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A Metabolic Health Initiative in the City of Phoenix

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For references, please visit www.ihpm.org/jhp

ABSTRACT

Objective: The Metabolic Health Initiative (MHI) was designed to measure the impact of a comprehensive screening, education and compliance intervention on clinical indicators, health behaviors and workplace performance among employees of the City of Phoenix, Arizona, who had metabolic health risks (pre-diabetes, diabetes, pre-hypertension, hypertension, dyslipidemias and excess body fat).

Methods: Employees who volunteered were screened for the metabolic risks above through a comprehensive health status and risk survey, the WLQ productivity assessment, laboratory tests (fasting blood glucose, lipid profile, AIC), physical measurements (blood pressure, waist circumference, weight, height), and fitness assessment (grip strength, lumbar flexibility and three-minute step test). Qualified volunteer participants then chose a 6- or 12-month intervention with on-line and on-site health education and information, nutrition and exercise training and healthy lifestyle choices and behaviors. The baseline screenings above were repeated at six and twelve months to quantify changes due to participation in the MHI.

Results: Forty-nine and a half percent of the cases of metabolic health risks were previously unrecognized prior to the screenings; 65% of the participants eliminated a total of 440 risk factors; 32% of the participants reduced a total of 411 risk factors; 3% of the participants worsened or did not improve risk factors. Participants had an average of 46% improvement in workplace performance and 50% of participants who began the program also completed the program. Reports of the program results were provided in aggregate to the City of Phoenix. Reports to participants were integrated at the individual level and those reports contained protected health information that was managed per HIPAA. Marked improvement occurred in the frequency and duration of exercising and adherence to healthy eating habits.

Conclusions: The MHI identified several important areas to focus on in workplace health interventions for employees:

- need to quantify and qualify previously unrecognized risk factors;
- opportunity for early detection of risks;
- methods to reduce risk factors;
- impact of risks on workplace performance.

KEYWORDS: absenteeism, presenteeism, co-morbidities, dyslipidemias, metabolic health, metabolic syndrome, metabolic risk factors, lipids, obesity, ASVD

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INTRODUCTION

Metabolic health risks and diseases are both very prevalent and costly for employees and employers, collectively being a major component of total direct health costs in the U.S. Also, the impact of metabolic health risks and diseases is a major component of other health-related costs due to reduced workplace performance.[1,2,3,4,5,6,7,8]

This paper describes the procedures, methodologies and outcomes from a recent comprehensive identification, intervention and behavior change pilot for metabolic risks and diseases in the fifth largest municipality in the country.

STAKEHOLDERS

Metabolic Health Initiative (MHI)

The Metabolic Health Initiative (MHI) was a comprehensive education and lifestyle behavior change pilot focused on hypertension, diabetes, central obesity and lipid disorders. The initiative was designed, created and delivered through a partnership among the City of Phoenix, the Institute for Health and Productivity Management and Abbott.

About the City of Phoenix

The City of Phoenix is the fifth largest city in the U.S. and the largest capital city by population. Phoenix has a reputation

among its peers as a progressive employer. In January 2000, after a year-long, in-depth study of management efficiency by the Maxwell School of Citizenship and Public Affairs at Syracuse University, Phoenix was the only city among the nation's 35 largest urban centers to earn an overall grade of "A." Phoenix also was named the "Best Run City in the World" by the Carl Bertelsmann Foundation and has earned numerous other awards for efficient government operations.

The employee base of the City of Phoenix includes 14,500 employees of which 67.8% are male and 40.1% are minority. The average employee age is 41 years.

The value of participating in MHI for the City of Phoenix and employees included the following:

City of Phoenix as an employer

- Learn new business approach for managing employee health.
- Understand methodology and value of quantifying prevalence and severity of major causes of employee health problems through an integrated process including a personal health survey, laboratory tests and physical measurements.
- Categorize employee health costs as an investment in human capital requiring the same decision-making process as other types of capital investments.
- Develop active, not passive, role in employee health.
- Evaluate impact of chronic illness on employee performance and organizational productivity.
- Quantify lost productivity in employees at work due to chronic health conditions that cause functional impairment.
- Improve bottom line by improving employee health.

Employees of the City of Phoenix

- Identify many previously unrecognized metabolic risk factors and diseases by participating in measurements for baseline health status.
- Enhance awareness and understanding of the significance of metabolic risk factors and diseases.
- Engage in education, training and behavior compliance programs that improve health and reduce risks.
- Learn to be a better partner with their healthcare system through improved communications with their providers.
- Learn how to become better purchasers and consumers of healthcare products and services.
- Understand the impact of lifestyle behaviors on health and health risks.

About the Institute for Health and Productivity Management (IHPM)

IHPM is a global enterprise that exists to establish the full value of employee health in the workplace and maximize its impact on business performance. IHPM does this by:

- collecting and interpreting health and cost data;
- measuring the loss of productivity related to chronic health conditions;
- managing interventions to improve health and productivity;
- communicating results to larger audiences through conferences and publications;
- educating employers and other stakeholders on health and productivity management (HPM).

