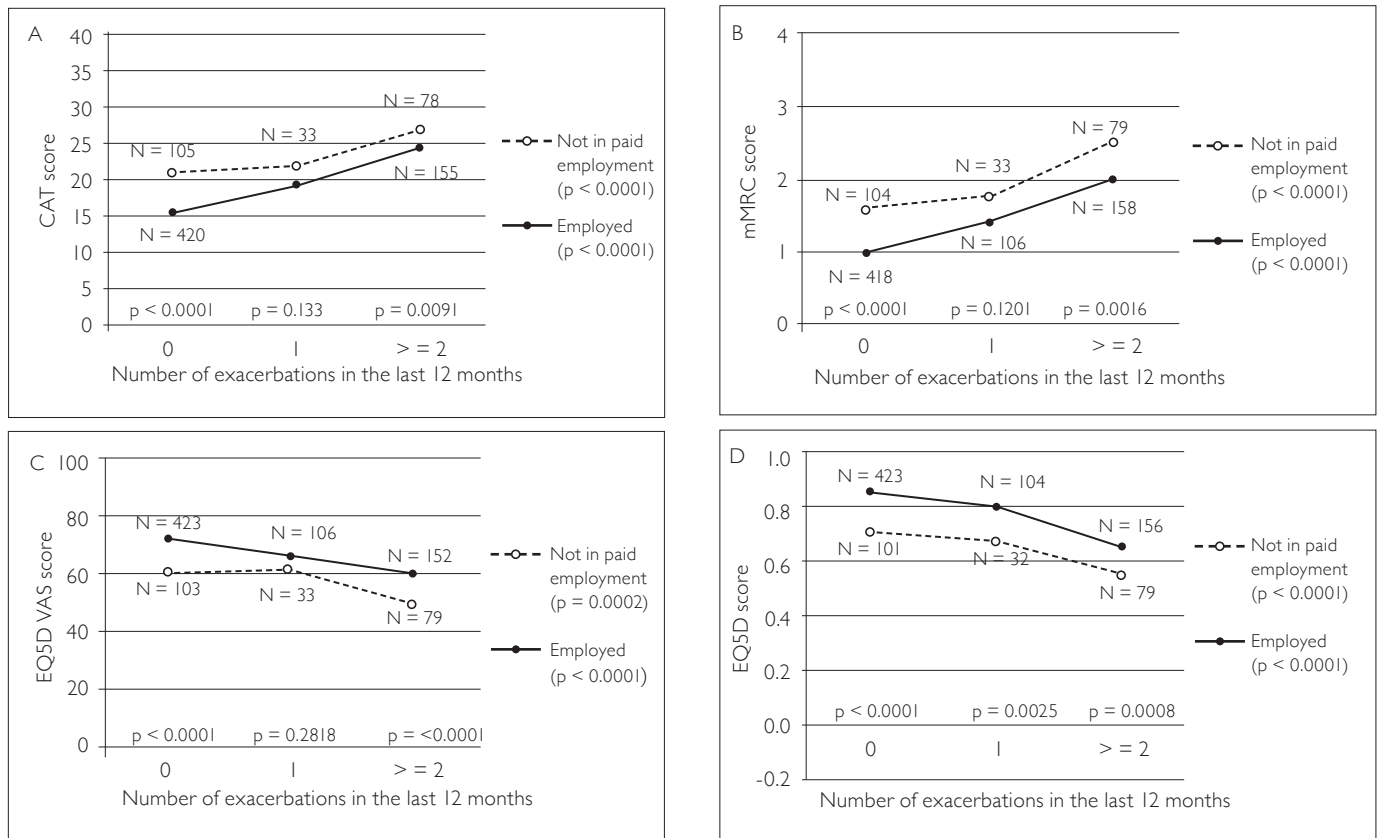
**DEMOGRAPHIC DATA AND EMPLOYMENT STATUS**

Demographic data obtained from patients and their physicians are summarized for

employed, 'not in paid employment' (patients not currently employed or seeking paid employment), and retired patients (Table 1). For selected parameters, data are presented according to the patients' age groups 40 to 50 year-old, 51-64 year-old, and 65 plus year-old for employed (Table 2) and those 'not in paid employment' (Table 3).

The analyses are based on 1,823 patients for whom a self-completion form was received and matched to the physician record form. The mean age of patients was 64.9

Figure 1: Association of COPD exacerbations with measures reflecting the quality-of-life, health state, and dyspnea (All patients)



CAT = COPD Assessment Test  
 mMRC = modified MRC (mMRC) Breathlessness Scale  
 EQ5D = The EuroQol Group 5-Dimension Self-Report Questionnaire score  
 EQ5D VAS = Visual analogue scale.

All patients (irrespective of age) were asked to provide information on their quality-of-life, using the four instruments CAT (A), mMRC (B), EQ5D VAS (C), and EQ5D (D). The p-values indicate statistical differences between the exacerbation frequency of patients for each subset ('not in paid employment' vs employed) (Mann-Whitney Tests for between group analysis; Kruskal-Wallis and Mann-Whitney Tests for within-group analysis).

