

The Management of Metabolic Health in the Workplace

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Abstract

Metabolic syndrome is a recently defined disorder characterized by insulin resistance with elevated fasting blood glucose levels, abdominal obesity, hypercholesterolemia, and elevated blood pressure. It is highly prevalent in the adult population, and people with at least three of the risk factors above also are at increased risk for morbidity and mortality. These metabolic and related cardiovascular risks are increasing in prevalence, and contributing to rising employer health costs and diminished work productivity. To sharpen the focus of all stakeholders on the importance of metabolic health, a consensus conference of experts was convened under the aegis of the Institute for Health and Productivity Management's Workplace Center for Metabolic Health to address some of the key health and economic issues associated with the overall state of metabolic health in the workplace. The conference considered two questions: (1) What are the healthcare and workplace costs of metabolic health issues? (2) Can workplace health initiatives addressing these issues improve functional health status and work productivity? The conference concluded that new approaches to employee disease management focusing on metabolic risk factors have the potential to improve the health status and performance of the work force while producing a positive return on investment for employers.

The initiative was made possible by support from Abbott – a global, broad-based health care company devoted to the discovery, development, manufacture, and marketing of pharmaceuticals and medical products, including nutritionals, devices, and diagnostics.

Introduction

A disorder of recent description, metabolic syndrome refers to a constellation of prothrombotic and proinflammatory risk factors that include insulin resistance (i.e., impaired insulin action), abnormal abdominal fat distribution, atherogenic dyslipidemia, and hypertension¹. Nearly one quarter of U.S. adults (47 million people) meet this definition, and this percentage is expected to rise as the prevalence of obesity continues to increase in the population.^{2, 3} These people have an elevated risk of morbidity and mortality from cardiovascular disease, peripheral

vascular disease, Type 2 diabetes mellitus, myocardial infarction, and stroke. The probability of developing coronary heart disease, stroke, or diabetes over a 20-year period increases from 12 percent for those without these risks to 31 percent for those with three metabolic abnormalities and 40 percent for those with four or five metabolic abnormalities⁴. The prevalence of this condition is greatest among Americans of working age and, consequently, has contributed markedly to rising employer health costs and diminished employee productivity.⁵⁻¹¹ This situation has prompted corporate management to introduce coordinated health improvement programs to promote wellness in the workplace—the goal of which is to reduce the substantial health and economic burdens associated with multiple metabolic and related health risks.

Metabolic Health vs. Metabolic Syndrome

Metabolic syndrome is a combination of health risk factors that includes enlarged waist circumference (central obesity), elevated fasting blood glucose, elevated blood pressure, elevated triglycerides, and reduced HDL cholesterol. An individual with any three of the five risk factors can be given a diagnosis of metabolic syndrome.

Atherosclerotic vascular disease (ASVD) is clearly the major outcome from metabolic risks and diseases, which are individual, independent risks of varying degrees for ASVD as well as co-morbidities for each other and other diseases. A comorbidity raises the likelihood of the development of another condition and may make another condition more difficult to manage. An example is that obesity raises the risks of developing dyslipidemias and Type 2 diabetes.^{10, 12, 13}

There are other risk factors that could be considered part of the metabolic syndrome, such as prothrombotic and pro-inflammatory risks, but the definition above is the most common and widely accepted one. It is known as the ATP III model, adopted by the Third Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults: Adult Treatment Panel III (ATP III).^{1, 10} (See Exhibit 1)

The problems with the various definitions of met-

Exhibit 1: Clinical identification of metabolic syndrome

RISK FACTOR	DEFINING LEVEL
Abdominal obesity <ul style="list-style-type: none"> • Men • Women 	Waist circumference <ul style="list-style-type: none"> • >102 cm (>40 in) • >88 cm (>35 in)
Triglycerides	≥150 mg/dL
HDL-cholesterol <ul style="list-style-type: none"> • Men • Women 	<ul style="list-style-type: none"> • <40 mg/dL • <50 mg/dL
Blood pressure	≥130/85 mm/Hg
Fasting glucose	≥110 mg/dL

Adapted from: National Institutes of Health. Third Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Bethesda, MD: National Institutes of Health; 2001. NIH Publication 01-3670.

abolic syndrome, including ATPIII, are that they:

- do not include a full lipid profile, omitting valuable markers of risk (total cholesterol [TC], LDL, HDL, TC/HDL ratio, triglycerides); and
- do not identify for the employer the impact of the risk factors on workplace performance.

