Our Approach: Goal-Congruent Risk Visualizations

Communicating health risk information is complicated. People need to be able to understand and respond to multiple types of risk information, ranging from their precisely calculated, estimated risk of cancer or another disease to indirect measures of risk like blood pressure values. Once they have that information, people also have many potential goals: They may need that data to help them to recognize that a risk exists, to judge whether the level of risk is acceptable or not, or to make a decision among risky options.

A key tenet of our approach is the humble belief that displays or visualizations cannot achieve all goals equally well. A display that is optimized for helping patients choose between options is not going to be as effective or as efficient at helping people to recognize the existence of risk or whether their health status is acceptable or not. Different goals means that we need to have different requirements for our visualizations based upon each specific task.

We asked the graphic designers to develop images for 16 common kinds of risk communication problems (or "use cases") – scenarios where an individual might be faced with health data:

**Tables of side effect risks.** Many health information displays use tables to compare multiple alternatives on an even longer list of dimensions (risks, benefits, costs, etc.) The goal of the images for this use case is to use visual cues to make it easier to make such comparisons across multiple options.

**Translating test results into risk.** Biomarkers (things like blood pressure and cholesterol) predict risk. However, while high blood pressure (BP) is related to risk, the relationship is not linear. The visuals for this use case are designed to help a person who has an elevated BP level (e.g., at a doctor’s visit) recognize (a) that their risk is elevated AND (b) that further increases in BP would be really bad.

**Visualizing health scores.** The results of health risk assessments (HRA) are often returned to patients using some form of summary score. The goal of this image was to make an abstract (and arbitrary) HRA score have more intuitive meaning.

**Racial disparities in rates of disease.** News stories often try to clarify disparities in disease risk across populations. For example, when a disease is more common in this group vs. that group. Images for this use case convey not only that one group’s risk is more but also just how much more.
**Putting outbreaks of disease into context.** Images for this use case communicate the case counts of an outbreak of disease (here, measles) in a way suitable for a news story. The challenge is to present information about the relevant population in a way that draws attention to the risk as important but also reminds people of its (current) rarity.

**Icons to show severity of side effects.** We asked designers to develop a set of icons that could be embedded within larger tables of risk information to draw attention to differences in severity among the set of risks shown.

**Icons to show likelihood of side effects.** The goal of this set of icons is to create visual cues for variations in risk likelihood that will be more intuitive than simple numbers yet small enough to be replicated repeatedly in summary tables.

**Tables of side effect risks with icons.** This use case is an example of a summary table that uses both severity icons and likelihood icons to show information about multiple treatment side effects in a systematic way.

**Visual displays of side effect risks.** Images show the relative likelihood and severity of multiple side effects in *non-tabular* ways, using color, size, shape, etc to represent the attributes of the side effects. Consumers can quickly get the “gist” of what might happen to them if they took a medication.

**Personally tailored data about side effect risks.** Images for this use case represent the relative likelihood and severity of multiple side effects in a table structure. They organize this information to ensure that viewers pay attention to very rare but very severe events. They also represents whether risk numbers are based on general population samples or are tailored by characteristics such as age, gender or race.

**Risk calculator: More than a number.** These images present a risk estimate to a patient. Its primary goal is to help patients categorize their risk (i.e., to make sure that patients know when they are at “high” risk or not). The images have to work with a behind-the-scenes program that gives the consumer a calculated risk estimate based on questions they answer.

**The benefits of risk reduction.** These graphics help patients compare their current risk *without screening tests* to their reduced risk *with screening tests*. In particular, it aims to help patients understand the absolute size of the possible risk reduction.
**Showing how side effects change over time.** It is very hard to show patients how risks vary over time and how those time patterns themselves differ between options. These images illustrate this problem using the case of prostate cancer treatment. They visually explain how likely a patient is to experience each of 2 common side effects with each of 2 different treatment options over multiple time points.

**Visualizing very small risks.** Sometimes, we need to help people visualize just how rare very rare events are. A common example occurs in prenatal genetic testing. If a couple has no other risk factors, the baseline risk of genetic diseases such as Down Syndrome is often much smaller than even 1 in 1000 (0.1%). Visually showing this ratio is challenging.

**Years of life saved by taking a drug.** The benefit of treatments to prolong life can be described in two main ways: 1) how many months or years they add to an *average patient’s life*, or 2) *how many patients* benefit. Many times, a few people benefit a lot but most don’t benefit at all. This image tries to show how the *average benefit* relates to *how many patients benefit*.

**The benefits of positive behavior change.** This visual tries to show risk reduction in a way that reinforces positive benefits of work that has already been done by the patient.

**The benefits of risk reduction.** This image presents a risk estimate to a patient, and more importantly, it also shows them how much that risk could be reduced. It uses an icon array display, which research has shown is a particularly effective type of graphic at showing risk but which needed new thinking about how to show risk reduction.