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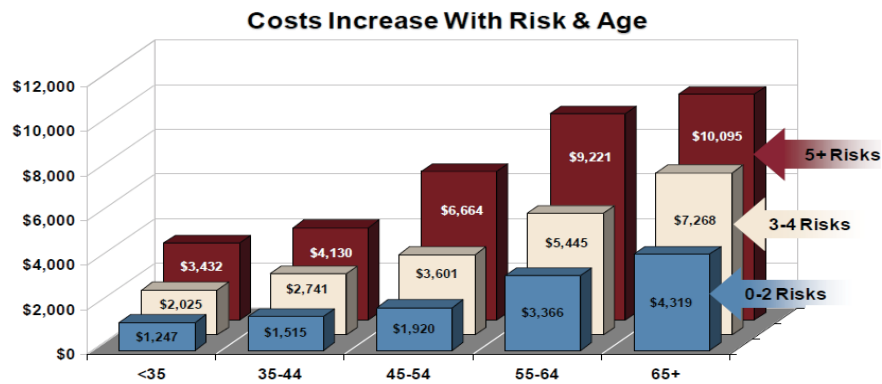
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Rationale for Biometric Screening

The purpose of screening is to identify common but serious health risks, in order to prevent future chronic illness and disability. Clinical and financial outcomes often depend on how soon behavioral modification and/or medical treatment are initiated. The most beneficial screening tests detect the presence of disease when a person is asymptomatic, and when the course of the disease can be altered or slowed. For example, blood pressure screening for hypertension can identify individuals at an early stage of the disease process, when they are still able to make lifestyle changes like diet and exercise, to alter the progression from pre-hypertension to hypertension.

Multiple studies have shown that the number of health risks is closely associated with increased healthcare expenditures.



Source: StayWell data analyzed by U of Michigan (N = 43,687) – HERO Study

Employees classified as high risk, based on biometric test results, have higher health care expenditures than employees at low risk. A study of 5,875 employees in the health care field showed that high biometric lab values resulted in excess medical care costs of 13% for females and 22% for males, as well as increased short-term disability payments and increased presenteeism. Specifically, the presence of one or more high biometric values increased annual medical care costs by \$516 for women and \$557 for men. (Goetzel, 2009).

Other studies have also demonstrated precisely how particular high biometric values relate to increased costs. One study of six large employers identified the exact cost associated with high blood glucose and blood pressure over a 3-year period. In that study of 61,568 employees, Goetzel et al. (1998) found that employees with elevated blood glucose and blood pressure had 35% and 12% higher medical expenditures respectively than those at low risk.

A study by the Health Enhancement Research Organization (HERO; Anderson, 2000) found that significantly higher medical expenses were associated with

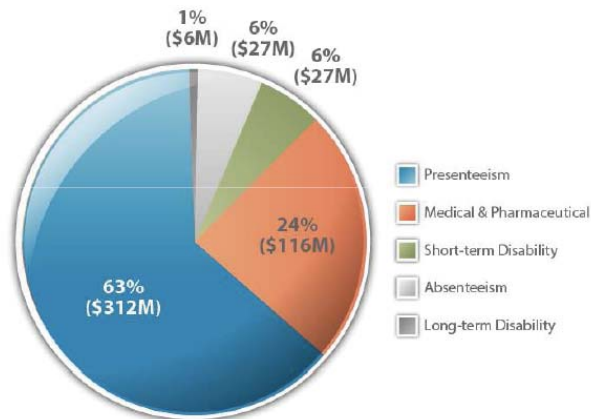
seven lifestyle risk factors, all of which were identified through screening or self-reported health risk assessments.

The table below shows elevated blood sugar, weight and blood pressure resulted in excess health care costs of \$902, \$541 and \$306 respectively. High biometric values were on par with the costs associated with significant risk factors like depression, stress and tobacco use.