IHPM has established WorkPlace Centers to help employers manage the impact of costly health issues. The centers advance appropriate prevention, diagnosis, treatment and management of health risks and chronic medical conditions that have significant impact on employee health and productivity.[11]

The IHPM WorkPlace Center for Metabolic Health was created as part of a strategic priority to improve the health and productivity of employees with metabolic diseases. It promotes healthy behaviors, as well as appropriate management of the indicators of metabolic health risks and diseases, including the metabolic syndrome. This integrated approach of risk reduction, behavior change and health management reduces the incidences of metabolic health risks and diseases and their impact on workplace performance. The Center accomplishes its objectives through interventions such as the Metabolic Health Initiative (MHI) for City of Phoenix employees.[11]

About Abbott

Abbott was the founding sponsor of IHPM's WorkPlace Center for Metabolic Health. Abbott's objectives were to:

Conduct a literature review to compile an evidence base of metabolic diseases and risks

- develop baseline understanding of the problem
- identify effective ways to address the problem
- publish results of the literature review to serve as a reference

Develop innovative interventions

- use the evidence base to develop best practices for improving metabolic health in public and private sectors
- implement the best practices in a series of intervention projects to promote metabolic health and its impact on performance in the workplace

Create significant references for employers, disease management vendors and providers

- publish and report the results of the interventions in health journals and at conferences and other proceedings
- convene a Consensus Conference to define guidelines for improving metabolic health and its impact on workplace performance by stimulating independent activity in the public and private sectors

The IHPM WorkPlace Center for Metabolic Health has established an Advisory Board of prominent opinion leaders in medicine and industry around metabolic diseases and risks, launched four workplace interventions, completed multiple conference presentations, published an evidence based paper and has convened a consensus conference on metabolic health.

BACKGROUND

Metabolic Health vs. Metabolic Syndrome

Metabolic syndrome is a combination of health risk factors that includes enlarged waist circumference (central obesity), elevat-

ed fasting blood glucose, elevated blood pressure, elevated triglycerides and reduced HDL cholesterol.[9,11] An individual must have any three of the five risk factors to be given a diagnosis of metabolic syndrome.

Atherosclerotic vascular disease (ASVD) is clearly the major outcome from metabolic risks and diseases. ASVD occurs when blood lipids, platelets and other components create obstructions (plaques) in arteries carrying blood from the heart to cells in all parts of the body. The cells can become deprived of oxygen and can function poorly or even die.

This is the basic problem underlying heart attack, heart failure, stroke, transient ischemic attack (TIA), some types of kidney failure and peripheral vascular disease (reduced blood supply to the lower extremities).

The risks and diseases of metabolic health are individual, independent risks for ASVD and are co-morbidities for each other and other diseases. A co-morbidity 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. Heart attack, stroke and reduced blood supply to the legs are more likely to develop in people with metabolic health risks.

There are other risk factors that can be included in the metabolic syndrome, such as pro-thrombotic risks and pro-inflammatory risks, but the definition above is the most common and widely accepted one. It is known as the ATPIII 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 (ATPIII).[9]

The problems with the various definitions of metabolic syndrome, including ATPIII, are that they:

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

For those reasons, the Metabolic Health Initiative focused on an extended number of metrics, including:

- *Fasting glucose
- A1C
- Fasting lipid profile – total cholesterol, 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 – workplace performance

The reporting from the MHI was from all of the above risk factors and from a "metabolic syndrome" sub-population. The asterisks (*) above are the risk factors for that metabolic syndrome sub-population.

METHODS

Pilot Design

The pilot was designed to determine the procedures and methodologies in the workplace that could reduce metabolic risks and diseases and improve employee workplace performance.

The objective was not to disprove, improve or validate, for example, the medical literature's position on the physical and fiscal benefits of lowering total cholesterol from 250mg% to 175mg% or to debate the necessity of combining and maintaining the right nutrition plan with regular exercise of a certain frequency, intensity and duration to reduce weight. Rather, the objective of the pilot was to help determine how to convert the vast information about all metabolic risks and diseases from the medical literature into actionable interventions and applications that improved metabolic health risks and diseases in employees.

To accomplish this goal, multiple content sources were used and various delivery methods were applied (see below) to facilitate health changes through lifestyle behavior choices and changes. The pilot included one six-month and one 12-month intervention. Participants were free to choose which they preferred. The curriculum was the same for both, so a participant would experience the same curriculum twice in a 12-month program.

Employees of the City of Phoenix, their spouses and significant others were invited to participate. The participants who volunteered for the pilot were free to choose from any or all of the education and training opportunities.

Data sources for the project included only data collected from the participants themselves, including survey responses, results of lab tests, physical measurements and fitness assessments from third-party vendors. Medical and prescription medication claims were not used in the pilot.

The volunteer, not mandatory, self-selected participation model could have introduced an opportunity for bias into the study group. But the mandatory participation model was not acceptable to the City of Phoenix. Likewise, the use of control groups was not acceptable for cultural and potential discrimination reasons.