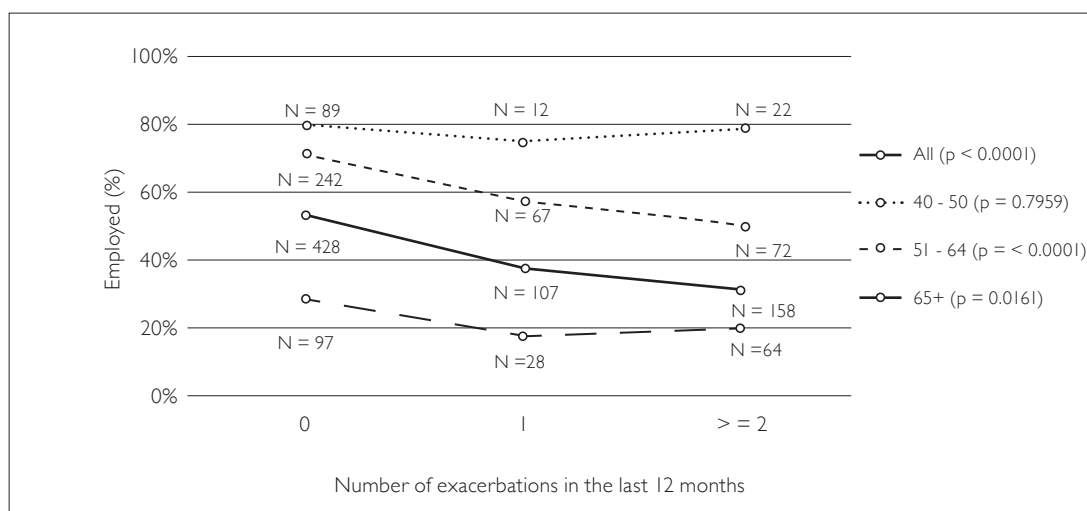
years ( $\pm 10.4$ ); nearly half (46.9 percent) were of a working age, between 40 to 64 years old. There were more men (69.1 percent) than women (30.9 percent) (Table 1). Patients were managed for their COPD by a primary care physician alone (16 percent), a primary care physician together with a pulmonologist (37 percent), or solely by a pulmonologist (46 percent); for one percent of patients this information was not provided.

All patients were either ex-smokers (63.6 percent) or current smokers (35.6 percent) and these proportions were similar among men and women. The mean length of time since the first diagnosis of COPD for all patients was  $6.05 \pm 5.81$  years (mean  $\pm$  SD). For those 'not in paid employment' and

employed patients, the time since the diagnosis of COPD was (mean  $\pm$  SD)  $5.82 \pm 6.60$  years and  $4.47 \pm 4.5$  years, respectively ( $p = 0.0344$ ), and as would be expected, longer for the retired patients ( $7.59 \pm 6.27$  years) (Table 1). The time since the diagnosis of COPD increased with increasing age for the employed patients ( $p < 0.0001$  across the three age groups) (Table 2). A similar trend was seen for the 'not in paid employment' patients, although the number of years since the diagnosis was higher than for the employed patients in each age group ( $p = 0.0002$ ) (Table 3).

For most evaluated parameters, data are presented for the whole group of patients and also by their employment status (employed,

Figure 2: Association of COPD exacerbations with employment status (All patients)



All patients were asked to provide information on their employment status in the past 12 months. The figure shows the association between COPD exacerbation and employment for all patients and according to age groups. Employment was defined as one of either professional, managerial or technical, skilled non-manual, skilled manual, partly skilled, unskilled, or armed forces. The term 'not in paid employment' was defined as student, unemployed, homemaker, or long term disability. Retired status was also defined.

The p-values indicate statistical differences between the exacerbation frequencies of patients overall and within each age group (Chi-Squared Tests for within-group analysis).

'not in paid employment', retired). Based on the overall data, 12 percent of patients were 'not in paid employment', 38 percent were employed, 37 percent retired, and for 13 percent no data regarding employment status was recorded.

When comparing the employment status of men versus women, it can be seen that in this survey more men were employed than women (76.2 percent vs 23.8 percent); the reverse was true when the 'not in paid employment' population was examined (Table 1). It should be noted that 58.7 percent of women 'not in paid employment' classified themselves as homemakers, with 21.0 percent considering themselves as unemployed. Analysis of the employment status with regard to gender and age showed that in all age groups the proportion of employed women was statistically significantly lower than men ( $p = 0.0025$ ) (Table 2).

#### SEVERITY OF COPD

The assessment of patient's COPD severity was physician-observed; pulmonary function data are not available. The overall proportion of patients evaluated to be in each severity group was: mild 27.5 percent,

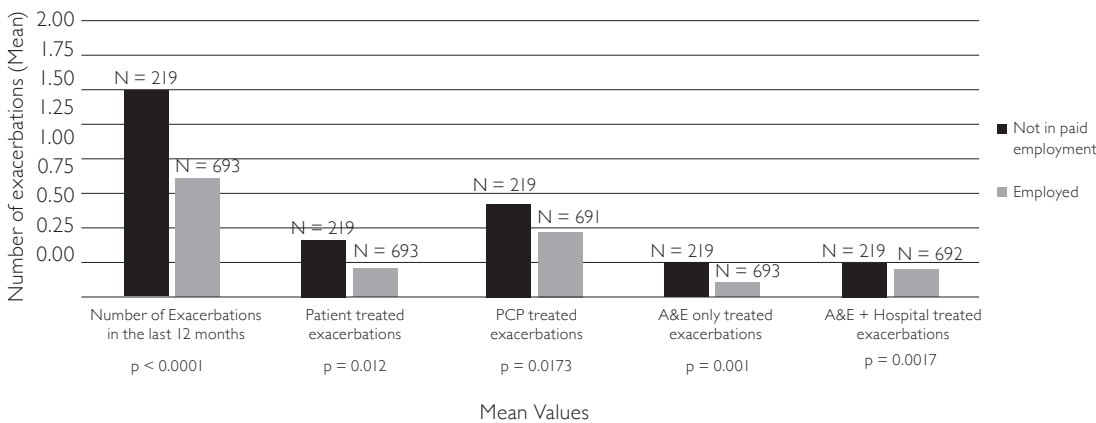
moderate 50.2 percent, severe and very severe 21.5 percent. For analytical purposes, data from patients with the severity of COPD assessed as severe ( $N = 285$ , 15.63 percent) and very severe ( $N = 106$ , 5.81 percent) were combined into one category, and referred to as 'severe'.

