Adoption and Trends in Uptake of Updated ICD-10 Codes for \textit{Clostridioides difficile}—A Retrospective Observational Study

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**Background.** In October 2017, the single International Classification of Diseases, Tenth Revision (ICD-10), code for \textit{Clostridioides difficile} infection (CDI), A04.7, was replaced with 2 codes delineating “recurrent CDI” (rCDI; A04.71) and “nonrecurrent CDI” (nrCDI; A04.72).

**Methods.** To evaluate and validate use of the updated codes, this retrospective study included inpatient encounters with a CDI-related ICD-10 code from October 2016 to May 2019 in the PINC At\textsuperscript{TM} Healthcare Database (PHD). Encounters after the October 2017 code update were characterized by clinical, facility, and provider variables and whether coding was concordant or discordant to the 8-week recurrence period. Multivariable regression analysis assessed variables associated with concordant coding.

**Results.** Widespread adoption of the updated CDI codes across PHD hospitals occurred in October 2017. After October 2017, 21 446 CDI-related encounters met sample selection criteria (concordance in 67% of rCDI and 25% of nrCDI encounters). Higher proportions of rCDI vs nrCDI-coded encounters (P < .05) had emergency room admission, admission by a gastroenterologist or infectious disease specialist, and were prescribed fidaxomicin, bezlotoxumab, or fecal microbiota transfer (FMT), with no significant difference by coding concordance status. Encounters coded concordantly were significantly more likely to be for rCDI (odds ratio [OR], 5.67; 95% CI, 5.32–6.03), a nonelective admission (OR, 1.35–1.69), or prescribed fidaxomicin (OR, 1.11; 95% CI, 1.01–1.23) or FMT (OR, 1.29; 95% CI, 1.17–1.42).

**Conclusions.** Our study findings suggest no delay in transition to the updated CDI-related codes. Treatment patterns for rCDI vs nrCDI encounters were consistent with Infectious Diseases Society of America guidelines, regardless of concordance status.

**Keywords.** \textit{Clostridioides difficile}; ICD-10; concordance; recurrence.

\textit{Clostridioides difficile} remains the most common cause of health care–associated infection and is associated with significantly high morbidity, mortality, and costs [1–3]. Approximately 10%–20% of patients have recurrence of \textit{C. difficile} infection (CDI), either owing to relapse (recurrence of the same infection) or reinfection (new exposure to \textit{C. difficile}) [4–6].

Patients with recurrent \textit{C. difficile} infection (rCDI) also have higher morbidity, mortality, and hospital costs, and the management and treatment approach are different than for nonrecurrent \textit{C. difficile} infection (nrCDI) [5, 7–10]. A study of aggregate data collected from 2007 to 2013 for patients with primary CDI compared with rCDI found median increases of 8 inpatient days and $15 050 attributed to CDI-related expenditures, and increases of 13 inpatient days and $24 455 for the total burden [8]. A systematic review of articles from 1980 to 2009 found similar differences in cost between primary and rCDI [11].

In October 2017, the single International Classification of Diseases, Tenth Revision (ICD-10), code for CDI (A04.7) was replaced with 2 codes delineating rCDI (A04.71) and nrCDI (A04.72). Before this, cases of CDI using ICD-10 codes were identified using A04 (other bacterial intestinal infections) or A04.7 (enterocolitis due to \textit{C. difficile}), regardless of whether a patient had recurrent or nonrecurrent CDI. Previous studies of resource utilization and costs related to CDI were conducted before the introduction of the more granular codes. It is expected that the updated CDI codes, if implemented appropriately, will provide more accurate tracking of the rates of the 2 types of CDI, which in turn could inform more appropriate CDI disease management strategies and research. However, data associated with implementation of the updated codes have been limited. Thus, this study evaluated and validated trends in ICD-10 coding for CDI before and after the 2017 CDI
ICD-10 coding update among patient encounters at hospitals contributing to the PINC AI \textsuperscript{TM} Healthcare Database (PHD; Premier Inc., Charlotte, NC, USA) \cite{12}.