Objective Risks, Subjective Risks and Lifestyle Risks

Lab test results, physical measurements and fitness assessments constituted the data that were the objective risk factors. They were measured three times during the pilot and were the "scientific" basis of the outcomes.

The pilot also produced subjective findings. These included quality of life, participants' satisfaction with the pilot, risks for anxiety, frequency of inadequate sleep and risks for depression, among others. Tobacco use, alcohol use, nutrition plans and exercise habits were among lifestyle risks that were monitored in the pilot.

Privacy, Security, Reporting

All personal health messages for the individual participants were available on the dedicated web site. The health messages

included results of all surveys, lab tests, physical measurements and fitness assessments.

When the Protected Health Information (PHI) message was ready for delivery, an email was sent to the individual participants directing them to log-in with their self-created ID and password to the protected portion of the website. There they would find a personal message box with their PHI.

Participants were encouraged to take each PHI report to their physician, and a printable report was available on the dedicated website.

Any message without PHI for all participants was delivered by posting on the website or by email blasts to all participants.

Aggregate, de-identified reports were available for the City of Phoenix management team, Abbott (sponsor) and IHPM.

Incentives

The City of Phoenix determined that the intrinsic value of the products, services, and opportunities to improve personal health provided to employees was the only incentive to be offered for participating in and completing the MHI.

Institutional Review Board

The Western Institutional Review Board provided oversight approval of the pilot.

Pilot Components

The following components were integrated into a comprehensive pilot.

Management support

Strong buy-in and ongoing support were obtained from the City of Phoenix Mayor, City Manager, Personnel Director, EAP and Wellness Manager and Wellness Council (constituted from 30 people from various departments in the City government).

Employee awareness

The traditional and proven methods of communication were used to introduce the pilot, including the City of Phoenix wellness website, postcards to homes, posters, and open meetings.

Identification of participants

Employees qualified for the pilot if they completed the following:

a. Screening
- 1,543 employees completed a web-based screening survey
- based on survey responses, 859 of those respondents were asked to volunteer for the pilot, register on the dedicated website, complete a participation consent agreement, complete an on-line comprehensive health survey and participate in lab, physical measurements and fitness screening

b. Identification of participants
- 654 employees qualified for the pilot after meeting the above requirements and having at least one metabolic risk factor, not including the fitness assessment measurements

Intervention

Critical success factors were emphasized:

A) Education
- Comprehensive education about metabolic diseases (diabetes, high blood pressure, central obesity, lipid disorders), co-morbidities, diagnosis, treatment, complications, roles and responsibilities of healthcare providers and patients, communications tips for patients, understanding the causes, methods, and reasons for improving metabolic health risks, extensive nutrition and exercise training and behavioral health modification program, Body-*for*-LIFE™, now incorporated into Changes That Last a Lifetime®

B) Behavior Change
- Coaching and mentoring
- Individual and group support

C) Education and behavior change sessions delivered and repeated over various platforms by various content experts.
- Providers from various disciplines
  * On-site lecture and training series
  * Health experts – physicians, dieticians, exercise physiologists, PharmDs, advanced degree nurses, behavioral health therapists

Critical to the success of participants working to reduce metabolic risk factors was having the right nutrition plan and the right exercise intensity, frequency and duration. The MHI nutrition and exercise behavior change engine was provided through the Body-*for*-LIFE™ program, which includes nutrition education and compliance combined with resistance and aerobic exercise training.

The basic program is three twenty-minute cardio, conditioning workouts alternating weekly with three 40-minute sessions of resistance or weight training. The nutrition plan includes five/six small, well-balanced, low fat meals per day.

Body-*for*-LIFE™ is a powerful 12-week behavior change program that is supported by the following:
- Nutrition and exercise specialists who were onsite five times over the 12-week program to maintain enthusiasm and participation and provide education.
- An interactive website for education support and exercise demonstrations.
- Participant "Challenges" that offered competition opportunities to win cash prizes at both the local and national levels – based on mental and physical changes during the 12-week program.
- Journaling for recording food intake and exercise output.

RESULTS – DATA

The major categories of data were risk factors that could be objectively measured, such as laboratory tests, and risk factors that were subjectively assessed, such as survey responses. Both categories of data were collected pre- and post- intervention for comparisons. Medical and prescription medication claims were not included in the pilot.

The following data were collected at various points in the project:
- Baseline – responses to a comprehensive health survey including workplace performance, fasting glucose, A1C,

Table 1: Participation / Completion

654 employees qualified for pilot
- Volunteer, website registration, participation consent
- First lab, physical measurement, fitness assessment, surveys

328 employees completed one round
- Completed second lab, physical measurements, fitness assessment, survey
- 50% (328/654) completion rate

fasting lipid profile (total cholesterol, LDL, HDL, TC/HDL ratio, triglycerides), systolic blood pressure, diastolic blood pressure, waist circumference, body weight, height, fitness metrics (sit and reach, hand grip strength, three-minute step test)

- Six months – responses to a comprehensive health survey, fasting glucose, A1C, fasting lipid profile (total cholesterol, 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)
- Twelve months – responses to a comprehensive health survey including work place performance, fasting glucose, A1C, fasting lipid profile (total cholesterol, 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) and program satisfaction assessment.