For these reasons, initiatives to improve metabolic health should focus on an extended number of metrics, including:

- *Fasting glucose
- A1C
- Fasting lipid profile – total cholesterol, [TC], LDL, *HDL, TC/HDL ratio, *triglycerides
- *Systolic blood pressure
- *Diastolic blood pressure
- *Waist circumference
- Body weight
- Fitness metrics – sit and reach, hand grip strength, three- minute step test
- Presenteeism – impaired workplace performance due to chronic health conditions

The reporting from the Metabolic Health Initiative described later in this article was for all of the above risk factors for a “metabolic syndrome” sub-population. The asterisks (*) above are the risk factors for that metabolic syndrome sub-population.

To address clinical and economic issues related to metabolic health, the Institute for Health and Productivity Management (IHPM) convened a Consensus Conference on the Management of Metabolic Health in the Workplace on September 24, 2008. Following a day of presentations by experts in the relevant fields, a consensus panel chaired by William Bunn, MD, and John Seibel, MD, considered the evidence and formulated a consensus statement that addressed the following questions:

Exhibit 2: Eliminated Risk Factors

328 completed

- 212 (65%) people **eliminated** at least 1 risk factor
 - 83 eliminated only one risk factor
 - 62 eliminated 2 risk factors
 - 41 eliminated 3 risk factors
 - 21 eliminated 4 risk factors
 - 4 eliminated 5 risk factors
 - 1 eliminated 6 risk factors
- 212 people **eliminated** 440 risk factors

An average of 2.08 risk factors eliminated per participant who eliminated at least one risk factor
 - Does not include risk factors improved but still above target

- What are the healthcare and workplace costs of metabolic health issues?
- Can workplace health initiatives addressing these issues improve functional health and work productivity?

These questions are addressed in the following sections. Answers are based on information from presentations at the Consensus Conference and from the panelists’ discussion.

What Are the Healthcare and Workplace Costs from Metabolic Health Issues?

Healthcare Costs

Although scant research on the costs associated with metabolic health issues is available, a large body of evidence on the health and economic burden of the discrete metabolic and related cardiovascular risk

Exhibit 3: Improved Risk Factors -
Risk Factors Improved but Still Above Target

328 completed

- 212 people **eliminated** at least 1 risk factor
 - 116 people **did not eliminate** at least 1 risk factor
 - 107/116 people **improved** in at least 1 risk factor
 - 13 people improved in 1 risk factor
 - 12 people improved in 2 risk factors
 - 25 people improved in 3 risk factors
 - 14 people improved in 4 risk factors
 - 25 people improved in 5 risk factors
 - 11 people improved in 6 risk factors
 - 4 people improved in 7 risk factors
 - 3 people improved in 8 risk factors
- 107 people improved 411 risk factors

An average of 3.84 risk factors *improved* per participant who improved at least one risk factor

factors indicates a substantial impact. Obesity, a critical metabolic risk factor, is now a well-recognized public health problem that continues to worsen at an alarming rate and makes a large contribution to aggregate U.S. healthcare expenditures. Wolf and Colditz estimated that in 1995 the economic impact of obesity was nearly \$100 billion, half of which (\$52 billion) was attributable to direct medical costs¹¹. Approximately 62 percent of these medical expenses stemmed from Type 2 diabetes. The direct costs of obesity represented 5.7 percent of all health spending in the United States for that year.

