PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Simulating the impact of changing trends in smoking and obesity on productivity of an industrial population - an observational study
AUTHORS	Bhojani, Faiyaz; Tsai, Shan; Wendt, Judy; Koller, Kim

VERSION 1 - REVIEW

REVIEWER	Brian Gifford Integrated Benefits Institute USA
REVIEW RETURNED	14-Feb-2014

GENERAL COMMENTS	The authors use estimates from the research literature on the productivity loss attributable to smoking and obesity to estimate productivity losses to an organization given its trends in the prevalence of these health risks. They examine employee level data from physical examinations and health survey to generate estimates of smoking and obesity rates over time, but do not have data on employees' absences except in certain cases (i.e., long-term absences that trigger a requirement for verification). They cite published literature to generate values of lost work time, and test their results against different value assumptions. Given the data limitations, this is a reasonable approach. However, the paper could benefit from additional clarity about the data and methods, and from presentation of the results in a context that makes them more immediately relevant to readers. The paper would be stronger if the authors described the data in a bit more detail. For example, why are employees taking physical examinations to which their employer can access results? Is a health certification required for certain positions are is participation voluntarily? What percent of the workforce is required/eligible for evaluation, and what proportion participate? Information such as this will help readers assess the precision with which to view the smoking and obesity rates (which now can only be inferred by the general number of employees as somewhere between 20,000 and 28,000 and the reported number of employees with usable data). Adding confidence intervals to Figure 1 would also be helpful. While it may seem merely like a stylistic point, given the authors' research strategy, they are not studying the "impact of" changing trends (as stated in the title and objectives statement). Instead, they are conducting "a simulation of the productivity implications" of changing trends. That is not a subtle distinction since they are deriving the impact from the published literature. The authors reasonably opt for a conservative estimate of lost work

	days in their simulation, but they need not. An alternate strategy would be to score their cited literature for quality as they would if they were conducting a systematic review or meta-analysis and use the estimates from the highest-quality studies. They would of course document these quality standards and results as part of the published work. Presuming the authors' confidence in both the health risk rates and the impact measures used in the simulation, the productivity implications become clear: as seen in the growing ratios of excess lost work days, over time the organization has lost more productive work time to obesity than to smoking. However, the authors do not take advantage of this finding as fully as they could. Showing the total number of excess lost work days per year likely has less relevance to most readers than showing the number of excess days per 100 employees. The tables would benefit additionally from showing the total number of days – or better still, the authors may wish to show the results in a stacked column chart. This will immediately communicate the change the composition of excess lost workdays without reference to the ratio (while the % of days for obesity at different time points can be referenced in the text). A chart would also permit utilization of all available data years, rather than reporting the mid-points alone. Calculating from Table 1, the total number of excess lost workdays in 2007 is 50% greater than in 1982 – this is an important implication that I did not see described in the text. It suggests that all of the productivity improvements from reduced smoking that might have accrued to the company have been more than wiped out by the increase in obesity. By the same token, over the 25 years of observation, obesity accounts for two-thirds of all excess lost workdays for both health risks (using just the data years shown). However, both findings depend on the simulation of 20,000 in each observed year. This may not be a reasonable assumption, and using the actual employment totals in each year should be considered (the authors cite a range of 20,000 to 28,000) in order to understand better how the timing in health risk rates matter. For example, if we assume a linear trend and there were 28,000 employees in 1982 and 20,000 (i.e., a shrinking workforce) in 2007, then total excess lost work days still grew by about 7%. Assuming a growing workforce, total lost workdays more than doubled. Finally, I encourage the authors to consider ways to communicate the magnitude of the findings in terms of social or business values. On one hand, the 32,000 excess lost work days in 2007 noted in table 1 seems large. But if we assume 20,000 FTEs, it is less than 1% of labor inputs in 2007. If valued at average daily wages, what does this mean to the organization relative to other financial metrics (e.g., revenues, profits, etc.). If we applied future value calculations to the lost work time in the earlier years, what is the total investment value of excess lost workdays over 25 years? Explaining this would help the reader put the timing of health risks changes (and therefore the value of earlier vs. later efforts to reduce risks) into a larger financial context.