Given the sample size of 328 completing participants and the pre-conditions described above for selection into the pilot group, the results of the study are statistically accurate within +/- 6% assuming a 95% confidence level.

To enhance participation and convenience, the on-line surveys were available for up to six weeks on the dedicated website, and the lab and physical measurements and fitness assessments were available for up to six days over two consecutive weeks at each of the three collection intervals mentioned above.

Table 2: Risk Factor Changes Among Participants Who Improved in Either the 6- or 12-Month Program

	6-Month Program							
	Pre MHI				Post MHI			
	Highest	Lowest	Average	Median	Highest	Lowest	Average	Median
Glucose	364.0	78.0	107.0	102.0	297.0	62.0	97.3	95.0
A1c	10.3	4.8	5.6	5.5	9.6	4.7	5.4	5.4
HDL Cholesterol	83.0	30.0	50.7	48.0	107.0	36.0	57.3	56.0
LDL Cholesterol	206.0	81.0	124.5	124.0	180.0	60.0	107.4	109.0
Total Cholesterol	300.0	151.0	206.0	203.0	299.0	119.0	185.7	181.0
Total Cholesterol/HDL	7.3	2.3	4.0	3.8	7.0	2.1	3.5	3.2
Triglycerides	944.0	72.0	187.0	166.0	627.0	50.0	132.8	119.0
Systolic Blood Pressure	164.0	110.0	132.1	130.0	142.0	96.0	119.2	120.0
Diastolic Blood Pressure	108.0	68.0	84.6	84.0	94.0	60.0	76.2	76.0
Waist Circumference	57.0	27.5	39.8	39.0	55.0	26.5	37.9	38.0

	12-Month Program							
	Pre MHI				Post MHI			
	Highest	Lowest	Average	Median	Highest	Lowest	Average	Median
Glucose	229.0	84.0	105.3	101.0	138.0	76.0	93.2	93.0
A1c	8.3	5.1	5.9	5.6	8.2	4.9	5.6	5.4
HDL Cholesterol	98.0	28.0	53.4	49.0	101.0	33.0	59.1	55.0
LDL Cholesterol	261.0	53.0	132.3	135.0	180.0	51.0	108.6	107.0
Total Cholesterol	369	126.0	211.6	211.0	285.0	116.0	184.3	188.0
Total Cholesterol/HDL	22.7	2.2	4.4	4.1	5.4	2.1	3.5	3.4
Triglycerides	510.0	39.0	173.4	144.0	394.0	34.0	120.8	105.0
Systolic Blood Pressure	188.0	94.0	131.4	130.0	174.0	86.0	118.4	118.0
Diastolic Blood Pressure	110.0	56.0	83.1	82.0	98.0	50.0	75.3	76.0
Waist Circumference	54.0	28.0	40.3	40.0	51.0	26.5	37.8	38.0

RESULTS/DISCUSSION

Participation/Completion

The original project plan was to provide one six-month session of the intervention, including the Body-*for*-LIFE™ nutrition and exercise program, followed by six months of repeating the metabolic health education and behavior change content from the first six months.

Nearing the end of the first session, we learned there were many participants who had begun the session slowly and wanted a second chance to participate after seeing the successes in other employees who participated in the program.

The project management team chose to offer again the Body-*for*-LIFE™ program for a second session with lab, physical measurements and surveys at the end of both the six- and 12-month programs.

Thus, participants self-divided into two groups – 177 completed one round over six months and 151 completed two rounds over 12 months. This produced a completion rate of 50% – 328 completed out of 654 who qualified (Table 1).

A round was defined as a six-month intervention (pre- and post-lab, surveys, physical measurements and fitness assessments, completed participation consent, and volunteer participation in the Body-*for*-Life™ nutrition program, exercise training and metabolic health education).

Risk Factor Ranges

Table 2 displays the ranges, averages and median levels for the laboratory testing and physical measurements for both the six- and 12-month programs. Improvement was achieved in all risk factors. Table 3 compares risk factor improvement for female, male and all participants.

Using the first risk factor, fasting blood glucose, 56.4% of all female participants improved fasting glucose by an average of 11.6mgs%, while 62.8% of all male participants improved by 9.4 mgs%. The combined average is 58.2% improvement of 10.9 mgs% for all participants.

There are minimal differences in outcomes from the six- and 12-month programs. It appears from the data and from anecdotal conversations with employees at the health fairs that the participants in the 12-month program progressed more slowly and tended to be late adopters compared to the six-month participants.

Even though a fitness evaluation can include many different measurements and is not traditionally part of a metabolic health program, the changes in fitness scores were exciting to watch over the course of the program. Incremental improvement changes in grip strength, back flexibility and pulse rate after a step test energized and encouraged participants. They viewed these changes as proof that they could positively impact their health even if their fitness assessments did not reach the stated goals.

