

The Compelling Display of Health & Safety Data to Achieve Desired Decision Making

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Introduction

An inevitable finding of any review of a health and safety program is the need for “improved communications”. The recurrent commentary provided by groups ranging from front line workers to executive management is that they often don’t really understand what health and safety programs do and don’t know how the program’s efforts actually contribute to the organizational mission or the bottom line. When presented with such findings, the natural response on the part of the health and safety professional is to explore ways to improve the transmission of information orally or in writing. While efforts to enhance oral and written communication are always laudable, there is another means of communication that also warrants close examination. The way in which important health and safety data is displayed is an equally important avenue of communication, and it is ironic that in an era when health and safety professionals are implored to develop and collect key performance measures and metrics, little attention is provided to the way the data is actually displayed and communicated. This is a crucial shortcoming within our profession, and one that we believe serves as a major barrier to achieving full management support. This impression is based on five years of intensive field research, where we examined the existing literature on the science and art of effective data displays, and then reviewed data displays from literally hundreds of actual health and safety programs. From this effort, we’ve learned that when data is displayed in a manner that is compelling, desired decision making often ensues.

Barriers to Effective Communications

When trying to communicate the message inherent to the health and safety data we have accumulated, we should always first think about what the message is that trying to convey. One of the major barriers we have observed are overly complex data displays that obscure the underlying message. So we should always first ask ourselves: what is our message? Is injury frequency increasing? Is compliance improving? Are levels of job satisfaction changing? Once we determine what the message is, then we should keep that concept foremost in our minds as we create the graphic display that we will subsequently rely upon to convey this point.

Another common problem we encountered when reviewing real world data displays is the absence of any valid comparisons. This is an issue that Dr. Edward Tufte repeatedly addresses in his works, the notion of “compared to what?” (see bibliography). For example, if we wish to communicate that hazardous waste disposal costs are escalating, we should make sure to include data describing the basis for this escalation. For example, perhaps an increase in production or expansion of facility size is the underlying driver for such cost increases. If this is the case, then we should be sure to display this important data as well, as this will help convey the message to upper management and facilitate their understanding of the issue and the causality. Another key point that Tufte addresses is the notion of presenting such data “adjacent in the eye span” so that comparisons can be easily made. In other words, if two graphs were shown on the same page in immediate proximity to reach other, a viewer could easily reach the conclusion that as production increases, hazardous waste volumes are likewise increasing, and as such, so are the costs for disposal.

Key Data Display Aspects

Although there are many techniques that can be considered when displaying data, we have encountered a list of very basic precepts that are better described by Tufte and others, but can at least help get people started on improving the way in which information is conveyed:

- Do not blindly rely upon the automatic formatting provided by standard graphing tools imbedded in software. The programs provide useful basis upon which to create a good data display, but rarely do compelling data displays automatically spew out upon hitting a button.
- Eliminate the unnecessary - in other words, most of the ink on the data display should be employed to show data, and not all of the superfluous stuff around it. For example, in some graphic programs, the automatic graphs produced carry with it a gray background which only serves to diminish the importance of the actual data being displayed.
- Use clear and thorough labeling. Make sure each axis is labeled and add text and lines to help the reader understand others aspects. Be sure to include a clear descriptive title too.
- And don't forget to include comparison data, as this will help tell the story as well.

Data Display Example

To drive home some of the points described above, let's take a very simple example. For this example, we'll use a real world data set from a sixth grader's science experiment.

The first step is to determine what we're trying to say. This sixth grader would like to perform an experiment to estimate what the optimal thickness of blubber is of a penguin that lives in Antarctica. To do this, cooking lard will be used to simulate penguin lard. An ice chest filled with water and ice will be used to simulate the water conditions in the Antarctic. The lard will be formed into spheres and allowed to equilibrate to room temperature. Then each sized ball will be immersed in the ice water for 10 minutes, at which time a thermometer will be interested into the ball's center and the temperature recorded. The idea is that at some point in lard thickness, the insulating quality will become self limiting, e.g. no significant additional insulating value is obtained by the added thickness (and weight) of the lard. The theory is that this would be the point likely where actually penguin blubber thickness falls.

Based on this experimental design, the following data is obtained:

Lard Ball Radius (cm)	Recorded Temp (Degrees C)
0	2
1	15
3	22
4	22
5	22
6	22
7	23
8	24

Table 1.

