Introduction to Research Methods for Actuaries

By Kara L. Clark

Where would you expect to find more than 90 actuaries at 8:00 in the morning in New Orleans? Enjoying coffee and beignets at Café Du Monde? Believe it or not, on June 16, you would have found them in the "Introduction to Research Methods for Actuaries" session at the Health/Pension Spring Meeting. Margie Rosenberg, PhD, FSA of the University of Wisconsin-Madison and Henry Dove, PhD of Yale University served as the session panelists; Ian Duncan, FSA, FIA organized the session and served as the moderator.

This session covered a range of relevant issues on interpreting and conducting research for practicing actuaries. Research provides an opportunity to expand actuarial thought and application as well as to enhance the visibility of the profession with other disciplines. Other disciplines such as medicine and law have a much more robust tradition of practitioner research. Granted, the actuarial profession is smaller, but we would all benefit from increasing our research output. Therefore, the presenters at this session strongly encouraged practitioners to take a more active role in original research (the health practice area in particular seems woefully underrepresented in the actuarial literature), but the lessons here also benefit those primarily interested in increasing their awareness and interpretation of the latest research in order to incorporate it into their daily work.

The Research Article

The most important aspect of the research is that its focus must be well-defined and manageable. We can't solve world hunger in a single paper. It must also clearly define the contribution it makes to the professional literature that already exists on the topic. What about it is unique?

The research article itself is typically comprised of the components described below. To illustrate the research process, the panelists referred to an article that appeared in *Medical Care*, April 1990, "Explaining Variability of Cost Using a Severity-of-Illness Measure for ICU Patients" by Rapoport, Geres, Lemeshow, Avrunin, and Haber. (For a copy of this paper, contact me at the email address below, or Margie Rosenberg at mrosenberg@bus.wisc.edu.) You can refer to any number of research journals to "follow along" with other articles, including *Health Affairs, Health Care Financing Review, Health Services Research, Journal of Managed Care*, etc. You don't need to fully understand the specifics of this illustrative article; what's important is that you get a sense of how the authors addressed each of the following components in the write-up.

Abstract

The abstract is a high level overview of the research topic and methodology, as well as a summary of the findings. The form and length of the abstract may vary depending on the specifications of the publishing journal.

Introduction/Background

The introduction provides the purpose of the paper (that is, a definition of the problem that is being studied), background on the subject, a literature review, and a sense of what is coming in the paper. For example, in the *Medical Care* article, the authors' underlying question was whether the use of Diagnosis Related Groups (DRGs) may have led to inequities in Intensive Care Unit (ICU) reimbursement.

The literature review demonstrates that the author has researched the existing literature related to the topic at hand, and articulates how the new research "fills in" one or more of the gaps that might be present or extends previous research. For completeness and context, the literature search should also investigate research in disciplines outside those of the authors.

There are a few publicly available resources to support conducting a literature review, including www.ncbi.nlm.nih.gov/entrez and www.scholargoogle.com. Another option is to Google PubMed. As with many Internet searches, using a variety of search terms can help, including MESH-subject headings, journals, articles, exact words, etc. These can also be combined to help focus the results of the search.

Data

In this section of the article, the researchers should explain what data was used, how it was "scrubbed", etc. Data summaries should be explained in words in addition to any tables or figures (that is, the authors should not rely on the tables to get their points across).

In the illustrative *Medical Care* article, the data used in the study was those patients admitted to the General Medical/Surgical ICU of Baystate Medical Center in Springfield, MA from February 1, 1983 to January 20, 1985. The data was scrubbed to exclude certain types of patients.

Methods

This part of the article describes what methodology was employed and why. What is the methodology? (Describe it.) Why did the researcher choose to use this particular model versus others that were available? What other studies or resources can the reader refer to for more information on the methods and models?

In the *Medical Care* article, the main independent variables included:
- DRG (the paper focused on four specific DRGs),
- Length of stay in the ICU,

- Length of stay in the hospital,
- Age, and
- Mortality Prediction Model (MPM) probability.

The main dependent variable in the study was a cost "surrogate" equal to weighted hospital days. The researchers used three analyses to investigate the ability of MPM to improve the use of DRG classifications as a predictor of resource use

Results

What were the outcomes of the study? Again, summaries should be explained in words and not only tables or figures. There are a few key statistics that often show up in the results section. If you're an actuary who remembers that exam fondly but faintly, a quick review may be helpful.

First, there are means and standard deviations. You probably remember how to calculate them (or know how to get Excel to calculate them!). One of the keys here is how large the standard deviation is relative to the mean. That will provide you a sense of how much variability there was in the data for that particular set.