Table 3: Average Risk Factor Changes Among Participants Who Improved in Either the 6- or 12-Month Program by Gender

	Female		Male		All Participants	
	% People Who Improved	Actual Improvement	% People Who Improved	Actual Improvement	% People Who Improved	Actual Improvement
Lab Measurements						
Glucose Lower (mg%)	56.4%	11.6	62.8%	9.4	58.2%	10.9
Alc Lower (%)	30.8%	0.2	36.2%	0.3	32.3%	0.2
Total Cholesterol Lower (mg %)	52.1%	23.5	46.8%	25.9	50.6%	24.1
HDL Cholesterol Higher (mg %)	37.2%	7.2	43.6%	5.8	39.0%	6.7
Total Cholesterol/HDL Lower	43.6%	0.7	47.9%	0.7	44.8%	0.7
Triglycerides Lower (mg %)	58.1%	51.1	63.8%	58.2	59.8%	53.3
LDL Cholesterol Lower (mg %)	44.0%	20.0	39.4%	21.6	42.7%	20.4
Physical Measurements						
Blood Pressure Lower						
Systolic (mm)	50.0%	13.2	44.7%	14.2	48.5%	13.5
Diastolic (mm)	45.7%	8.5	43.6%	7.5	45.1%	8.2
Waist Circ. Smaller (inches)	50.6%	2.3	56.4%	3.1	56.1%	2.5
Weight Loss (lbs)	68.4%	8.8	57.4%	11.0	65.2%	9.3
Step Test (pulse lower)	19.2%	15.2	41.5%	13.4	25.6%	14.3
Hand Grip Strength						
Left Hand Increase (kg)	67.5%	7.9	69.1%	14.2	68.0%	9.7
Right Hand Increase (kg)	63.2%	8.3	71.3%	12.6	65.5%	9.6
Sit and Reach Increase (cm)	67.1%	2.2	68.1%	2.7	67.4%	2.3

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 risk levels of the components of the Metabolic Syndrome were used in this analysis as presented in Table 4:

- Fasting blood glucose ≥ 110 mg %
- Blood pressure ≥ 130 / 85
- HDL < 40 mg% for men, <50 mg% for women
- Triglycerides - ≥ 150 mg%
- Waist circumference > 40 inches for men, >35 inches for women

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 to be diagnostic of the risk.

- Pre-hypertension – blood pressure > 120 / 75 and < 130 / 85
- Pre-diabetes - fasting blood glucose between 99 mg% and 109 mg%
- 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% (900 / 1,818) of the risk factors were previously unrecognized among those participants who had survey, lab and physical measurements data.

Bias is possible in the previously unrecognized data, as the participants self-selected and volunteered for the screenings in the pilot. Lack of understanding of such terms as HDL, triglycerides and others could have also resulted in under-reporting. Previously knowing and not reporting health risks may have occurred as well.

However, regardless of the reasons, and given the impact of co-morbidities, an unrecognized prevalence of nearly half is a major problem for the employer, employee and the health plan. The opportunities for early detection and prevention are obvious.

Left alone, unrecognized cases escape the traditional process of being coded for reimbursement – there is not a code for services not provided.

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. (Table 5)

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% to 175 mg% (target level of less than 200 mg%).

Three hundred and twenty-eight participants completed one round of the pilot. In that group, 212 (65%) participants eliminated at least one risk factor. There were 440 risks eliminated among the 212 participants for an average of 2.08 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 achieving the "not at risk" category, such as beginning with a total cholesterol of 300 mg% and moving the level to 225 mg%, still above the target of less than 200 mg%. (Table 6)

Since there can be clinical value when risk factors are improved without being totally eliminated, we 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.

Table 4: Unrecognized Risk Factors in 692 Employees

Condition	Known	New	Pre-
Elevated FBS	73	82	165
Increased BP	187	116	232
Reduced HDL	57	145	n/a
Elevated Trig	124	157	n/a
Increased WC	477	3	n/a
Total	918	503	397

900 cases previoulsy unrecognized/1,818 total cases

1/2 or 49.5% of total cases unrecognized before MHI

Table 5: Eliminated Risk Factors

328 completed

- 212 (65%) people ***eliminated*** at least 1 risk factor
  - — 83 eliminated only 1 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

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 at changing their health behaviors through classes and other kinds of education offered during the program

In summary, 65% of the participants eliminated a total of 440 risk factors, 32% of the participants improved 411 risk factors and 3% of the participants did not eliminate, improve or report risk factors.

We were careful to educate the participants who eliminated or improved health metrics that the measurements can move back into, or further into, the "at risk" category. If the participant changed behavior (added exercise and a nutrition plan) and lowered total cholesterol, as an example, to a "not at risk" category, that metric could return to pre-pilot level of "at risk" if the new behavior was not maintained. So, in reality, these modifiable risk factors were always present at either a controlled or not-controlled level.

Determining the prevalence of single and multiple risk factors before and after intervention has obvious impacts on early detection, risk migration, co-morbidities and complications of the metabolic health issues at the center of this pilot.

