UAW-GM LifeSteps Health Promotion Program
III. Documentation

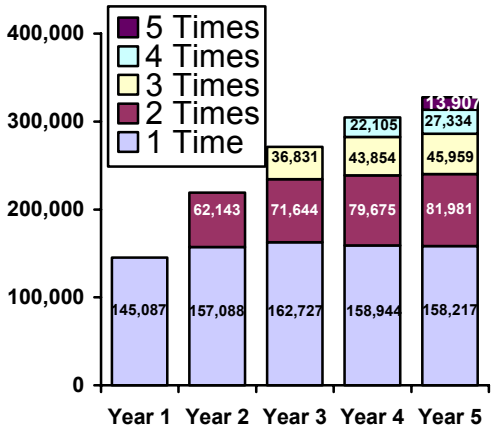
UAW and General Motors selected the University of Michigan Health Management Research Center (UM-HMRC) to be the third party evaluator of LifeSteps. UM-HMRC has more than twenty years of experience in evaluating health promotion programs and the relationship between health behaviors, health care costs and other outcome measures. The groundbreaking Steelcase study (Edington et al.) established the link between changes in health practices and the resultant changes in health care costs. The fact that health costs follow health risks has been the key component for many corporate health promotion programs.

D.W. Edington, L.T. Yen, P. Witting. The Financial Impact of Changes in Personal Health Practices. Journal of Occupational and Environmental Medicine. 1997;39(11):1037-1046.

Participation

After five years, LifeSteps has achieved participation from **43%** of the 610,965 **households** and **34%** of the total **1,060,617 adult individuals**. The LifeSteps trackable program has reached **356,833** unique people and **325,278** have taken an HRA. Employees in the plants in Flint and Anderson, with the more intensive LifeSteps program, have **77%** participation. Over half of the participants have participated more than once. This repeat participation rate is an important indicator of additional risk reduction and eventual savings in medical costs. (Report to GM and UAW, year 5)

A stratified random sample survey made it possible to identify participation in all programs including those that are not trackable, such as newsletter readership, audio health library use, self-care book use, etc. This participation rate is **78%**. That is, more than **800,000** people have been touched by the LifeSteps program.



Repeat participation continues to increase over time. The graph at right, which was updated in a report to UAW-GM LifeSteps Working Committee, shows the number of 1-time and repeat participants in the LifeSteps Questionnaire in each of the five program years. Program year 6 began in January 2002.

In a recent study of HRA participation, Musich et al looked at HRA participation among five corporations, including GM. The purpose of this study was to benchmark Health Risk Appraisal (HRA) participation trends over time. Measuring HRA participation in different corporations with varied health promotion programs is valuable in benchmarking industry expectations for new or existing programs. Participation at three manufacturing companies and an insurance-holding company were compared: General Motors Corporation, Steelcase, Inc., Xerox Corporation and The Progressive Corporation. Health promotion programs varied in length of years and distribution methods for the HRAs. Program designs were characterized by the following descriptions: 1) continuous annual mature; 2) continuous annual early; 3) waves/annual combination; and 4) interrupted annual.
HRA participation patterns were consistent across industry types, geographical locations, company sizes and unique demographics of the four corporations.

Participation was not dependent on specific designs of health promotion programs or distribution methods for the HRA. LifeSteps compared favorably to programs in the other corporations, even though LifeSteps was only three years old at the time.

Average annual/wave HRA participation rates ranged from 24% to 34% for each of the programs with GM near the average with 27.4%. This pattern underestimates the reach of the program into those employees who remain with the company. In mature programs, cumulative HRA participation reached 50% after three years and plateaus at about 80% with two and three-time HRA participation leveling at about 60% and 40%, respectively. Even though the LifeSteps program at the time was only three years old, it had already achieved a 50.9% cumulative participation among the active employees indicating that the program is on target for achieving benchmarking and corporate goals.

University of Michigan Health Management Research Center. UAW-GM Quarterly Update. Dec. 2001.

University of Michigan Health Management Research Center. 1999 Survey Report. June 21, 1999.

University of Michigan Health Management Research Center. 2001 Savings to Cost Technical Report to Expanded UAW-GM LifeSteps Working Committee. March 2002.