The severity of COPD was significantly higher for patients 'not in paid employment' and retired than for the employed ( $p < 0.0001$ ) (Table 1). Furthermore, the severity of COPD was significantly associated with age, as can be seen from the proportion of patients with severe COPD that increased from 8.94 percent in the 40 to 50 year-old age group to 23.68 percent in the  $\geq 65$  age group ( $p < 0.0001$ ) for the employed population (Table 2) and from 6.43 percent for the 40 to 50 age group to 30.77 percent for the  $\geq 65$  age group ( $p = 0.0443$ ) for patients 'not in paid employment' (Table 3).

#### QUALITY-OF-LIFE AND DYSPNEA SCORE

The scores for QoL as defined by EQ5D VAS, utility as defined by EQ5D-3L, health state as defined by CAT and dyspnea (mMRC) were significantly different for

Figure 3: Association of exacerbations with use of health-care services and QoL according to employment status. (All patients experiencing exacerbations)



ED = Emergency department  
 ED + Hospital = emergency department with admission to the hospital  
 N = Number of patients  
 PCP = Primary care physician  
 QoL = Quality of life

Responses were received from the physicians for N = 219 patients 'not in paid employment' and for N = 693 employed patients (except for PCP-treated exacerbation employed patients N = 691 and ED+Hospital-treated patients N = 692). The p values indicate statistical differences between patients 'not in paid employment' vs employed (Mann-Whitney Tests).

most of the between-group analyses (employed vs 'not in paid employment') and for all within-group analyses ( $p < 0.0001$ ,  $p = 0.0002$ ). Regarding the number of exacerbations in the last twelve months and the employment status, 'not in paid employment' patients scored significantly worse than employed patients, particularly at the evaluated points of zero exacerbations ( $p < 0.0001$ ) and at two or more exacerbations ( $p = 0.0091$ ) (Figure 1 A-D).

The values for the CAT scores were, 20.91 for patients 'not in paid employment' experiencing zero exacerbations, and respectively, 22.12 and 26.84 for patients experiencing one, two or more exacerbations (a higher score indicates a more negative impact of COPD). For employed patients, the corresponding values were 15.6, 19.4, and 24.4, respectively. The data show that as the number of exacerbations experienced in the last twelve months increased, both groups of patients 'not in paid employment' and employed had a lower health state. However, at all evaluated points the scores were significantly worse for the group 'not in paid employment' (Figure 1 A).

The dyspnea score, assessed by the mMRC, increased as the number of exacerbations

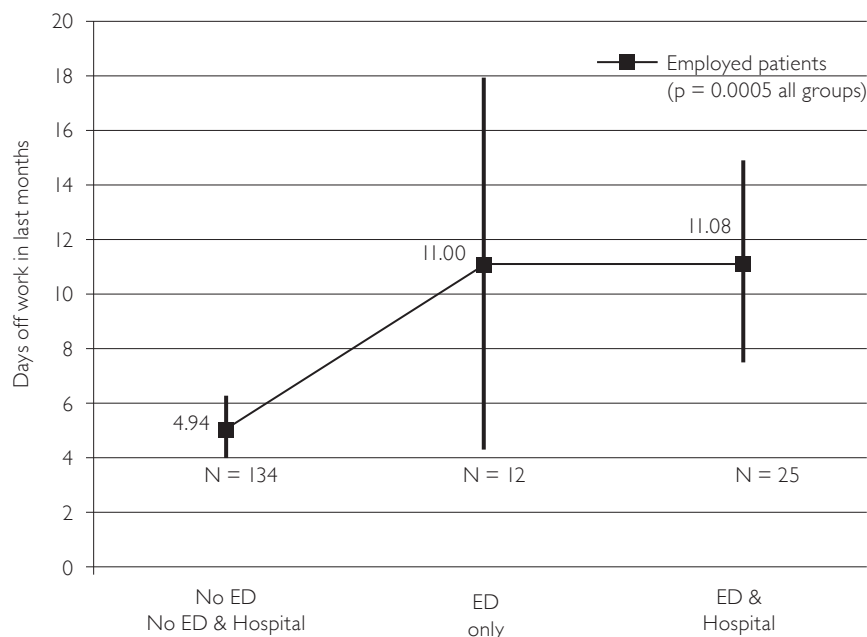
increased, implying that patients experienced or perceived more extensive breathlessness. The mMRC score was 2.62 for patients with severe COPD, 1.54 for moderate, and 0.96 for mild COPD ( $p < 0.0001$  between group analysis). Moreover, 61 percent of patients with severe COPD had mMRC of 3 or 4, whereas only 9 percent and 20 percent, respectively had mild and moderate COPD, showing that in more than half of the patients the physicians' assessment correlated well with the objective measurement of dyspnea reported by the patient (Figure 1 B).

Results with a similar trend as seen for the CAT score were obtained for the QoL-related measures (EQ5D-3L and the EQ5D VAS scores), indicating a greater (more negative) impact on QoL (Figure 1 C, D).

**CO-MORBIDITIES**

Only 12.8 percent of all COPD patients had no co-morbidities. The corresponding values for no co-morbidities according to employment status were: 'not in paid employment' 12.2 percent, employed 19.7 percent, and retired 7.4 percent. The most frequent co-morbidities among all patients were cardiovascular diseases (69.7 percent), diabetes (18.2 percent), obesity (12.0 percent),

Figure 4: Association of exacerbations with utilization of health services and number of 'days off work' in the last 12 months (Employed patients)



ED = Emergency department  
 ED + Hospital = emergency department with admission to the hospital  
 N = Number of patients

Mean days off work in last 12 months and 95% Confidence Interval. For all employed patients that had suffered One or more exacerbations in the last 12 months physicians were asked to provide information on how the patient treated these exacerbations. The patient was asked to provide the number 'days off work' in the last 12 months (values in italics). The p value indicates statistical differences between the groups of employed patients using the various options to deal with exacerbation(s) (Kruskal-Wallis and Mann-Whitney Tests for within-group analysis).

anxiety (9.3 percent), and depression (8.6 percent). The proportion of patients with co-morbidities was significantly different in patients 'not in paid employment' and employed patients particularly for anxiety (16.3 vs 6.9) ( $p = 0.0003$ ) and depression (16.3 vs 5.3) ( $p = 0.0001$ ) (Table 1).

