Applying Information Literacy Skills in a Technical Crisis

Ralph Stuart, CIH, CCHO
Environmental Safety Manager
Chemical Hygiene Officer
Keene State College
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Where I'm Coming from

- I worked in environmental chemistry labs at Cornell and UVM for 5 years, then started the lab safety program at UVM in 1985
- In 2011, I went back to Cornell to work on lab ventilation for 3 years, including work in both chemistry and BSL-3 labs
- In 2014, I moved to Keene State to be Chemical Hygiene Officer at a PUI

The ideas I talk about in this paper are connected to ideas in other papers I am giving at this meeting. The common theme is safety is a property of an evolving, complex system, not a condition which can be established and then left to run on its own.
What do I mean by "Technical Crisis"?

- Crises occur when unrecognized assumptions in standard practices are no longer being met. This creates new risks with low quality (poor fit) information about them.
- In response, many people change technical lanes, often without checking outside the other lane.
- For example, in 2020, Covid broke the assumption that infectious aerosols are rare and can be confined to BSL-3 facilities. This led to applying traditional practices in a new risk situation, so that:
  - PPE production was suddenly inadequate
  - 6 foot of physical distance was no longer found to be adequately protective
  - There was a sudden interest in optimizing ventilation systems, that were not designed to control biological hazards
The Impact of Changing Lanes

- Technical Crises have both **scientific** and **cultural** aspects.
- These aspects are **historically based** and can not be changed quickly, but they will evolve as the technical and social environment changes.
- **Technical silos** are one of these aspects; for example, chemical safety and biosafety have fundamentally different assumptions and cultures. These contrasts became prominent during Covid.
- Understanding these contrasts is part of **risk literacy**.
Confusion in the Media about Covid and Ventilation

In the Mainstream Media

- The press has published many stories about the role of ventilation in managing Covid. These stories are often based on numerical models, calibrated with superspreader events, but are not peer reviewed.
- A few studies include Covid lab data, none include field data.

In Professional Discussions

- Professional organizations start with different definitions and make different assumptions; e.g. medical vs engineering approaches to ventilation practices.
- Many vendors are proposing novel solutions based on a mixture of technical justification and speculation (UVC, ionizers, air cleaners).
Technical Professionals in the Twittersphere

These suggestions don't explain what "Just do it" means in an actionable way.

However, these voices help to shape perceptions in the media and on campus.

An article Dr. Marr co-authored notes that:
"As of early 2021, no in situ research has evaluated the independent impact of ventilation and air cleaning for reducing the risk of COVID-19 transmission in schools."
"Risk Literacy" exists at the intersection of Internal and Systemic Information Literacy

<table>
<thead>
<tr>
<th>Internal Information Literacy (peer reviewer questions)</th>
<th>Systemic Information Literacy (citizen reviewer questions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the logic follow the &quot;scientific method&quot;?</td>
<td>Does this information address questions I am interested in?</td>
</tr>
<tr>
<td>Does it include references to appropriate literature?</td>
<td>Do the technical observations address the management questions at hand?</td>
</tr>
<tr>
<td>Does the data presented support the results?</td>
<td>Do the authors respect our knowledge and their own ignorance?</td>
</tr>
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Information Literacy Advice from the National Academy of Medicine

Models for Evaluation of Source Credibility

- Clinical Practice Guidelines We Can Trust.
- The CRAP and/or SIFT Test.
- Health on the Net Foundation Certification.
- MEDLINE and MedlinePlus (National Library of Medicine).
- URAC Certification for Health Content Providers and Health Websites.

* A discussion paper, not a report

Identifying Credible Sources of Health Information in Social Media: Principles and Attributes

Raynard S. Kington, MD, PhD, MBA, Phillips Academy in Andover; Stacey Arnesen, MS, National Library of Medicine; Wen-Ying Sylvia Chou, PhD, MPH, National Cancer Institute; Susan J. Curry, PhD, The University of Iowa; David Lazer, PhD, Northeastern University; and Antonia M. Villarruel, PhD, RN, FAAN, University of Pennsylvania

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Disclaimer: The views expressed in this paper are those of the authors and not necessarily of the authors’ organizations, the National Academy of Medicine (NAM), the National Academies of Sciences, Engineering, and Medicine (the National Academies), or the National Institutes of Health (NIH). The paper is intended to help inform and stimulate discussion. It is not a report of the NAM or the National Academies.

ABSTRACT | Social media is widely used as a source of health information for the general public. The potential for information shared through social media to influence health outcomes necessitates action by social media platforms to enhance access and exposure to high-quality, science-based information. This paper summarizes the work of an independent advisory group convened by the National Academy of Medicine that deliberated and gathered information to develop a set of initial principles and attributes that could inform platforms’ identification and possible elevation of credible sources of health information. Using these principles and attributes as a framework, the authors discuss the likelihood of credibility among major categories and types of nonprofit and government organizations that share health information through social media. The authors also emphasize the need for parallel strategies in addition to source evaluation, including assessment of content, as well as important ethical considerations such as the protection of free speech and individual autonomy. The paper also stresses that, in order to be considered credible themselves, social media platforms should share data with behavioral and public health researchers to understand the effects of such policies on both online and offline behaviors.