Race / Ethnicity

Figure 7 displays the ethnicity of participants in the pilot. The minority races / ethnicities all had fewer participants, by percentages, completing the pilot than those who began it. The percentage of caucasians who completed the pilot was higher than those who qualified due to the decrease completion of all other participants. White participants were 66.6% of the qualifiers, they were 73.6% of the completion group. The reasons for this are not known.

Figure 1: Race / Ethnicity

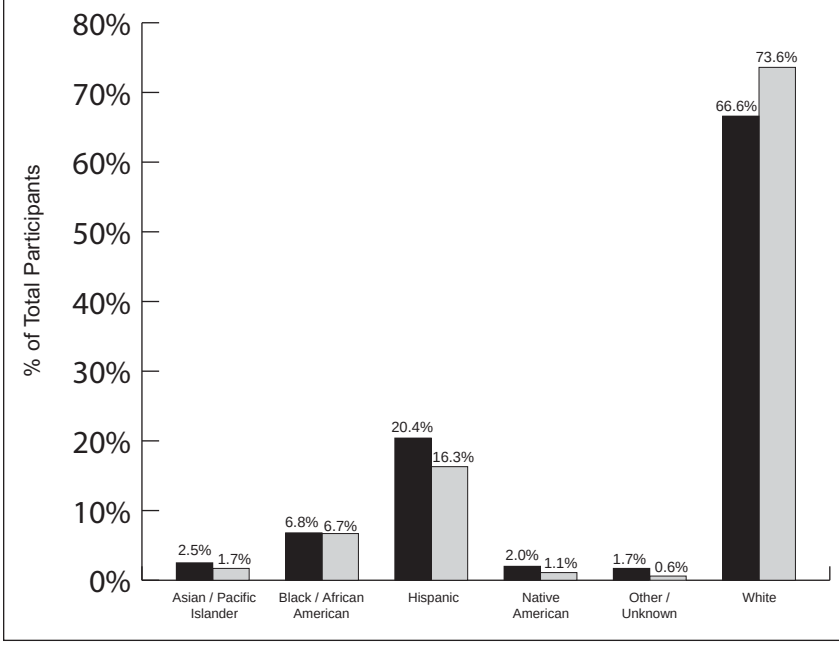


Table 6: Improved Risk Factors – Risk Factors Improved but Still Above Target

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

Measuring Workplace Performance

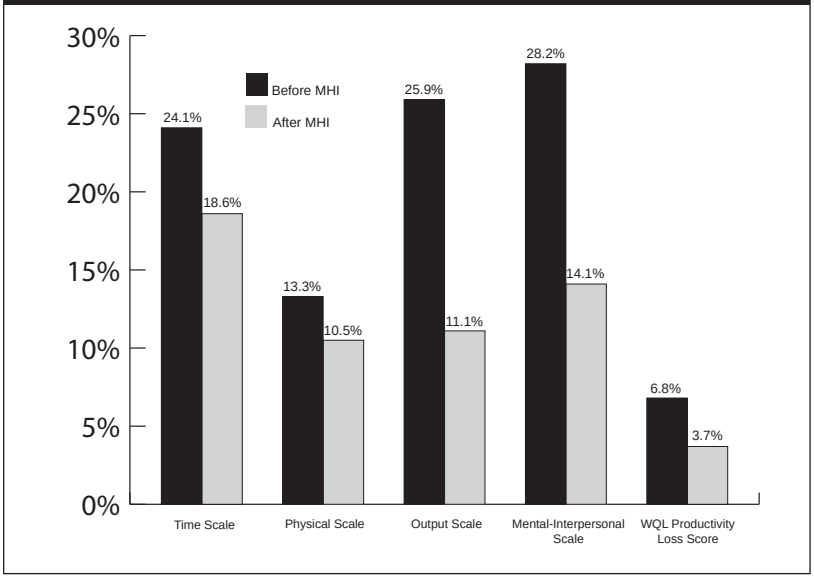
Metabolic health risks and diseases are both very prevalent and costly for employees and employers, collectively being a major component of total health costs. This impact can be quantified with self-reported surveys completed by employees. There are several survey instruments in the market. The Work Limitations Questionnaire (WLQ) was used in the MHI. (Figure 2)

The WLQ indicates the degree to which health problems interfere with specific aspects of job performance (called, "on-the-job disability" or "presenteeism".) Responses to the questions are combined into four areas of potential work limitation. These capture the multi-dimensionality of job roles (most jobs involve numerous demands). They also reflect an important characteristic of many health problems – they may result in limitations in performing some aspects of jobs but not others.

The WLQ's Time Management Scale contains two questions addressing the difficulty of performing a job easily at the beginning of the workday and starting the job soon after arriving at work. The two-question Physical Demands Scale covers a person's ability to perform job tasks that involve sitting and standing in one position and repeating the same motion repeatedly. The Mental-Interpersonal Demands Scale has two questions pertaining to the difficulty concentrating on work and a person's ability to interact with people on-the-job. The fourth scale is the Output Demands Scale. It contains two questions concerning the person's ability to complete work.