The proportion of patients with co-morbidities increased with age both for the employed (Table 2) and 'not in paid employment' patients (Table 3). Considering the age groups in the employed population, there was a marked increase in cardiovascular diseases for the 51 to 64 year-old group (60.6 percent of patients) as compared with the 40 to 50 year-old group (38.2 percent); in the 65 plus years-old group, 74.2 percent of patients were affected. The occurrence of obesity and anxiety were conditions that were not significantly associated with age. Occurrence of depression decreased

quantitatively with age from 7.3 percent (40 to 50 years old) to 5.0 percent in 51 to 64 years-old and 4.7 percent in 65 plus years-olds (Table 2).

For patients 'not in paid employment', a similar pattern as for the employed patients was observed across the age groups for cardiovascular diseases, diabetes, and obesity. Anxiety affected about 16 percent across the age groups. Nearly a third (29 percent) of the 'not in paid employment' 40 to 50 year-old patients had depression, with a decrease to 18 percent in both the 51 to 64 year-old and in the  $\geq 65$  year old patients (Table 3).

A statistically significant association was seen with the number of exacerbations and the reported incidence of cardiovascular diseases and depression. Overall, 83 percent of patients suffering two or more exacerbations in the past twelve months had at least one cardiovascular condition as compared to 59

percent of patients not suffering exacerbations. Increased incidence of depression was also significantly associated with the number of exacerbations, affecting 7 percent of patients who had zero exacerbations and 15 percent of patients who had two or more exacerbations in the past twelve months.

### COPD EXACERBATIONS

COPD exacerbations in the last twelve months were evaluated in all patients and analysis was made according to employment status. Overall, 50.5 percent of patients had no exacerbation, 18.4 percent reported one exacerbation, and 30.7 percent reported two or more exacerbations. According to the employment status ('not in paid employment' vs employed) 47.5 percent vs 61.7 percent had no exacerbations; about 15 percent of patients in both groups had one exacerbation, and 36.7 percent vs 22.8 percent had two or more exacerbations; 58.6 percent of the retired patients experienced exacerbations. For all categories, the differences between the 'not in paid employment' vs employed COPD patients were statistically significant ( $p < 0.0001$ ) (Table 1).

The mean number of exacerbations in the past twelve months was  $1.15 \pm 1.80$  for all patients (mean  $\pm$  SD). The mean was significantly lower for employed patients ( $0.83 \pm 1.48$ ) than for 'not in paid employment' ( $1.47 \pm 2.30$ ) or retired patients ( $1.35 \pm 1.77$ ) ( $p < 0.0001$  for 'not in paid employment' vs employed and between all three groups) (Table 1).

The proportion of the overall employed population decreased significantly as the number of exacerbations increased ( $p < 0.0001$ ). This association was observed in particular for the 51 to 64 years-old group ( $p < 0.0001$ ) and the  $\geq 65$  years-old ( $p = 0.0161$ ), whereas the 40 to 50 year-old working population remained employed despite exacerbations (Figure 2).

### USE OF HEALTHCARE SERVICES

The effect of exacerbation on the use of healthcare services in the last twelve months is available from 219 'not in paid employment' and 693 employed patients (Figure 3). Evaluation of the way the patients managed their exacerbations in the last twelve months revealed that irrespective of the numbers of exacerbations, a substantial proportion of all

patients (employed or 'not in paid employment') managed their exacerbations by themselves, without seeking professional health services. Of the patients who experienced an exacerbation, 20.4 percent managed at least one exacerbation by themselves, 57.1 percent used their primary care physician setting, 7.2 percent required a visit to the emergency department, but no stay in the hospital, and 15.3 percent required hospitalization. Irrespective of where and by whom an exacerbation was managed, the mean number of exacerbations in the past twelve months was higher for the 'not in paid employment' patients than for the employed patients ( $1.47 \pm 2.30$  vs  $0.83 \pm 1.48$ ; mean  $\pm$  SD,  $p < 0.0001$ ) (Figure 3). Likewise, the number of patients experiencing exacerbation(s) and requiring hospitalization was substantially higher for the 'not in paid employment' than for the employed COPD patients, i.e. 36 of 219 (16 percent) 'not in paid employment' vs 60 of 693 (8 percent) employed ( $p = 0.002$ ).

### DAYS OFF WORK

Of the 694 employed patients, the mean number of 'days off work' over the past twelve months was 3.69 days (range 0 to 45 days). *Almost half of the patients (314 of 694, 45.2 percent) took no days off work, 10.7 percent took 1 to 5 days off work, 9.2 percent took 6 to 10 days off work, and 7.4 percent took more than 10 days off work; for 27 percent of patients this information was missing* (Table 2). Severity of COPD was an influencing factor for the number of days off work. Patients with mild COPD took a mean 2.50 days off work, mean 3.8 days for moderate and mean 7.4 days for severe. Moreover, patients experiencing a COPD exacerbation that required a visit to emergency department had a significant association with the number of 'days off work'. Patients who have visited emergency department at least once in the last twelve months due to their exacerbations had over three times as many 'days off work' than those that did not visit emergency department (mean 11.7 vs 3.4 days). Furthermore, patients who were hospitalized once or more times in the last twelve months took over three times more 'days off work' than those who were not hospitalized (mean 11.08 vs 4.94,  $p < 0.005$  between group analysis) (Figure 4).

