Modifiable Healthy Lifestyle Behaviors: 10-Year Health Outcomes From a Health Promotion Program

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Introduction: Previous studies have examined the impact of healthy lifestyle choices on health-related outcomes; however, given their fragmented, often cross-sectional nature, assessing the relative impact of daily modifiable behaviors on overall long-term outcomes, particularly for a diverse working adult population, remains challenging.

Methods: Relationships between ten self-reported healthy lifestyle behaviors and health outcomes during the subsequent 9 years in a cohort of 10,248 participants enrolled during 2003 in a voluntary workplace wellness program were assessed. Cox proportional-hazards models computed hazard ratios (HRs) for lifestyle characteristics associated with time to one of seven self-reported chronic diseases or death. Data were collected between 2003 and 2012 and analyzed between 2014 and 2016.

Results: Behaviors that most significantly affected future outcomes were low-fat diet, aerobic exercise, nonsmoking, and adequate sleep. A dose–response effect was seen between dietary fat intake and hypertension, obesity, diabetes, heart disease, and hypercholesterolemia. After dietary fat intake, aerobic exercise was the next most significant behavior associated with development of outcomes. Compared with sedentary participants, those who exercised 4 days per week were less likely to develop new-onset diabetes (HR=0.31, 95% CI=0.20, 0.48); heart disease (HR=0.46, 95% CI=0.27, 0.80); and hypercholesterolemia (HR=0.61, 95% CI=0.50, 0.74). Low-fat diet and adequate sleep were more significant than commonly promoted healthy behaviors, such as eating a daily breakfast.

Conclusions: Modifiable lifestyle behaviors targeted in health promotion programs should be prioritized in an evidence-based manner. Top priorities for workplace health promotion should include low-fat diet, aerobic exercise, nonsmoking, and adequate sleep.

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Introduction

One of the unanswered questions in the workplace wellness field is "Of the health behaviors that can be controlled on a daily basis, which are most strongly associated with overall long-term outcomes in a working population?" Approaches to health promotion risk factor analyses often include factors that are not controllable on a daily basis, such as BMI or depression.[1–3] Others include factors that are actually conditions or outcomes, for example hypertension, that result, in part, from poor daily habits.[2,4] Much of the literature on risk factors is limited in scope for the number of risk factors or the breadth of outcomes,[1,2,4–18] making it difficult to assess the relative importance of behaviors on overall future health. Additionally, the dichotomization of risk factors, such as being sedentary versus not, fails to optimally assess the effect of varying degrees of engagement on future outcomes.[1,10,13,19] Furthermore, there is a dearth of published research from longitudinal data to evaluate the comparative effect of behaviors on the development of

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future health outcomes.[20,21] Previous research on multiple healthy lifestyle factors has provided information on the prevalence and clustering of such factors, but not on overall long-term outcomes.[22]

The problem that this study addresses is that it is unclear from the current medical literature which daily modifiable health behaviors are most significantly associated with the development of the most common chronic diseases, specifically among participants in a worksite wellness program. This longitudinal study describes the relationship between the daily modifiable lifestyle behaviors of working adults participating in a voluntary workplace wellness program and subsequent physical health outcomes. These results from a large modern cohort for a set of future health end points provide information regarding areas of focus for population preventive health efforts in employer-based settings.

Methods

Study Sample

Participants were full-time employees of Vanderbilt University who voluntarily enrolled in the "Go for the Gold" employee wellness program in 2003. Details of this program and the outcome trends over time have been described previously.[23–26] Approval for this project was obtained from Vanderbilt University's IRB.

The Go for the Gold wellness program consists of three steps, including a yearly health risk assessment (HRA), for which participants receive incentives of up to $240 per year, depending on number of completed sequential steps.[23,26] For the first 9 years, the Wellsource Concise HRA was used.[27] A revised version (Advantage) was used in Year 10 (Appendix Table 1, available online).[28] To assess the validity of the self-reported results, agreement analyses were performed between these results and those obtained from onsite biometric screenings.[23,24]

To protect the confidentiality of employees, the HRA data are de-identified prior to analyses. Each year, the HRA data set is merged with previous HRA data and with a master human resources file of all employees, which provides demographic and mortality data. This de-identified master data set was used for these analyses.

