New study finds digital clinical decision support tools save lives of pneumonia patients

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Drs. Nathan Dean and Catherine Vine review digital electronic support tool for pneumonia. Credit: Intermountain Medical Center

A new study by Intermountain Medical Center researchers in Salt Lake City found that using advanced clinical decision support tools reduces mortality for the 1.1 million patients in the Unites States who are treated for pneumonia each year.

Data from the new year-long study showed the tool saved up to 12 lives in hospitals where the tool was utilized, compared to routine care standards. More than 50,000 Americans die each year due to pneumonia.

Findings from the study are published in *Annals of Emergency Medicine*, the leading journal for emergency department physicians.

The advanced computer program designed at Intermountain Medical Center combines a patient's personal medical information and risk factors in real time to alert emergency department physicians if the patient possibly has pneumonia.

Once pneumonia is confirmed by the physician, the tool automatically provides a calculated severity assessment as well as management recommendations, which include diagnostic testing and antibiotic selection, based on current North American pneumonia treatment guidelines.

"Because of the complexity of pneumonia, physicians can't easily make consistent decisions that follow current treatment recommendations," said lead author Nathan Dean, MD, a pulmonologist and chief of critical care medicine at Intermountain Medical Center. "The result is, doctors have to rely on their unaided judgment on how to best treat pneumonia patients.

Intermountain Medical Center's researchers identified more than 4,000 patients in seven hospital emergency departments where the tool was either used or not used. Researchers found mortality rates decreased in the emergency departments where the tool was used.

"This tool doesn't take over for doctors, but it does assemble the needed information, calculates the patients' severity of illness and likelihood of infection with resistant bacteria, and presents recommendations to help

doctors make better decisions. It's all about giving local doctors tools to be more consistent, objective, and focused on best practices."

Dr. Dean says those numbers fluctuate from year to year due to the severity of air pollution, different types of bacteria, and varying strains of influenza. Because of those and other factors,, crucial information may be overlooked that might help a patient survive.

"Unlike the human mind, computers aren't limited in their scope," said Dr. Dean. "Doctors, as with all people, are only able to process three to five factors at any given time despite their experience. Our screening tool uses 40 different factors in its evaluation of whether or not a patient has pneumonia and whether they should be admitted to the hospital for treatment."

How does the tool work? The computer-based tool monitors the flow of clinical data in each emergency department patient's electronic medical record, extracts the relevant clinical information, and analyzes the data to calculate a probability for the presence of pneumonia in real-time.

When the calculated probability of pneumonia reaches 40 percent, the tool alerts physicians with an icon that appears on the ED electronic tracker board. After confirming the diagnosis, the doctor is provided with treatment recommendations.

Features of the tool

1) It identifies patients who are at increased risk for drug-resistant bacteria by searching the electronic medical record for patients hospitalized longer than 48 hours within the previous 90 days. It recognizes the names and addresses of skilled nursing homes, rehabilitation facilities, and long-term care facilities.

2) It extracts prior microbiology results for bacteria that are resistant to antibiotics.

3) It objectively estimates the severity of the patient's illness.

4) It processes the radiologist's chest imaging interpretation to identify patients with radiographic evidence of pneumonia, presence of multi-lobar disease, and pleural effusion.

It then recommends:

1) Whether the patient should be admitted to the intensive care unit, a hospital ward, or outpatient services.

2) Laboratory tests to identify the organism(s) responsible for the infection.

3) Which antibiotics should be given based on site of care, risk factors, and prior isolation of bacteria resistant to antibiotics.

In the mid-90s, Intermountain Healthcare implemented paper-based pneumonia guidelines that had moderate success. The inherent limitations of paper processes, however, prevented effective implementation of detailed, individualized pneumonia management recommendations.

A few years later, Dr. Dean and his team of emergency physicians and experts at the Homer Warner Center for Informatics Research began developing an electronic screening and management tool. However, deployment was not practical until dictated radiology reports became electronically available within 20 minutes after the imaging was complete.

The use of the tool is increasing as emergency department doctors see how it benefits patients. "I was pretty skeptical of the tool at the beginning of the study," said Peter Lenz, MD, an emergency physician who practices in the EDs of Intermountain Healthcare's Salt Lake-area hospitals . "I've been diagnosing patients with pneumonia for 20 years, but this tool has changed the way I practice medicine. It's very user-friendly, and it's definitely alerted me about things I've overlooked. Now I'm a believer."

"This tool is evidence of Intermountain's reputation," said Dr. Dean. "We're focused on quality of care, electronic support, and collaboration between disciplines. Our development and study of this tool was made possible because the folks in Medical Informatics, Radiology, Pulmonary-Critical Care Medicine, and Emergency worked together. If we didn't work collaboratively the way we do, this tool would be useless, and we wouldn't be able to improve care for patients with pneumonia."

Dr. Dean and his team are currently developing an improved version of the tool and are planning wider deployment using a commercially available electronic medical records platform.

Provided by Intermountain Medical Center