## DISCUSSION

**MAIN FINDINGS**

*The presented data are based on a large cross-sectional retrospective analysis of real world data collected from 1,823 consulting patients with COPD and their consulted physicians, located in five European countries. The focus of the analysis was on the comparison of COPD-related parameters in employed and 'not in paid employment' patients with COPD. We have found significant differences between the employed and 'not in paid employment' groups of patients, with respect to the perceived burden of the disease on the severity of COPD, number of exacerbations, frequency of health-care services visits, and QoL.*

The patients in the present study were at least 40 years-old and more than a third (38 percent) were employed. Irrespective of the mean age, most of the employed patients were men (69.1 percent), while most of the 'not in paid employment' patients were women (62.4 percent). Thus, it seems that although the women's employment over two decades has been generally increasing in Europe, this trend is not reflected in the data for female patients with COPD.<sup>25-27</sup> It is possible that COPD may have a greater negative impact on employment possibilities or on retaining employment for women than for men.

COPD severity was significantly lower in the employed than in the 'not in paid employment' population; for employed patients, more had mild COPD (35.3 percent). These data are similar to the working-age population with mild COPD (36 percent) reported in another large international study.<sup>9</sup> Our data suggest that COPD severity has an impact on employment and this is in agreement with some previously published data that showed an inverse association between severity of airflow obstruction (measured by spirometry) and work force participation.<sup>28</sup> Nevertheless, others showed that even mild to moderate airflow obstruction can be strongly associated with an impaired health status and missed working days.<sup>29</sup> The authors of the later study concluded that such findings could justify systematic screening for COPD in the general population because identified cases suffer from a significant although underestimated impact of the disease, which might

be reduced by early implementation of preventive and therapeutic measures.

COPD exacerbations imply acute worsening of symptoms that tend to accelerate the decline in lung function, resulting in reduced physical activity, poorer QoL, and an increased risk of death.<sup>2;30</sup> In our evaluation, the mean self-reported exacerbation rate for all patients was  $1.15 \pm 1.80$ /year which is similar to 1.21 exacerbations/year reported by others.<sup>30</sup> Furthermore, our data show that the number of exacerbations was significantly higher in the 'not in paid employment' than in the employed patients (1.47 per year vs 0.83 per year). In the overall study population, the number of exacerbations experienced correlated with a higher proportion of those 'not in paid employment', an association that was statistically significant. It is noteworthy that the subgroup of 51 to 64 year-old patients reported higher levels of unemployment as the number of exacerbations increased, whereas this was not the case for the younger subgroup of patients with COPD (40 to 50 years-old) whose employment status did not change despite increased number of exacerbations. A possible explanation for this observation could be the greater proportion of patients with mild COPD among the younger group of patients.

COPD exacerbations account for a large proportion of use of healthcare services and thus for direct medical costs.<sup>2</sup> In our study, most patients (57.1 percent) contacted their primary care physician to manage their exacerbations. Nevertheless, a relatively large proportion of patients (20.4 percent) managed at least one of their exacerbations in the past twelve months themselves, with no contact to any healthcare services. Self-treatment of exacerbations may be a sign of emancipated patients and their action could reduce some immediate direct costs of COPD. However, a lack of contact with a physician, who would precisely assess the exacerbation and treatment needs, may also pose a risk that the patient's condition is not being treated sufficiently and lead in the future to a greater overall impact on the patients' health and costs.

For patients with exacerbations 'not in paid employment', 16 percent required



hospitalizations. This is twice as many as for the employed patients (8 percent) and is possibly due to the higher proportion of patients with more severe COPD among the 'not in paid employment' patients and the overall greater number of exacerbations suffered by these patients. Exacerbations had a major impact on the employed patients on the number of 'days off work'. Patients who have visited emergency department at least once in the last twelve months due to their exacerbations had over three times as many 'days off work' than those that did not visit emergency department (mean 11.7 vs 3.4 days off work). Moreover, patients who were hospitalized once or more times in the past twelve months took over three times more 'days off work' than those who were not hospitalized.

Validated instruments for QoL, utility, and health state are useful to determine the prognosis of COPD and to provide an estimate for the overall personal and societal impact of COPD.<sup>31</sup> Our data show that similar to other studies with working-age COPD populations, these parameters declined with the severity of COPD.<sup>9;14;15</sup> We found a significant association between 'not in paid employment' and worsening scores for all tested parameters. Relatively little is known about the effect of work participation and quality of life (QoL) of employees with chronic diseases. Orbon et al., examined the associations between employment status and QoL in COPD patients and showed that patients assessed as 'disabled for work' (not employed) had lower QoL scores than "paid workers" (employed).<sup>19</sup>

Co-morbidities were frequent in our COPD patient population. Nevertheless, no concomitant disease was observed for 12.2 percent patients 'not in paid employment' and for significantly more employed patients (19.7 percent). Other authors with similar patient populations reported up to 25 percent of participants free of other comorbid conditions.<sup>9</sup> Our data show that cardiovascular diseases, diabetes, and obesity were not associated with employment status but rather with increasing age. However, patients 'not in paid employment' had a greater occurrence of depression than those employed (16.3 percent vs 6.9 percent) and in both of these groups, depression decreases

with increased age. Anxiety and depression in patients with COPD have been shown by others to be associated with increased dyspnea, reduced functional performance, and lower QoL;<sup>32;33</sup> the reported occurrence of depression in patients with COPD ranges from 10 to 42%.<sup>34;35</sup>

#### STRENGTHS AND LIMITATIONS OF THIS STUDY

The strength of the presented data is the large number of COPD patients, representing all severities of the disease and having a clear differentiation between employed and 'not in paid employment' groups, which allows comparisons between the groups. Furthermore, the data are based on clinical evidence provided by the physicians and also on self-reporting responses from the patients, thereby capturing the real life burden and impact of COPD at a patient level. The methodology used to collect the information directly from physicians and patients has been previously used<sup>20</sup> and validated in different medical fields.<sup>36;37</sup> The patient sample in this survey is representative of that who consult physicians and reflects the way in which the disease is managed within each country included in the survey. While possibly biased with regard to the total COPD population, the data is representative of patients who regularly consult the physician. To avoid bias, physicians reported data for their next six consecutive patients. This is an appropriate way to collect physician-reported data that are matched to patient-reported data and used for analysis.