Using data from the Third National Health and Nutrition Examination Survey (NHANES III), a subsequent analysis found that obese individuals (body mass index ≥ 32.5) aged 45 to 64 incur lifetime medical costs for five obesity-related diseases—hypertension, Type 2 diabetes, hypercholesterolemia, coronary heart disease, and stroke—that are \$10,000 to \$16,000 higher than the costs incurred by those who are not obese.¹⁴ And young adults and middle-aged people who were seriously obese had almost 75 percent higher average annual health expenses in old age than non-obese individuals, with total cumulative charges ranging from \$125,470 and \$119,318 in mildly obese women and men to \$174,752 and \$176,947 in seriously obese individuals vs. \$100,959 and \$100,431, respectively, for normal-weight women and men.¹⁵

The health costs associated with Type 2 diabetes and hypertension also are substantial. Estimated direct costs for Type 2 diabetes mellitus were \$92

billion in 2002; expenditures for hypertension were \$69.4 billion in 2008.^{16,17} Complications from both conditions, which include kidney disease, heart disease, and stroke, also can lead to substantially higher healthcare costs. Caro, Ward, and O'Brien reported in 2002 that the average lifetime cost of complications from Type 2 diabetes was \$47,240 per patient, the largest portion of which stemmed from macrovascular diseases.¹⁸ A 2001 study found that, on average, people with high blood pressure spent \$3787 per year for all disease-related charges.

Workplace Costs

Workplace costs of metabolic health issues include the economic impact of lost productivity: time away from work due to illness, short- and long-term disability, workers' compensation, and presenteeism (decreased on-the-job performance).¹⁹ Numerous studies document the productivity losses associated with employee health risks.^{5, 7, 20-25} For instance, at a large Midwestern manufacturing concern, 36.2 percent of all time away from work was due to excess health risk, costing the company \$1.7 million a year.⁷

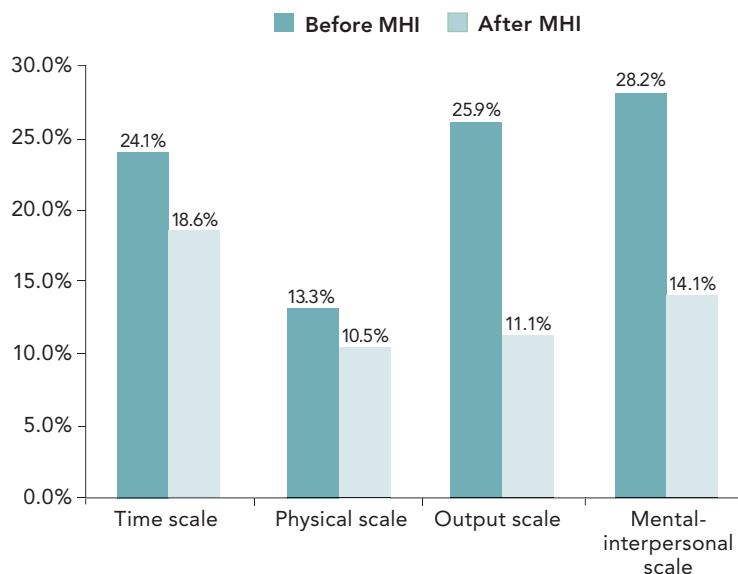
At another national corporation, the number of self-reported health risk factors was directly correlated with work limitations²⁰. Each additional risk factor was associated with a 2.4 percent loss of productivity, with medium- and high-risk employees reporting 6.2 percent and 12.2 percent lower productivity, respectively, than low-risk individuals²⁰. The annual lost-productivity cost to this company was between \$99 million and \$185 million, or between \$1,362 and \$2,592 per employee.²⁰

Employees at a third corporation who experienced a favorable change in their health risk status by participating in a wellness program, by contrast, saw a measurable improvement in their work productivity.²¹ Those who favorably changed one risk factor decreased their presenteeism by 9 percent and lowered their absenteeism by 2 percent.²¹ Goetzel, et al indicated that reducing absenteeism and presenteeism by eliminating health risk factors could save employers \$392 per person annually for workers with hypertension and \$368 for those with heart disease.⁵

Several validated self-report survey instruments now are available to help employers track productivity and its relationship to health impairment. Most widely used among them are the Work Limitations Questionnaire (WLQ), the Health and Performance Questionnaire (HPQ), and the Work Productivity and Activity Impairment Questionnaire (WPAI). Multiple uses of these instruments have produced large databases of metrics for estimating the impact of disease on work performance.²⁶

Metabolic health issues, then, are associated with

Exhibit 4: Changes in productivity loss for all valid participants who completed WLQ surveys, regardless of risk factor status.