S. Musich, L. Adams, D. Hirschland, T. McDonald, D. Napier, R. Page, D.W. Edington. Benchmarking Longitudinal Health Risk Appraisal Participation Trends. AWHP's Worksite Health. 2001;8(2):37-43.

Health Risk Identification and Reduction

The health risk appraisal is the leading tool for program involvement, risk awareness, and as a measure of health status and risk change. Sixty-one percent of the population is low-risk (0-2 risks), 26% is medium-risk (3-4 risks) and 13% is high-risk (5 or more risks). The data are examined for active employees, retirees and dependents.

One of the primary roles of the HRA is to identify risks. In the GM population, over 800,000 risks have been identified to date.

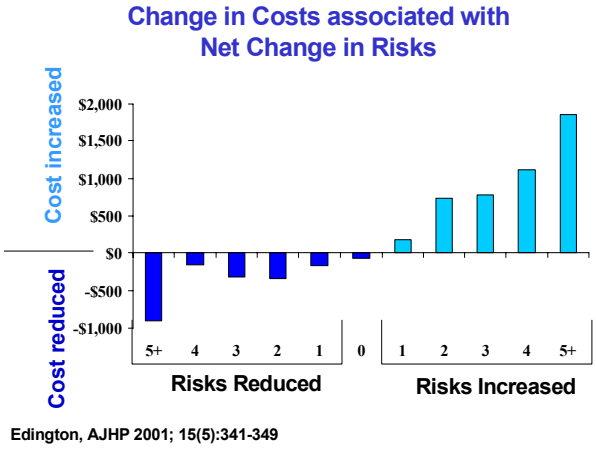
Employee Status	N	Number of Risks Identified
Active	81,618	174,434
Retiree	179,445	433,941
Dependent	98,326	206,923
Total	**359,389**	**815,298**

Two strategies are designed into the LifeSteps program to achieve an increase in the number of low-risk individuals. One strategy is to reduce health risks in the population and the other strategy is to maintain low-risk behaviors. As a measure of success in reducing high risks in the population, we measured the number of risks reduced over the first four years of the program. Participants report over 185,000 risks reduced.

Employee Status	N	Gross Number of Risks Reduced
Active	21,471	29,658
Retiree	82,707	114,650
Dependent	33,967	41,242
Total	**138,145**	**185,550**

Each net risk reduced results in approximately $150 reduction in health care expenditures. These data show that changes in costs are associated with changes in risks. As risks decrease, medical costs decrease. In addition, as risks increase, medical costs increase.

The program goal is to maintain and increase the low risk and low cost categories. The increase in the overall low-risk population (representing over 600,000 individuals) has moved approximately 1% in the two-time participants. This is a significant accomplishment since the natural flow of the population results in fewer individuals maintaining low-risk status over time due, in part, to the lifestyle of Americans and the aging of the population. By establishing the natural flow of the population early in the program, this flow of risks and costs was used as the benchmark measure for success.



Edington, AJHP 2001; 15(5):341-349

A population experiences risk and cost transitions over time. A snapshot of the population at two points in time shows the prevalence of smokers, for example. Only by examining individual risk transitions can we know if the same people are smoking at Time 1 and Time 2 or if some people quit while others started. Eliminating the transition to high-risk status, that is, by keeping those people at low-risk status, LifeSteps reaches success in total population health management.

Looking at the intensive site active employees with two or more HRAs (n=7,201), the LifeSteps program has reduced low safety belt usage 50.6%, high blood pressure 28.7%, alcohol use 24.6%, poor life satisfaction 21.1%, stress 20.9%, smoking 17.3%, HDL cholesterol 14.3%, illness days 8.6% and increased exercise 16.2%. Overall the percentage of people at low-risk (0-2 risks) has increased 13.4% while the percentage of medium (3-4 risks) and high-risk (5+ risks) have decreased 12.1% and 24.8%, respectively.

If the intensive program were available to all active employees and the same risk changes took place in that group, it would mean that 22,000 employees would increase their safety belt usage, 14,000 people would reduce their blood pressure, 9,500 employees would reduce their stress risk factor, and 8,000 employees would reduce their risk for life satisfaction. Again, extrapolating to all active employees, 14,000 people would have moved to the low-risk category (0-2 risk factors).