**METHODS**

**Study Design, Data Source, and Study Population**

This was a retrospective panel study that used data obtained between October 2016 and May 2019 from the PHD. The PHD is a comprehensive electronic service–level, all-payer US health care database that includes information on inpatient discharges, including demographic information, hospital characteristics, physician specialties, discharge diagnoses, and procedure codes \cite{12}. At the time of this study, the PHD contained detailed administrative inpatient data for CDI-related hospital encounters from 835 acute care hospitals that were drawn from all regions of the United States. However, hospitals in urban settings and hospitals from the Southern region have some overrepresentation in the database.

The study sample included inpatient encounters for patients 18 years of age or older with a CDI-related ICD-10 code between October 2016 and May 2019. Encounters coded before October 2017 used the previous version of the ICD-10 code for CDI (A04.7), and those after were coded using the current version of the ICD-10 codes for CDI (A04.71 or A04.72). Duplicate records were removed, and the second (postindex) encounter with CDI coding was selected. Because the PHD is an aggregated, deidentified data set, no patient consent was required, and the study was exempt from Institutional Review Board oversight.

**Outcomes**

Patients were classified as having 1 of the following CDI-related ICD codes: nonspecific (A04.7), rCDI only (A04.71), nrCDI (A04.72), or rCDI and nrCDI (encounters double-coded with both A04.71 and A04.72). Based on the 2017 Infectious Diseases Society of America (IDSA)/Society for Healthcare Epidemiology of America guidelines that recommended an 8-week window for identifying rCDI \cite{5}, ICD coding for rCDI and nrCDI after October 2017 was categorized as either concordant (new CDI episode within 8 weeks after index CDI episode coded as recurrent, and after 8 weeks as nonrecurrent) or discordant (new CDI episode within 8 weeks after index CDI episode coded as nonrecurrent, and after 8 weeks as recurrent).

Health care resource utilization included hospital length of stay, treatments received for CDI as either monotherapy (oral vancomycin, fidaxomicin, or metronidazole) or as combination, and adjunctive CDI therapies (bezlotoxumab or fecal microbiota transfer [FMT]; identified using Current Procedural Terminology codes 44705 or 44799 or mention of FMT in standard charge descriptions). As reported in prior studies using the PHD \cite{13, 14}, \textasciitilde75\% of the participating hospitals provide information on actual hospital costs, and the remaining hospitals provide cost estimates based on the Medicare cost-to-charge ratios. Consequently, hospital costs assessed in the current study comprised actual costs and cost estimates. Hospital costs included the entire cost of hospitalization (bed charge, medications, and laboratory tests). Costs were inflation-adjusted to 2019 US dollars using the medical care Consumer Price Index from the US Bureau of Labor Statistics (www.bls.gov/cpi/).

Several covariates were considered. Sociodemographic factors included age, gender, race/ethnicity, and payer type. Clinical factors included prior all-cause hospitalization in the past 6 months, intensive care unit (ICU) admission at index, and comorbidities, which were calculated using Elixhauser Comorbidity Software, version 3.7 (Agency for Healthcare Research and Quality) \cite{15, 16}. Risk of mortality, admission type (elective, emergency, trauma center, urgent), point of origin/admission source, and discharge status were also assessed. Data were also analyzed according to admitting physician specialty and facility/hospital characteristics (type, location, size, geographic region, and volume of patients with CDI).

**Statistical Analysis**

Continuous variables were reported as mean ± SD or median and interquartile range; categorical variables were reported as relative frequencies and proportions. Differences in characteristics were assessed using repeated-measures of analysis of variance (ANOVA) for continuous variables and the chi-square or Fisher exact test for categorical variables, except where noted. To evaluate the uptake of the updated ICD-10 coding after the October 2017 revision, a Mann-Kendall test was used to detect if there was any trend in the frequency of CDI ICD-10–coded encounters over time during both pre- and postupdate periods. Descriptive statistics are reported according to ICD-10 code type and concordance status for clinical, facility, and provider characteristics, as well as for resource utilization and costs.

