Summary of the Discussion: What Have We Learned about Population-Based Investigations?

Jerris R. Hedges, MD, MS

From the Department of Emergency Medicine, Oregon Health Sciences University, School of Medicine, Portland, Oregon.

THE JOURNAL OF TRAUMA: INJURY, INFECTION, AND CRITICAL CARE 1999;47:S67-S68

It is my task to summarize the responses of the Skamania conference attendees regarding population-based investigations of trauma outcome. Others have noted that the meeting attendees arrived with the belief that population-based studies demonstrated evidence favoring trauma systems. Richard Mullins has nicely summarized the basis for that support. Turner Osler and Frank Lewis also have noted that, by design, these longitudinal, observational, and generally retrospective studies are not free of problems.

We now must take a step back and ask ourselves, "What have we learned?" We know there are several things that population-based studies offer. Generally, they address a broad and somewhat inclusive population. Although some datasets used for population-based studies focus on admitted patient data, as in administrative claims-based datasets, other datasets can be defined or developed that incorporate emergency department and out-of-hospital data. These linked datasets provide a unique view of the all-inclusive injured population.

Another important issue that was not discussed at the session earlier today is that existing claims-based datasets represent one of the few means by which one can obtain data before a trauma system is established. Without using such datasets, retrospective longitudinal studies are not possible. Furthermore, these datasets may be the only tool for reviewing trauma outcomes at multiple hospitals should there be reluctance of some hospitals to participate in a regional trauma registry.

Furthermore, the use of claims data is valuable for analyzing some specific outcomes that should be impacted by the development of a trauma system, i.e., evidence for a redistribution in site of admission for major trauma cases and location of death. We have heard from Richard Mullins that common factors found in those regions where outcomes for major trauma have not improved after trauma system implementation are the absence of effective out-of-hospital triage and minimal interhospital transfer of seriously injured patients to the highest level trauma centers. By the same token, we have identified many problems with current datasets used for population-based studies. Issues that have been raised include a limited number of clinical variables and the potential for inconsistent definition or reporting of variables. These shortcomings limit our ability to adjust for severity of injury and physiologic dysfunction. Our primary outcome must be mortality, although length of stay and site of hospitalization also can be assessed. Fortunately, datasets can be linked and additional data can be obtained by chart review to complement outcome and risk stratification information found in these claims-based datasets.

We also are limited by the observational basis of the data. When attempting to evaluate the impact of a trauma system, different hospitals may implement a trauma response differently and may join a
system at different times. We certainly are limited by the way data are collected at different sites. Hence, variables must be validated by dataset audits, comparison with other datasets, and internal logic checks. For example, an administrative dataset may show a patient discharged alive from the hospital within 48 hours of arrival with a Glasgow Coma Scale score of 3. This patient was likely administratively discharged after brain death was declared to permit readmission for organ harvesting without an additional financial burden on the family. Such cases of misclassification must be identified by performing logic checks on the dataset.

We also need to address secular trends, e.g., safety legislation such as implementation of helmet or seat-belt laws. These laws that modify injury may have a profound effect on the types of injury seen at trauma centers. Evaluating the outcome of major trauma from similar, adjacent states-one with a trauma system and one without-during the same time interval provides a powerful means of removing major secular trends.\(^2\)

Longitudinal, population-based mortality studies have been criticized for using different variables in reported models intended to help stratify risk of death. For the most part, the models used in population-based trauma system research have been similar and have been based on an established clinical knowledge of factors associated with trauma deaths. Variations of the regression models have been introduced to reduce variance in the statistical model. Such variance may be due to missing variables (e.g., physiologic state or underlying health status) that cannot be addressed satisfactorily in administrative claims datasets.

In addition to longitudinal, population-based studies helping address the question, "Has the system impacted patient mortality?", these studies can help us address whether or not the system has been successfully implemented.\(^3,4\) For example, were seriously injured patients preferentially taken to the designated trauma centers or were admission patterns unaffected?