MHI = Metabolic Health Initiative; WLQ = Work Limitations Questionnaire.

(Reprinted from Nevins²⁷, in press)

enormous healthcare and workplace costs to both employees and employers—higher direct medical expenses and larger productivity losses. Reducing risk factors has the potential to enhance employees’ job performance as it improves their health status – reducing the total burden of illness-related costs, which can be several times larger than direct medical expenditures.

Can Workplace Health Initiatives Addressing Metabolic Health Issues Improve Health and Work Productivity?

Workplace health initiatives now are well-established interventions to promote employee health and enhance productivity.²⁷⁻³⁶ These programs have demonstrated that well-designed jobsite health promotion activities can produce sizable gains in employee health status and work productivity, thereby providing a substantial return on investment (ROI) for employers.

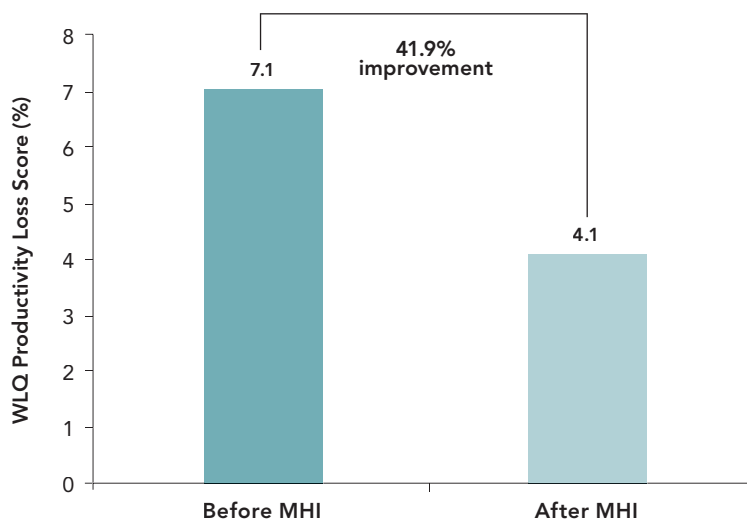
A multinational corporation in the United Kingdom introduced a multifaceted health promotion program consisting of a health risk appraisal questionnaire, a health improvement web portal, health literature, and seminars and workshops devoted to targeted health issues.²⁹ Of the 618 employees who enrolled in the program, 266 (43 percent) completed questionnaires prior to and following the 12-month program.²⁹ A matching group of controls also com-

pleted the questionnaires.²⁹ At the end of the initiative, employees who participated showed significant mean reductions in number of health risk factors (0.45), monthly absenteeism days (0.36), and impaired work performance (0.79 percent), compared with controls.²⁹ The investigators found that the ROI for employers from this intervention was favorable (\$1,364 per individual).

In Utah, 37 pre-diabetic and previously undiagnosed diabetic employees at a medical supply company participated in a 12-month worksite diabetes prevention program.³¹ After six months, participants saw beneficial changes in risk factors for metabolic syndrome, including weight, body mass index, waist circumference, oral glucose tolerance testing, fasting insulin, blood lipids, and aerobic fitness—and these positive changes were largely sustained through 12 months.³¹ After two years, the 22 employees who continued in the study showed significant improvement in oral glucose tolerance, HDL-C levels, and aerobic fitness ($P < .0001$), suggesting that worksite diabetes prevention programs have the potential to lower blood glucose to normal levels.³¹

Comparing the relative efficacy of employer-directed educational programs, monetary incentives, or customary care in reducing low-density lipoprotein cholesterol (LDL-C) levels, Bloch et al showed that workers with elevated LDL-C (>130 mg/dL) who participated in multidisciplinary jobsite educational programs or received small cash awards

Exhibit 5: Changes in productivity loss for participants with improved glucose.



