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Actuarial Model for Wellness

STUDY REPORT

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SOCIETY OF ACTUARIES

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Actuarial Model for Wellness

Introduction

In the current work environment, employers may encounter the deteriorating health status of their workforce, resulting in increases in related health and absence costs, as well as lost productivity. In addition, employers are grappling with how to reduce the cost of health care. Both employers and employees alike are considering an approach to harness the rate of increase in these costs through good health (wellness). At the start of this project, surveys indicated that at least two-thirds of employers plan to increase investments in wellness over the next year or two[1]. As these investments grow, actuaries have an opportunity to help shape the landscape.

While good health encompasses many things (e.g., physical, mental, emotional, social, spiritual),[2] significant data and research has been developed over the past decade to understand what needs to be collected, measured, and analyzed to affect change related to (the lack of) wellness in the United States. Sibson's recent Healthy Enterprise study found that the orientation and maturity of an employer's initiatives may explain more of the variance in outcome indicators of workforce health (health costs and disability), withdrawal (absence and turnover) and safety (workers' compensation costs) than traditional actuarial factors such as geography, demographics and industry.[3]

Actuaries can compile this information in a manner that helps recognize and quantify the risk associated with health, lifestyle behaviors and the effectiveness of an organization. The development of a model with an actuarial perspective to incorporate this dimension of risk into projections of health, life, disability, retirement and workers' compensation cost can help leadership make better decisions, by recognizing the implications of health. It can also help spur the development of validated models for individuals to better understand the implications of their personal risks and lifestyle behaviors.

This report outlines the current environment, the objectives of the study and provides a summary of the overall study findings. This report is supplemented by the following companion reports:

1. Research Summary
2. Survey Results
3. Interviews with Researchers

This document includes a summary of key findings from each of the three phases.

[1] 2010 IBI More than Health Promotion: How Employers Manage Health and Productivity
[2] 1989 O'Donnell, American Journal of Health Promotion Definition of Health.pdf
[3] 2011 Sibson Healthy Enterprise Study http://www.sibson.com/publications-and-resources/surveys-studies/?id=1608

The Current Environment

Wellness received a significant amount of attention over the past decade as employers continue to seek options for "bending the cost curve." Public focus heightened over the past couple years along with the Health Care Reform debate. While academia conducted considerable research around wellness, most of it focused on Return on Investment (ROI). As an example, Harvard University published a meta-study focusing on wellness that claimed for every dollar invested in wellness programs, there was a return of $3.27 in reduced health care costs and $2.73 in reduced absenteeism costs.[4]

Other research indicates that wellness does not always have an impact on health care costs. Rand published a study indicating that wellness programs have minimal impact on health care costs and estimated it takes an average of five years for a new wellness program to become cost-neutral, let alone generate a positive ROI.[5] Another research article from the American Journal of Health Promotion found that the ROI may depend on the quality of the study methodology.[6]

Much of the public discussion and research seems to treat wellness in a binary fashion (either it is effective and produces an ROI, or it does not), but, from a practical perspective, there is a range of programs with varying effectiveness that generate a range of outcomes. When taking a closer look at the 36 studies included in the Harvard meta-study (eight of which looked at both health care and absence costs) and the 61 studies in the AJHP meta-study, it appears that there is quite a bit of variability in outcomes as presented in the below tables. Table 1 represents health care cost savings per employee per year, in 2009 dollars.

TABLE 1: SUMMARY OF WELLNESS IMPACT BY OUTCOME

Studies Considered	Average	Minimum	Maximum
Health Care Only (22 studies)	$300	$(426)	$1,168
Absence Only (22 studies)	$294	$0	$1,033
Health Care and Absence (8 studies)	$687	$11	$1,510

[4] Health Affairs, February 2010

[5] http://www.rand.org/content/dam/rand/pubs/research_reports/RR200/RR254/RAND_RR254.pdf

[6] http://ajhpcontents.org/doi/abs/10.4278/ajhp.130731-LIT-395)

Table 2 represents the ratio of the benefit, or savings, relative to the cost of the program.

