COMMUNICATING COMPLEX RESEARCH RESULTS REGARDING ENVIRONMENTAL RISK TO A LAY AUDIENCE: EXPERIENCES FROM THE UNIVERSITY OF MICHIGAN DIOXIN EXPOSURE STUDY

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Introduction

There is a dearth of direct research on communicating results back to study participants. The literature in risk communication tends to be proscriptive: general advice and "best practices" dominate.[1] Additionally, the risk and health communication literature tends to have attitudinal or behavioral modifications as its goal, rather than the more general concept of knowledge or understanding. A related literature, best practices advice on graphic or tabular display of data are generally aimed toward a statistically oriented audience[2,3] and have little empirical evidence about their efficacy in improving understanding of the presented material.

Community-based studies frequently report study results back to the community of interest. However, the degree to which the community actually understands the study results is not known. Why are we concerned about whether the public can understand the study findings? In 2003, the National Adult Literacy Survey determined that about one fourth of the US population was at the lowest level of document literacy (i.e., having the ability to identify material in documents, including tables and graphs).[4] Only thirteen percent of the general population was able to understand documents at the highest level of document literacy, including being able to interpret a three-way table. Literacy was highly related to exposure to such materials, such as in the newspaper, and to socioeconomic indicators of income, education, and poverty status. An evaluation of readers of informed consent documents showed that literacy was also related to how well information from that document was recalled (Campbell, et al., 2004).

Communication of the study findings to the study is a central goal of the University of Michigan Dioxin Exposure Study (UMDES). Difficulties in accomplishing this task successfully were anticipated. This paper relates the results of research specific to the task of communicating the UMDES study results to the general population.

Materials and Methods

Qualitative research methods, focus groups in particular, were used for this research. Focus groups employ small group discussions with individuals expected to be homogeneous on the topic of discussion within a group and heterogeneous on the topic across groups. Participants in focus groups are recruited through a variety of methods, including newspaper ads, posting of fliers in public locations, organization membership lists, word of mouth, or telephone calls to listed phone numbers or registered voters (Krueger and Casey).

For this study, eight focus groups with residents of a mid-size city in Michigan were conducted by two trained moderators. Participants were recruited through newspaper ads and fliers posted in public locations. Males and females were in separate groups, as were individuals with education levels of some college or lower and individuals with bachelor's degrees and above. Four groups discussed display of univariate statistics and general statistical terms. The other four groups discussed display and understanding of multivariate results. Table 1 presents the total number of participants across the eight groups.

Table 1. Number of participants in eight focus groups

	Univariate		Multivariate		Total
	Some college or less	College or more	Some college or less	College or more	
Male	6	7	9	11	33
Female	10	10	6	11	37
Total	16	17	15	22	70

Structured moderator guides were developed for each set of focus groups. The topics were developed after consulting with project staff about the kinds of analyses likely to be conducted and presented for the UMDES, but are similar in scope to those conducted in most research studies, including univariate and bivariate descriptive statistics and multivariate linear regression models. Topics for the first set of focus groups included awareness of research findings as presented in newspapers, radio and television, graphical display of descriptive statistics and distributions, awareness of statistical terms (e.g., median, percentile, regression model), and the size of the booklet for distribution. Topics for the second set of focus groups replicated the awareness of research findings in newspapers, examined variations in graphical display of charts making comparisons of subgroups, verbal versus graphic display of regression model results, diagrams illustrating exposure pathways, understanding of kriged maps, and comparisons of colors to use in graphs and charts. Each focus group lasted approximately 90 minutes.

Results and Discussion

Six preliminary themes emerged from the eight focus groups:

- *Keep it simple*. Emphasize the "story" from the findings as represented by primary conclusions without using statistical language or other scientific jargon. Complexity in either language or graphical displays leads to confusion and disengagement from the final results. Graphics that seem simple or commonplace to a scientific audience may be rarely seen in the lay public. For example, focus group participants were shown a variety of graphics comparing distributions of Body Mass Index for men and women – a table displaying mean, standard deviation, minimum, median, 95^{th} percentile, and maximum, box and whisker plots, scatter plots, and histograms with and without normal curves superimposed. None of the focus group participants could discern the content of the box and whisker plots or the scatter plots; by comparison, the histograms seemed easier, but were still unfamiliar to most of the participants. Even the language of mean, standard deviation, etc. was too complex for most participants. For example, many participants confused the term "percentile" with "percentage."
- *Be cautious when using terms that have a lay meaning that is different from its scientific meaning*. A particularly salient example of this is the term "significantly different." Although the scientific meaning is that the difference exceeds a chance occurrence, participants in the focus groups consistently interpreted significantly different as "extremely different." Many wondered why the word "significantly" was included, rather than simply "different."
- *Graphics convey more information than text*. This theme had both positive and negative implications for the use of graphics in displays to the lay public. Stories that are consistent can be more easily conveyed through the use of graphics – e.g. monotonically increasing trends, dramatic differences between two subpopulations that can be represented using pie or bar charts. Graphics that convey a mixed message – e.g., differences that are not statistically significant between populations, even though the numbers are not identical – can lead to confusion, especially when text accompanies the graph stating that the observed differences are not actually different.

- *Titles that provide information about the conclusion to be drawn from the table or graph may be more useful when presenting results to the lay public.* The title of a display was usually the first item examined in the graphic. Although standard practice for the scientific literature is to title tables and charts with the statistics presented, data set and years of data collection, this approach may not be as effective with the general public as one that indicates the story contained in the display. Almost all of the lower education groups and half to two-thirds of the higher education groups preferred informative titles.
- *Readers in the general public will seek out personally relevant information first.* Participants were asked to react to five newspaper articles, each on a different topic and using different graphic displays. The first article looked at contained titles that indicated that the article was on a topic of personal interest for the respondent. Regression results presented in list and pictorial format reinforced this emphasis – when grouped into categories, participants examined the characteristics that were most personally relevant or important first.
- *Color must be used meaningfully*. Although many scientists use the default settings from their computer analysis programs when creating visual displays without thought to the meaning of the colors, all groups commented on color when in a graph. Not surprisingly, red or darker colors were associated with items being "bad" and blue tones or lighter colors with items being "safe" or "good." Somewhat surprisingly, this interpretation was present even when the display was neutral and not intended to indicate direction or harmfulness (e.g., a bar chart comparing TEQ level by gender and location).

These preliminary findings are not surprising, but are a useful reminder that communicating results to the general public requires awareness of the literacy level and familiarity with statistics and scientific findings of the general public. This awareness level is not high. All groups emphasized the KISS method -- "Keep it simple, stupid." They also urged those communicating results to the public to keep in mind the target audience when presenting results, tailoring the presentation to particular subpopulations.

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