For example, the *Medical Care* article includes the following table:

Table 3: Descriptive Statistics for Study DRGs (an excerpt)

DRG	% of All Hospital Admissions in this DRG that Spent Time in ICU	Weighted Hospital Days Mean (Standard Deviation)
1	78.5	32.7 (24.4)
5	72.5	17.0 (11.6)
110	72.4	31.7 (38.7)

You can see that the standard deviations are quite large relative to the mean weighted hospital days for each of these DRGs. That result implies that there was significant variability in the weighted hospitals days for those patients with each of these DRGs.

Another statistic that you will see quite often in peer-reviewed literature is the P-value. The P-value indicates whether or not two means differ "significantly" from one another. In many fields, including health services research, P-values equal to or less than .05 suggest "significant" differences.

Again, the *Medical Care* article includes the table below:

Table 1: Comparison of High ICU Users with Rest of Users (excerpt)

ICU Length of Stay	Top 10% of Patients Based on ICU Length of Stay	Other 90% of Patients	P Value

ICU Length of Stay-Mean	16.9	3.8	<.001
Age – Mean	61.0	58.8	0.082

Here, a P-value of <.001 suggests that indeed, the means between these two groups are "significantly" different. However, in the case of mean age, the P-value is greater than .05, which suggests that the difference in age between these two groups is not significant.

Conclusion/Discussion

In the discussion section, the authors should comment on what the results and outcomes of the study mean. What are the implications? How can the results be used? These are essentially the "so what?" questions that follow from the results.

Following along with our example, the authors of the *Medical Care* article concluded that the use of "weighted days" is appropriate. They also summarized their key findings relative to the most costly ICU patients and the relationship of resource use and severity. In a business sense, their findings suggested that if a hospital has "sicker" patients that require more intensive use of medical resources, that hospital could be disadvantaged under a DRG payment system.

In addition, the article will describe the limitations of this particular approach to the research. All approaches will have some limitations; these do not suggest that the approach was flawed or otherwise inappropriate. Discussing the limitations provides the reader with some assurance that the thought process regarding the research was thorough and robust. The limitations outlined for the *Medical Care* article noted that the study did not address cost issues between ICU and non-ICU patients; that the conclusions were based on only 4 DRGs during a two year time period soon after the payment system was introduced; that the MPM system is not appropriate for use with all conditions, and that the use of MPM requires additional data collection which could be cumbersome.

Finally, the discussion section will describe what follow-up research is suggested by the results of the study. For practitioners interested in conducting original research, reviewing this section of previously published articles can provide good fodder for new research topics. The authors of the *Medical Care* article suggested that beneficial future research might improve the misclassification rates of developed models and include the development of predictive models.

References

As important as the paper itself is the list of prior research that was consulted in the development of the study. Any article listed in the reference list should be cited in the paper, and likewise, any facts stated in the paper should be cited in the references.

Getting Published

If you are an actuary that has an interest in original research and its publication, it's important to "start with the end in mind". Knowing your target journal and its audience will influence how you write your article and perhaps how you organize the research. Each journal outlines instructions to potential authors, including the target length of the abstract and/or paper, the structure of the article, and the formatting of the bibliography. It's important to read a number of articles published by your target journal to determine its style; this approach can help you tailor your paper appropriately.

The process of publication can be arduous. There are peer-reviewed and non peer-reviewed journals. Those that are peer-reviewed are the most prestigious and can have low acceptance rates. Once you submit an article, it can take weeks to several months for a response. Peer reviewers will provide comments; you as the author will respond to those comments, and in the end, it is the decision of the editor as to whether the article will be put to print.

But as noted earlier, there are a number of benefits to conducting research and pursuing publication—it can enhance your personal reputation and is a great opportunity to collaborate and network with other disciplines, either within or outside of the actuarial profession. It can keep your work dynamic and interesting, and what's more, you may actually learn something in the process! Finally, as you have success, please let us here at the SOA know about it. We can help provide current and potential members as well as other disciplines with some visibility into your contributions, which helps enhance the profession's overall image.

I hope this introduction has piqued your interest and curiosity both in research and in publishing. Remember that the SOA has research funds available, and regularly calls for papers on a variety of topics. If you want to further explore the idea, Margie Rosenberg at the University of Wisconsin would be happy to serve as a resource for you; you can find her contact information in the SOA directory. Happy researching!

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This article is summary of the session "Introduction to Research Methods for Actuaries," presented at the SOA Health/Pension Spring Meeting in New Orleans in June 2005, and is based on the PowerPoint material from that session, which is publicly available on www.soa.org.

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