The table (Change in Risk Prevalence) also shows the change in wellness score for this population. The wellness score is a function of the number of health risks, an interaction related to the appraised age calculations from the UM-HMRC-modified Carter Center revisions, and a function related to the use of preventive services. The wellness score is sensitive to the age, gender and presence or absence of existing disease. As can be seen here, over the course of the program, the wellness score has improved 1.44 points. Yen et al. demonstrated that a one point difference in the wellness score equals a $56 difference in the total annual healthcare expenditure in this population.

Change in Risk Prevalence

Active Employee Intensive Program Participants in Two or More Years (N=7,201)

Risk	First HRA	Most Recent HRA	Change
Safety Belt Usage	22.9%	11.3%	-50.6%
Blood Pressure	25.6%	18.3%	-28.7%
Alcohol drinks	5.6%	4.2%	-24.6%
Life satisfaction	19.6%	15.4%	-21.1%
Stress	23.7%	18.7%	-20.9%
Smoking	19.1%	15.8%	-17.3%
Exercise	20.3%	17.0%	-16.2%
HDL	26.3%	22.6%	-14.3%
Illness Days	15.2%	13.9%	-8.6%
Perceived Physical Health	12.2%	11.7%	-4.5%
Cholesterol	20.2%	20.2%	0.2%
Weight	39.5%	44.8%	13.4%
Existing Medical Problems	11.0%	13.0%	18.5%
Overall			
0-2 risks	55.0%	62.4%	13.4%
3-4 risks	29.7%	26.1%	-12.1%
5+ risks	15.3%	11.5%	-24.8%
Average Number of Risks	2.53	2.22	-0.31
Average Wellness Score	77.12	78.56	1.44

* A negative percentage indicates positive change for individual risks.

A corporate wellness score also has been developed and is useful as a benchmark to compare companies or divisions within a company. The corporate score can be positively influenced by the improved health status of employees and by better overall program participation rates. Plant and location leadership has considerable influence on the participation rates through the number of programs offered and marketing, and indirect influence over the health status of the employee population by providing effective programming.

In a study of GM active employees, Yen et al looked at 12,984 people who participated in an HRA in each of two program years. Using multivariate regression models, baseline risk and participation in multiple programs were examined to determine the relationship with risk change. A greater decrease in the number of health risks was observed with increased program participation. The decrease was significantly related to the number of baseline risk factors and eligibility for high-risk programs. Associated with program participation, the number of people at low-risk status increased from 70.1% to 71.3% at the year two among nationwide participants and from 52.4% to 58.9% among intensive site participants. Participation was associated with a significant impact on health risk. The value of using multivariate regression techniques was shown by baseline risk of participants and eligibility for high-risk programs being necessary factors to control when measuring program effect on health risk change.

Braunstein et al explored risk associations between health variables and compared the associations with the prevalence of each risk using cluster analysis. GM employees (N=16,879) completed a self-reported health risk appraisal with on-site biometric screening. Risk prevalence and risk association findings differed by gender, age, and overall risk level. Risks that were most highly associated with other risks were different from risks that were most prevalent. The findings suggest

that in addition to risk prevalence, individual characteristics and the level of association between risks are also important to consider when planning health interventions. For example, we found that low life satisfaction was likely to co-exist with high stress and poor perceived health.

D.W. Edington. Emerging Research: A View from One Research Center. American Journal of Health Promotion. 2001;15(5):341-349.

L. Yen, M. Edington, T. McDonald, D. Hirschland, D.W. Edington. Changes in Health Risks among the Participants in the UAW-GM LifeSteps Health Promotion Program. American Journal of Health Promotion. 2001;6(1):7-15.

A. Braunstein, Y. Li, D. Hirschland, T. McDonald, D.W. Edington. Internal Associations Among Health-risk Factors and Risk Prevalence. American Journal of Health Behavior. 2001;25(4):407-417.

L. Yen, T. McDonald, D. Hirschland, D.W. Edington. Association Between Wellness Score from a Health Risk Appraisal and Prospective Medical Claims Costs. Journal of Occupational and Environmental Medicine. 2003;45(10):1049-1057.

University of Michigan Health Management Research Center. 2001 Savings to Cost Technical Report to Expanded UAW-GM LifeSteps Working Committee. March 2002.