Health risk factor	Excess health care spending per person by risk factor
Sedentary Lifestyle	\$265
High Blood Pressure	\$306
Obesity	\$541
High Blood Sugar	\$902
Tobacco Use	\$350
Stress	\$1,125
Depression	\$1,824

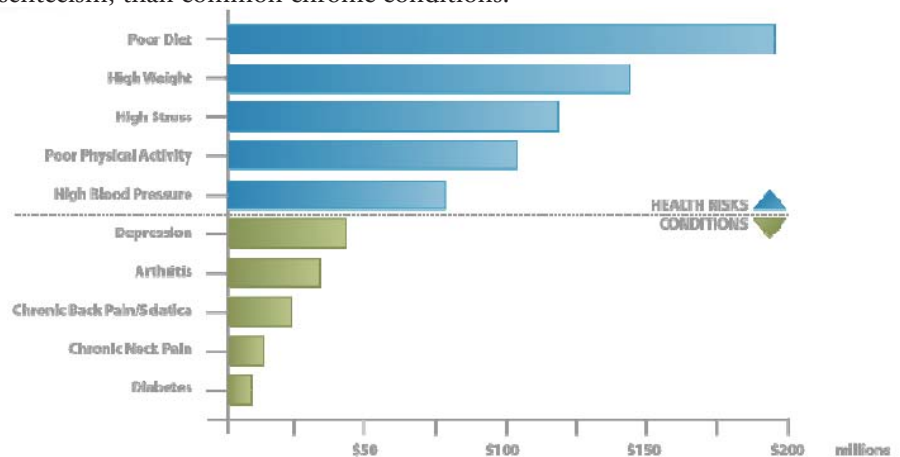
Although the damaging effects of certain lifestyle choices may take years to surface, a reversal of chronic conditions can manifest rapidly. For example, in 2006, Towers Perrin studied the impact of improving blood values among a diabetic population. The study found that lowering hemoglobin A1C levels below seven percent (7%) resulted in annual savings of \$279 for each diabetic. Similarly, lowering LDL-cholesterol levels to below 100 mg/dL resulted in savings of \$369, and lowering systolic blood pressure under 130 mmHg delivered \$474 in savings per individual. This cost containment represented a significant portion of the financial toll exacted by these conditions. In addition to financial benefits, lowering biometric values plays a significant role in preventing adverse health events. For example, as little as a 13% reduction in blood pressure was shown to reduce the rate of heart attacks by 21%, strokes by 37% and overall mortality by 25%, pursuant to an analysis of 2006 data by the U.S. Department of Health and Human Services.

Elevated biometric values also impact productivity, which is an important driver of total health-related costs. One study from the Harvard Business Review identified that presenteeism alone accounts for more than twice the cost of medical and pharmaceutical claims. The expected outcome of biometric screenings should therefore reflect savings from productivity as well as direct health care expenditures.



Source: Hemp, P. (2004). Presenteeism: At Work—But Out of It. *Harvard Business Review*, 82(10), 49-58.

WebMD Health Services has studied the impact of specific modifiable health risks on presenteeism across their book of business of 250 employer clients. A WebMD study has shown that a single risk factor that is widely prevalent in a population can be more costly in aggregate, as measured by its impact on presenteeism, than common chronic conditions.



Source: WebMD Webinar in collaboration with Debra Lerner

Long-term tracking of screened cohorts

Employees who participate in biometric screening are tracked as a cohort in the data warehouse, to determine whether their risks change over time. Individuals without prior known risks are tracked as a special cohort.

The biometric measurements are used as a baseline for these cohorts. Changes in risks and costs are compared against the baseline measure. The screened cohorts are compared to the group of unscreened individuals, to measure the effectiveness of the program in reducing risks and controlling costs. These groups are also compared on engagement in other programs, prescription drug utilization, utilization of medical services, and adherence to evidenced-based medical standards. Comparisons between the biometric cohorts and the non-participants determine whether the biometric program is cost effective and reduces risks.

Tracking and analyzing the data also helps to identify areas of improvement for the population health programs.

Case study – Early results from a biometric screening campaign

The Cammack LaRhette model has been derived from the firm's experience with hospital clients that leverage their own clinical staff for screening and onsite coaching. Recently, Cammack LaRhette planned and managed a biometric screening program for a large urban hospital system, comprising over 5000 employees. The initial launch of the screening program was organized as a concentrated campaign over several months. Subsequent screening was incorporated in the mandatory annual tuberculin testing performed by the employee health department. Biometric screening included fasting blood glucose, total cholesterol and HDL-cholesterol, blood pressure and height and weight measurements. The results were added to the hospital's data warehouse, which was overseen by Cammack LaRhette, and analyzed in the context of each employee's clinical profile. Results were also included in the predictive modeling algorithms, to enhance patient stratification and identification of employees for outreach by local, client-dedicated personal health coaches.