The bar graph demonstrates the improvement in productivity in each of the four scales, comparing the productivity loss before and after the MHI for participants who improved.

Figure 2: Changes in Productivity Loss
Regardless of Risk Factors



The fifth pair of bars are the pre- and post- Productivity Loss Score. It is calculated from variously weighting the scores from the four scales. In the MHI the Productivity Loss Score represents a 46% change in workplace performance.

This data are productivity changes among all of the risk factors. It clearly demonstrates a reduction in productivity loss, an increase in workplace performance.

Participants' Assessments Before and After MHI

Self-reported data were created by asking participants to rate changes in their quality of life, mental and physical energy and emotional / mood assessments as a result of participation in the MHI. The areas of focus included quality and quantity of sleep, anxiety, depression, insomnia, fatigue and impact of health on life. Respondents were asked to describe the changes from the following choices – not applicable, no change, very slight improvement, moderate improvement, large improvement and very large improvement.

Analysis of the data from the moderate, large and very large improvement responses indicated significant improvements. These subjective, quality-of-life improvements may be very influential in employees' choices to participate in these kinds of programs, as well as in the development of a culture of health at the worksite.

Participants were asked to rank the value of the components of the MHI. The response choices included no comment, little value, moderate value and high value. (Table 7)

The highest value ratings were given to the Body-*for*-LIFE™ program, on-site health education classes taught by healthcare providers and other content experts and the Body-*for*-LIFE™ text, journal and recipe book. These components were the core of the education and behavior changes objectives of the program.

The relatively high satisfaction rankings from use of the dedicated website and email communications were encouraging considering the concerns by the City of Phoenix project management team about their choice to require computer and Internet skills to participate in the MHI. Also, the wesite rankings were encouraging given the increased efficiency and reduced costs of those kinds of programs compared to those delivered in hard copy only. This has relevance in the city's decision about future projects.

The vales ratings of mentoring and coaching were consistence with the poor attendance at the sessions. There were only 27 mentoring and coaching interactions among the entire group of 328 participants.

The reasons for this poor attendance are unknown, given the fact that mentoring and coaching opportunities and potential outcomes were explained in detail to all participants at the health fairs and the fact that the health coaches had previous successful experiences with a migraine program for city employees.

SUMMARY / CONCLUSION

The Metabolic Health Initiative (MHI) was designed to measure the impact of a comprehensive workplace health education and behavior change intervention on the prevalence and severity of metabolic risk factors and diseases, and the impact of these chronic health conditions on workplace performance. Several important considerations for any employer trying to improve health and capture the enhanced corporate performance from healthier employees are discussed below. The reader is referred to several citations regarding other programs focusing on multiple risk factors.[1,2,11]

Critical findings from the MHI

The MHI identified and established several value propositions, processes and methodologies for worksite employee health interventions.

Identifying previously unrecognized risk factors. Nearly one half (49.5%) of the abnormal risk factors were previously unrecognized prior to the screenings and surveys. Bias toward finding risk factors is possible as the participants self-selected and volunteered for screenings in the pilot. Bias against finding new self-reported risk factors, due to lack of understanding of such terms as HDL and triglycerides and possible confusion with survey questions could have resulted in under-reporting. Bias against finding risk factors may have occurred deliberately if the participants did not want an employer or insurer to know about health risks in an effort to avoid riders, exclusions and increased insurance costs.

Regardless of the reasons, and given the impact of co-morbidities, an unrecognized prevalence of half the cases is a major problem for the employer, its employee and the health

plan. Unrecognized risk factors escape the traditional coding process for reimbursement (medical services and prescription medications) since there is no code for services or products not provided. These facts illustrate one of the problems with relying on medical service claims to determine the prevalence and severity of health risk factors. Left alone, unrecognized cases will be worse or more advanced when recognized and more likely to develop co-morbidities and complications.[1,6,11]

Continued laboratory testing, physical measurements and health risk assessment surveys are the best ways to identify previously unrecognized risk factors, while at the same time quantifying and qualifying the prevalence and severity of known and unknown risks. The opportunities for early detection and prevention are obvious. That was clearly demonstrated by the percentage of employees who either reduced or eliminated metabolic health risk factors in the MHI.

Quantifying and qualifying risk factors. Reducing the total number and severity of risk factors (new and known) is the important primary objective of an on-site employee health program. The specific risk factors should be determined (such as control of cholesterol) and the specific goals should be established (reduce cholesterol to less than 200 mg%). This is the approach used by healthcare providers in their offices, and the MHI has proven that it works in the employee setting to reduce risk factors.

To make a sound business decision regarding health plan options or workplace health interventions like the MHI, the employer, or a third party HIPPA business associate representing the employer, needs to know more about the employee population that just how many cases of diabetes exist.

The employer needs to know how many are controlled, how many have average fasting blood glucose levels above the recommended ranges, how many have A1C levels in the desired range and what risk factors for co-morbidities exist in employees. Laboratory testing and physical measurements are the most accurate methodologies since they determine both the prevalence and severity of risk factors – making them much more accurate than claims analysis.