MHI = Metabolic Health Initiative; WLO = Work Limitations Questionnaire.
(Data from Nevins²⁷)

(\$100 checks) achieved significantly greater reductions from baseline in LDL-C levels than did those continuing to receive their usual care.³² This study enrolled 171 employees who sought lipid screening at a local hospital system health fair and then randomized them into the three groups described above. All received online educational materials at baseline. Those in the educational program received additional classroom instruction from nurses as well as monthly “tele-health” calls.³² After 6 months, the cash award and educational program groups each experienced mean LDL-C reductions of 17.9 mg/dL from baseline (mean LDL-C=156 mg/dL), compared with mean reductions of 5.5 mg/dL in the customary care group, a difference that was significant ($P=.02$).³² Although the study did not investigate which intervention produced a higher corporate ROI, the results demonstrate that partnerships between area hospitals and employers have the potential to achieve positive changes in health behaviors over time.

Metabolic Health Initiative in the City of Phoenix

The Metabolic Health Initiative (MHI), a recent pilot program designed to identify and reduce metabolic and related cardiovascular health risks among municipal employees of the City of Phoenix, Arizona, demonstrated that an integrated intervention strategy can achieve beneficial changes in risk factor status and work productivity.²⁷ The MHI included comprehen-

sive education about metabolic health, coaching and mentoring to promote behavior change, and onsite lecture and training sessions.²⁷ Participants were free to choose any or all of the components. At baseline, 654 city workers qualified for the pilot, of whom 328 completed at least one round.²⁷

Previously Unrecognized Risks and Diseases

Participants were required to complete a comprehensive personal health survey, laboratory testing, physical measurements and a fitness assessment. The following definitions were used.

Known cases – Survey responses indicated the respondents had knowledge of current or past abnormal levels of risk factors and lab and physical measurements confirmed those risk factors abnormalities consistent with survey responses.

New cases – Survey responses indicated no knowledge or history of an abnormal risk factor, but laboratory results and physical measurements found abnormal risk factor level(s).

Pre – Laboratory or physical measurements indicated an abnormal value between the normal level and the level at which the individual would be diagnosed with the risk or disease in question.

- Pre-hypertension – blood pressure > 120 / 75 and < 130 / 85
- Pre-diabetes – fasting blood glucose between 99 mg percent and 109 mg percent
- Only pre-hypertension and pre-diabetes have

specific ICD-9 codes, adding emphases to their roles in early detection and prevention of the diagnoses of hypertension and diabetes.

The analysis demonstrated that 49.5 percent (900 / 1,818) of the risk factors were previously unrecognized among those participants who had survey, lab and physical measurements data. This finding identifies a potentially costly subpopulation because, left alone, unrecognized cases will worsen, be more advanced when recognized and be more likely to develop co-morbidities and complications.

Eliminated, Improved and Unchanged Risk Factors

Eliminated risk factors

Risk factor changes were categorized by risk factors that were eliminated, risk factors that were improved, and risk factors that were unchanged, worsened or not completely reported through the pilot. (Exhibit 2)

Elimination of a risk factor was defined as moving that risk factor below the target level or within the target range, such as total cholesterol from 250 mg percent to 175 mg percent (target level of less than 200 mg percent).

Three hundred and twenty-eight participants completed one round of the pilot. In that group, 212 (65 percent) participants eliminated at least one risk factor. There were 440 risks eliminated among the 212 participants for an average of 2.08 risk factors eliminated per participant who eliminated at least one risk factor. This does not include risk factors that were improved but not eliminated.

Improved risk factors

Improvement in a risk factor was defined as moving that risk factor to a more favorable level without reaching the “not at risk” level, such as beginning with a total cholesterol of 300 mg percent and moving the level to 225 mg percent, still above the target of less than 200 mg percent. (Exhibit 3)

Since there can be clinical value when risk factors are improved without being totally eliminated, the analysis looked at the prevalence of improved risk factors among the 116 participants who did not eliminate any risk factors. Four hundred and eleven risk factors were improved in 107 participants, yielding an average of 3.84 risk factors improved per participant who improved at least one risk factor.

