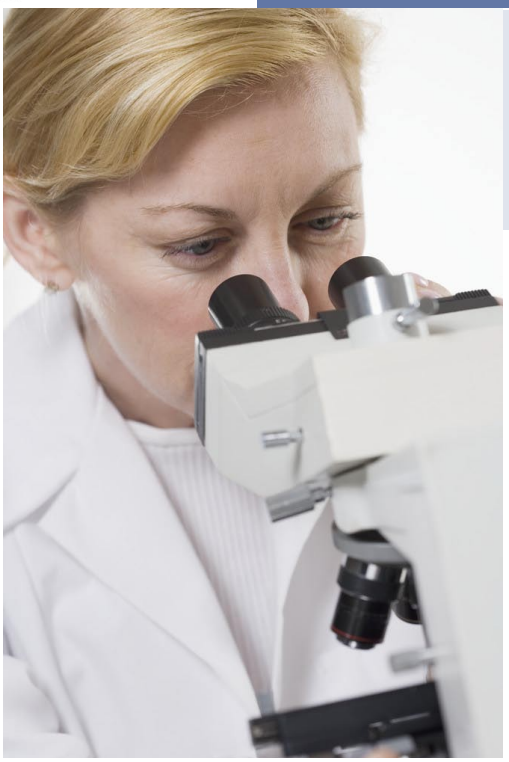

Sound Science?

Important Questions to Ask When Interpreting and Evaluating Research Studies

By Sai Cherala, MD, MPH and Laura Holmes, MPA
Co-Chairs, Emerging Issues in Cancer Work Group

Almost daily we see the results of a new health-related research study appear in newspaper headlines or make the rounds on the Internet. And while many of us like to be kept up-to-date on emerging science, the barrage of studies that come across our desks can be overwhelming.

As public health professionals, we know that research impacts the work we do. As Jeffrey Fraser of the University of Pittsburgh's Office of Child Development states, the influence of research is far reaching. "It informs and guides policy and practice, provides evidence of the effectiveness of approaches and programs, identifies the characteristics that strengthen and weaken them, and can shape the opinions of policymakers and the public on important issues.[1]"

But not all research is equal. Numerous factors can affect the quality and credibility of a study. So how can you tell which can be trusted? Ask yourself these important questions.

1. Why is this study important?

Identifying the purpose of the study helps us to understand its value. When reading about a study, think about questions like:

- Does the study answer a previously unaddressed question?
- Does it address an old question in a new way or with surprising results?
- Does it confirm the results of previous studies, strengthening the evidence or showing that a program can be effective in multiple settings?
- Does it build on past work to show trends over time?

2. Who conducted the research and wrote the report?

It is important to evaluate the credibility of the researcher and the organization that produced or funded the research. Ask yourself:

- Is there a conflict of interest? Who might stand to profit from the findings? Researchers are generally required to release their financial disclosure statement that helps determine if the researcher is independent or if their work could have been influenced by the company, government agency or advocacy group that employed or funded them.
- Are the authors well known (not notorious) in the scientific community? What are their professional credentials? Have they published previously and, if so, in what journals?
- Is the researcher from a reputable organization, university or research institution? Does the person or organization have a political agenda they consistently promote? Keep in mind that good researchers committed to a political, social or personal agenda can still conduct unbiased, trustworthy studies that can withstand independent evaluation, provided they follow practices designed to protect the quality and integrity of the research.

3. Who published the report?

Scientific research is often disseminated through journal articles. When reading a published study, ask yourself:

- Is the study published in a peer-reviewed journal? This means that the study has been evaluated by experts in the field to help ensure that it meets high scientific standards.
- How does the publication rank? Each field has its own hierarchy of journals and you can look to the prestige of the journal as one indication of a study's quality. If you are not sure how a journal ranks, look on its front pages for a statement that it is peer-reviewed and a list of who serves on its editorial committee or review board.
- Studies from sources other than journals, such as research institutions, may also contain solid, useful information. Look to the "acknowledgments" to see if the authors mention outside sources of input and advice, such as an expert advisory panel or external reviewers.
- With the exception of some online journals, information on the Internet is not reviewed as rigorously before being posted, but some sites do have a review process. In general, if an external review process is not mentioned, you should assume that one does not exist—which means you will need to be cautious about accepting the study's conclusions.