The research team met and reviewed the 39 questions from the HRA used in 2003 (the Wellsource Concise Assessment Plus Personal Wellness Profile)[27] and identified ten questions that met the following criteria: daily modifiable behaviors, biologically plausible contributors to health outcomes, commonly promoted in wellness programs, and supported by literature as potentially beneficial.[1,3,17,29–31] BMI, blood pressure, stress, and cholesterol were excluded because they either could not be controlled to a recommended target on a daily basis or were more consistent as health outcomes rather than as short-term modifiable behaviors. The positive health behaviors that met these aforementioned criteria were: aerobic exercise, nonsmoking, low fat intake, adequate sleep, seat belt use, strength exercise, avoidance of unhealthy snacks, consumption of whole grain breads, regular breakfast, and increased intake of fruits/vegetables.

End points, identified from the HRA between 2004 and 2012, were: time to development of new-onset diabetes; heart disease; cancer; obesity (BMI ≥ 30); hypertension; stroke; hypercholesterolemia; or death. The wording for each behavior and end point on the HRA tool is listed in the Appendix (available online).

Statistical Analysis

Data were collected between 2003 and 2012 and analyzed between 2014 and 2016. The goal of this program was to include as many employees as possible; therefore, no sample size or power calculations were performed at inception. Nevertheless, this program has one of the largest longitudinal assessments of a workplace wellness program with an annual participation rate significantly higher than that of most wellness programs.[23,32] Based on the 15:1 statistical guideline for survival models of events per variable,[33,34] the sample size was adequate to fit ten behavior variables along with two covariates (age and gender) for the seven chronic diseases.

A Cox proportional-hazards model was used to assess the relative importance of each behavior on the time to each condition or outcome.[35] Time to first onset of disease or last completed HRA was used in this survival analysis. Individuals with the end point condition at baseline were excluded from that particular analysis but included in other models. The adjusted models controlled for age and gender according to the prespecified analysis plan. A time-dependent Cox proportional-hazards analysis was performed for each outcome that also included the healthy lifestyle behaviors after baseline and before the outcome of interest. To compute 95% CIs for skewed variables (such as age and sick days), the bootstrap method was used with 1,000 iterations and a seed of 1,234. All tests of significance were two-tailed. The statistical analysis was performed with R, version 3.1.1,[36] Stata, version 11.0, and IBM SPSS, version 22.0.0.0. Details of the statistical analysis are in the Appendix (available online).

Results

In 2003, a total of 10,248 of 15,070 eligible (68%) Vanderbilt University employees participated in the Go for the Gold wellness program and were incentivized to complete subsequent annual HRAs. The mean age of participants was 41.2 (SD=10.8) years; the majority were female (68.1%), white (78.2%), and nonsmokers (88.5%) (Table 1).

Table 2 illustrates follow-up data and outcomes that occurred between Years 2 (2004) and 10 (2012). Of the 10,248 employees who enrolled in Year 1, 26.4% (n=2,707) participated in all 10 years. The most common conditions that developed between Years 2 and 10 were hypercholesterolemia (1,703/9,250, 18.4%); hypertension (1,551/8,728, 17.8%); obesity (890/7,513, 11.8%); and diabetes (453/9,878, 4.6%). The denominators differ because those with the condition at baseline were removed from that model. For example, 998 had

Table 1. Baseline Characteristics of the 10,248 Participants in the Wellness Program During 2003 (Year 1)