The methodology reflects the views of physicians and patients on COPD outside a controlled clinical trial setting and provides examples of insights on clinical understanding and decision-making, which all likely have impact on the accurate understanding of diseases at the patient level combined with trends in treatment practice.

The authors also acknowledge some limitations of the present analysis and these should be considered when interpreting the results. The limitations include the selection and diagnosis of participating patients. For the collection of data, respondents were requested to select consecutive patients to avoid selection bias. However, in the absence of randomization this is dependent

upon the integrity of the participating respondent rather than formalized source data verification procedures. Moreover, diagnosis in the target patient group is based primarily on the judgment and diagnostic skills of the respondent physician rather than on a formalized diagnostic checklist, although it is acknowledged that in real life situation, patients are managed in accordance with the same routine diagnostic procedures representative of that clinical practice setting. A further limitation is the cross-sectional nature of the data that precludes conclusions to be made regarding the cause and effect of the results. The assessment of patient's COPD severity was physician-observed and was not based on pulmonary function data. Nevertheless, we know that COPD may not correlate with the degree of airflow limitation, as measured by spirometry methods<sup>38</sup> and this was confirmed by the recent updated GOLD Strategy that recommend the classification of COPD not only on the degree of airflow limitation but also on symptoms, exacerbations, and comorbidities.<sup>3,39</sup> The present results are limited by the missing possibility to analyze and adjust for treatments that are known to alter the frequency of exacerbations of COPD. Another limitation is the declarative nature of the data on 'days off work'. It can be assumed that, because 'days off work' are important events in the life of employed patients, they are likely to remember these accurately enough and not grossly underestimate them, either due to lack of awareness about the disease or possible cultural reasons.<sup>9,38</sup>

#### INTERPRETATION OF FINDINGS IN RELATION TO PREVIOUSLY PUBLISHED WORK

Several studies have examined the impact of COPD on the working populations.<sup>9,14-16;19;40;41</sup> Although diagnosis of COPD has been shown previously to be associated with a reduction in workforce participation and disability, the causes are still unclear. To our knowledge only one study by Orbon et al. compared employed and 'not in paid employment' COPD patients,<sup>19</sup> and a decrease in the likelihood of employment of 8.6 percentage points for COPD patients was reported by Thornton Snider

et al.<sup>42</sup> This association rivals that of stroke and is larger than those of heart disease, cancer, hypertension, and diabetes. Similar trend regarding employment for COPD patients was reported by Sin et al. who showed a reduction in the adjusted probability of being employed<sup>28</sup> and by South American epidemiological data.<sup>43</sup> Our data regarding a greater level of COPD severity, increased number of exacerbation and hospitalizations, as well as increasingly poorer scores for QoL, utility, health state, and dyspnea may provide some explanations for a decrease in employment among patients with COPD.

#### IMPLICATIONS FOR FUTURE RESEARCH, POLICY AND PRACTICE

Our data indicate that efforts should be made to minimize the impact of COPD, as this might enable people to remain employed. COPD patients 'not in paid employment' have a more severe disease, lower QoL, and more exacerbations all of which impact on direct and indirect costs carried by the disease. The data provide a strong argument to promote early diagnosis of COPD and treatment of patients suspected to have COPD in an attempt to slow down the progression of the disease to a more severe stage.

The European Federation of Allergy and Airways Diseases Patient Associations (EFA) advocates coordinated and harmonized actions at the EU and national governments levels.<sup>44</sup> The proposed programs include early recognition and early treatment of the disease, smoking cessation campaigns, better communication between all health care professionals, equal top quality healthcare to prevent exacerbations of COPD, access to clear and easily understood information on the disease, as well as social- and employer-supported programs. To achieve this, employers need to be motivated to adopt flexible approaches that allow their staff with COPD to remain in the work force. Policymakers should promote such flexibility, with a view to achieving a sustainable improvement in the quality of life for COPD patients and ensuring their contribution to society.

Parallel to the efforts of EFA, other organizations, including the International Primary Care respiratory Group (IPCRG), European

Respiratory Society (ERS), and the Global Alliance against chronic Respiratory Diseases (GARD) of the World Health Organisation (WHO), work actively to improve early diagnosis of the disease, promote prevention measures to reduce the risk factors for COPD development, progression and exacerbation, and co-morbidities, disseminate the existing guidelines and facilitate access to harmonized high quality treatments of chronic respiratory disease across all sectors of the population.<sup>45;46</sup>

## CONCLUSIONS

Our cross-sectional data show that compared with employed patients with COPD, the patients with COPD 'not in paid employment' have a more severe disease, lower QoL and health state, more exacerbations, higher incidence of co-morbidities including anxiety and depression, and greater use of health-care services. For these associations the direction and a precise cause are not clear at present. Nevertheless, our data could be interpreted to indicate that by providing improved management of COPD, may allow patients to remain in employment for an extended period of time. This also could lead to fewer exacerbations, fewer visits to health-care facilities, lower incidence of co-morbidities, and a more favorable QoL and reported health state. To achieve this requires active implementation of COPD-related healthcare policies and adjustments to workplace strategies that accommodate patients' needs while retaining employment and productivity.

## CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest in relation to this article.

## AUTHORS' AFFILIATIONS AND CONTRIBUTIONS

Miguel Roman Rodriguez, is a family physician at Centro de salud Son Pisà. Balearic Health Service. Palma de Mallorca, Spain and contributed to the clinical interpretation of the data, drafted, edited all sections of the manuscript and performed literature review on the research topic.