4. How are the results communicated?

Media reporting of research tends to oversimplify findings, sometimes resulting in misinterpretation, especially if the study involved technical and complex issues. When learning about research from the media, do a little more digging.

- Was the coverage brief? If so, read the full research paper for details.
- Was the reporting provocative? If so, suspect that the reporting may be playing to a specific angle or position, or determine if the study may have controversial implications.
- Are other media sources reporting the study the same way? Google the study and compare the coverage—you may find another perspective.

5. What are the findings and do they make sense?

The key findings or results of a published study are usually found in the "abstract" or summary. When reading the findings, ask yourself if they make sense, given what we know about the topic. When we come across a study whose findings don't seem to make sense, consider these questions:

- Are the findings within what is expected and rooted in the existing body of research?
- If the findings are different than expected, did the researchers explain why?
- Is the report properly referenced? Are original sources for factual statements cited? Is data from other research clearly cited?
- Remember, one function of research is to test common assumptions and reexamine earlier findings. Findings that challenge conventional wisdom are not necessarily incorrect; however they do deserve more careful examination.

6. Are the results of a single study valid?

No matter how well done, a single study does not tell the whole story. It needs to be interpreted in context of other research on the same topic. When we hear the results of a single study consider these questions:

- Is there past research on the same topic? If not, claims made based on the findings may be premature
- If the study's findings are different than past research, did the researcher explain why?
- Does the study add to a larger body of research on the topic or does only a small amount of research exist? Individual studies in new areas are important and may give us a new understanding of a topic but they are not definitive; we should consider those types of studies as suggestive of what might be going on.

7. Are the methods appropriate to the research purpose?

Any research method has both advantages and disadvantages. Usually the research question would drive the choice of research methods, but other issues like logistics, resource availability and ethical concerns can also influence that choice. To evaluate the findings properly, you should consider the method used in relation to the research question and be aware of each method's advantages and disadvantages. Most studies rely on either *quantitative* or *qualitative* methods or a combination of the two. Quantitative methods are for collecting and analyzing measurements such as "How much?" "How many?" "How often?" or "When?" By examining associations or correlations between factors, quantitative studies can also indicate important relationships, such as whether women of low socio- economic are more likely to get pap smears or mammograms than women of higher socio-economic group.

Qualitative methods are for recording and analyzing interactions with people through techniques such as in-depth interviews, focus groups, or participant observation. These techniques may be more useful if the goal is obtaining a better understanding of complex contextual, attitudinal or behavioral issues or documenting a process. For example, understanding socio cultural differences in cancer treatment or survivor issues.

8. How was the study designed?

The design of a research study is an indicator of its quality and credibility. Experimental design studies, such as double-blind placebo-controlled studies, are considered the "gold standard" and are the only type of study that can show a causal relationship. However, because experimental studies are very expensive and sometimes impractical, other types of research can inform policy and practice as well. These include:

- **Epidemiological studies.** These look at groups of people to detect associations between two variables, e.g., diet and the likelihood of getting a particular disease. Epidemiological studies can suggest potential relationships between factors but don't necessarily show that one factor caused the other.
- **Small Non-Randomized Studies or Surveys**. When repeated on a regular basis, surveys can document trends and sophisticated analyses can suggest the reasons behind the trends. As long as the group of people surveyed is scientifically selected, surveys are good for explaining what people in general think or do and for identifying subgroup differences. Statistical analysis allows a researcher to draw a more comprehensive picture of the study population by breaking down the information in various ways. By examining relationships among many variables, the researcher can understand which factors are most relevant.