Reducing Risks. Effective health-risk reduction requires education, training and persistency among the participants. The MHI has shown the value of a multi-media educational approach for reducing risks. It has also demonstrated the value of a curriculum that included on-site information and education by healthcare providers, content experts and behavior change specialists. Web-based and on-site programs were ranked by the participants as the two most valuable components of the MHI.

Participants on the MHI showed the following risk factor reductions:

- 65% (212) of the participants eliminated a total of 440 risk factors;
- 32% (107) of the participants reduced a total of 411 risk factors;
- 3% (9) of the participants worsened or did not improve risk factors.

Table 7: Participation Satisfaction

	High Value	Moderate Value	Little Value	No Comment
Body-*for*-LIFE™ nutrition plan	44.6%	29.2%	7.7%	18.5%
Body-*for*-LIFE™ exercise plan	45.1%	31.8%	7.2%	15.9%
Health Education Classes	48.7%	24.6%	7.7%	19.0%
BeBold (MHI) website	30.3%	43.6%	10.8%	15.4%
Education videos	20.5%	33.3%	14.4%	31.8%
Body-*for*-LIFE™ rallies	30.3%	26.7%	18.5%	24.6%
Body-*for*-LIFE™ book/journal	43.1%	31.8%	9.2%	15.9%
Body-*for*-LIFE™ recipe book	45.1%	30.8%	7.2%	16.9%
Email notification	52.3%	27.2%	10.3%	10.3%
Body-*for*-LIFE™ website	36.4%	29.2%	13.3%	21.0%
Wellness website	35.9%	34.9%	9.7%	19.5%
Coaching	16.4%	20.0%	18.5%	45.1%
Mentoring	14.4%	19.5%	19.0%	47.2%

We were careful to educate the participants who eliminated or improved health metrics that the measurements can move back into, or further into, the "at risk" category. If the participant changed behavior (added exercise and a nutrition plan) and lowered total cholesterol, as an example, to a "not at risk" (under 200 mg%) category, that metric could return to pre-pilot level of "at risk" (greater than 200 mg%) if the new behavior was not maintained. So, in reality, these modifiable risk factors were always present at either a controlled or not-controlled level.

Improving workplace performance. The impact of chronic illness on workplace performance (productivity) was measured through use of the Work Limitations Questionnaire (WLQ) at the baseline and in follow-up. It demonstrates that during the MHI there was a 46% improvement in workplace performance. These data are average productivity changes among all of the risk factors in all of the participants.

This area of health costs, known as presenteeism, is often significant and rarely addressed by employers. Measuring presenteeism and implementing programs to reduce it will provide the employer with a new methodology of categorizing and reducing indirect health costs, while improving corporate productivity.[11]

Determining Cost/Benefits. The purpose of the MHI was

to determine what components are the best for success in a workplace program for managing multiple metabolic health risks. The purpose was not to determine the cost-benefit ratio or return on investment for the employer using the MHI. The reader is referred to several citations as examples from many in the literature regarding costs and benefits in worksite programs like MHI.[5,6,7,8]

Future Studies and Limitation of the MHI Pilot

The MHI used laboratory testing, physical measurements and survey responses to monitor and drive reduction in metabolic health risks. It focussed on the ability to reduce metabolic health risks in the workplace and measure the impact on work performance. Medical and pharmacy claims and predictive methods were not used.

IHPM is launching two studies to determine the impact of laboratory results, physical measurements, survey responses and workplace performance from a prescription drug monitoring and compliance education program.

Behavior lifestyle changes were a key component of the success of the MHI. However, that was true only for the people who participated and only for the health risks being studied. A better understanding among the entire employee base of the need for behavioral lifestyle changes would likely have resulted in a greater number of participants and an even higher completion rate than the 50% completion rate realized in the MHI.

Futures studies should include a program either preceding or included in the health risk management activities that addresses the readiness of the organization and its employees to create a culture of health in the workplace.

Future studies also should compare the traditional methodology of using medical claims analysis for predicting clinical and financial outcomes with the use of physical measurements, health risk assessments surveys and laboratory testing for predicting. Workplace performance changes should be included in both methodologies.

Direction communications between the program and participants' healthcare providers should be studied to determine the best way for the employer to engage providers in sustained employee risk reduction. The MHI did not do this.

The true test of the clinical and financial values of an MHI program would be found in a program with mandatory participation. Short of that, the use of control groups would provide a valuable look at the employee population in a way which the MHI could not do as a totally volunteer program.

The follow-up maintenance phase of 6 to 12 months with the same laboratory, physical measurements and surveys repeated at each interval would provide valuable data regarding adherence and persistency with recommendations, training and lifestyle behavioral changes. The MHI did not include such follow-up.

Incentives to enroll, complete and succeed at risk reduction should be considered with any programs like the MHI. The City of Phoenix chose not to offer incentives, above the value of the health education and improvement gained from participation in the program.

Similar metabolic health initiatives have been conducted at additional public and private employer sites. JHP