Research and Statistics : Cohort Studies

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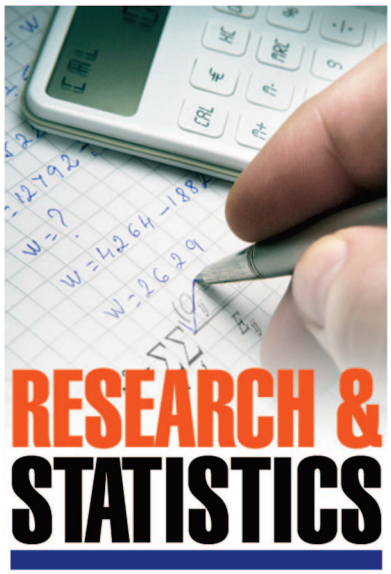

Cohort Studies

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Author Disclosure

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Case Study

You are seeing a previously healthy 10-year-old boy for a complaint of periumbilical abdominal pain. He reports that over the past several weeks, the pain has occurred intermittently, without fever, nausea, or diarrhea. His mother adds that he has asked to stay home from school due to this pain numerous times. The physical examination yields unremarkable results. His mother asks you whether bullying could be the cause of his abdominal pain.

You recall a recent article that posed the question, "Do bullied children get ill or do ill children get bullied?" (1) This cohort study demonstrated that children who were bullied were two to four times more likely to experience health symptoms, including abdominal pain, over the course of a school year. You wonder whether the results of this study are accurate and how they could be relevant to your patient.

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Cohort Studies

Cohort studies are essential to answering the proverbial question of what came first . . . the chicken or the egg. Unlike cross-sectional or case-control studies, in which a time-sequence often cannot be assessed, cohort studies follow a group of people forward in time from *exposure* to *outcome,* thereby allowing inferences of causality. In the aforementioned study, investigators compared the onset of symptoms (*outcome*) in a group of school-age children who were bullied (*exposed*) with the experiences of children who did not report bullying (*unexposed*).

Advantages of a cohort design include allowing an estimation of the incidence or natural history of a disease or health problem (eg, bullying): "How often is bullying reported in this group of children?" and "What symptoms occur in children who are bullied?" Data derived from observing patients over time also allow reporting of relative risks, hazard ratios, and survival curves, which often facilitate understanding of associations between exposure and outcome. This study design is especially relevant when there is already good evidence (clinical, physiologic, or otherwise) to suggest an association of a disease with a certain exposure. Although the groups frequently are defined by a single exposure event, multiple outcomes can be assessed. In our case, abdominal pain was one outcome of interest, although investigators also studied whether bullying increased the risk of developing depression, sleeping problems, headaches, and other symptoms, thus allowing for a broad assessment of the potential effects of bullying.

Critical Evaluation of Cohort Studies

Grimes and Schultz propose consideration of four questions when critically evaluating a cohort study to determine its clinical relevance. (2)

How Much Selection Bias is Present?

Most cohort studies have a component of selection bias, or bias in the way individuals are enrolled in the exposed and unexposed groups. Were steps taken to reduce the differences between the two groups on items other than the exposure? In the bullying study, where the sample was obtained from multiple schools, it would be important to consider how different school environments may have affected selection of the exposed and unexposed participants. Did most of the bullied group come from the "rough" side of town, resulting in children from more affluent neighborhoods comprising most of the nonbullied group?

After reviewing this type of study, the answer to the question of "who is exposed and who is unexposed?" should be readily apparent. Without such clarity, selection bias may significantly limit an understanding of the relationship between exposure and outcome. Thus, for investigators to determine whether a true relation-

ship actually exists between a complex problem such as bullying and health outcomes, they first must define systematically the group of children who met their criteria for bullying. In the study, the exposed group consisted of students reporting being bullied "a few times or more" when asked the question, "How often did other children bully you in recent months, since summer break?"

Using the same internal population (persons from the same time and place such as a hospital or school) to identify the control or unexposed group reduces the risk for selection bias and improves the estimate of the background rate of the outcome. When this arrangement is not possible and an external control must be recruited (often termed a double-cohort study), investigators must be careful to select populations that have similar baseline risks for the outcome.

What Steps Were Taken to Minimize Information Bias?

Information bias refers to a difference in the quality of information obtained from the exposed and unexposed groups with respect to exposure and outcome. Methods by which information bias can be reduced include using validated instruments or tests to define outcomes consistently and having investigators "blinded" to exposure to reduce disparities in identifying the outcome of interest based on their knowledge of the participants.

Retrospective studies are particularly challenging in this respect because participant data are obtained from past records and may not contain key information. In cases where the outcome of interest is subjective (eg, pain, erythema, mood), attempting to keep those measuring the outcome blinded from the participant exposure status is critical to reducing information bias. When objective measures such as death, fever, or positive serologic testing are used, blinding is not believed to be a necessary step to minimize information bias. Investigators in the bullying study were not blinded to the children's reports of bullying, but validated questionnaires were administered to all enrolled children and used to identify the symptoms of interest.

How Complete Was the Follow-up of Both Groups?

Nonresponse bias and bias from loss to follow-up can skew comparisons significantly between the exposed and unexposed groups. For example, children who enrolled in the bullying cohort at the start of the school year but then remained home due to illness after being bullied for the subsequent surveys mistakenly could be considered nonresponders in the study. If, however, both bullied and nonbullied children were found to have equal rates of nonresponse (or absence from school to prevent study participation), the nonresponse bias could be assumed more accurately not to affect the study results.

Participant attrition is an expectation in most longitudinal studies. Yet discontinuation from a study can reflect a nonrandom event related to the exposure and outcome. When loss to follow-up is disproportionate, it is critical to evaluate what differences may have contributed to the losses to follow-up and how this phenomenon might affect the relationship between exposure and outcome.

Were Potential Confounding Factors Sought and Controlled for in the Analysis?

Examples of potential confounders (variables that relate to both the exposure and outcome) for the relationship between being bullied and child health outcomes could include factors such as child ethnicity, social background, and prior health status. Because the current study did not account for these factors, questions that arise regarding the study conclusions include, "Does race or ethnicity play a role in the relationship between bullying and health outcomes?" and "What effect does socioeconomic status have on child health outcomes in those being bullied?" The greater the degree to which potential confounders are considered in a cohort, the greater the potential for valid conclusions regarding the exposure and outcome.

Conclusion

Your patient and his mother are anxiously awaiting your return. As a diligent practitioner, you have noted the advantages and potential limitations of the bullying cohort study. You decide that the conclusions regarding bullying as an antecedent to the onset of abdominal pain and other health symptoms in school-age children are relevant to your patient and may validate the mother's suspicion of the effect of the child's school experiences on his pain. In your patient's case, it may require a more detailed history to determine "what came first." However, critically understanding the results of a relevant cohort study can help you start to make the connections.

References

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Suggested Reading

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