Characteristic	Participants from 2003[a] (*n*=10,248)
Age, M ± SD (range), year[b]	41.2 ± 10.8 (18.2–83.5)
Median (95% bootstrap CI)	41.1 (40.7, 41.5)[c]
Gender	
Male	3,273 (31.9)
Female	6,975 (68.1)
Race or ethnic group	
White	8,012 (78.2)
Black	1,324 (12.9)
Hispanic	158 (1.5)
Asian	690 (6.7)
Native American	21 (0.2)
Other	43 (0.4)
BMI[d]	
M ± SD	27.4 ± 7.2
<18.5	211 (2.1)
18.5–24.9	4,383 (42.8)
25.0–29.9	2,919 (28.5)
≥30	2,735 (26.7)
Sick days in past year due to illness or injury, M (95% CI)	2.45 (2.38, 2.49)[c]
Physical activity (days per week of aerobic exercise of at least 20–30 minutes)[e]	
0 days	2,794 (27.4)
1 day	1,351 (13.2)
2 days	1,670 (16.4)
3 days	1,977 (19.4)
4 days	959 (9.4)
5 days	874 (8.6)
6 days	321 (3.1)
7 days	265 (2.6)
Smoking status	
Smoker (current cigarette smoker)	1,179 (11.5)
Non-smoker	9,069 (88.5)
Dietary fat intake[f]	
Nearly always eat the high-fat foods	352 (3.5)
Eat mostly the high-fat foods, some low-fat	1,357 (13.3)
Eat both about the same	3,686 (36.2)
Eat mostly low-fat foods, some high-fat	4,410 (43.0)
Eat only low-fat foods	390 (3.8)
Unhealthy snacks ("How often do you eat snack foods between meals [chips, pastries, soft drinks, candy, ice cream, cookies]"?[g]	
Three or more times per day	535 (5.2)
Once or twice per day	2,555 (25.1)
Few times per week	4,130 (40.5)
Seldom or never eat typical snacks	2,971 (29.2)
Sleeping 7–8 hours per night[h]	
Seldom or never	1,227 (12.0)
Less than half the time	2,612 (25.6)
Most of the time	4,999 (49.0)
Always	1,365 (13.4%)
Engaging in strength exercising (sit-ups, pushups, or use weight training equipment)[i]	
None	5,858 (57.6)
Once a week	1,300 (12.8)
Twice a week	1,420 (14.0)
Three or more times a week	1,593 (15.7)
Using a seat belt[j]	
Seldom or never	207 (2.0)
Less than half the time	248 (2.4)
Most of the time	949 (9.3)
Always	8,776 (86.2)
Breads and grains[k]	
Nearly always eat refined grain products	1,003 (9.9)
Eat mostly refined grain products	1,988 (19.6)
Eat about the same	2,998 (29.5)
Eat primarily whole-grain products	3,496 (34.4)
Eat only whole-grain products	668 (6.6)

(continued on next page)

Table 1. Baseline Characteristics of the 10,248 Participants in the Wellness Program During 2003 (Year 1) *(continued)*

Characteristic	Participants from 2003[a] (*n*=10,248)
Consuming fruits and vegetables (servings per day)[l]	
One or less	2,688 (26.4)
Two daily	3,306 (32.5)
Three daily	2,256 (22.2)
Four daily	1,069 (10.5)
Five or more daily	862 (8.5)
Breakfast (more than just a roll and a cup of coffee)[m]	
Seldom or never eat breakfast	2,260 (22.2)
Eat breakfast two to three times per week	1,571 (15.4)
Eat breakfast most mornings	1,913 (18.8)
Eat breakfast every day	4,445 (43.6)
Conditions and chronic diseases at baseline	
Obesity (BMI ≥30)	2,735 (26.7)
Hypertension (BP 140/90 mmHg or higher)	1,520 (14.8)
Hypercholesterolemia (240 mg/dL or higher)	998 (9.7)
Asthma	823 (8.0)
Diabetes (high blood sugar)	370 (3.6)
Heart disease	189 (1.8)
Cancer (excluding skin cancer)	164 (1.6)
Stroke or restricted blood flow to head or legs	74 (0.7)

[a]Values are *n* (%) unless otherwise indicated.
[b]Age was calculated from date of birth to January 1, 2004.
[c]95% CI for the mean number of sick days and median age were computed using a bootstrap.
[d]The BMI is the weight in kilograms divided by the square of the height in meters.
Missing data:
[e]Exercise days, *n*=27.
[f]Fat intake, *n*=53.
[g]Snacking, *n*=57.
[h]Sleep, *n*=45.
[i]Strength exercising, *n*=77.
[j]Seat belt, *n*=68.
[k]Breads, *n*=95.
[l]Fruits and vegetables, *n*=67.
[m]Breakfast, *n*=59.

