

## Brief Communication

# Changes in hospital bond ratings after the transition to a new electronic health record

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## ABSTRACT

**Objective:** To assess the impact of electronic health record (EHR) implementation on hospital finances.

**Materials and Methods:** We analyzed the impact of EHR implementation on bond ratings and net income from service to patients (NISP) at 32 hospitals that recently implemented a new EHR and a set of controls.

**Results:** After implementing an EHR, 7 hospitals had a bond downgrade, 7 had a bond upgrade, and 18 had no changes. There was no difference in the likelihood of bond rating changes or in changes to NISP following EHR go-live when compared to control hospitals.

**Discussion:** Most hospitals in our analysis saw no change in bond ratings following EHR go-live, with no significant differences observed between EHR implementation and control hospitals. There was also no apparent difference in NISP.

**Conclusions:** Implementation of an EHR did not appear to have an impact on bond ratings at the hospitals in our analysis.

**Key words:** electronic health records, health care financing, hospitals, economics, hospital

## BACKGROUND AND SIGNIFICANCE

In the past decade, hospitals in the United States have rapidly adopted electronic health records (EHRs).<sup>1</sup> As many organizations continue to transition from paper records to EHRs, even more are switching from one EHR system to another. Given the large investment necessary, hospitals are justifiably concerned about the impact of EHR implementation on their financial health. These concerns have been reinforced by high-profile cases of financial losses following EHR implementations at well-known health systems.<sup>2,3</sup>

One important measure of a hospital's financial performance is its bond rating. A bond rating for a hospital is a publicly available measure of financial performance that serves a role roughly

equivalent to an individual's credit score, which changes based on the hospital's financial standing and affects its ability to borrow money. A strong capacity to borrow is crucial for a hospital to purchase new equipment, conduct renovations, or expand.

## OBJECTIVE

Given growing concerns about the financial impact of EHR implementation, we sought to analyze whether transitioning to a new EHR was associated with changes in hospital bond ratings. As a secondary analysis, we also sought to determine whether implementing a new EHR was associated with changes in net income from service to patients (NISP).

## MATERIALS AND METHODS

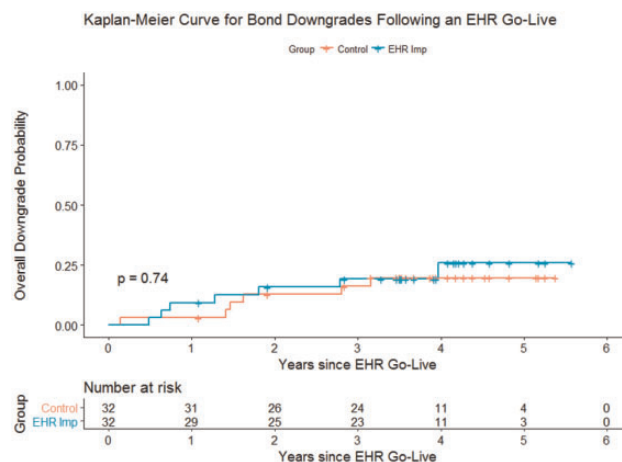
We identified the EHR “go-live” dates of hospitals that implemented a new inpatient EHR between 2011 and 2015 from a previous study,<sup>4</sup> which identified go-live dates using data from the information technology supplement of the American Hospital Association’s annual survey and publicly available information documenting go-live dates, such as hospital press releases. For each of these organizations, we collected bond ratings from Moody’s Corporation,<sup>5</sup> which determines bond ratings for hospitals based on market position, operating performance, and debt. We identified bond ratings from the EHR go-live through December 31, 2016, for organizations rated by Moody’s that best mapped to each hospital. We excluded hospitals when (1) Moody’s did not issue a bond rating for the hospital following the EHR go-live, (2) Moody’s issued bond ratings for the city or university that operates the hospital, but not specifically for the hospital, or (3) Moody’s issued bond ratings for the health care system that operates the hospital (but not specifically for the hospital), and the hospital accounts for <10% of that system’s total patient revenue.

To account for the potential impact of regional trends on hospital finances, we matched each EHR implementation hospital to a randomly selected hospital from its hospital referral region (HRR) (or from a bordering HRR when no other hospital in the HRR met the inclusion criteria). We then collected bond ratings for these hospitals as described above. To compare the likelihood of bond downgrades and upgrades at EHR implementation hospitals vs our control group, we compared survival distributions for downgrades and upgrades in these 2 groups. Comparisons were made using the log-rank test, a nonparametric test to determine whether 2 observed survival curves could be attributed to the same underlying distribution.

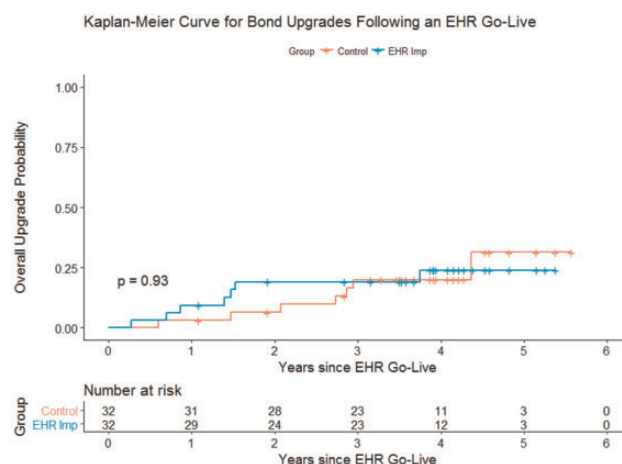
As a secondary analysis, we assessed whether EHR implementation had an impact on NISP using data reported to the Centers for Medicare and Medicaid Services through the Healthcare Cost Report Information System (HCRIS).<sup>6</sup> To do so, we collected NISP (defined as net patient revenues less total operating expenses) from the calendar years prior to and after go-live at EHR implementation and control hospitals. NISP was collected from HCRIS datasets curated by the National Bureau of Economic Research.<sup>7</sup> We then determined whether each organization saw an increase or decrease in its NISP relative to the year prior to EHR go-live. We excluded from our analysis organizations that did not report NISP in either the year before or after go-live (and the matched hospital in the other study group). We then compared the number of hospitals with increases and decreases in their NISP following go-live at EHR implementation hospitals compared to the control group using Fisher’s exact test.