TABLE 2: SUMMARY OF WELLNESS BENEFIT COST RATIO (BCR) BY METHODOLOGY QUALITY[7]

• Studies Considered	Average	Minimum	Maximum
High Quality (18 studies – 2 outliers)	1.80 (2.41)	-3.30 (0.26)	4.47 (4.47)
Moderate Quality (16 studies – 2 outliers)	3.73 (2.39)	-2.45 (0.10)	28.71 (5.00)
Low Quality (27 studies – 2 outliers)	2.97 (2.34)	0.33 (0.33)	15.60 (4.85)

As can be seen, merely looking at the average does not tell the full story of what any individual organization might anticipate.

Through research, Sibson identified a number of models used by various stakeholders. For example, some vendors developed internal models to calculate an individual's adjusted age based on his or her health status. Each model incorporates different factors and is based on the vendor's own internal research and methodology. Ian Duncan included a few chapters on wellness in his book, "Managing and Evaluating Healthcare Intervention Programs,"[8], which is now part of the syllabus for actuarial exams. His discussion focuses on an overview of current practices, a literature review, and a model he developed in the course of his work to identify the relationship between health risk factors and health claim costs.

Even though wellness programs affect many actuarial practice areas (health, retirement, life, workers' compensation, disability, risk management, etc.) there are few publicly available, validated and transparent models to understand and estimate the value of these programs. As a result, the actuarial profession could benefit from a well-considered wellness model that actuaries can use in conjunction with their current models and yet also support evolving models (e.g., complexity science).

While a cell-based tabular model, the mainstay of the actuarial profession today, might be an appropriate model to support actuaries in their work, wellness does not "fit" the tabular mold very well. A tabular model might not be able to reflect desired elements of wellness programs, such as the impact of social networks on participant behavior, the implications and multi-directional interdependencies of the environment, lifestyle factors, risk conditions and disease on participant behavior, variations in motivation, decision making/heuristics, stages of behavioral change among individuals, or emergent phenomena such as management's response to participant behavior.

[7] The parenthetical figures represent the figures calculated with top and bottom 5% outliers removed

[8] Second Edition, ACTEX Publications, 2008, Part IV addresses wellness and integrated programs.

More recent research conducted by the SOA investigated models from complexity science, such as "agent-based models" that can reflect such relationships. In simplified terms, these types of models are part of a larger construct belonging to complexity science, and deal with the bottom-up criteria of interactions (interdependencies) and behaviors between agents and other agents, the environment, and individuals.

For more information on complexity science, please see the related SOA research project on "Complexity Science–an introduction (and invitation) for actuaries" at: www.soa.org/research/research-projects/health/research-complexity-science.aspx.

Objectives

The primary objectives for this study were to collaboratively:

- Envision the possibilities for an actuarial wellness model and the actuary's role in wellness,
- Document what currently exists in the marketplace,
- Create a conceptual actuarial model framework to support actuaries in the modeling, evaluation, and assessment of wellness programs and the impact of health on various practice areas.

The conceptual model, once populated, would then be used in conjunction with agent-based behavior models or other traditional actuarial tools, such as disability, mortality and morbidity tables, to allow better understanding and modeling of the progression of health through an employee's working lifetime and the implications of workforce health on retirement, disability, life and even casualty risk.

The end use of the model will need to drive what is ultimately included in the model. For example, if the model is intended to be used to incorporate health risk assessment data to model impact of lifestyle behaviors on various outcomes and help individuals understand the implications of their lifestyles, then risk specific tables may make sense. However, if the intent is to model the impact of interventions, then the risk specific tables may be less practical, and an agent-based model that also addresses social networks and organizational risk factors (e.g., cultural, socioeconomic, environment, etc.) may become more important. It is important to limit the discussion to modifiable factors in lifestyle or the organization and exclude discussion of the impact of genetics, which is consistent with the concept of wellness. A suite of models, with varying sophistication, would provide actuaries with flexibility to reflect the variation in timeliness and complexity of information available.

Definitions of "Model"

It is important to recognize that there are many types and aspects of modeling. A model is generally defined as a representation of something else. Adapted from Wikipedia, two types of models referred to in this report, Conceptual Model and Computational Model, can be defined as:

- A **"Conceptual Model"** is a model that exists in the mind, and may be an illustrative representation of a Computational model. It is an abstract model meant to introduce, and help the user to understand the subject matter, and does not define the complete and detailed way to arrive at a computational solution (or simulation), or contain the data necessary to do so.