Table 2. Follow-up Data and Outcomes That Occurred Between Year 2 (2004) and Year 10 (2012)

Variable	Follow-up data and outcomes
Conditions and diseases absent at baseline and developed between Year 2 and Year 10	
Hypercholesterolemia (240 mg/dL or higher)	1,703/9,250
Hypertension (140/90 mmHg or higher)	1,551/8,728
Obesity (BMI ≥30)	890/7,513
Diabetes mellitus	453/9,878
Cancer (excluding skin cancer)	380/10,084
Heart disease	271/10,059
Stroke or restricted blood flow to head or legs	181/10,174
Death	93/10,248
In Year 10 (2012)	
Hospitalized	294/4,056
Emergency department visit	461/4,058
Sick days in past year due to injury or illness, M (95% CI)	2.28 (2.17, 2.36)[a]
Participants from baseline who also participated in the wellness program in future years	
Year 2 (2004)	6,955
Year 3 (2005)	6,639
Year 4 (2006)	6,509
Year 5 (2007)	6,002
Year 6 (2008)	5,658
Year 7 (2009)	5,274
Year 8 (2010)	4,827
Year 9 (2011)	4,500
Year 10 (2012)	4,168
All 10 years	2,707

Note: Participation includes those who participated in Year 1 and a given year. It is not limited to those who participated in all years up to that point.
[a]95% CI for the mean number of sick days was computed using a bootstrap.

hypercholesterolemia at baseline; therefore, 9,250 were at risk of developing hypercholesterolemia after baseline (10,248–998 = 9,250).

Forest plots for the unadjusted hazard ratios (HRs) of the association between healthy behaviors and the eight outcomes that developed between Years 2 and 10 are depicted in Figure 1 and Appendix Table 2 (available online). Fat intake had a significant impact on most of the outcomes (Appendix Figure 1, available online). Having a higher proportion of low versus high fat intake had a protective effect in a dose–response fashion on development of hypertension, obesity, diabetes, and hypercholesterolemia.

