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## Newsroom

# Johns Hopkins Medicine Researchers Identify Health Conditions Likely to be Misdiagnosed

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Death and disability from medical diagnostic errors are often associated with missed strokes, blood infections and lung cancers



*Credit: Getty Images*

For a patient, a diagnostic error can mean the difference between life and death. While estimates vary, likely more than 100,000 Americans die or are permanently disabled each year due to medical diagnoses that initially miss conditions or are wrong or delayed.

Now a research team, led by a [Johns Hopkins Armstrong Institute for Patient Safety and Quality](#) expert, reports it has identified three major disease categories — vascular events, infections and cancers — that account for nearly three-fourths of all serious harms from diagnostic errors. The team's findings, based on analysis of a large repository of malpractice insurance claims, are described in a [paper](#) published online today in the journal *Diagnosis*.

The researchers found that diagnostic errors were the most common, most catastrophic and most costly of medical mistakes. Diagnostic errors leading to death or serious, permanent disability were associated with misdiagnosed cancers (37.8%), vascular events (22.8%) and infections (13.5%) — categories that the team led by [David Newman-Toker, M.D., Ph.D.](#), director of the [Johns Hopkins Armstrong Institute Center for Diagnostic Excellence](#), calls the “big three.” The authors describe 15 specific “big three” conditions that together account for nearly half of all the serious, misdiagnosis-related harms. The top conditions in each category are stroke, sepsis (a blood infection) and lung cancer, respectively. These are accompanied by heart attack, venous thromboembolism (blood clots in the legs and lungs), aortic aneurysm and dissection (a rupture of the aorta), arterial thromboembolism (a blockage of the blood supply to internal organs), meningitis and encephalitis, spinal infection, pneumonia, endocarditis (a heart infection) and breast, colorectal, prostate and skin cancers.

“We know that diagnostic errors happen across all areas of medicine. There are over 10 thousand diseases, each of which can manifest with a variety of symptoms, so it can be daunting to think about how to even begin tackling diagnostic problems,” says Newman-Toker, “Our findings suggest that the most serious harms can be attributed to a surprisingly small number of conditions. It still won't be an easy or quick fix, but that gives us both a place to start and real hope that the problem is fixable.”

For the study, the researchers analyzed all 11,592 diagnostic error cases between 2006 and 2015 that were drawn from a list of open and closed U.S. malpractice claims documented in the national [Comparative Benchmarking System](#) (CBS) database. Frequently used as a source for patient safety research projects, CBS is owned and maintained by CRICO, the medical malpractice insurance program associated with Harvard medical institutions and their

affiliates. The database includes information from 400 hospitals, including more than 30 academic and teaching hospitals covered by both member-owned and commercial insurance programs representing more than 180,000 physicians from all 50 states plus Washington, D.C., and Puerto Rico.

The research team, which included Dana Siegal, R.N., director of patient safety at CRICO Strategies, a division of CRICO, grouped all health conditions presented in the claims according to a standard, epidemiologic classification system created by the Agency for Healthcare Research and Quality, with the help of the agency's Clinical Classifications Software. This allowed the authors to identify and rank top conditions.

For example, says Newman-Toker, "There are dozens of different diagnosis 'codes' that all represent strokes. The same is true for heart attacks and some of the other conditions as well. These differences often matter more for treatment than diagnosis. To my knowledge, grouping these codes together to identify the most common harms from diagnostic error had not been done before, but doing so gives us an 'apples to apples' comparison of the frequency of different diseases causing harms."

Among diagnostic-error cases of varying severity, the median age of the patients with errant diagnoses was 49, and more than half were female. For children and young adults (0–20 years old), harms most often were from missed infections (27.6%) rather than vascular events (7.1%) or cancers (9.1%), while the reverse was true for middle aged and older adults. About half of the high-severity harm cases the researchers studied resulted in patient death, while the other half resulted in permanent disability.