- A **"Computational Model"** attempts to simulate an abstract model of a particular system. A system would need definition (a detailed process or design) and data in order to create such a model. This type of model is a physical model, producing results that can be summarized as an estimate or solution. Cell-based tabular actuarial models as well as an agent-based model both fall into this category.

Conceptual Model

A model will likely need to look at factor prevalence and impact by age and risk and reflect more than a mean value of prevalence and/or cost. Prevalence and cost will vary depending on socioeconomic, environmental and cultural factors. In addition, when looking at risk factors, there will be significant variances in the resulting cost. As such, it may be necessary to look at distributions of cost and impact for risks and conditions.

The following figure illustrates the conceptual model for this project resulting from the research review and researcher interviews conducted by the Sibson research team and feedback from the project oversight group (POG).

PROGRESSION OF HEALTH IN AN ACTUARIAL MODEL FOR WELLNESS

Personal Factors	Environmental Factors	Lifestyle Factors	Risk Conditions (measures)	Disease States	Actuarial Outcomes	Actuarial Impact
Time						
Age/Gender/ Genetics	Work Environment	Diet/Nutrition/ Healthy Eating	Obesity (Body Fat/BMI/Waist Circumference)	Diabetes/ Asthma/COPD	Complications/ Morbidity	Health Cost
Beliefs	Home Environment	Exercise/Physical Activity/Fitness	Hyperlipidemia (Elevated Cholesterol/LDL Level)	Heart Disease/Heart Attack	Presenteeism/ Engagement/ Satisfaction	Productivity Impact
Emotions	Network (Family, friends, colleagues, acquaintances)	Stress (Levels, Management, Resilience)	Hypertension (Elevated Blood Pressure)	Depression/ Substance Abuse	Absence	Absence Cost
Income/Socio Economic Status	Geography (Pollution, noise, education system)	Addictive Behavior (Smoking/Tobacco/ Alcohol/Other Substance Consumption)	Hyperglycemia (Elevated Blood Sugar/Glucose)	Stroke/Kidney Disease	Litigation/Accident/ Property Loss	Property/Casualty Cost
Education Level	Health Care System	Risky Lifestyle Behavior	Hypertriglyceridemia (Elevated Fatty Molecule/ Triglycerides)	Cancer	Workplace/ Traumatic Injury & Return to Work	Workers' Compensation Cost
Ability and Willingness to Change Behavior	Culture (Norms, shared values, climate)	Sleep	Anxiety	Other Chronic and Non-Chronic Conditions	Disability	Disability Cost
Interventions					Loss of Activities of Daily Living	Long Term Care/ Custodial Care Cost
					Mortality	Life Insurance, Retirement, Retiree Health

Each column represents a stage of the progression of health, from the environment in which we live and the lifestyle we choose, to the actuarial outcomes and impact that results. While there is an intricate web of interdependencies, some of which may impact factors in the same or prior columns, for simplicity sake, the model depicts the flow from left to right. Each factor may have a distribution for determining prevalence, probabilities, and impact (severity). The model follows the progression reflected in the red timeline (which are the column labels). Note it is not intended to imply any specific dependence across each row.

The table shows the progression from personal, environmental and lifestyle factors to the risk conditions, disease states and other outcomes that result, together with their metrics. Even though it is convenient to think about such factors flowing amongst the columns from left to right, and even though such a conceptual model lends itself to modeling with traditional cell-based tabular actuarial models, the underlying details of the reality of the continuum are far more complex, resulting in business risk along the entire continuum. In fact, there is an intricate web of interdependencies among the columns and rows of the table. For example, a person's disease state affects the person's lifestyle choices, and an employer's health expenditure amount affects the amount the employer can spend to improve the working environment. Similarly, a person's sleep habits can affect the person's stress level, and vice versa, stress can impact ability to sleep. There are a myriad of such relationships the table cannot (simply or conveniently) show. It is important to recognize that the rate of progression of health is influenced by, and one's condition influences, psychosocial factors such as self-efficacy/confidence, readiness to change, level of social isolation, motivation and one's perception of health.

Another way to think about health and health outcomes is to think about individual people. A person lives in a particular environment; makes lifestyle choices according to the person's goals, capabilities, psychological tendencies, environment, social network, and other factors; falls ill; misses work; becomes disabled or dies; and generates employer and/or insurance expenditures. A conceptual model based on a complexity science approach can capture the myriad of interrelationships that a table cannot. It can be modeled by simulating an entire population, to build an agent-based model from the bottom up. Of course, the associated challenge becomes defining the universe of relevant influences, decisions, and behaviors (some of which are not rational) to a degree that is at all manageable, while maintaining a desired level of precision.