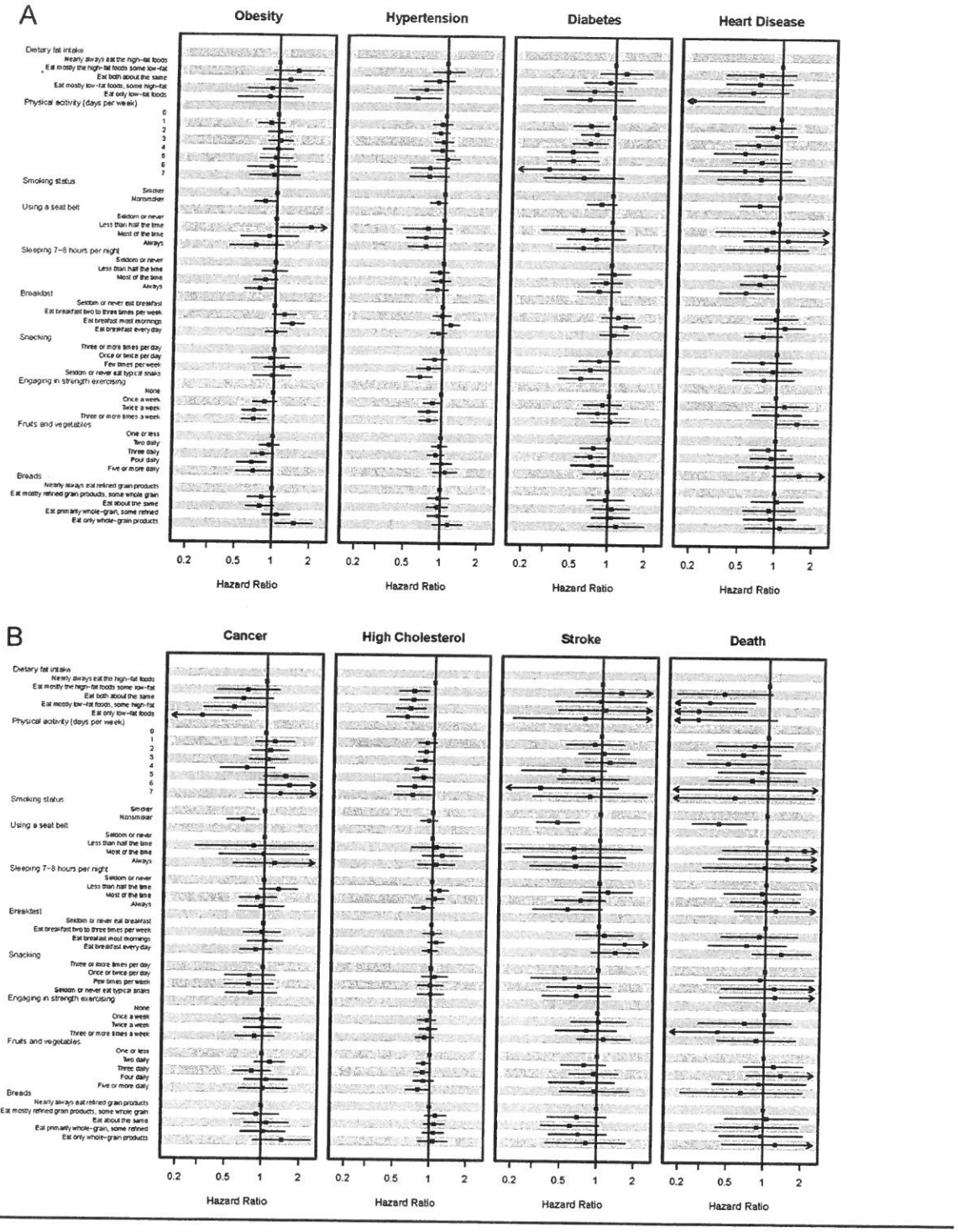

Figure 1. (A) Forest plot of the hazard ratios for the healthy lifestyle characteristics on obesity, hypertension, diabetes, and heart disease. (B) Forest plot of the hazard ratios for the healthy lifestyle characteristics on cancer, hypercholesterolemia, stroke, and death.

Note: The hazard ratios are based on univariate unadjusted Cox proportional-hazards models using the unhealthiest behavior category for each as the reference. The box represents the hazard ratio and the lines represent the 95% CIs. Arrows represent CIs that extend beyond the limits of the graph. This graph corresponds to Appendix Table 2A (available online). These results are derived from the Vanderbilt University "Go for the Gold" employee wellness program. The health behavior data are from 2003 and the outcomes data are from 2004 to 2012.

Note: The hazard ratios are based on univariate unadjusted Cox proportional-hazards models using the unhealthiest behavior category for each as the reference. The box represents the hazard ratio and the lines represent the 95% CIs. Arrows represent CIs that extend beyond the limits of the graph. This graph corresponds to Appendix Table 2B (available online). The narrow CIs for hypercholesterolemia reflect the fact that 1,703 people developed high cholesterol, and the wide CIs for death reflect the fact that only 93 people died. These results are derived from the Vanderbilt University "Go for the Gold" employee wellness program. The health behavior data are from 2003 and the outcomes data are from 2004 to 2012.

Aerobic exercise was associated with lower risk of developing new-onset diabetes, heart disease, and hypercholesterolemia, with 4 days per week as the most consistent level associated with good outcome. The upper limit of the 95% CI for the HR was <1.0 for these three outcomes with 4 days per week of exercise (Figure 1A and 1B).