If we then take this data and place it into the spreadsheet cells of a widely used computer graphics display package, this is what the automatic formatting would provide (except it would likely be in blue):

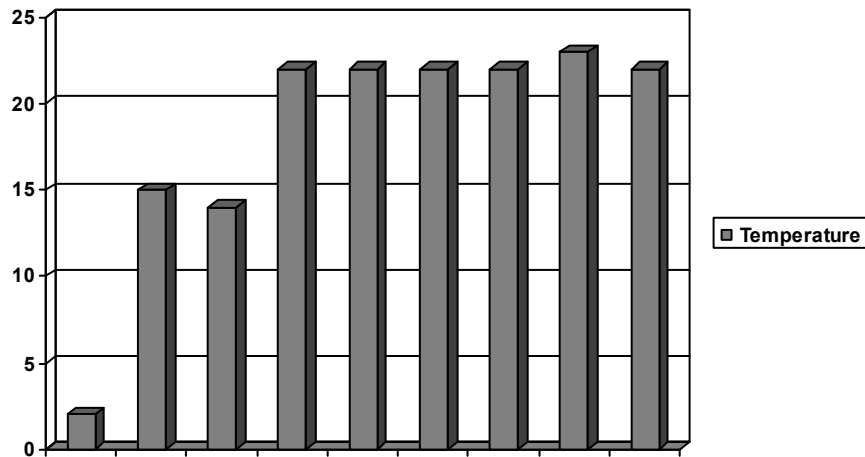


Exhibit 1.

Now let's see what we can do to improve this data display. Some key steps include:

- Elimination of the unnecessary three dimensional effect shown on the bars
- The elimination of the text box labeled "temperature" as this will be the variable specifically mentioned in the title
- The inclusion of a title, axis labels, and units
- The inclusion of some key reference points so comparisons can be made easily

These modifications allow for the creation of a much improved data display:

Recorded Temperature in Center of Lard Ball After 10 Minute Immersion in Ice Water

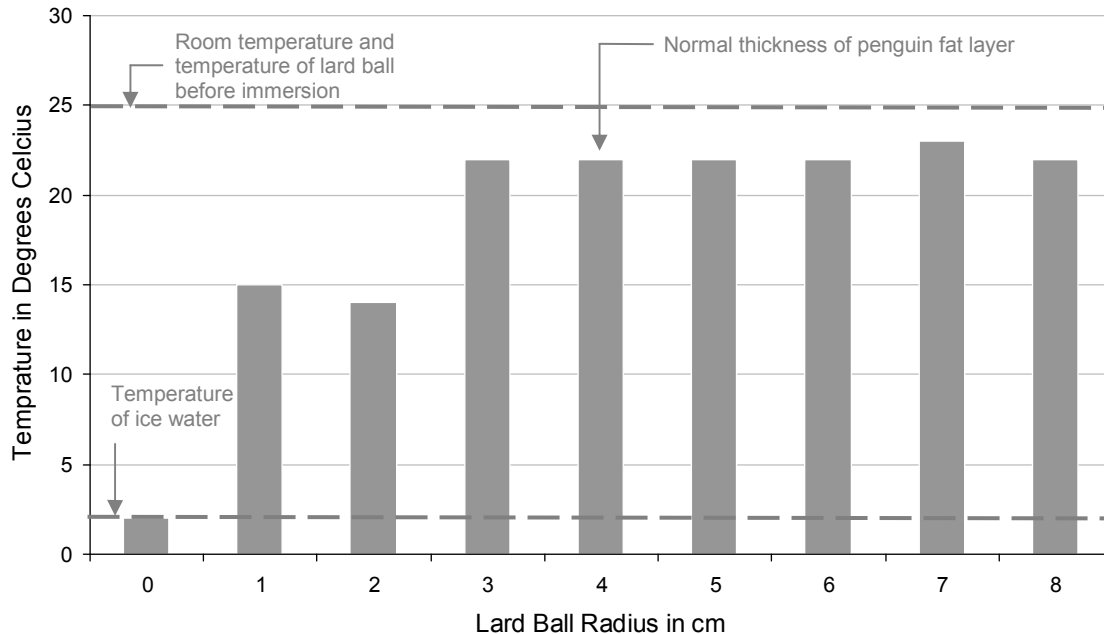


Exhibit 2.

With this improved graphic, we can clearly see all of the important information: what the graph is about, the temperature of the ice water, the room temperature, the nominal thickness of actual penguin blubber, and the experimental data collected. Showing the data in this way allows the viewer to draw the conclusion that a lard thickness of approximately 4 cm is the point at which nature has determined where sufficient insulation is achieved without having to expend additional energy to carry about excess weight. This improved example provides a stark comparison to the previous graph that was automatically generated from a graphing function in a spreadsheet or presentation software.

Summary

From our intensive review of the data display literature and the examination of hundreds of real world health and safety data displays, we have become convinced that the key to desired decision making on the part of executive leadership (and other key stakeholders) is the ability to display data compellingly. If we can take the time to think about what it is we're trying to say, and then refine the way our data is displayed to clearly make this point, we are more likely to achieve desired decision making. In our experience, most of these data display adjustments require the removal of unnecessary graphical features and the inclusion of clear and through labeling. The creation of graphics for paper distribution rather than temporary projection onto a screen also improves the way in which information is conveyed and comprehended.

Those wishing to learn more about the science and art of effective data displays are encouraged to examine the works listed in the bibliography by Tukey and Tufte. By taking the time to digest and reflect upon their messages, you will be able to improve the way in which you can convey your message as well.

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