Obesity

Obesity is the most prevalent health risk among General Motors health risk appraisal participants. With increasing attention being given to the severe consequences of obesity, several research studies were undertaken to better understand the condition and to explore the development of alternative strategies for interventions.

The first study was a cross-sectional study examining the relationship between the 1998 National Heart, Lung, and Blood Institutes (NHLBI) weight guidelines and concurrent medical costs. The study population consisted of a total of 177,971 employees, retirees and their adult dependents enrolled in indemnity/PPO insurance plans. Six weight groups were defined from body mass index (BMI) according to NHLBI guidelines: underweight (<18.5), normal weight (18.5-24.9), overweight (25-29.9), obese I (30-34.9), obese II (35-39.9) and obese III (≥40). Five age subgroups were considered for males and females: 19-44, 45-54, 55-64, 65-74 and 75+ years. The median medical charges of the six weight groups were $3,184, $2,225, $2,388, $2,801, $3,182 and $3,753, respectively, with statistical differences existing between any two groups of the last five categories. Similar trends were evident in most of the age-gender subcategories.

Although medical costs and the prevalence of diabetes have been studied across increasing body mass index (BMI) categories, little attention has been given to the association of additional health risks within those categories. In this second study, the association of health risk levels on medical charges and prevalence of diabetes across BMI categories were examined within a population of 38,841 active employees under age 65. Higher medical charges and increased prevalence of diabetes were significantly associated with additional health risks across the BMI categories. Medical costs and the prevalence of diabetes were lower when the numbers of additional health risks were lower, regardless of the BMI category. These results suggest that a strategy focused on reducing health risks within any weight category could provide an alternative to achieve medical cost savings and lower prevalence of diabetes.

In the most recent study, the relationship between physical activity and health care costs were examined among 23,490 active employees in normal, overweight and obese categories. After adjustment for covariates, physically moderately active (1 to 2 times/week) and very active (3+ times/week) employees had approximately $250 less paid health care costs annually than sedentary employees (0 time/week) across all weight categories. The difference was approximately $450 in the obese subpopulation. As a strategy to control escalating health care costs, wellness programs should facilitate engagement in moderate physical activity of at least 1 to 2 times a week among sedentary obese individuals.

F. Wang, A.B. Schultz, S. Musich, T. McDonald, D. Hirschland, D.W. Edington. The Relationship Between National Heart, Lung and Blood Institute Weight Guidelines and Concurrent Medical Costs in a Manufacturing Population. American Journal of Health Promotion. 2003;17(3):183-189.

S. Musich, C. Lu, T. McDonald, L.J. Champagne, D.W. Edington. Association of Additional Health Risks on Medical Charges and Prevalence of Diabetes Within Body Mass Index Categories. American Journal of Health Promotion. 2004;18(3):264-268.

F. Wang, T. McDonald, L.J. Champagne, D.W. Edington. Internal Relationship of Body Mass Index and Physical Activity to Health Care Costs Among Employees. Journal of Occupational and Environmental Medicine. 2004;46(5):428-436.

Disease Management

Concerns regarding the effectiveness and impact of disease management are largely based on disease compliance measures. Although disease management programs have measured improvements in compliance, quality of life and cost savings from reductions in hospitalizations and emergency room visits, few programs have focused on changing behavioral health risks not directly related to the specific disease.

In a study of disease management, Musich et al. looked at 135,251 current and retired employees of General Motors Corporation who had completed a Health Risk Appraisal (HRA). Those with and without self-reported disease averaged 19.2% and 9.1% excess healthcare costs associated with excess health risks, respectively. The magnitude of the impact, however, differed across age groups and diseases. Individuals less than 45 years with self-reported disease were most affected by the presence of additional health risks (44.0% excess costs) while those 65 years and older without disease were least affected (8.2% excess costs).

S. Musich, T. McDonald, D. Hirschland, D.W. Edington. Excess Healthcare Costs Associated With Excess Health Risks in Diseased and Non-Diseased Health Risk Appraisal Participants. Disease Management & Health Outcomes. 2002;10(4):251-258.

