Author's response to reviews

Title: Application of Disability-Adjusted Life-Year to Predict the Burden of Injuries and Fatalities due to Public Exposure to Engineering Technologies

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Author's response to reviews: see over
- Table 1 (Disability weights related to TSSA specific Injuries [1]) is one of the most important aspects of this analysis because the measured DALYs scale algebraically based on the entries for disability weights. However, the manuscript does not describe the source of these numbers and whether the disability weights are meaningful. The citation "[1]" points to the 2003 Australian Burden of Disease report but when I looked through that report I did not find any listing of disability weights that corresponds to Table 1. I believe that the Australian BOD study used the original GBD disability weights. However, the original disability weights (available from http://www.who.int/healthinfo/global_burden_disease/GBD2004_DisabilityWeights.pdf) do not include such categories as "swelling" and many other entries in Table 1. It is important for this paper to provide an explanation of the source of Table 1 and a discussion of the suitability of the choices in Table 1.

A reference to the spreadsheet published on AIHW website has been added. This includes the source of the numbers. A dedicated section “Adaptation of AIHW disability weights to TSSA specific injuries” has been added to the manuscript to explain the variations.

- Some of the high disability weight entries in Table 1 do not seem to be injury related. E.g. Table 1 and Fig 4 list "Heart Attack". I do not understand why these are are counted in the study. Shouldn't this study only be counting health events that are related to the devices being regulated (i.e. elevation devices)? Please clarify in the manuscript. If a "heart attack" was brought on by an injury, then wouldn't the disability weight of the injury already capture the disability associated with such a "heart attack"?

Heart attacks are possible health outcomes from several scenarios such as entrapments, electrical shocks, or even falls that have been reported to the TSSA field inspectors. A note has been added to the manuscript as well in the new section stated above.

- Figure 4 shows incidence of the various injury sequelae. It is clear that ~90% of the incident cases are very minor injuries. There is a large literature (e.g. Haagsma 2008 in Injury Prevention) surrounding the problems with using GBD methods for high-incidence low-disability conditions. GBD implicitly assumes that low-incidence high-burden conditions contribute most to the population public health burden. As a consequence, GBD prioritizes measurement of the incidence and disabilities associated with severe injuries, focusing attention on cases that would at least need attention in a medical facility. As a result, GBD parameters (disability weights, durations) for high-incidence low-disability conditions are not likely to be accurately measured. Thus, it is not clear to me if application of GBD
parameters (I am assuming that Table 1 is somehow adapted from GBD disability weights) is meaningful for the spectrum of injuries shown in Figure 4. It may be ok … but it is important that the authors discuss this and make the assumptions clear.

TSSA regulates a number of sectors and the injury types across these sectors vary from minor injuries to permanent ones including fatality. However, TSSA acknowledges the assertion that a high volume of injuries deal with low disability conditions. However, he AIHW disability weights were the best available source during early stages of adoption of the DALY as the appropriate measure for evaluating health outcomes resulting from technology failures regulated by TSSA. A dedicated section “adaptation of AIHW disability weights to TSSA specific injuries” has been added to the manuscript in light of the reviewer’s comments. Based on the reviewer’s comments, TSSA is actively planning to revise the weights based on Haagsma (2008) and the new GBD study released in 2012.

Minor Revisions:
The paper makes a few references to "Unobservable states" - I was not sure what this meant -- could the text provide an example?

Certain injury types may not have been observed historically. For example, a fatality, burn or whiplash may not have been observed in the past but are a possibility in a future occurrence. In such cases, the injury type distribution assumes that these could occur with a total frequency of 1. This scheme ensures that unobserved injury types are considered, yet, assigned a minimal frequency. The same explanation has been cited in the manuscript.
Reviewer: Harold Weiss

1. While a promising subject, I found the article difficult to read, full of jargon and wordy. It is too long and contains too many tables and figures. It needs to be condensed and better organized. Minor but numerous grammatical mistakes made it even more difficult to get through.

To make the paper concise, the significance of under-reporting is highlighted and associated formulation and simulation results are omitted. Instead, the paper focuses on practical applications of the proposed approach successfully implemented at TSSA including regulatory risk-based scheduling and enforcement, performance measurement and target setting.

Major Compulsory Revisions
2. The title should focus more on this as a proof of concept case. It misleads readers into thinking the work and concepts are more advanced than they are.

The title has been modified to address reviewers concern. The title now reflects application of the DALY metric for prediction purposes.

Minor Essential Revisions
3. In the conclusion, p 14, DALY is talked about as predictive. DALY’s aren’t predictive, they are only an outcome measure for the prediction.

Agreed. The term “predictive DALY” is avoided throughout the text. The title also has been modified to give the impression that DALY metric is applied to predict burden of injuries.