Nonsmokers were at substantially lower risk of developing most outcomes. The effect size was particularly strong for mortality (HR=0.37, 95% CI=0.23, 0.60) and stroke (HR=0.48, 95% CI=0.3, 0.69) (Appendix Table 2, available online).

Appendix Table 3A (available online) shows the *p*-values for the relationship between the baseline behaviors and the outcomes, adjusted for age and gender. Appendix Table 3B (available online) provides the results of the relationship between the behaviors and the outcomes based on a Cox proportional-hazards model with time-dependent covariates. For each model, all ten behaviors were included, as well as age and gender. Both models demonstrated that low-fat diet, aerobic exercise, and nonsmoking were more often associated with health outcomes than other behaviors. Low-fat diet was significantly associated with seven of eight outcomes; aerobic exercise with three (diabetes, hypercholesterolemia, and heart disease); and nonsmoking with four (stroke, death, cancer, and heart disease) (Appendix Table 3A, available online). Furthermore, the dose–response effect of low-fat diet and aerobic exercise illustrated the stronger association of these behaviors with outcomes than, for example, a regular breakfast (Figures 1A and 1B).

For diabetes, the most significant factors were lack of exercise and high fat intake. For obesity, there were multiple behavioral factors, and the majority of the impact was from daily modifiable behaviors—as opposed to age (Figure 1A, Figure 2). For hypercholesterolemia and hypertension, age had an important effect; however, the daily modifiable behaviors played a significant independent role (Figure 2, Appendix Table 3A, available online).

Discussion

The daily modifiable lifestyle behaviors most significantly associated with healthy outcomes were: eating a low-fat diet, engaging in aerobic exercise, maintaining a nonsmoking status, and obtaining adequate sleep. Although the fact that these behaviors are related to health outcomes is not new information, the demonstration of their relative effect on a broad range of outcomes is new and clinically important. By not including the