REVIEWER	Otto Wong Applied Health Sciences San Mateo, California, USA
REVIEW RETURNED	28-Feb-2014

GENERAL COMMENTS	Comments to the Editor: This is an important investigation on the economic/social loss due to obesity in a large industrial population. The analysis was thorough and the report well written. The alarming findings were quite convincing. I recommend acceptance for publication. Comments to the authors: Two minor questions. (1) The authors used 20,000 as the average size of the workforce in the calculation. Would it have made any difference if a different assumed value (e.g., 28,000) were used? (2) Are similar data available for the "overweight" group (BMI 25-30)? If so, a similar analysis for the group would be informative.

VERSION 2 – AUTHOR RESPONSE

Reviewer(s) Reports:
Reviewer: 1
Reviewer Name Brian Gifford
Institution and Country Integrated Benefits Institute
USA
Please state any competing interests or state 'None declared': None declared

The authors use estimates from the research literature on the productivity loss attributable to smoking and obesity to estimate productivity losses to an organization given its trends in the prevalence of these health risks. They examine employee level data from physical examinations and health survey to generate estimates of smoking and obesity rates over time, but do not have data on employees' absences except in certain cases (i.e., long-term absences that trigger a requirement for verification). They cite published literature to generate values of lost work time, and test their results against different value assumptions.

Given the data limitations, this is a reasonable approach. However, the paper could benefit from additional clarity about the data and methods, and from presentation of the results in a context that makes them more immediately relevant to readers.

We thank the reviewer for his positive comment and constructive suggestions.

The paper would be stronger if the authors described the data in a bit more detail. For example, why are employees taking physical examinations to which their employer can access results? Is a health certification required for certain positions are is participation voluntarily? What percent of the workforce is required/eligible for evaluation, and what proportion participate? Information such as this will help readers assess the precision with which to view the smoking and obesity rates (which now can only be inferred by the general number of employees as somewhere between 20,000 and 28,000 and the reported number of employees with usable data). Adding confidence intervals to Figure 1 would also be helpful.

The following sentences were added to the Methods Section (1st paragraph)
"The frequency of periodic examinations, as well as participation in the various examination programs,

differed depending on the type of examination and age of the employees. For example, surveillance examinations were generally performed annually, and since they were mandated by the U.S. Occupational Safety and Health Administration, had participation rates near 100%. Pre-placement physical examinations were required prior to placement in certain positions and also had nearly complete participation. Voluntary examinations were offered to all employees every one to five years, depending on the age of the employee, i.e., older employees were allowed more frequent examinations. Approximately 30% of employees participated in the voluntary examination program during the study period."
95% confidence intervals are added to Figure 1.

While it may seem merely like a stylistic point, given the authors' research strategy, they are not studying the "impact of" changing trends (as stated in the title and objectives statement). Instead, they are conducting "a simulation of the productivity implications" of changing trends. That is not a subtle distinction since they are deriving the impact from the published literature.

We have changed the title to: Simulating the impact of changing trends in smoking and obesity on productivity of an industrial population. We have also clarified the purpose of our study in the last paragraph of the Introduction.

The authors reasonably opt for a conservative estimate of lost work days in their simulation, but they need not. An alternate strategy would be to score their cited literature for quality as they would if they were conducting a systematic review or meta-analysis and use the estimates from the highest-quality studies. They would of course document these quality standards and results as part of the published work.

We appreciate the reviewer's suggestion. However, since our estimates are more conservative and also consistent with those reported in meta-analysis, further analysis suggested by this reviewer was not conducted.

Presuming the authors' confidence in both the health risk rates and the impact measures used in the simulation, the productivity implications become clear: as seen in the growing ratios of excess lost work days, over time the organization has lost more productive work time to obesity than to smoking. However, the authors do not take advantage of this finding as fully as they could. Showing the total number of excess lost work days per year likely has less relevance to most readers than showing the number of excess days per 100 employees. The tables would benefit additionally from showing the total number of days – or better still, the authors may wish to show the results in a stacked column chart. This will immediately communicate the change the composition of excess lost workdays without reference to the ratio (while the % of days for obesity at different time points can be referenced in the text). A chart would also permit utilization of all available data years, rather than reporting the mid-points alone.