Preventive Services

In a study of 59,670 retirees 65 years and older, Musich et al. looked at the utilization of preventive services. Increased utilization of preventive services among the aging has been associated with improved health status and decreased medical costs. Preventive health services compliance was measured using selected HRA questions. Gender, HRA participation patterns, overall health risk status, medical plan selection and disease status were examined as predictors of increased compliance. Multivariate logistic regression models were developed to test the relative contributions of participant characteristics to increased utilization. The Healthy People 2010 goals for the preventive services studied were met and exceeded (with the exception of tetanus immunization). Higher compliance was associated with being male, younger than 70 years, multiple-year HRA participation, overall low risk status and HMO insurance plan selection.

In a similarly designed study, Musich et al. looked at the utilization of preventive services among active employees 55 to 64 years of age (N=9,289). Gender, HRA participation patterns, overall health risk status, medical plan selection and disease status were examined as predictors of increased compliance. Multivariate logistic regression models were developed to test the relative contributions of participant characteristics to increased compliance. The Healthy People 2010 goals for most of the preventive services studied were met and/or exceeded. Higher compliance was associated with being male, multiple-year HRA participation, overall low-risk status, HMO insurance plan selection and selected diseases.

S. Musich, A. Phatak, T. McDonald, D. Hirschland, D.W. Edington. Self-Reported Utilization of Preventive Health Services Among Retired Employees 65 Years and Older. Journal of American Geriatrics Society. 2001;49(12):1665-1672.

S. Musich, T. McDonald, D. Hirschland, D.W. Edington. Self-Reported Utilization of Preventive Health Services Among Active Employees 55 to 64 Years. AWHP's Worksite Health. 2001;8(3); 28-35.

Program Satisfaction

Nine months after the LifeSteps program implementation, a questionnaire was distributed to a random sample of employees, retirees and their adult dependents, for the purpose of measuring awareness, participation and perceptions of the program. Survey responders in 1997 reported wide support for the LifeSteps program regardless of demographics and participation status. Seventy-seven percent were aware of the program, over 70% agreed that UAW and GM should continue to provide it, and 50% of responders said that LifeSteps had improved their opinion of GM and/or the UAW regarding employee well being (Yen et al).

A second stratified random sample survey was conducted in 1999. Edington et al described the results along with a description of the LifeSteps program, its implementation and evaluation. Survey responders reported increased program satisfaction (85% now supported program continuation and 74% reported an improved opinion of UAW and/or GM). With documented participation at 37% of all households in 1999, self-reported participation that included non-trackable readership of book and newsletter or use of the telephonic audiotapes reached 78%.

L. Yen, M.P. Edington, C. Lu, D.W. Edington. Early Survey Evaluation of the United Auto Workers and General Motors LifeSteps Health promotion Program. AWHP's Worksite Health. 1999;6(1):28-34.

M.P. Edington, T. Karjalainen, D. Hirschland, D.W. Edington. The UAW-GM Health Promotion Program Has Successful Outcomes. American Association of Occupational Health Nursing Journal. 2002;50(1):26-31.

Health Care Savings and Savings to Cost Ratios

The LifeSteps program was able to achieve savings within the first four years while providing services to a U.S.-wide population of actives, spouses, and retired individuals. Projections indicate that LifeSteps will continue to increase in its savings payout as participation reaches 50% and the rate of savings per participant enters into a steeper phase.

The program savings analysis covers the first four years of program costs and savings but only the first three years of program participation. Program

participation for year-four was not included since the respective savings are not yet available. The limitation is the medical claims data, which require one year to show an impact and another year for full claims run out.

One of the accounting rules we use is to assign all program costs to the individuals in the current personnel file. Thus, if an individual is not in the current personnel eligibility file their costs are reassigned to the remaining individuals. Program savings from those missing individuals are not captured. The result of these conservative accounting rules is that additional costs are added while some of the savings are lost. Likewise the savings for those individuals not remaining in the Indemnity/PPO plans are lost. Thus the savings to costs ratios for the participants is likely underestimated**.**

Other examples of our conservative calculations are (a) the total program costs include the pre-program start-up costs and the first three years of high costs for the telephonic, toll-free nurse line, which were rectified in year four, (b) only the savings from the 168,717 long-term (9 years) Indemnity/PPO participants are counted towards the overall program savings while there are an additional 136,906 other Indemnity/PPO, HMO or other LifeSteps participants added to program costs, and (c) the savings from disability absences are not included.