Needing rewording:
P 4 Active information on the sate of => Active information on the state of …
P5 The Disability-Adjusted Life-Years (DALY) => The Disability-Adjusted Life-Year (DALY)
P5 inspect this device in a frequency=> inspect this device at a frequency
P10 may not prolong for the rest of the life, => may not last for the rest of the life
P10 Reference error
P11 Occurrences for which it a root cause => Occurrences for which a root Cause
The above concerns have been addressed.

P13 A relatively larger near-miss count reported by the industry would be one of the significant value-added information towards risk-informed decision making at TSSA. => Awkward sentence

Sentence changed to:An accurate reporting of near-misses would be significant value-added information towards risk-informed decision making at TSSA.
Reviewer: Ronan Lyons

1. Is the question posed by the authors new and well defined?
There is no real question defined. The authors discuss a conceptual approach which is never clearly defined and then state it could be viewed as an advancement without providing any quantitative metrics to back up this assertion. I think I understand where they are coming from and sympathise with the difficulties of working in this field but more clarity is needed.

The abstract background clearly lays out the objective of the paper as the application of DALY metric and simulation to quantify future burden of injury due to engineering technologies. To stay clear of the ambiguity, the title of the paper has been reworded.

Agreed that the paper is not a theoretical advancement, yet it is a genuine and very useful application that brings together an important health metric and simulation features. This could set as a role model for many other public safety regulators dealing with public safety related to engineering devices.

2. Are the methods appropriate and well described, and are sufficient details provided to replicate the work?
The methods could be defined more clearly. I had to read the manuscript twice before I grasped what they were attempting to do. I am still not absolutely certain so I will describe what I think has been attempted. As I understand their methodology they applied a modified DALY approach to data collected on safety of lifts in Canada and used the results to decide whether or not a threshold of 1 fatality equivalent per year was exceeded. That threshold would be used to inform the frequency of safety inspections. This is indeed a novel approach but I struggled to follow exactly what they had done.
They divided thereported non fatal injuries into categories developed by the AIHW and then applied AIHW disability weights to allow them to calculate the years lived with disability component of DALYs, but very little data are provided on well this worked or not.
They then made some allowances for under-reporting injuries which are difficult to follow with use of an equation (2) in which not all of the variables are defined. I assume r stands for random occurrence rate but the justification of choices of r=1 or 10 are never discussed.
Combining the Years of Life Lost and YLDs created DALYs (no data shown on how this was achieved but it seems to have involved some MC simulations which produce an output in figures 8-12 which are poorly described and so it is difficult to interpret what they mean. It is not clear how DALYs were then turned into fatality equivalents. As some of the results shows predicted DALY mean exceeding 100 this is interpreted as exceeding the pre-set threshold (never stated it pre-set) and justify the conclusions.

The reviewer has summarized the paper very well and we are glad to know that the reviewer thinks that the content is novel in nature.
The phrase “risk acceptability criteria” was used instead of “pre-set threshold”. However, the suggested phrase has been used at least once in light of reviewer’s comment and a dedicated section has been added to convey how fatality-equivalent is derived and benchmarked.

Justification for \( r=1, 10 \) has been reinforced while discussing the results.

To make the paper concise, the significance of under-reporting is highlighted, however associated formulation and simulation results are omitted. Instead, the paper focuses on practical applications of the proposed approach successfully implemented at TSSA including regulatory risk-based scheduling and enforcement, performance measurement and target setting.

3. Are the data sound and well controlled?  
Uncertain

4. Does the manuscript adhere to the relevant standards for reporting and data deposition?  
I don’t think so

There are two pieces of data used in this paper:  
(1) Data from the Australian Institute of Health and Welfare (AIHW)  
(2) Data from Technical Standards and Safety Authority (TSSA) which is audited and has been maintained over a number of years

5. Are the discussion and conclusions well balanced and adequately supported by the data?  
I don’t think enough detail has been provided to say this is the case. The conclusion states that Monte Carlo simulation can be used to predict DALYs and this has been demonstrated by applying it to the elevating devices programme in Ontario. Whilst these statements are true they hardly constitute a conclusion.

The conclusion has been modified and highlighted to reflect the title, abstract and the manuscript content.

6. Do the title and abstract accurately convey what has been found?  
No

The title has been modified to reflect the fact that the paper deals with applications of the DALY health metric to predict injury burden due to technical systems rather than to advancing the concept of DALY.

7. Is the writing acceptable?  
I think it needs to be clearer in relation to methodology and how the results justify
the conclusions drawn.

To address the reviewer’s concern, the title, abstract and conclusion have been modified. Secondly, the paper is abridged to focus on the direct applications. The flow of the paper also has been streamlined.