As such, an actuarial computational model that eventually is developed needs to consider the current needs of the actuarial profession, which tends to work with tabular models, while also anticipating the emerging complexity science models, such as agent-based models. This might lead to the development of a tabular model that actuaries can use with existing actuarial models, and also to help create inputs to agent-based models that can model the more complex interrelationships of people and organizations involved with wellness. The model, or suite of models, will need to be flexible enough to address varying needs based on the user. A challenge for actuaries will be to determine the appropriate level of complexity for a model design in order to capture enough detail to enable the actuary to understand, translate, incorporate, and caveat models that they build.

Research Summary

Sibson utilized its Information Research Center (IRC) to identify 133 wellness related published research articles and surveys that were primarily published between 2000 and 2010.The Sibson research team reviewed the abstracts of the research studies to identify 32 articles, including at least three research articles for each of the major modifiable risk factors (weight, diet/nutrition, fitness/physical activity, cholesterol, blood pressure, addictive behavior, stress/anxiety/ depression). For this research, the review focused on studies of large US based populations (>1,000 lives, when available) where the abstract summaries appeared to focus on quantifiable impact of the health risks related to health costs, Presenteeism, absence, disability, turnover, mortality and/or

workers' compensation costs. Articles primarily focused on the evaluation of a program or on ROI were avoided, unless it included associated data on prevalence, cost and the impact of the specific risk factor/wellness on outcomes. Table 1 summarizes the count of articles by topic.

TABLE 3: ARTICLE COUNT BY TOPIC

Topic	Number of Articles
Research Approaches and Limitations	2
General Wellness Research	7
Weight	5
Diet/Nutrition	3
Physical Activity	3
Addictive Behavior / Smoking / Alcohol Abuse	3
Stress/Anxiety/Depression	3
Hypertension	3
Cholesterol	3
Total	32

The research summary report (https://soa.org/Research/Research-Projects/Health/Actuarial-Model-for-Wellness.aspx) includes a summary of each of the articles, including the objectives of the study, methods used, limitations, results/conclusion (including any tables of pertinent data included with the study).

In our review, many research studies included 60 plus references related to specific risk factors. As such, our review of only a couple articles per risk factor really only scratches the surface and a much more comprehensive review of available research will be required to complete the discussion. Further review will need to look at other factors such as the impact of environment, socio-economic factors, social networks, behavioral economics, various conditions, mortality and disability studies, etc.

Much of the recent research focuses on ROI and the impact of the number of risk factors and how to motivate people to change their behavior. There is less research on the "actuarial" impact of these risk factors. The research for specific risk factors varies widely. For example, the research is much more prevalent for smoking, fitness and obesity than factors such as risky lifestyle behavior.

The research that does evaluate specific lifestyle factors and/or risk conditions usually does not account for the impact of other potentially present lifestyle factors/risk conditions, which could lead to an overstatement of the impact of the evaluated lifestyle factor/risk condition.

Furthermore, wellness activities impact retirees, their longevity, and their quality of life. This not only can impact employer health costs, but costs to the Medicare system. Likewise it may have an impact on Medicaid. Therefore, wellness may have a broad impact on not just the employer's ROI, but on a societal ROI as well. This was not addressed in any of the reviewed research.

Gaps in Research

There appears to be a limited amount of data on the impact of wellness on disability, workers compensation claims and productivity. By major risk factor, there appears to be the least number of useful (and recent) studies on the impact of hypertension (elevated blood pressure) on health care costs, mortality, etc. (and some of the research was based on studies in Japan, which may not be appropriate for a US based model).

There may be a need for further review of condition-specific research that identifies more data on the risks that lead to the condition and the impact the condition has on mortality, disability, morbidity and safety. It may make sense to leverage existing research, bot sponsored by the SOA (e.g., agent based modeling, 2004 care management papers, the disability experience studies) and other sources, as a starting point for further work on the progression of health continuum from wellness to chronic disease. The existing research does not definitively identify the order of risk factors in the progression of health from the inception of being healthy (or having a current state of no risk factors or conditions) to the actuarial outcome of death, disability, etc. Mapping out the relationships and identifying available data, may be a good initial step.