All of the program costs are included in the analyses but we include the savings only from those who remained in Indemnity/PPO for all the years 1993 through 2001. If individuals moved in and out of Indemnity/PPO, or enrolled in an HMO, or left the GM benefits rolls their savings were not included, although their program costs were attributed to those remaining in the personnel file.

The cost of the program is attributed to each of the program components and a per-participant rate is established. Thus, at the individual level, people in the General Motors Corporation personnel file are assigned a program cost in accordance with their respective participation in LifeSteps. Each individual has a cost assigned since everyone gets the newsletter, a self-care book, and other anonymous services. It should be noted that the non-trackable portion of the LifeSteps program, which is assigned in the overall cost of the program, influences the total population of 1,060,617.

Over the four years the costs of the services assigned to the non-participants is approximately $24. The incremental four-year costs for the participants typically range from less than $40 in the U.S.-wide programs to over $300 for the actives in the intensive sites, with an average of $83 per participant. The incremental costs of the LifeSteps program are the costs of the participants minus the costs of the non-participants.

The overall participant medical savings were determined by a trend forecasting method. The trend analysis resulted in an estimate of the **savings per participant** over four years of **$97** or approximately $24 per participant per year. These are impressive savings considering that the savings are for all age-gender groups, including employees and dependents, hourly and salaried, and non-medicare and medicare populations (168,717 9-year Indemnity/PPO participants). The savings result in a cumulative medical savings-to-cost ratio of 1.2.

The incremental, cumulative savings per participant were calculated by multiple regression analyses in order to estimate each program component and sub-population. The active employees show savings of $313 and the retirees, $182 (See Table below). The savings-to-cost ratios in these two groups are 2.6 and 2.3,

respectively. Given the breadth of the LifeSteps target populations the results are very positive. No cost-savings were found in the dependent population.

Selected Populations	N	Medical and Drug Cost Savings	Savings-to-Cost Ratio After Four Years
Active employees	24,963	$313	2.6
Intensive program	7,079	$590	2.1
US-wide	7,884	$204	3.7
Retired employees	78,583	$182	2.3

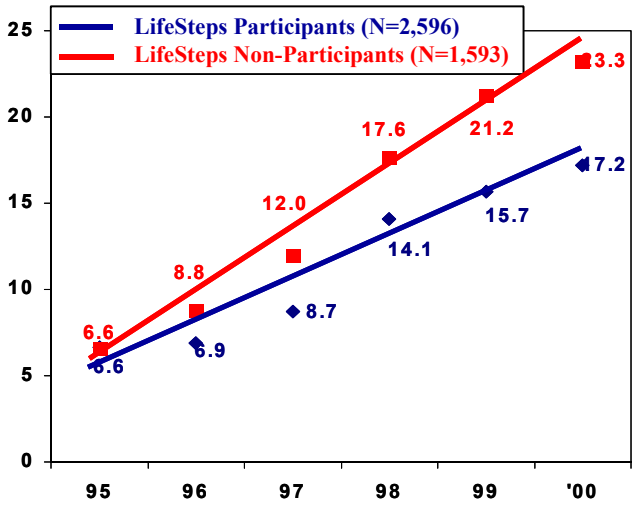
Results from several selected individual programs show high savings-to-cost ratios, ranging from 4.8 to 14.3.

Selected Program Components [Participated in a Single Component]*	N	Savings-to-Cost Ratio
Screening – Active employees	2,052	4.8
Wellness Programs – Active employees	1,602	11.0
Mailed HRA - All participants	90,724	14.3

*** Participation in One Program and One Program Only**

University of Michigan Health Management Research Center. 2001 Savings to Cost Technical Report to Expanded UAW-GM LifeSteps Working Committee. March 2002.