Given this background information as discussed in the prior panel presentations, we can now readdress the Skamania conference attendees' views on the strength of evidence for trauma systems based on longitudinal, population-based research. The attendees were asked to rate the strength of the collective evidence from longitudinal, population-based studies. In the rating scale, a score of 1 indicated that the attendee believed that there was no evidence whatsoever for trauma systems based on the published literature. A score of 2 represented weak evidence; a score of 3 represented moderate evidence; and a score of 4 represented compelling evidence.

Comparing the group's scores regarding the strength of the evidence before and after our critical review of the published literature, the median score was unchanged at 2.25 with an interquartile range (IQR) of 2.0 to 3.0. Hence, even after the rigorous critique of this conference, the majority of respondents believed there was weak to moderate evidence for trauma systems based on published population-based studies.

After the literature critique, the attendees also were surveyed regarding whether one can make a direct inference regarding "what works" in a trauma system by using population-based studies. The scoring system varied from a score of 1 (strongly disagree) to 4 (strongly agree). The median score was 2.5 with an IQR of 2.0 to 3.0. Hence, although conference attendees believe these studies provide some evidence in support of trauma systems, they were less certain about the specific implications of the studies. Certainly, observational studies are less powerful than prospective, interventional studies in determining cause and effect. The attendees also were surveyed regarding "how useful these studies are for policy decisions." The scale ranged from 1 (not useful) to 4 (very
useful). The median score was 2.25 with an IQR of 2.0 to 3.0.

Because this study format may have greater impact on a health system or program administrator, we also analyzed the postpanel survey results for the 11 administrators who attended. For the administrators, the "strength of the evidence" median score was 2.5 with an IQR of 2.0 to 3.0. With respect to inferring "what works," the median score was 3.0 with an IQR of 2.6 to 3.0. And finally, with respect to "how useful these studies are for policy decisions," the median score was 2.75 with an IQR of 2.0 to 3.0. These findings suggest that health care administrators tended to give this form of study a bit more credence and would base policy on this form of evidence.

This latter point is an important message for investigators. That is, we collect, analyze, and present data for a variety of reasons. One important outcome is the guidance of policy. Although the data may not seem as rigorous or as strong on a purely scientific basis as a randomized controlled trial, the data do carry considerable weight for policy guidance in the absence of other data.

I now ask the question, "Can we do better?" There are at least four different ways to improve the population-based research efforts. First, validate the dataset. This validation can be done by performing logic checks on the dataset or by cross-checking data points against independent datasets. Second, perform parallel analyses with other datasets. Richard Mullins mentioned one of the OHSU studies for which we not only looked at mortality by using the administrative claims-based dataset, but also examined mortality in a region by using the Fatal Accident Reporting System and the regional Vital Statistics dataset. Although the datasets were different, the analyses were complementary and told different aspects of the same story.

Third, collect supplemental data to reinforce key outcomes or variables. Fourth, create better datasets. One point of caution must be stated here. Comprehensive and detailed datasets can be expensive and may not be adequately used to warrant the expense of their collection. Perhaps use of a prospective computerized patient record as the basis for data collection and subsequent analysis rather than continued use of the standard administrative claims dataset will be the next step.

Are there also key applications that we can emphasize to a greater extent by using population-based datasets? Certainly, injury surveillance can be expanded by using this tool. We can use the technique to identify key injuries that may be most likely to benefit from trauma system intervention. We can also identify common injuries for which no apparent benefit from the trauma system is evident at this time. We can then ask whether the trauma system is appropriately configured for those specific injuries. Another potential application is to track the maturation of the trauma system. That is, these datasets can determine whether we are "getting the right patient to the right location at the right time."

In conclusion, longitudinal, population-based research has an important role in evaluating trauma care and helping guide policy. We have heard about many important concepts derived by using this tool, and we have learned more about its limitations. The technique can guide and support other research modalities, which may ultimately provide more specific information. We are beginning to understand how we can strengthen the methods, and we will improve the methods, if we are to be successful. Thank you.

REFERENCES


Address for reprints: Jerris R. Hedges, MD, MS, Department of Emergency Medicine, MP-52, Oregon Health Sciences University, 3181 SW Sam Jackson Park Road, Portland, OR 97201-3098; email: hedgesj@ohsu.edu.