The conceptual model may be a series of tables defining the relationship between lifestyle risks, health risks, conditions and actuarial outcomes that takes us from one end of the spectrum to the other. The Research Summary document provides more detail on the current gaps in research that might need to be bridged in order to support this model.

Research Approaches and Limitations

It is important to address the limitations and challenges within the various research approaches, which makes it difficult to find or develop a study that meets the gold standard of randomized controlled sample studies. The research summary document identifies a number of data challenges and limitations that were identified in the various research articles.

Survey Results

The Society of Actuaries, with the support of Sibson Consulting, distributed a survey to the actuarial and vendor communities to gather feedback on the proposed conceptual model and better understand the potential uses of, and value to the actuarial and vendor communities that would use such a model. The survey, issued in 2012, sought to understand the potential applications and sources of data for an actuarial model and potential future role of the actuary. The survey found that the current use of existing models is limited, but the interest and expected use for models in the future is much greater.

Existing Models and Likely Future Use

The survey probed respondents on the uses for existing and future models as well as the factors incorporated. Both existing models and desired future models primarily focus on determining ROI of wellness (68% existing, 79% future), demonstrating impact (66% existing, 86% future), and designing wellness incentive programs (56% existing, 69% future). The top factors used in

existing models are Disease States (74% existing, 90% future), Risk Conditions (74% existing, 89% future), Lifestyle Factors (72% existing, 85% future), Health Morbidity and Cost (66% existing, 81% future) and Environmental Factors (56% existing, 70% future). Of the 153 participants responding to this question, 80% indicated that they use current wellness models to adjust medical premiums, but only 5% to 7% indicate that they use current wellness models to adjust short-term disability, long-term disability or life insurance premiums. The results are likely skewed toward medical because the survey was only distributed to the SOA's Health Section and 93% of respondents indicated that they are health actuaries and less than 15% work in any other area.

Conceptual Model Feedback

Overall, there was a significant amount of support in favor of building a conceptual and possibly a computational actuarial wellness model. While an extremely high number of responses indicated that it was important (95%), about 20% less indicated that it is feasible to construct (72%). This difference suggests that there is recognition of the challenges inherent in developing such a model.

Further, most survey respondents that currently work with actuarial wellness models for calculating ROI or impact of wellness (>50%) liked the model and felt it captured an appropriate level of factors, risks, disease states and outcomes.

Data Sources

The survey participants identified dozens of potential types of data to be gathered as well as potential sources of data. Further analysis would need to be conducted to understand the appropriateness and validity of the data sources identified.

Role of Actuaries

Three quarters or more of the respondents indicated that each role choice that was presented in the survey (other than helping people understand the implications of their behaviors) is important (4 or 5 on a scale of 1 to 5 of importance, with 1 being least important and 5 being most important).

Researcher Interviews

Sibson Consulting conducted researcher interviews with a few key researchers in the field of actuarial and wellness modeling. Ron Goetzel, Alan Mills, Don Morris, and Tuan Dinh all participated in these interviews. Feedback from these interviews, as well as discussion on best practices in modeling methodology around wellness, allowed Sibson to further refine the conceptual model to take into account some concepts to enhance the model. The interviews sought to gather feedback on the model developed, discuss model alternatives, understand different modeling methodologies, and determine possible data sources that could be investigated if the conceptual model were to be converted into a computational model. This allowed Sibson to investigate a possible future role for actuaries in this area.

Key Findings

Sibson provided those interviewed with a copy of the conceptual model from Phase I. The researchers provided the following feedback with most of it incorporated into the model:

- Separate personal vs. environmental factors;
- Reflect a time element within each stage and between each stage (moving from one stage to the next);
- Consider that a continuum exists for each factor in the model (reflecting both an internal timeframe and process);
- Consider co-morbidities and interdependence of factors and conditions;
- Recognize the impact of interventions on progression and time within each factor's continuum;
- Determine how to best reflect the "risk measures", which are not really a risk factor, but a measure of one's health condition at various points in time throughout the continuum; and
- Revisit some of the factors included under the different stages on the progression of health.