Disability Absence Days Reduction



Male hourly workers at two plants in the intensive program were included in a study of disability absence days. Data for the salaried employees were not available and the numbers of female hourly employees were too few to provide valid results. Short-term and long-term disability absence days were compared between LifeSteps participants and non-participants. After adjusting for baseline disability absence days and age, LifeSteps non-participants (N=1,593) averaged an increase of 1.2 disability absence days more than LifeSteps participants (N=2,596). It was estimated that each disability absence day cost $200 in wages. These data included only working days, not weekends or holidays. This resulted in a savings of $240 per participant per year, for a total of **$623,040** per year for the 2,596 LifeSteps participants. This savings was compared with the program costs of all 4,189 employees and a savings to cost ratio of **2.3** was calculated. If these results were expanded to the entire male hourly worker population who participated in the intensive LifeSteps program (n=34,494), the disability savings would amount to $8,278,560 in wages per year. Including the

medical savings with disability absences, active employees would show a savings of $830 and a savings-to-cost ratio of 3.0.

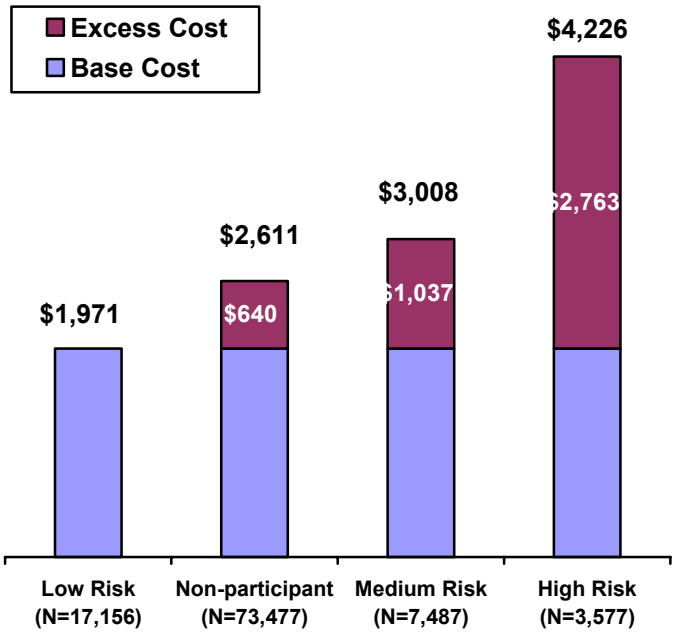
A.B. Schultz, C. Lu, T. E. Barnett, L.T. Yen, T. McDonald, D. Hirschland, D.W. Edington. Influence of Participation in a Worksite Health-Promotion Program on Disability Days. Journal of Occupational and Environmental Medicine. 2002;44(8):776-780.

Excess Cost--Excess Risk

When risks are compared with health care costs, we see that low risk participants have the lowest costs and participants with more risks have higher costs. The percent of total costs attributable to excess risks is 24.4%.

For 101,697 active employees with Indemnity/PPO insurance coverage: Total annual medical cost = $265,204,148.

Annual excess medical cost = $64,672,550 (24.4% of total).



University of Michigan Health Management Research Center. 2001 Savings to Cost Technical Report to Expanded UAW-GM LifeSteps Working Committee. March 2002.

Prediction Models

Diabetes. A neural network architecture was created and used to identify individuals at risk of diabetes within specified time intervals by sequential adaptation for k-step prediction. The proposed sequential neural network (SMLP) outperformed the baseline neural network and logistic regression model, in terms of final prediction error (0.0025) and sensitivity (86.04%). An explicit model of time-varying inputs along with the sequentially obtained prediction probability at each exclusive time interval was used, which was obtained by embedding a multivariate logistic function for consecutive years.

Mental Health. Using SAS Enterprise Miner, a logistic regression model using stepwise selection was used to determine significant factors affecting depression. All demographics, health related behaviors, quality of life indicators and medical history were included in the model. Illness days, life satisfaction and stress were major factors associated with depression. It was determined, using non-cumulative lift charts, that the models were most useful for the top 20% of people with the highest probability of having depression.

J. Park, D.W. Edington. A Sequential Neural Network Model for Diabetes Prediction. Artificial Intelligence in Medicine. 2001;23:277-293.

J. Park, D.W. Edington. Application of a Prediction Model for Identification of Individuals at Diabetic Risk. Methods of Information in Medicine, 2004;43(3):293-301.

University of Michigan Health Management Research Center. A Case Study Using HRA Information to Determine the Probability of Depression with Predictive Models. Technical Report to GM. February 14, 2002.