Mark Small, is affiliated with Adelphi Real World, Macclesfield, UK and designed collection of the data, performed an essential review of the data, critically reviewed the content of the manuscript and is guarantor for the manuscript.

Steve Fermer, is affiliated with Adelphi Real World, Macclesfield, and provided support for the development of the manuscript outline and prepared the Methods Section.

James Bailey, is affiliated with Adelphi Real World, Macclesfield, and designed and supervised collection of the data. He collaborated closely with the statistician in data review, contributed to content of all sections of the manuscript and is a guarantor for the manuscript.

Robert Wood, is affiliated with Adelphi Real World, Macclesfield, and performed statistical analysis of the data, prepared tables, figures and contributed to the interpretation of the data.

Antje-H. Fink-Wagner, is affiliated with the European Federation of Allergy and Airways Disease Patients Association (EFA), Brussels, Belgium and evaluated data, contributed to concepts and content of all sections of the manuscript.

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# The Association Between Health Risk Change and Presenteeism Change

Increases and decreases in health risks are associated with increases and decreases in presenteeism.

Using results from WLQ-Work Limitations Questionnaire (short-form), 1.9% excess loss of productivity was associated with each changed health risk factor over time -equivalent to \$950 per year risk changed.

This study used an eight-question short-form version of the Work Limitations Questionnaire (WLQ) incorporated into a standard Health Risk Appraisal (HRA) to measure changes in productivity loss and changes in health risks in a large financial institution employee population.

The study population was required to participate in two HRAs in 2002 and 2004 (N=7,026; participation rate of 10% of eligible population).

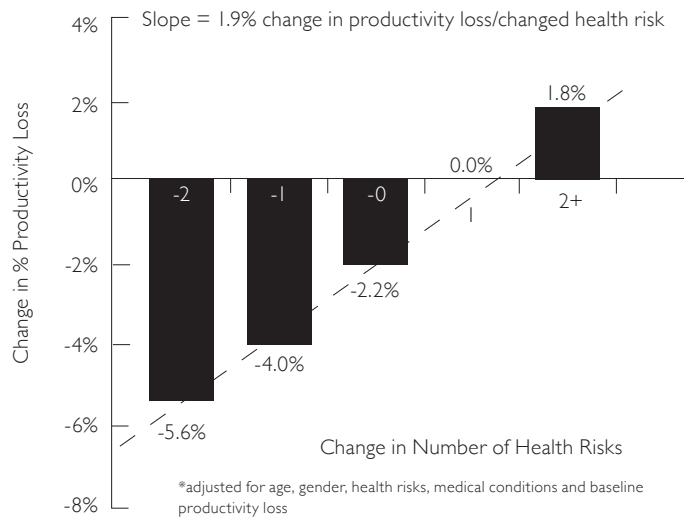
Individuals who reduced their risks experienced an improvement in productivity, whereas those who gained risks or remained high-risk, experienced deterioration in productivity.

Each risk factor increased or reduced was associated with a commensurate change of 1.9% productivity loss over time (adjusted for age, gender, health risks, medical conditions and baseline productivity loss). This change in productivity was estimated to be \$950 per year per risk changed.

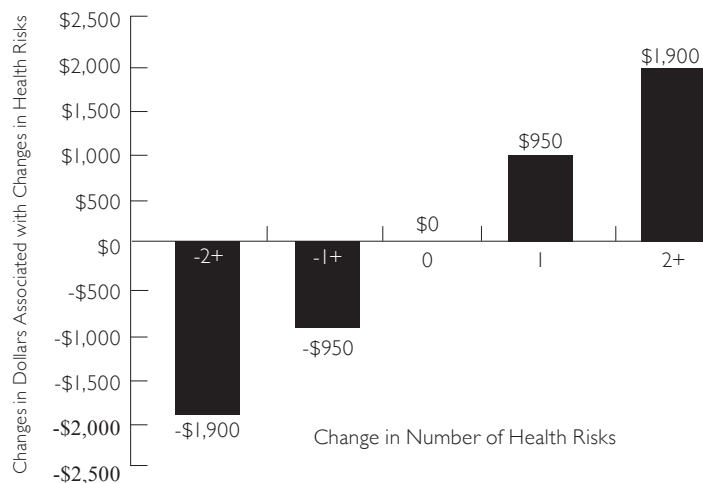
Considering the number of individuals with “any” productivity loss, overall, each risk change (positive or negative) equaled a 5.8% change in the percent of people reporting ant productivity loss (adjusted for age, gender, health risks, medical conditions and baseline productivity loss).

Both versions of the productivity loss metric (average productivity loss and any productivity loss) showed significant linear trends of changed productivity associated with changes in health risks. Risk change and changes in productivity were thus demonstrated to be strongly associated and to change in the same direction - productivity loss increased as health risks increased and productivity loss decreased as health risks decreased.

Change in Percent Productivity Loss and Number of Changed Health Risks



Estimated Changes in Dollars Associated with Changes in Health Risks



**Reference:** Burton WN, Chey CY, Conti DJ et al. The Association Between Health Risk Change and Presenteeism Change. *Journal of Occupational and Environmental Medicine.*2006;48(3):252-263

(Academy Briefs: edited by Shirley Musich, PhD)



# The Clinical and Occupational Correlates of Work Productivity Loss Among Employed Patients With Depression

FIGURE 1  
Mean % Time Health Interfered with Performing Job Demands (WLQ Scales)

