RISK KNOW-HOW FRAMEWORK: SUPPORTING COMMUNITIES AS THEY EVALUATE INFORMATION ABOUT STATISTICS AND RISK

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Risk know-how is about informed decision-making, and it is often underpinned by statistics. Risk know-how entails not simply taking statistical information at face value but asking questions and interrogating the data—a lifelong process of developing statistical reasoning skills. By developing a framework in collaboration with risk communication and statistics experts and with insights developed from interviews with communities around the world, it provides a structure for modelling best statistical practice and encourages the involvement of all community members. The aim is to develop more confidence in the decision-making process using data. The framework will also center the needs and efforts of community practitioners around the world and encourage reflection on how efforts in statistics education can be extended to support these practitioners and communities.

INTRODUCTION

From dwindling fishing stocks to increasing rainfall and from emerging diseases to new types of mining and power generation, the need for communities to make new tradeoffs and develop risk know-how is growing. Communities can be geographical (e.g., a village), demographic (e.g., students at a school), or a group of people that come together to support each other in the face of a risk to understand it and make decisions (e.g., breast cancer online support group). Statisticians the world over are involved, formally and informally, in discussions with many user communities, and by reflecting on different experiences, we will respond to the need for communities to develop risk know-how sooner and better.

Across the world, there are people who take responsibility for helping their communities understand risk. In this paper we use the term risk as expressed in conversations by community leaders around the world, often used instead of hazard, and which refers not only to the potential of exposure to danger, be it danger about climate change, cyberbullying, work safety, natural disasters, etc., but also to the probabilities of those dangers. These leaders who help their communities do not just communicate how likely it is for a hurricane to impact a community tomorrow, for example, but also communicate how they know about the risk and what lies behind making decisions in light of the risk such as, for example, whether to evacuate a community or not. They help empower communities in how these trade-offs and decisions can be evaluated and decisions made. Community practitioners often are not experts and do their work with limited support. Thus, they can benefit greatly from the help of these leaders.

Whether it is a radio journalist in Kenya engaging with their community on climate change and the effects it has on rainfall patterns, a Bangladeshi fishing safety facilitator explaining what a one in 100-year cyclone means, a midwife explaining what a prenatal test means for a pregnant woman, or a liaison to the village of Fukushima communicating whether it is okay to drink tap water, these conversations are all about risk. Often these same community experts feel they are not included in conversations about what is needed to convey risk information to their general communities. They are left feeling that their expertise in what does and does not work for a particular community context is not incorporated in providing risk information.

In this paper, we will explore how healthy statistical literacy is a priority for all members of a community, and one that goes beyond formal education. We will present the Risk Know-How framework.

METHODS

We have interviewed approximately 100 people in communities around the world to understand: what key insights do their communities find useful when it comes to understanding risk; what are the barriers to better conversations about risk within their communities; and what supports do they wish they had? In the conversations, we also sought to identify the specific insights and concepts that empower people to navigate information and to discuss risks in a constructive way. We have tried

to distill what it means for a community to have *risk know-how.* Risk know-how is aimed at supporting communities around the world as they navigate risk information, assessing benefits and trade-offs within the context of their own communities.

In parallel, we have engaged leading figures in statistics, risk literacy, and communication to develop a practical framework for risk know-how. The framework, which brings together the information provided by both risk and statistics experts and community experts, covers both a description of outcomes of what a community can do and actions they can take to achieve those outcomes. As David Spiegelhalter, chair of the Winton Centre for Risk and Evidence Communication told us, "If we want to genuinely communicate statistical evidence, I am now utterly convinced that users have to be involved from the very start."

In our discussions, Olivia Jensen, lead scientist for environment and climate at the Institute for the Public Understanding of Risk, National University of Singapore, stressed how local decision-makers need tools to help them navigate difficult trade-offs: "Risk information is often transmitted down to communities in the form of regulations, guidelines, and targets issued by central government and specialized agencies. […] problems often arise: top-down directives can't be applied because of local conditions; they fail to address underlying vulnerabilities; or they shift risks to different communities rather than reducing them."

This framework will be the structure on which people can find information and add their own experiences. The risk know-how framework was first published in the December 2021 edition of *Significance* Magazine (Brown et al., 2021). It is a dynamic document that continues to evolve with feedback and as more resources are added. It can be found at https://riskknowhow.org.

In our interviews, people have told us why risk know-how and many of the concepts described in the framework matter to their communities. They have also offered a perspective on how broadly communities experience risk; they experience many different types of risk in many different settings. The people that have to mediate these decisions for communities are also very diverse and offer differing expertise. We have talked to people in Argentina that engage women in conversations about maternity mental health risks; community organizers working in coastal Bangladesh that help fisherman fish more safely; a nun in Puerto Rico that talks to people about all kinds of risks and supports them in their needs (from domestic violence to COVID-19 and from earthquakes to drug addiction); a local radio journalist in rural Kenya that helps communities address the risks from changing rainfall patterns to their crops; a non-profit in Chile that deals with cyberbullying risks; and many others. A few quotes of what they have told us include:

- *Bernard Okebe, radio journalist and a coordinator for the Community Empowerment and Media Initiative, Kenya:* "It is very helpful to speak to others in other communities about these topics and share stories because different communities understand and deal with risks and hazards in different ways and therefore understanding such, especially risk, from the community perspective is very important whenever we talk of risks. This will help in minimizing or reducing risks in communities/societies."