- **Large Randomized Studies** draw from diverse populations and include relevant, appropriate control groups. Such large studies, often done at multiple geographic locations, are very expensive but the findings from such research are robust and can be generalized to others far more easily, so their value to research is important.
- **Clinical Trials** test the effect of an intervention, such as a medication or an educational program. In an uncontrolled trial, the researcher examines a subject group before and after applying the intervention and measures the difference. In a controlled trial, the researcher adds a "control group," which is comparable in every important way to the subject group but does not receive the intervention. If the groups are truly similar at the beginning of the study and carefully monitored to limit influences (other than the intervention) that might affect outcomes, then changes that occur in the subject group, but not in the control group, can be said to result from the intervention.
- **Meta-Analytic Study** is similar to a literature review in that it seeks to examine all previous research in a very specific topic area. However, unlike a literature review, a meta-analytic study takes the review one important step further – it actually pulls together all of the data from previous studies and analyzes it with additional statistics to draw global conclusions about the data. The key to meta-analytic studies is to understand that researchers can alter the results of such a review by being particular (or not very particular) about the kinds of studies they include in their review. Meta-analytic studies, when done properly, are important contributions to our scientific knowledge and understanding. When a meta-analysis is published, it generally acts as a new foundation for other studies to build upon. It also synthesizes a great deal of previous knowledge into a more understandable knowledge for everyone.

9. Does the study establish causation?

The goal of a study is to determine the effect of something; however, since research takes place in the real world it is usually difficult to isolate the effects of one discrete factor from all the other things going on in people's lives. By 'controlling for' certain variables, the researcher can rule out some possible explanations for the study results, even in the absence of an experimental design. By using statistical techniques that eliminate the effects of other factors on the results, the researcher can determine which explanation is more likely to be correct. In general, studies—particularly observational studies—can prove only that an outcome is 'associated with' or 'correlated with' (rather than 'caused by') a characteristic or intervention. The information may still be extremely useful, but be alert to researchers who make claims about cause and effect that seem dubious or who ignore other possible explanations for their findings.

10. Are the results statistically significant?

When a research study uses a sample (as opposed to surveying an entire population), it is important to determine mathematically that there is little probability the result could have occurred by chance—that is, that a different sample could have produced other results. A study's findings are generally considered statistically significant if there is no more than a 5% probability that it could have occurred by chance (often expressed as a "p-value" of 0.05 or less). Statistical significance alone is not enough to prove cause and effect, but it lends credibility to an argument. Statistical significance also does not necessarily make a study's findings important. In a large enough sample, a small difference can be statistically significant but of limited real world importance. A study may be perfectly designed, conducted without bias, appropriately analyzed and statistically significant, yet convey nothing important to you. But if the findings are something that you care about, and you believe that the research is sound, you are in a position to play a critical role in research—interpreting the findings and translating them to the wider world to have a greater impact.

Sources:

1. Fraser, Jeffrey. *Evaluating Research: Understanding Elements of a Study Helps Determine Credibility*. University of Pittsburgh's Office of Child Development. http://www.education.pitt.edu/ocd/publications/sr2002-12.pdf

2. Schaefer, Stephanie A. *Understanding Research: Top Ten Tips for Advocates and Policymakers*. National Association of Child Advocates. 2001. http://eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/19/98/9e.pdf

About Us

In the past two decades, many exciting developments have occurred in the field of cancer research. The challenge is to speed the translation of promising cancer research into practical methods for diagnosis and treatment. Incorporated into the NHCCC plan in the spring of 2005, the Emerging Issues in Cancer work group was charged with the goal of ***identifying emerging issues in cancer and developing an action plan to benefit New Hampshire residents***.

The most important role of this work group is in translating and promoting evidence-based research and information regarding emerging issues in cancer prevention, detection, treatment, survivorship, and palliation; environmental factors that may lead to cancer; and emerging studies and data.

For more information about the Emerging Issues in Cancer work group, please contact Sai Cherala, sai.s.cherala@dhhs.state.nh.us or Laura Holmes, LHolmes@dhhs.state.nh.us