## RESULTS

We identified bond ratings for 32 hospitals that implemented a new EHR between 2011 and 2015 and a set of geographically similar controls. Of these, 24 (75%) implemented an EHR from Epic Systems (Verona, WI), 3 (9%) implemented an EHR from Cerner Corporation (North Kansas City, MO), and the remaining 5 (16%) implemented an EHR from another vendor. After implementing a new EHR, 7 hospitals had a bond downgrade, 7 had a bond upgrade, and 18 had no change in their bond ratings. Among control hospitals, 6 had a bond downgrade, 6 had a bond upgrade, and 20 had no change in their bond ratings following the go-live date of the matched hospital from the EHR implementation group. There was no difference in the probability of bond downgrades (Figure 1,  $P = .74$ ) or upgrades (Figure 2,  $P = .93$ ) following go-live at EHR



**Figure 1.** Kaplan-Meier plot showing the proportion of hospitals experiencing a bond downgrade in the years following an EHR go-live at EHR implementation vs control hospitals.



**Figure 2.** Kaplan-Meier plot showing the proportion of hospitals experiencing a bond upgrade in the years following an EHR go-live at EHR implementation vs control hospitals.

implementation hospitals vs the geographically matched control group. When we focused our analysis on hospitals that implemented an Epic EHR, we also found no difference in the likelihood of bond downgrades ( $P = .43$ ) or upgrades ( $P = .43$ ) following go-live in the EHR implementation group vs the control group.

NISP was available in the calendar year both prior to and after go-live for 27 (84%) of the 32 hospitals that implemented a new EHR. Relative to the year prior to EHR go-live, 18 hospitals that implemented an EHR saw an increase in their NISP in the year following go-live. Meanwhile, 9 hospitals saw a decrease in their NISP after go-live. In the control group, 9 hospitals reported increased NISP and 11 hospitals reported decreased NISP. The difference between the intervention and control group was not statistically significant ( $P = 0.7786$  using Fisher’s exact test).

## DISCUSSION

Despite widespread concern about the impact of EHR implementation on health care organizations’ financial health, most hospitals

saw no change in their bond ratings following EHR implementation, with a similar number of hospitals experiencing bond downgrades and upgrades. Likewise, we found that NISP did not consistently increase or decrease following implementation of a new EHR. We found similar results in a set of geographically matched control hospitals, suggesting that hospitals that implemented a new EHR experienced similar financial trends in the years following the implementation as other hospitals in the same geographic regions that did not implement an EHR. These findings suggest that the financial impact of EHR implementation, at least on broad measures of financial performance like bond ratings and NISP, is variable, and likely depends on institution-specific factors. This should be reassuring to hospitals concerned for their financial health when considering adopting a new EHR.

## LIMITATIONS

Our study has several important limitations. First, our sample consists of a limited set of hospitals in the United States with verified EHR go-live dates identified from a previous study focused on the impact of EHR implementation on adverse event reporting.<sup>4</sup> This sample was inherently limited in size due to the number of hospitals in the United States with verifiable go-live dates that also had bond ratings from Moody's in the years following their EHR go-live. This may have limited our ability to detect minor differences in bond rating trends at EHR implementation hospitals vs control hospitals. Second, our set of control hospitals was matched on location only. While we feel that this control group is important to exclude the possibility of systematically different financial trends at hospitals in similar regions, conclusions regarding bond ratings relative to hospitals matched on other factors (such as size, patient population, structure, etc.) cannot be made from these data. We did not match on other factors due to the limited number of closely matched potential comparands. Third, our analysis does not attempt to identify the root cause of changes in bond ratings and NISP observed at our set of control hospitals. Bond ratings and NISP are just two of several important measures of hospital financial performance. While our analysis suggests that EHR implementation has a limited impact on hospital bond ratings and NISP, it does not exclude the possibility that there are other important financial implications.

## CONCLUSION

Our analysis of 32 hospitals that recently implemented a new inpatient EHR and a set of geographically matched controls did not detect a significant impact of EHR implementation on bond ratings or NISP.

## FUNDING STATEMENT

None.

## COMPETING INTERESTS

We have no competing interests to disclose related to the content of this manuscript.

## CONTRIBUTORS

DM collected bond ratings data from Moody's Corporation for EHR implementation and control hospitals, performed the primary analysis of the data, and prepared the initial draft of the manuscript with supervision from AW. SA collected and analyzed the NISP data from HCRIS to support our findings regarding bond ratings. AW and DFS coordinated the design of this research and provided input for the primary analysis and interpretation of the data for this manuscript. MLB and AM collected EHR go-live dates for EHR implementation hospitals and provided input on the interpretation of data for this manuscript. All authors provided critical revisions to the manuscript, approved the final version of this manuscript, and take responsibility for the integrity and accuracy of this work.

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