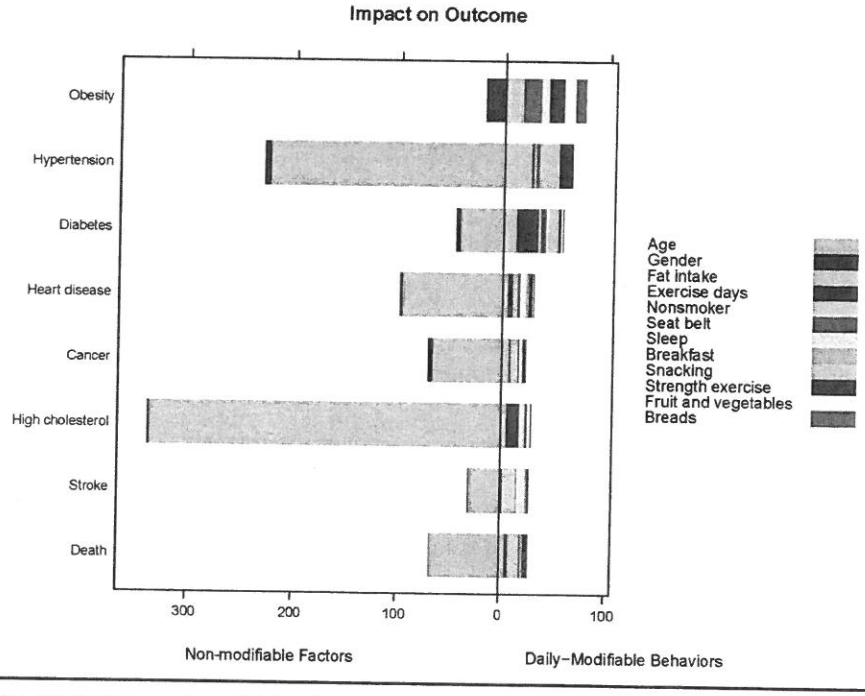

Figure 2. Impact of the 12 factors on the eight outcomes sorted by size of the total daily-modifiable impact.
Note: The size of the bars to the left of zero represents the impact of the nonmodifiable factors (age and gender) in a multivariate Cox proportional hazards model. The size of the bars on the right of the vertical line represents the impact of the daily-modifiable behaviors on outcomes. The impact is represented as the chi-square value (penalized for df) for each of the 12 factors from a multivariate Cox proportional-hazards model of time to the end point. Age plays a major role in the development of hypercholesterolemia and hypertension but almost no role in obesity. Obesity is a function of a large number of daily-modifiable behaviors. These results are derived from the Vanderbilt University "Go for the Gold" employee wellness program. The health behavior data are from 2003 and the outcomes data are from 2004 to 2012.

intermediate risk factors, such as BMI, the results provide an accurate assessment of impact of those that can be controlled on a daily basis. A meta-analysis of the existing literature would not be able to answer this research question because of a lack of standardization in measuring behaviors and outcomes.

Because wellness resources are almost always limited, these findings provide guidance on prioritizing initiatives for behaviors that have the most significant effect on population wellness. For example, these results suggest that an employee wellness program might preferentially invest in nutrition education and skill-building resources in promoting low-fat diet and aerobic exercise as opposed to eating a regular breakfast or selecting whole-grain bread. The low impact of regular breakfast is partially supported by a recent RCT that demonstrated that regular breakfast was not associated with successful weight-loss attempts.[37]

This study provides encouraging results about the potential benefits of minor improvements in health behaviors. As Figure 1 and Appendix Table 2 (available online) show, there is a substantial benefit for most health outcomes, such as diabetes, in exercising even 1 day per week, which has important health promotion implications in that it reinforces that doing something is better than nothing, even if it does not meet ideal guidelines. Another positive implication is that wellness programs typically already impact physical activity and other behaviors most associated with poor outcomes, such as cigarette smoking,[23] whereas factors that historically are less impacted by wellness programs, such as consumption of fruits and vegetables, have a weaker association with future outcomes.[29,30] As the U.S. Patient Protection and Affordable Care Act now incentivizes employers to adopt and expand employee wellness programs, these results provide timely, evidence-based information about where to focus those expanded resources.[20,38] Many existing wellness programs address exercise and smoking but could be improved by increasing emphasis on eating low-fat diets and obtaining adequate sleep. For primary care physicians who treat a comparable working adult population, this information could be useful in focusing on behaviors that show greater effect on the selected outcomes and in justifying reimbursement for this time.[39]

By studying these behaviors and outcomes in one longitudinal comprehensive cohort study, these results not only support the finding that less aerobic exercise, smoking, and an unhealthy diet are associated with development of chronic diseases[1,40–45] but also contribute in a unique way to understanding the relative effect of these various daily behaviors. Much of the current literature on wellness programs suffers from a lack of longitudinal evaluations,[1,20,30] which can also result in biased conclusions from problems such as reverse causation and residual confounding. The incentive program (structured around completing an annual HRA and programming targeting the risk identified in the HRA), along with voluntary annual participation rates of approximately 80% for more than a decade (2003–2015), has provided a unique data set to answer these questions.

In addition, as much of the medical literature is limited specifically to cohorts of men,[6,10,19,40,46,47] women,[47–52] the elderly,[41,43,53–57] or other subgroups,[13,28,58–61] these findings add to the literature by providing information from a more diverse population in a modern workforce.

This work builds on The Health Enhancement Research Organization findings by Goetzel et al.[1,31] regarding the link between ten modifiable health risk factors and healthcare cost by focusing on only the daily modifiable factors and including a longer follow-up period. Evidence suggests that promoting these behaviors that can be controlled on a daily basis can result in improved outcomes, particularly in incentive-based wellness programs where healthcare cost containment is an important organizational goal.[62,63]