We agree with the reviewer and have replaced "total workdays lost" with the "number of excess days per 100 employees in Table 1, Table 2 and in the rest of the manuscript. In addition, results of Tables 1 were displayed in stacked column chart (new Figure 2).

Calculating from Table 1, the total number of excess lost workdays in 2007 is 50% greater than in 1982 – this is an important implication that I did not see described in the text. It suggests that all of the productivity improvements from reduced smoking that might have accrued to the company have been more than wiped out by the increase in obesity. By the same token, over the 25 years of observation, obesity accounts for two-thirds of all excess lost workdays for both health risks (using just the data years shown).

We have added several sentences to the Results section (2nd paragraph) highlighting this.
“It is noteworthy that excess lost workdays from these two risk factors was 50% greater in 2007 than in 1982(Figure 2), as productivity improvements that might have accrued from reduced smoking were more than offset by the steep increase in obesity prevalence. During the 30-year study period, obesity accounted for two-thirds of all excess lost workdays for these two risk factors.”

However, both findings depend on the simulation of 20,000 in each observed year. This may not be a reasonable assumption, and using the actual employment totals in each year should be considered (the authors cite a range of 20,000 to 28,000) in order to understand better how the timing in health risk rates matter. For example, if we assume a linear trend and there were 28,000 employees in 1982 and 20,000 (i.e., a shrinking workforce) in 2007, then total excess lost work days still grew by about 7%. Assuming a growing workforce, total lost workdays more than doubled.

As mentioned earlier, we have replaced “total workdays lost” with the “number of excess days per 100 employees throughout the manuscript.

Finally, I encourage the authors to consider ways to communicate the magnitude of the findings in terms of social or business values. On one hand, the 32,000 excess lost work days in 2007 noted in table 1 seems large. But if we assume 20,000 FTEs, it is less than 1% of labor inputs in 2007. If valued at average daily wages, what does this mean to the organization relative to other financial metrics (e.g., revenues, profits, etc.). If we applied future value calculations to the lost work time in the earlier years, what is the total investment value of excess lost workdays over 25 years? Explaining this would help the reader put the timing of health risks changes (and therefore the value of earlier vs. later efforts to reduce risks) into a larger financial context.

We added this text to the Discussion Section (2nd paragraph).
“At the beginning of the study, the number of lost workdays attributable to obesity was 43 per 100 employees. During the 30-year study period, workdays lost due to obesity increased to 127 per 100 employees. The economic impact of this to an employer, in terms of lost productivity, is alarming. Based on an average annual wage of $60,000 ($256 per day), direct costs of obesity can be estimated. At the end of 30 years, and assuming a workforce of 20,000 employees, the potential economic impact due to illness-absence from obesity would be $6.5 million per year.”

Reviewer: 2
Reviewer Name Otto Wong
Institution and Country Applied Health Sciences
San Mateo, California, USA
Please state any competing interests or state ‘None declared’: None declared

This is an important investigation on the economic/social loss due to obesity in a large industrial population. The analysis was thorough and the report well written. The alarming findings were quite convincing. I recommend acceptance for publication.

We thank the reviewer for his positive comment and constructive suggestions.

Comments to the authors:
Two minor questions. (1) The authors used 20,000 as the average size of the workforce in the calculation. Would it have made any difference if a different assumed value (e.g., 28,000) were used?

These numbers are no longer relevant since we used the workdays lost per 100 employees as the outcome measure.

(2) Are similar data available for the “overweight” group (BMI 25-30)? If so, a similar analysis for the group would be informative.

The overweight group during the study period remained relatively stable although it did decrease in the last 20 years because some portion of normal weight employees became overweight while a larger portion of overweight employees became obese. The impact of this change was not calculated.