Additionally, the researchers offered alternative models based on their research and work in the field. This included agent-based simulation modeling, mathematical population simulation for treatment interventions, and data simulations which model wellness outcomes based on large linked databases. Also recommended were several large sources of data that could possibly be used to populate or source any future computational models. These included the National Health and Nutrition Examination Survey (NHANES), the National Ambulatory Medical Care Survey (NAMCS), the National Hospital Ambulatory Medical Care Survey (NHAMCS), private databases such as MarketScan, population models based on clinical trials, observational studies and population studies, and private statistical sampled surveys such as Gallup-Healthways Well-being Index. The researchers all felt that future actuarial endeavors in wellness modeling could be of value and could be attained through the actuarial models already in early stages.

The Affordable Care Act (ACA) Impact on Wellness

The Affordable Care Act (ACA) included the following provisions related to wellness:

- Non-grandfathered plans must cover certain preventive services at 100%, which includes some wellness services and certain pharmaceuticals;
- Minimal Essential Health Benefits (EHBs) are required to be offered by all non-grandfathered plans and generally includes certain wellness, preventive and condition management services. Large plans do not have to cover all 10 of the essential health

benefits, but they do have to provide preventive care as defined, regardless of which EHBs they cover;

- There are indexed maximum allowable health plan incentive levels tied to health outcomes as a percentage of total health cost (increased from 20% to 30%, and potentially 50% in the future – already increased to 50% for tobacco use). However plan sponsors need to be careful to provide for reasonable alternatives for those who cannot meet a standard in order to receive an incentive;

- Under 4980H regulations, for the purposes of performing the affordability test, plan sponsors may treat everyone as meeting any tobacco incentive (but this does not apply to any other incentives);

- The loss ratio requirements for insured plans allows health insurers to include the cost of wellness and preventive services in the numerator of the loss ratio calculation, rather than as a retention charge;

- The introduction of Accountable Care Organizations (ACOs) – integrated delivery networks with payment and care delivery models tied to quality metrics and reductions in the total cost of care;

- Wellness-related pilot programs and grants are provided by the government for research surrounding outcomes for risk reduction (based on wellness initiatives);

- Health Resources and Services Administration Data Warehouse allows users to interact with data in charts, tables/reports, maps, and tools to support analytics;

- The Excise Tax, which imposes a tax on health plan costs that exceed a threshold level, provides an incentive for employers to develop strategies to create a sustainable health plan in order to avoid the Excise Tax without having to diminish the value of the benefit coverage, with wellness being one of the primary approaches;

- The Centers for Disease Control will provide tools to support wellness and health improvement; and

- There will be research and reporting on wellness and its effectiveness.

These provisions will influence and help further shape future wellness models. In addition to the ACA, there are a number of other regulations and compliance issues that need to be addressed.

Project Conclusions

In developing a conceptual actuarial model for wellness, this project serves as an initial step toward a computational actuarial model. The current conceptual model can shape approaches for analysis related to wellness. Additional research and analysis will be required to develop a computational model. Development of the model should leverage the best practices from software engineering and "agent-based" modeling approaches (see chapters 13 and 14 of Alan Mills' research report titled "Simulating Health Behavior" on the SOA web site). While there are

challenges in integrating the data that is available, there is a vast variety of available data that would require limits placed on just what degree of it should be used. From that perspective, a preliminary model could be built, and expanded upon, as more "branches" of the model are mapped out in greater detail and data is made more readily available.

The conceptual model could be the groundwork for initially mapping out what aspects of the computational model can already be created and what requires more data sources and more research. It will not be possible to include every aspect of the conceptual model in the computational model initially due to a lack of sufficient data in certain aspects of the model (e.g. how emotions and beliefs impact health factors and the timing of movement through each stage of the health continuum).

There will be a significant role for actuaries in wellness program design, ROI analysis, modeling, health environment behavioral data collection, and model verification. A conceptual and computational model may help to also further expand work in this area and build more awareness of these issues among health practitioners.

With their skills in modeling, actuaries may be well-equipped to take on a significant role in wellness. Developing an actuarial wellness model can help shift the conversation from whether or not wellness is effective, toward a discussion around how to structure the environment and programs to be effective and produce optimal results for a given population. Further benefits may include improvements in economic and educational value in its downstream impact on employers and employees.

Work in this area may also showcase the skills of actuaries as experts who are able to research and understand risk, as well as develop solutions to optimize outcomes. It may also present opportunities for actuaries to develop new approaches on how to collect and validate data gathered on behavioral decision-making in a health environment and in turn, further develop an emerging area of expertise.

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