Only a small fraction of Americans follow the four healthy lifestyle characteristics of having a healthy weight, not smoking, consuming fruits and vegetables, and engaging in physical activity,[64] and there has been little net change in the prevalence of healthy lifestyles in the U.S. over the past few decades.[65] These results suggest that it would be beneficial to also track and promote low fat intake and adequate sleep as a measure of a healthy lifestyle—at least to similar working populations. Total fruits and vegetables, however, may not be as strong a factor in the development of chronic disease in this setting because this does not measure types of fruits/vegetables or whether these are in place of unhealthy foods versus simply in addition to such foods.[1,61,66]

Although wellness programs aim to improve behaviors and outcomes, results showing that participants have improved outcomes compared with non-participants can be difficult to interpret because of various forms of bias.[67] Claims that those in high-risk groups benefit the most may be regression to the mean.[29,68] Study design issues, such as regression to the mean, must be accounted for when comparing the current findings with previous research.

Additionally, some conflicting information in the wellness literature is caused by the dichotomania in the field. Behaviors and outcomes are often divided into large groups for which the cut points are not supported by data. Figure 1A and Appendix Table 2 (available online) demonstrate the problems caused by dichotomizing behaviors, namely, that the relationship between

behaviors and health outcomes are U- or J-shaped, and if the variable is divided at the wrong point, these relationships can be incorrect. For example, in Figure 1A, the risk of heart disease and diabetes by days of exercise is U-shaped, for which a dichotomized version of the exercise variable would be inappropriate.

Per the prespecified analysis plan, the statistical models did not control for race in the multivariate analyses. Although this may be considered a limitation in that some outcomes do have variability in risk based on race, the justification for not doing so was to answer the research question about the relative importance of the daily behaviors on outcomes for a fairly diverse working population.

Limitations

This study has several additional limitations. First, the results are self-reported on an HRA. Although there are benefits to biometrics and health outcomes documented in an electronic medical record, there is a large body of research supporting the reliability, cost effectiveness, and benefits of structured self-reported data.[12,50,69–76] As this is a voluntary program with incentives for participation —not results—and there were no penalties, there was little motivation to report inaccurate data. One of this project's strengths is the quality and consistency of the longitudinal HRA data.

Some of the behaviors in this study are proxies for the actual cause, and thus a change in behavior may not manifest as a change in the outcomes. For example, not wearing a seat belt is often a proxy for a large waist circumference and obesity. Obviously, increasing seat belt usage will not prevent chronic disease outcomes.

The authors have previously described changes in behaviors related to development of diabetes.[24] For most of these behaviors and outcomes, however, the sample size is too small to detect significant differences in those who change a behavior and have the outcome during the 9-year follow-up.[24] Additionally, in that paper, the analysis did include weight as a healthy characteristic, whereas for this analysis, obesity was classified as an outcome affected by daily modifiable lifestyle characteristics. This may therefore underestimate the intermediate contribution of weight to the other outcomes studied in this evaluation. Finally, a perceived limitation may be the generalizability of the findings from the employees who participated in this university setting. The study population was mostly female (68%); however, the overall U.S. workforce is now 47% female[77] and this trend is increasing each year. Similarly, the average age of this population was young enough that some outcomes that tend to manifest in older age groups may be underrepresented when attempting to generalize to an older population. Participants in this program are, however, diverse and in many ways more representative of the U.S. workforce than other published medical research studies.[78] For example, the median age of U.S. employees in 2012 was 41.9 years, which is nearly identical to the median baseline age in this cohort of 41.1 years.

Conclusions

In this longitudinal analysis of a working population, a low fat intake diet, aerobic exercise, nonsmoking, and adequate sleep were the daily modifiable behaviors that were most consistently associated with prevention of chronic diseases. This provides justification for programs to include these behaviors in promotional efforts and prevention investments, especially when faced with limited resources and large populations. According to Schroeder,[79] "The single greatest opportunity to improve health and reduce premature deaths lies in personal behavior. In fact, behavioral causes account for nearly 40% of all deaths in the United States."[80,81] This study provides guidance to focus programs designed to improve these personal behaviors.

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Appendix

Supplementary data

Supplementary data associated with this article can be found at http://dx.doi.org/10.1016/j.amepre.2016.09.012.