**APPENDIX**

In addition to using each hospital’s overall CDI incidence, we also conduct a sensitivity analysis using only secondary diagnoses of CDI when calculating each hospital’s CDI incidence. The CDI incidence at a hospital contains cases that may be both community and hospital associated. However, many of the hypothesized links between CDI incidence and excess LOS, described in the introduction, occur via hospital-acquired CDI; for example, lower quality hospitals may have conditions that lead to both more hospital-acquired CDI and longer LOS on average. We conduct a sensitivity analysis, at both the hospital level and patient level, to assess whether the observed association between CDI incidence and LOS is being driven by cases of hospital-acquired CDI or CDI in general. To do this, we include only those cases of CDI that are coded as a secondary diagnoses, when calculating each hospital’s CDI incidence. Since a patient’s principal diagnosis is generally considered to be the primary reason for the admission, removing patients with a principal CDI diagnosis should reduce the number of non-hospital-acquired CDI cases included in the calculation. Moreover, if the association between CDI incidence and LOS is stronger when principal CDI cases are removed, this would suggest that the association is more likely due to hospital-acquired CDI. Table A1 reports the results of the sensitivity analysis using only secondary CDI cases in the calculation of CDI incidence.

For each year, and for all of the models we analyzed, the effect of CDI incidence significantly increased when only secondary CDI cases were used. In the hospital-level model, when only secondary CDI cases were included, the effect of CDI incidence increased from 1.19 to 1.38, from 1.61 to 2.00, and from 1.30 to 1.79, for the years 2009-2011, respectively. Moreover, the explanatory power of each model also increased. For each of the years, when the secondary CDI incidence was used, the model’s R2 values increased from .45 to .50, from .50 to .59, and from .42 to .51.

Results of the patient-level analysis mirror those of the hospital-level analysis. In the chosen GLM gamma model, the coefficient on CDI incidence increased from .043 to .055, from .072 to .091, and from .057 to .075 for 2009 to 2011, respectively. Similarly, in the OLS models the coefficient estimates increased from .64 to .78, from 1.05 to 1.35, and from .84 to 1.11, for each of the years. These findings, along with the hospital-level-sensitivity results, suggest that hospital-acquired-CDI incidence is associated with excess LOS.

Previous studies have often used a secondary diagnosis of CDI as an indicator of hospital-acquired status.35 Our results using only secondary cases of CDI in the calculation of each hospital’s CDI rate suggest that the primary effects captured here may be associated with hospital-acquired cases of CDI rather than CDI overall. For each year, and at both the hospital and individual level, removing primary CDI cases from the calculation increased both the effect size and significance of the CDI incidence variable. However, previous research has shown that secondary CDI may be an imperfect marker for hospital-acquired status.27 We found that identifying CDI cases based on secondary diagnostic codes often overestimated the true number of hospital-acquired cases, as community-acquired CDI may also receive a secondary CDI diagnosis. Therefore, the results of our sensitivity analysis should not be directly interpreted as the association between hospital-acquired CDI and excess LOS. However, given these results, and the fact that secondary CDI incidence may overestimate hospital-acquired CDI incidence, the effects reported in the sensitivity analysis likely underestimate the actual effects associated with hospital-acquired CDI. Future research should be conducted to further explore the relationship between the incidence of hospital-acquired CDI and excess LOS.

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| --- | --- | --- | --- | --- | --- | --- |
|  | **2009** | | **2010** | | **2011** | |
|  | **Coefficient (SE)** | **P Value** | **Coefficient (SE)** | **P Value** | **Coefficient (SE)** | **P Value** |
| **Hospital Level** |  |  |  |  |  |  |
| CDI rate | 1.3789 (.0518) | < .001 | 2.0006 (.0609) | < .001 | 1.7934 (.0632) | < .001 |
| **Patient Level GLM-gamma** |  |  |  |  |  |  |
| CDI rate | .0551 (.0006) | < .001 | .0909 (.0006) | < .001 | .0752 (.0006) | < .001 |
| **Patient Level OLS** |  |  |  |  |  |  |
| CDI rate | .7767 (.0036) | < .001 | 1.3478 (.0044) | < .001 | 1.1056 (.0042) | < .001 |

**Appendix Table 1:** Sensitivity analysis: patient-level results from generalized linear models (gamma family, log link) and ordinary least squares models. The dependent variable is LOS for patient without CDI. CDI incidence is calculated using secondary CDI