Nine participants did not improve, did not change, worsened or had incomplete test results during the program. Most of this latter group participated in the laboratory and physical measurements sessions and made little or no effort to change their health behaviors through classes and other kinds of educa-

tion offered during the program.

To summarize, 65 percent (212) of the participants eliminated a total of 440 risk factors (average of 2.08 risk factors each), 32 percent (107) of the participants improved 411 risk factors (average of 3.84 risk factors each) and 3 percent of the participants did not eliminate, improve or report risk factors.

The primary behavior change dynamics in the MHI resulted from early recognition of the need for products and services that encourage healthy lifestyle behavior choices. This led to the evolution from the intervention in Phoenix – a powerful behavioral change engine of nutrition and exercise called *Body-for-LIFE* – to a comprehensive health risk identification and reduction program, called *Changes That Last A Lifetime*[®] (CTLL) implemented at later sites. CTLL includes pre and post biometric screening, Know Your Numbers (KYN) report with disease risk assessment, daily e-mail reminders to participants for one year, education and monitoring of compliance, and robust reporting of clinical outcomes from participation in the program.

Workplace performance

Workplace performance was estimated at the beginning and end of the MHI using the Work Limitations Questionnaire (WLQ). As Exhibits 4 and 5 illustrate, there was substantial improvement during the MHI in all four scales of the WLQ, with a 41.9 percent improvement comparing pre and post intervention scores. This change can reduce the hidden costs of presenteeism and can be achieved through the elimination or improvement of risk factors.

Conclusion

The Consensus Conference focused on the healthcare and workplace costs of metabolic risk factors and the outcomes of workplace health initiatives to reduce metabolic risks and their impact on productivity.

The total healthcare and workplace cost burden of metabolic risk factors is substantial and places the American work force at risk for increased morbidity and mortality from cardiovascular disease, peripheral vascular disease, hypertension, dyslipidemias, Type 2 diabetes, myocardial infarction and stroke. The collective cost of the multiple risk factors associated with impaired metabolic health is greater than just the sum of the individual risks because of the “multiplier” effect of co-morbidities. This total cost burden includes direct medical expenses as well as the workplace costs of absenteeism and presenteeism on the job.

The Metabolic Health Initiative (MHI) in the City of Phoenix has shown that comprehensive workplace health education and behavior change

interventions can improve employee health and reduce the negative impact of chronic diseases on workplace performance. Combining the identification of previously unrecognized risk factors with the elimination or reduction of new and known factors provides an accurate analysis of the prevalence and severity of metabolic risks and an outcomes measurement of the success of the program.

Participants must make the commitment to enroll in and complete the program. Those employees will be successful if they understand the reasons for, and expectations from, the program. Participants must be ready to make changes in their health to improve their risk status. If they are not committed, success will be limited.

Programs such as the MHI are successful if they include a strong lifestyle behavioral change component. The MHI behavior change engine was the *Body-for-LIFE* e-nutrition and exercise program, a component of Abbott's *Changes That Last A Lifetime*[®]. It resulted in risk reduction, quality of life improvement, enhanced fitness levels and improved workplace performance. Various other types of incentives (cash, days off) also may be used to improve participation and completion rates.

Best Practices components of metabolic health initiatives would include:

- Emphasis on behavioral changes for sustainable outcomes;
- Comprehensive program of exercise and nutrition;
- Leadership from senior management;
- Data integration at the individual and aggregate levels;
- Incentives for participation and completion;
- Measurable program outcomes;
- Communications program based on the organization's culture.

Initiatives with these components can help reduce the prevalence and severity of metabolic health issues in the workforce, and mitigate their deleterious effects on health, functionality, and productivity.

The Consensus Conference was the culmination of a comprehensive four-year research, demonstration, and education initiative focusing on the importance of improving metabolic health in the workplace. The initiative was made possible by support from Abbott – a global, broad-based health care company devoted to the discovery, development, manufacture, and marketing of pharmaceuticals and medical products, including nutritionals, devices, and diagnostics. **JMCM**

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