EBM NOTEBOOK

Where do pretest probabilities come from?

The attending physician teaching in an outpatient clinic listens while a house officer presents the history of a patient in follow-up. She is 57 years old and presents with 3 weeks of dizziness, which she describes as a lightheaded feeling when standing up to walk. She has not fallen or lost consciousness. She describes no sensation of movement of either head or room. She takes a diuretic for essential hypertension, and its dose was increased a month ago. Examinations of her heart, lungs, and neurological system are normal, as is a head-hanging manoeuvre. While discussing the likelihood of possible causes of dizziness in this patient, the house officer asks the question that is this essay's title, "Where do pretest probabilities come from?"

Have you noticed the long pause that lingers after this question is asked, while learners wait and the teacher inhales before speaking? The teacher knows that pretest probabilities of disease are important for interpreting diagnostic test results (1, 2) and yet also knows that learners may lack both the clinical experience and the external evidence from which to estimate pretest probabilities. This teaching moment is an opportunity to demonstrate how to integrate expertise with evidence in order to practice evidence-based medicine (3), in this case evidence-based diagnosis (4, 5). This EBM note summarises 4 sources of information about disease frequency that we clinicians can use to form our estimates of pretest probability.

Remembered cases

As we encounter patients, we draw on our clinical expertise to recognise problems like persisting dizziness, to remember previous cases of these same problems, and to use their diagnoses to help estimate pretest probabilities for each new patient. This process seems automatic, fast, and always available. As our clinical experience evolves, our case list is continually updated in memory and calibrated directly to our local practices (indeed, they arise from them!). If we use uniform diagnostic criteria over

time, we could achieve high levels of diagnostic reproducibility. From our memories, commonly diagnosed causes of dizziness may be readily recalled, while less common disorders may be retrieved more slowly.

Despite these strengths, remembered cases have some drawbacks. Having cases to remember requires having had sufficient experience with previous patients with the same clinical problem, such as dizziness; experience with other problems doesn't help us store case memories for dizziness. The usefulness of case memories also depends on how consistently we have framed clinical problems (does the patient have "lightheaded dizziness" or "postural near-syncope"?), carried out diagnostic evaluations, and applied diagnostic criteria. Also, the frequency we remember from previous cases is prone to several biases, such as the distortions from recent experience ("my last dizzy patient had . . ."), from positive emotions ("my best dizzy diagnosis was . . .") or negative emotions ("my worst diagnosis was . . .") we feel for the ill persons, or from the perceived interest of a diagnosis ("my most fascinating dizzy patient had . . .") (6-9).

Practice databases

As health care organizations evolve in the information age, a growing number may assemble databases that track clinical information, such as diagnostic codes. If these databases capture all the practice patients seen with such clinical problems as dizziness (the denominators) and the full list of final diagnoses made after workup (the numerators), they can become useful sources of information about disease probability. If well built, these databases might be continually updated, rapidly accessible to practitioners, and well calibrated to the disease frequencies in the local community. By combining the experience of several practitioners, practice databases have larger patient samples and hence more precise disease frequencies. Us-

ers of these databases wouldn't need to have individual experience with dizziness to benefit from the collected experience with dizzy patients. The usefulness of these practice databases may be limited by incomplete data collection or by inconsistency in problem framing diagnostic evaluations, or diagnostic criteria applied by the contributing clinicians.

Planned research

Information about disease frequency can be found in the published reports of planned research, whether indirectly in articles about diagnostic tests or directly in studies of the epidemiology of symptoms (10), such as a study of the causes of dizziness (11). When well done, studies of disease frequency use uniform framing of the clinical problem (to get the denominator right), along with comprehensive and consistent diagnostic evaluations, uniform diagnostic criteria, and complete follow-up (to get the numerators right). Thus, rigorous planned research about disease probability should be the least biased and most accurate of the 4 sources (12), and using research about disease frequency does require that we have extensive personal experience with this clinical problem. Published studies of this sort are increasingly available, although they may be harder to find than randomised trials. When using such evidence, we should keep in mind that it may or may not be well calibrated to the frequencies of disease in our local communities and that over time these data become obsolete if they are not updated.

Population prevalence

Why not use statistics on disease prevalence in the whole population to estimate pretest probability? Such statistics are based on large samples and represent the collected experience of a very large number of clinicians. And like practice databases and planned research, no personal experience is needed to use the information.

However, just like practice databases, the usefulness of these data depends on the completeness of data collection and the consistency in problem framing, diagnostic workups, and diagnostic criteria. Data from the entire population may be poorly calibrated to the disease frequencies in our local communities, and it may be updated infrequently and hard to access quickly. Perhaps most important, the prevalence data represent fractions with the wrong denominators; if we want to know the fractions of dizzy patients found to have each underlying disorder, the proper denominator should be people with dizziness, rather than the general population (13).

Integrating evidence and expertise

Having considered the strengths and weaknesses of these sources of disease frequencies, how can we integrate them to estimate pretest probability? Little empirical research is available to guide us, so this advice is preliminary. We will probably always use remembered cases; doing so wisely means keeping in mind their drawbacks and learning to recognise situations when our memories might be most prone to bias. To supplement

our case memories, we would ideally have and use both good-quality practice databases (potentially more up-to-date and locally calibrated) and planned research (potentially more rigorously done). If neither is available, we might turn to data on population prevalence. Considering these sources together, we should be able to estimate pretest probability accurately enough for our next diagnostic step.

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