The screening campaign contributed to an understanding of the population as a whole, and identified significant numbers of individuals who required follow-up, and in some cases urgent medical evaluation. It transpired that employees who attended the voluntary campaign were not the "worried well", but represented a true cross-section of the population, including a mix of those with and without prior known risk. Secondly, it appeared that hospitals employees were not better informed about their health risks than the general population.

Results for two of three of the biometric tests were much higher than expected; the third test showed results that were much lower than expected. Sixty-three percent of the screened population had a blood pressure reading of $\geq 120/80$ mm Hg (levels associated with a diagnosis of prehypertension or hypertension, Stage 1 or 2). These results do not take into account the number of hypertensives with previously high blood pressure, now brought under control, as the screening looked simply at elevated readings. These findings are approximately 37% higher than expected. Nationally, however, 46% of the population had elevated blood pressure readings of $\geq 120/80$, which, adjusted for age/gender, would have a modest impact.

Although blood glucose levels were also high, the results may be overstated if employees did not actually fast for eight hours, as instructed. A full 9.2% of screened employees had fasting blood glucose (FBS) levels of ≥ 126 mg/dL, which is about 35% higher than those reported for the U.S. working population. When FBS levels were lowered to 110 to 125 mg/dL, which is associated with a diagnosis of pre-diabetes, the combined percentages of employees with elevated levels of blood glucose rose to 22%.

Total cholesterol levels, on the other hand, were nearly 50% lower than expected, with merely 7.2% at high risk (≥ 240 mg/dL). That level compares to a national rate of 15.6% of adults with serum cholesterol levels equal or greater than 240 mg/dL. The finding of borderline high cholesterol (200-239 mg/dL) was far more common in this hospital setting, at 21.3%, resulting in a combined frequency of 28.5% with borderline to high cholesterol. Serum level is reported without considering whether employees are taking lipid-lowering medications.

Another important discovery related to the number of high-risk individuals with no known prior risk. When results were added to the data warehouse, it revealed that a full 42% of screened employees with at least one elevated result had no prior known medical condition, based on claims. The no-known risk group was comprised of individuals that either did not seek medical care or were considered “healthy.” Yet their risk was similar to the group with known risks. While 83% of the individuals with no known risk had at least one risk factor, 56% had at least two risk factors and 22 people (10.7%) demonstrated four or more risk factors. Identifying the no-known risk group is especially important, as these individuals would not otherwise be targeted for medical management

Case study – Leveraging Occupational Health Services to improve engagement

Cammack LaRhette has found that integrating biometric screening with annual tuberculin testing is best practice for reaching employees. For another Cammack LaRhette hospital client with over 15,000 employees, the challenge of reaching employees through campaigns or departmental screenings seemed overwhelming to administer. In this highly unionized environment, there was also a heightened sensitivity to privacy. Occupational Health Services had the necessary private areas for testing and dedicated personnel accustomed to handling employee health information. The annual compliance visit was lengthened by ten minutes, which required additional personnel. However, the hospital found the investment worthwhile. In the first five months of the program, 57% of the employees (8,700) were screened for high blood pressure, diabetes, obesity and smoking. The results were significant: prevalence of high blood pressure was double the rate found through medical and pharmacy claims, i.e., 21% observed compared to 9.4% from claims. Diabetes prevalence was 44% higher than identified through claims. Obesity and smoking prevalence, not available through claims, mirrored community rates. This data provides important benchmarking for employee wellness and care management programs.

In conclusion, biometric screening is an effective strategy for identifying early stage diseases when intervention is most effective. Additionally, individuals who are not compliant with treatment or whose treatment regimen is not effective, are informed and encouraged to seek follow-up care.

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Carroll is the Vice President in the Healthcare Practice at Cammack LaRhette Consulting and brings over 25 years of in-depth experience building healthcare and technology businesses. She uses innovative strategies to help clients build a culture of health, improving the health and productivity of their workforces and reducing excess medical costs and absenteeism. She specializes in care management, healthcare analytics and decision support.

Ashley Jaksa

Ashley is a Consultant in the Healthcare Practice at Cammack LaRhette Consulting. She has extensive experience in both research and biostatistics. She has worked with organizations on large-scale research projects and has also completed statistical analysis for multiple publications and presentations.