

Impact of an Electronic Clinical Decision Support Tool for Emergency Department Patients With Pneumonia

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Study objective: Despite evidence that guideline adherence improves clinical outcomes, management of pneumonia patients varies in emergency departments (EDs). We study the effect of a real-time, ED, electronic clinical decision support tool that provides clinicians with guideline-recommended decision support for diagnosis, severity assessment, disposition, and antibiotic selection.

Methods: This was a prospective, controlled, quasi-experimental trial in 7 Intermountain Healthcare hospital EDs in Utah's urban corridor. We studied adults with *International Classification of Diseases, Ninth Revision* codes and radiographic evidence for pneumonia during 2 periods: baseline (December 2009 through November 2010) and post-tool deployment (December 2011 through November 2012). The tool was deployed at 4 intervention EDs in May 2011, leaving 3 as usual care controls. We compared 30-day, all-cause mortality adjusted for illness severity, using a mixed-effect, logistic regression model.

Results: The study population comprised 4,758 ED pneumonia patients; 14% had health care-associated pneumonia. Median age was 58 years, 53% were female patients, and 59% were admitted to the hospital. Physicians applied the tool for 62.6% of intervention ED study patients. There was no difference overall in severity-adjusted mortality between intervention and usual care EDs post-tool deployment (odds ratio [OR]=0.69; 95% confidence interval [CI] 0.41 to 1.16). Post hoc analysis showed that patients with community-acquired pneumonia experienced significantly lower mortality (OR=0.53; 95% CI 0.28 to 0.99), whereas mortality was unchanged among patients with health care-associated pneumonia (OR=1.12; 95% CI 0.45 to 2.8). Patient disposition from the ED postdeployment adhered more to tool recommendations.

Conclusion: This study demonstrates the feasibility and potential benefit of real-time electronic clinical decision support for ED pneumonia patients. [Ann Emerg Med. 2015;66:511-520.]

Please see page 512 for the Editor's Capsule Summary of this article.

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INTRODUCTION

Background and Importance

Pneumonia leads to 1.1 million hospital admissions and almost 50,000 deaths annually in the United States.¹ The Infectious Disease Society of America/American Thoracic Society 2007 pneumonia guideline recommends that “locally adapted guidelines...be implemented to improve process of care variables and relevant clinical outcomes.”² Despite evidence that adherence to guidelines improves outcome, management of pneumonia patients in emergency departments (EDs) varies considerably.²⁻⁴ Although the reasons are complex and myriad, most locally

implemented guidelines are paper based and do not integrate well into clinical workflows.^{5,6} The Agency for Healthcare Research and Quality reported that health information technology has the potential to make health care delivery safer, more effective, and more efficient; however, this potential has yet to be realized.^{7,8} A systematic review concluded that health information technology can increase adherence to guideline-based care.⁹ Negative effects, including alert fatigue and shifting of human roles, have also been identified.¹⁰

We developed a real-time, electronic, clinical decision support tool that helps providers identify ED patients with pneumonia and recommends evidence-based management using a Bayesian belief network (a probabilistic graphic model that represents a set of random variables and their

Editor's Capsule Summary

What is already known on this topic

Some emergency departments (EDs) are using clinical decision support modules in electronic medical record software, but there are few studies on clinical utility.

What question this study addressed

A module aimed at improving compliance with pneumonia treatment guidelines was incorporated into the electronic medical record software at 4 of 7 Utah EDs, and 30-day mortality outcomes were compared between EDs with and without the intervention for 4,758 pneumonia patients.

What this study adds to our knowledge

Physicians applied the tool for 62.6% of pneumonia patients in intervention EDs. There was no difference in overall mortality, but it was less among patients with community-acquired pneumonia at EDs using the tool (odds ratio=0.53; 95% confidence interval 0.28 to 0.99).

How this is relevant to clinical practice

These results are not compelling enough to recommend that EDs add electronic clinical decision support for pneumonia, but they are worthy of further study.

Study Population - 7 hospital emergency departments

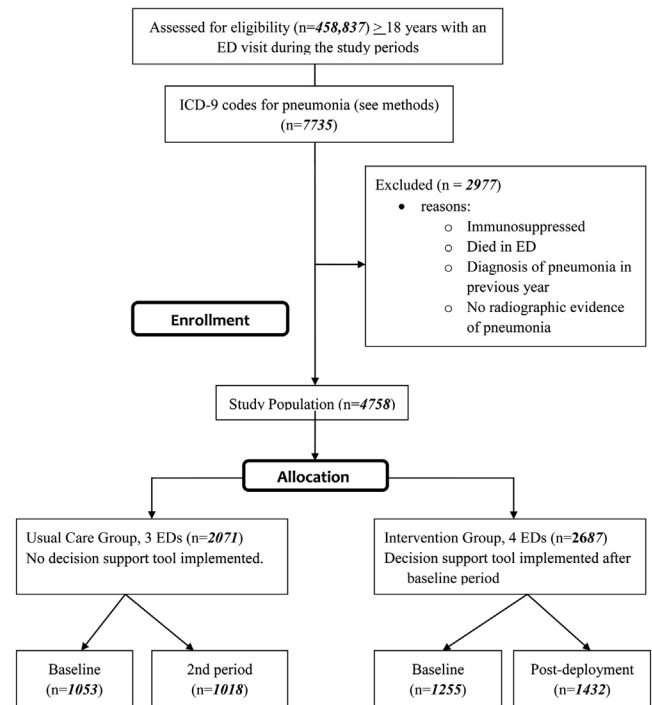


Figure 1. Derivation of study population.

designed the study as a prospective, quasi-experimental, controlled trial.^{14,15}

MATERIALS AND METHODS

Setting

conditional dependencies) integrated with the electronic medical record.^{11,12} An electronic protocol then provides automatically calculated objective severity assessment and management recommendations, including disposition, diagnostic testing, and antibiotic selection, based on the Infectious Disease Society of America/American Thoracic Society 2005 and 2007 pneumonia treatment guidelines.^{2,13} Seven Intermountain Healthcare adult hospitals serve approximately half of the 2 million people residing in Utah's urban corridor. In May 2011, we deployed the clinical decision support tool in the 4 intervention EDs, leaving the other 3 hospital EDs as concurrent, usual care controls, using paper guideline forms (Figure 1).

Goals of This Investigation

We studied the effect of tool deployment on 30-day all-cause mortality and patient disposition before and 6 months after tool deployment in 4 intervention hospital EDs compared with 3 usual care hospital EDs. We

In 1995, Intermountain Healthcare began to implement an electronic medical record in 7 network hospital EDs in the urban corridor of Utah. Intermountain Medical Center is the largest of these hospitals, with 86,400 ED visits during 2012, and is affiliated with the University of Utah emergency medicine residency. Two hospitals to the north and south host family practice residencies and had 64,600 and 46,900 ED visits during 2012, respectively. The other 4 are community hospitals that provide care for 19,500 to 25,000 ED patients annually. A paper-based pneumonia guideline had been implemented with moderate success in all Intermountain Healthcare EDs by 1998.^{16,17} The paper-based guideline is kept current by Intermountain's lower respiratory tract infection team; all hospitals experienced minor paper and computerized physician order entry updates during the study period. However, the inherent limitations of paper processes precluded effective implementation of detailed, individualized pneumonia management recommendations.¹⁷ In 1998, we began development of an electronic screening and management tool,¹⁸ but deployment was not practical until dictated

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