Introduction
People seek, share, and receive health information from a wide variety of sources, such as health care professionals, insurance and pharmaceutical companies, family and friends, media, educational materials, advertisements, and the internet—including social media. Increasing numbers of Americans have turned to internet sources for health and medical information in recent years, with approximately three out of four searching for health information online today, and similar rates among Europeans [1,2]. However, both high- and low-quality health information can be found online, and few social media platforms (SMPs) [3] differentiate between credible and non-credible sources of information. Consequently, consumers must make their own judgments about how much trust to place in a source and the quality of the information it shares. These judgments are influenced by their level of health and digital literacy, prior knowledge, personal situations, and personal beliefs [3].

“Misinformation” is that which conflicts with the best scientific evidence available at the time. *Misinforma-
## The CRAP Test in a Crisis

<table>
<thead>
<tr>
<th>CRAP Element</th>
<th>NAM description</th>
<th>Unspoken issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency/</td>
<td>How recent is the information?</td>
<td>News is speculative; older information has had time for peer discussion and review</td>
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<tr>
<td>Credibility</td>
<td>How recently has the website been updated?</td>
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<td></td>
<td>Is it current enough?</td>
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<tr>
<td>Reliability</td>
<td>What kind of information is included in the resource?</td>
<td>Do the citations actually say what the article suggests they do?</td>
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<td>Is this resource opinion? Is it balanced?</td>
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<tr>
<td></td>
<td>Does it provide references?</td>
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<tr>
<td>Authority</td>
<td>What are the author’s credentials?</td>
<td>Are those credentials relevant to the topic at hand?</td>
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<td></td>
<td>Who is the publisher or sponsor?</td>
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<tr>
<td>Purpose/Point of</td>
<td>Is this fact or opinion?</td>
<td>Does this answer the question I am asking?</td>
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<tr>
<td>View</td>
<td>Is the creator/author trying to sell you something?</td>
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<td>Section</td>
<td>Description</td>
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<tr>
<td>Recognize the model</td>
<td>What is the physical model that the numbers are based on? What are its strengths and limits?</td>
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<td>Assess the data</td>
<td>What is the type of data being used in the discussion?</td>
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<tr>
<td></td>
<td>• Speculative physical models</td>
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<td>• Lab based data</td>
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<td>• Field trial data</td>
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<td>• Population data</td>
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<td></td>
<td>Is this data FAIR?</td>
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<tr>
<td>Management implications</td>
<td>Is the information presented:</td>
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<td>• transferable</td>
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<td>• transparent</td>
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<tr>
<td>Prepare for new information</td>
<td>Are the uncertainties described and/or quantified?</td>
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This risk literacy model borrows from work in the chemical health and safety community over the last ten years.
Improving Risk Literacy:

1. Be Aware of the Risk Model You Are Using

- **Primary control**: Testing to screen infected individuals
- **Secondary control**: Physical distancing in classrooms
- **Tertiary controls**: Mask wearing (near field) and ventilation and air cleaning (far field)
Improving Risk Literacy:
2. Use FAIR Data from the Field

Findable
Accessible
Interoperable
Reusable
## Improving Risk Literacy:
### 3. Include Uncertainty

<table>
<thead>
<tr>
<th>Layer</th>
<th>Estimated impact</th>
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</table>
| 1) Medical Interventions: Testing and Vaccinations | - **Testing reached 95%** of the KSC population and isolation of positives and their contacts was rapid.  
- **Vaccinations are more than **90% effective**, but uptake in the population is currently 60% |
| 2) Physical distancing | Hallway observations and CO\(_2\) readings at KSC indicate that physical distancing was appropriate in most classrooms. There are CO\(_2\) concerns in some classes in low ventilated, crowded rooms. |
| 3a) Controlling Near-field exposures: Mask wearing | - **Lab research finds** that masks are about **65% effective** in controlling particles.  
- **KSC mask wearing was about 94%**, but some people don't cover noses (7% in April; much higher now). |
| 3b) Controlling far-field exposures: Ventilation and air cleaners | We deployed HEPA air cleaners to **poorly ventilated classroom spaces**. Initial results indicate that cleaners reduce the **time required to return to background particle levels** from 1 hour to 30 minutes. Covid transmissions have been reported in less than 15 minutes |
4. Acknowledge Outstanding Questions

- **Scientific Questions**
  - How are these management measures impacted by the emerging *variants*?
  - What *size* particles carry infectious materials?
  - What does the 2020-21 *flu season* tell us about our infection control practices last year?

- **Practical Questions**
  - Do classroom policies transfer to *offices, meeting rooms, dorms*?
  - How do we *value* air cleaners, both physically and perception-wise?
  - What are appropriate *ongoing monitoring* protocols?
Advantages of RAMP

**Acknowledging** the physical model used as the basis for discussion.

- All models are wrong (incomplete) but some models are useful (close enough for decision-making)

**Separating the model from the data**

- The model prejudices the data

**Disconnecting decisions from data**

- The NAM paper notes: *even the most credible sources have conflicts, and no organization should be exempt from disclosing them.*

**Including uncertainty** in the process

- Uncertainties increase the cognitive load associated with the information.
- The drive for memorable narratives drives information away from uncertainties.
Closing Thoughts

- Risk Literacy involves both technical and cultural considerations
  - Risk education is not well established in general education
  - There is a significant body of research into risk communication; this information is often ignored in crises
- Disciplinary silos can confuse discussions and audiences
- Science takes time; decisions have deadlines
References

The Safety "Use Case": Co-Developing Chemical Information Management and Laboratory Safety Skills
Stuart, Ralph B.; McEwen, Leah R.

Chemical safety education for the 21st century — Fostering safety information competency in chemists

Video: Quality Data for Safer Experiments
https://www.youtube.com/watch?v=b1h_yj3zf20