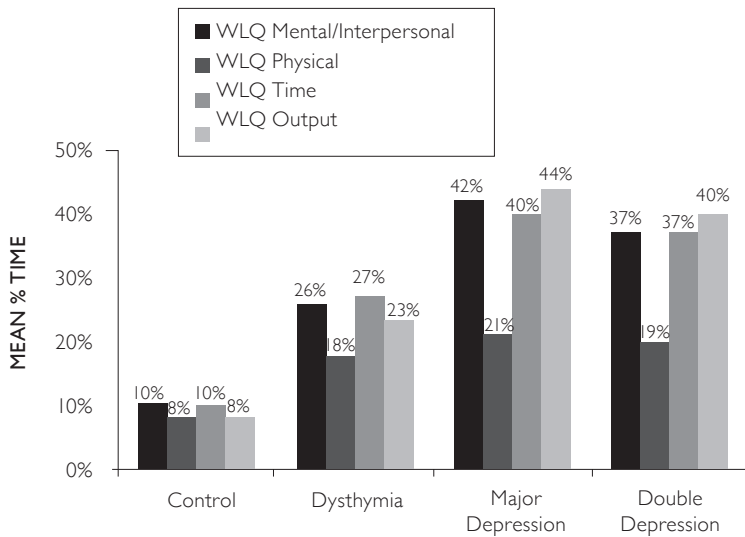


FIGURE 2  
Occupational requirements are associated with productivity loss among employees with depression

FIGURE 3

- Productivity loss was influenced by depression severity
- Losses increased when employees had occupations requiring proficiency in decision-making and communication and/or frequent customer contact
- By identifying employees with most productivity losses, the WLQ tool can help to identify productivity improvement priorities

Regression Models: Relationship of Productivity Loss to Specific Occupational Requirements and Specific Depression Symptoms

	Mental/ Interpersonal	Physical	Time	Output
Variables	β	β	β	β
Occupational Requirements				
Judgement/communication (0-1)	10.0	-3.9	16.9*	22.9*
External customers (0-1)	8.5*	8.8*	6.2	4.4
Depression Symptoms				
Concentration loss (0-1)	29.7*	9.0*	27.1*	36.0*
Fatigue/sleep problems (0-1)	15.6*	5.4	12.7*	18.8*
Physical health (0-1)	-28.4*	-49.6*	-37.6*	-23.4*

\*p<.05

The study sample consisted of 246 employees with diagnosed depression (dysthymia, major depression or double depression) and 143 healthy controls. All depression and control subjects were recruited from primary care physicians' offices between February 2001 and February 2003. Enrollees were asked to complete mail surveys every six months for eighteen months. A \$20 cash incentive was paid for the baseline survey and \$10 each follow-up.

Surveys included 25-item Work Limitations Questionnaire (WLQ), PHQ-9 depression questionnaire and SF-12 physical health assessment. Enrollees were primarily female (88%) and white (90%) with a mean age of 40 years.

Results indicated that depression severity and specific symptoms influenced productivity losses. Losses increased when employees had occupations requiring proficiency in decision-making and communication and/or frequent customer contact.

**Reference:**

Lerner D, Adler DA, Chang H, Berndt ER, Irish JT, Lapitsky L, Hood MY, Reed J, Rogers WH. The Clinical and Occupational Correlates of Work Productivity Loss Among Employed Patients With Depression. *Journal of Occupational and Environmental Medicine.* 2004; 46(6):S46-S55.



# Challenges and Opportunities for Preventing Depression in the Workplace: A Review of the Evidence Supporting Workplace Factors and Interventions

This literature review explores the existing scientific evidence for prevention of depression in the workplace. Seminal articles highlighting workplace factors and interventions for preventing depression in the workplace are highlighted. Much of the evidence base for primary and secondary depression prevention strategies remains a work in progress, nevertheless, the literature does provide guidance for employers. The need for population screening for depression should be evaluated based on numbers of employees at risk or, alternatively, screening can be limited to high risk subgroups. Both organizational factors and individual interventions should be considered. Organizational approaches have less evidence supporting specific interventions but several worker stress models (e.g., demand-control; effort-reward) have linked high worker stress with increased psychological problems. Organizational interventions could include strategies to reduce worker stress, improve mental health literacy and promote work-life balance. Individual interventions could include promoting protective factors, general healthy lifestyle habits, improvement of mental health literacy and access to early interventions and therapies. Employers should be aware of mental health benefits structures to minimize employee cost for mental health medical interventions. The value of depression prevention can be demonstrated by linking prevention strategies with other administrative databases including short-term disability, absenteeism, employee turnover or health risk appraisal psychosocial indicators (i.e., job satisfaction, stress, self-reported perception of health).

Primary and secondary prevention strategies by employers and employees can reduce the incidence and impact of depression in the workplace

- Primary prevention of depression requires multidimensional strategies to reduce modifiable risk factors, improve protective factors, increase mental health literacy and enhance mental health promotion
- Secondary prevention requires early detection of mental health symptoms and effective interventions
- The evidence base for interventions that promote primary and secondary prevention of depression are a work in progress, nevertheless, the scientific literature does provide guidance to employers

Employer Strategies to Prevent Depression:

- Decrease worker stress
- Clear job descriptions
- Better work design
- Joint employee-management committees
- Child and elder care options
- Career training/enhancement opportunities
- Job demands/rewards balance
- Enhance employee work-life balance
- Promote mental health literacy
- Review mental health plan benefits
- Consider depression screening and offer mental health interventions
- Demonstrate value by integration with productivity metrics

Employee Strategies to Prevent Depression:

- Build protective factors
- Coping skills
- Resilience training
- Stress management
- Social support
- Promote general good health habits including nutrition, sleep and exercise
- Enhance mental health literacy
- Participate in mental health promotion including depression screening
- Enhance mental health self-management skills
- Seek early interventions for mental health symptoms
- Use cognitive behavior therapy approaches

## Reference:

Couser GP. Challenges and Opportunities for Preventing Depression in the Workplace: A Review of the Evidence Supporting Workplace Factors and Interventions. *Journal of Occupational and Environmental Medicine*. 2008;50:411-427.

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