Based on claims data, the analysis also found that failures of clinical judgment were identified as causes in more than 85% of the misdiagnosed cases. The researchers say this adds to growing evidence that health care systems must do more to support bedside diagnostic decision-making by clinical providers. The authors point to interventions such as deploying computer-based diagnostic decision support tools, increasing immediate access to specialists at the point of care, supporting more effective teamwork and patient engagement in diagnosis, providing routine diagnostic performance feedback for clinicians and improving diagnostic education through simulation training.

Researchers also found that most of the diagnostic errors (71.2%) associated with the malpractice claims occurred in ambulatory settings — either in emergency departments, where missed infections and vascular events such as strokes were more of a concern, or outpatient clinics, where misdiagnoses were more likely to be cancer-related. “These findings give us a road map for thinking about what kind of problems we need to solve in which clinical settings,” Newman-Toker says.

He cautions that the focus on serious harms in the analysis leaves out many chronic or long-term conditions such as migraines or multiple sclerosis that can be misdiagnosed for years or even decades, leading to substantial patient suffering even if the diseases are eventually treated. He also says there is a bias built in the types of cases brought forth by attorneys that could have affected their findings. “It’s easier to bring a cancer claim forward, for example, since there’s usually more of a paper trail,” he says.

To address this anticipated bias, Newman-Toker and the research team analyzed previously published studies using nonclaims data from various clinical care settings. They still found that roughly three-quarters of diagnostic error cases were associated with the “big three” disease categories — though, unlike with the malpractice claims data, vascular events and infections dominated over cancers.

“The high percentage of serious-harm cases attributable to these ‘big three’ categories of conditions is likely accurate, despite the inherent biases in malpractice data,” Newman-Toker says.

He says the findings suggest that harms from diagnostic errors could be substantially reduced over the next decade, but only if the medical community takes seriously the National Academy of Medicine’s 2015 call to action that improving diagnosis “represents a moral, professional and public health imperative.” “Our current annual federal investment to fix diagnostic errors is less than what we spend each year researching smallpox, a disease eradicated in the U.S. over half a century ago,” he says. “If we devoted appropriate resources to tackling misdiagnosis of the ‘big three’ diseases we identified, we could potentially save half of the people who die or are permanently disabled from diagnostic errors.”

The researchers plan to build on their findings as they continue the phases of their planned three-part study. The next phase will estimate how frequently the 15 most common conditions are misdiagnosed, and the final phase will use nationally representative data sets to derive a population-level estimate of the total number of people in the U.S. harmed by diagnostic error each year.

Other researchers who worked on this study include Najilla Nassery, M.D., M.P.H., Ali Saber Tehrani, M.D., Gwendolyn Clemens, M.S., Zheyu Wang, M.S., Ph.D., Yuxin Zhu, Ph.D., and Mehdi Fanai, M.D., of Johns Hopkins, and Adam Schaffer, M.D., M.P.H., and C. Winnie Yu-Moe, M.B.A., M.A., of CRICO.

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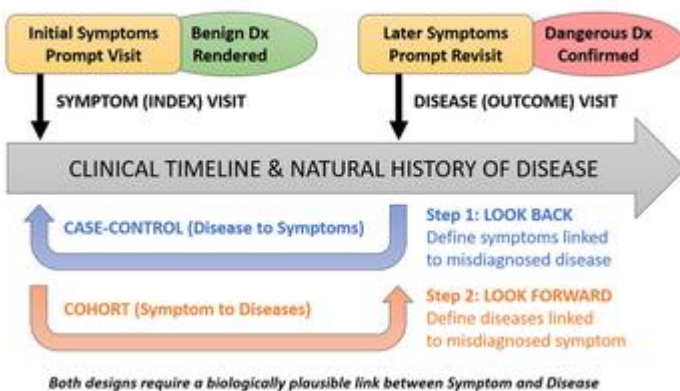
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