- *Rizki Affiat, researcher and activist working on intersectional gender issues, Indonesia/India*: "Developing local and collective knowledge at the grassroots level is great because it makes the people who are working with the communities know that they matter, that their knowledge and work matter to others around the world and that people can learn and emulate. When working with local communities, to avoid being too theoretical and abstract, a more practical and involved approach would be greatly appreciated."

- *Bambang Hero Saharjo, Executive Director of the Regional Fire Management Resource Center–South-East Asia, Indonesia:* "For many of these communities, it is not easy to change behaviour. They might understand the risks but if there aren't alternative ways for them to have an income, they will find it hard to stop what they are doing. They need support or to see other communities that have been successful."

- *Sarah Whitaker, forest kindergarten director, USA:* "As an outdoor educator, we make decisions about when we need to seek shelter, because of a thunderstorm or the cold, for example. Sometimes you face the same conditions but make different decisions, because it matters how young the group is, how large a group you oversee, and how quickly you can get to shelter. What feels like the right decision one day might feel too risky a different day."

RISK KNOW-HOW FRAMEWORK

Risk know-how is about informed decision-making. Every risk entails a trade-off with the benefits and costs of action or inaction, and we weigh these to make an informed decision.

The framework (see Figure 1) is divided into two sections. The first section discusses different components needed to weigh trade-offs in decision making for a given community. The second section goes into statistics and risk concepts in more detail, offering examples that resonate with communities, such as the following.

- *Jordan Phasey, water treatment professional, Australia:* "When making decisions about priorities in rural Australia, we need to clarify what the risks are to any given individual, but also how many people could be affected, how likely it is they will be affected, the kind of threat (microbial or chemical), the doses and for what period of time."
- *Tim Gill, global advocate for children's play and mobility, UK:* "Humans can have an ambivalent relationship with uncertainty. An entirely predictable life without risk would be unimaginably dull, and you can see that very clearly with children. In the workshops I run even just talking about uncertainty explicitly and expressing their fears can unburden people."

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1. Risk know-how in a community means we can:
    A. Ask questions about specific risks
    B. Find suitable and reliable risk information
    C. Understand how the framing of the information can be manipulated
    D. Examine a claim about the size and importance of a risk or the value of a safety measure
    E. Not be surprised by the consequences of a risk taken
    F. Make reasonable comparisons between potential risks and between the costs of action and inaction—trade offs
    G. Appreciate the danger of being drawn to information that confirms what we prefer
    H. Be aware of how new information might require a decision change about the risks that are tolerated
    I. Be respectful of the fact that other people's risk and benefit trade-offs are not the same and that not everyone has the opportunity to act upon risks

2. To do this we need to:
    A. Clarify what is actually being discussed
        - Definition of what is being discussed
        - Numerator or number of observed cases
        - Denominator or size of the group being assessed
        - Population and how many could be part of the group
        - Period of time over which cases were counted
        - Event and consequence in terms of the type of risk and who or what it might affect
    B. Make sense of what is being said
        - Give meaning to very big and very small numbers
        - Quantify values such as high risk and low risk
        - Understand the effects of comparisons and context
        - Differentiate between absolute and relative risk
        - Understand averages and recurrence intervals
        - Understand single event probabilities
        - Know uncertainty
    C. Discuss concepts that affect the accuracy of risk information
        - Conditional probabilities
        - Correlation and causation
        - Adjustment

Figure 1. Risk Know-How Framework

BEYOND FORMAL EDUCATION

This framework can also help risk information providers make their material more accessible and explicit about assumptions and underlying concepts. By testing and getting feedback to the framework, we can ensure that it is accessible to and useful for communities.

As one of the authors has previously advocated (Franklin, 2021), formal education must begin at the school level, developing the reasoning skills needed for statistical thinking to evolve and mature over an individual's schooling years. Recommendations for this educational journey are made in the *Pre-K–12 Guidelines for Assessment and Instruction in Statistics Education II: A Framework for Statistics and Data Science Education*, known as GAISE II (Bargagliotti et al., 2020). But it is important to also consider how we can go beyond formal education. Risk know-how entails not simply taking statistical information at face value but asking questions and interrogating the data—a lifelong process of developing statistical reasoning skills. It provides a structure for modelling best statistical practice and encourages the involvement of all community members, ideally resulting in more confidence and trust in the decision-making process using data.

Statistics literacy experts are also uniquely positioned to engage and support communities as they navigate decision-making, whether helping them find the information they need, interrogating the data, or clarifying misconceptions.

CONCLUSION

The work shows the appetite from communities to engage in these conversations about risk literacy and their desire for their expertise to be recognized. For engagement to be meaningful in supporting and empowering these community practitioners, it is important to listen to what they need and what they already know. Across the board, the stories we heard were of communities that wanted their voices to be heard; to navigate these issues in partnership with decision-makers; and to be supported by experts and information providers who can recognize the context in which information will be received. Examples of successful partnerships between experts and communities show how important the support for responding to questions and developing tools and material in conjunction with experts can be, and we think statistical literacy experts can play a key role in this.

REFERENCES

Bargagliotti, A., Franklin, C., Arnold, P., Gould, R., Johnson, S., Perez, L., & Spangler, D. A. (2020). *Pre-K–12 guidelines for assessment and instruction in statistics education II (GAISE II): A framework for statistics and data science education*. American Statistical Association; National Council of Teachers of Mathematics.

Brown, T., Franklin, C., & Sierra, L. (2021). What is risk know-how? *Significance*, *18*(6), 30–35. https://doi.org/10.1111/1740-9713.01590

Franklin, C. (2021) As Covid makes clear, statistics education is a must. *Significance*, *18*(2), 35. https://doi.org/10.1111/1740-9713.01509

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