Multivariable logistic regression was used to assess factors that may contribute to coding concordance. Specifically, we looked at whether coding concordance differed between nrCDI and rCDI cases and whether facility-level and treatment factors were associated with coding concordance. All analyses were conducted using Python 3.8.3 (Python Software Foundation, Beaverton, OR, USA). All tests were 2-sided, and a \( P \) value <.05 was considered statistically significant.

**RESULTS**

Table 1 shows attrition of the sample population used for the trend analysis and other study analyses. There was a total of 212,447 patient encounters with CDI-related ICD-10 codes...
from October 2016 to May 2019 (intermediate sample), and these were included in the trend analyses. The updated CDI codes were adopted across hospitals in the PHD in October 2017, the month these codes were implemented (Figure 1). Overall, CDI rates appeared to decrease over time. Specifically, in the postcode update period, the rate of nrCDI (slope, −0.678; P < .001) declined more than the rate of rCDI (slope, −0.6; P = .002).

The final sample included a total of 21,446 second (postindex) CDI-related patient encounters after the October 2017 code update (Table 1). Approximately 42.3% of these CDI-related encounters were coded concordantly; of the concordantly coded encounters, 64.3% were for rCDI and 35.7% were for nrCDI (Table 2). In the overall sample, the nrCDI-vs rCDI-coded encounters (P < .05) had higher proportions with ICU admissions and higher mortality, lower mean comorbidity scores, and lower proportions with emergency department admission and admission by a gastroenterologist or infectious disease specialist. These trends were repeated across concordantly and discordantly coded encounters, with a few exceptions. Specifically, for discharge type, the difference between nrCDI and rCDI was observed among discordant cases, not concordant cases. Also, the trend of lower proportions of nrCDI- vs rCDI-coded encounters in the overall sample of patients admitted by a gastroenterologist was reversed in concordant cases.

A higher proportion of patients with rCDI compared with nrCDI received fidaxomicin, bezlotoxumab, or FMT, and this pattern was consistent regardless of coding concordance status (Table 3). Overall patient costs were similar between rCDI and nrCDI cases; however, rCDI cases tended to have lower medical procedure and supply costs but higher drug and diagnostic costs. Concordantly coded patients had significantly lower overall costs in rCDI vs nrCDI cases, whereas for the discordantly coded cases no difference was found in overall costs.

Regression analysis showed that CDI encounters were significantly more likely to be coded concordantly if they were for rCDI (odds ratio [OR], 5.67; 95% CI, 3.28–6.03); involved an admission that was classified as an emergency (OR, 1.69; 95% CI, 1.49–1.91), urgent (OR, 1.42; 95% CI, 1.23–1.64), or unknown (OR, 2.21; 95% CI, 1.53–3.19); or included treatment with fidaxomycin (OR, 1.11; 95% CI, 1.01–1.23) or FMT (OR, 1.29; 95% CI, 1.17–1.42) (Table 4).

**DISCUSSION**

It is important to differentiate between patients with rCDI vs nrCDI to assist in making informed treatment decisions and appropriately allocate resources. In October 2017, 2 ICD-10 codes delineating rCDI and nrCDI replaced a single ICD-10 code for CDI. Appropriate implementation of the updated codes would allow for more accurate tracking of rCDI and nrCDI to support improved disease management and research. Thus, this study was undertaken to evaluate trends in ICD-10 coding for CDI before and after the 2017 CDI ICD-10 coding update and to assess rCDI and nrCDI ICD-10 coding among patients experiencing another CDI encounter within 8 weeks after an index CDI episode.

This study shows that the updated ICD-10 codes for rCDI and nrCDI were readily adopted after they were introduced in October 2017, indicating no latency in implementation of the updated codes. This is important because the updated codes are expected to help with monitoring burden of disease, which will subsequently drive public health research, such as identification of risk factors and the development of preventive strategies for rCDI in those at risk. Furthermore, an overall decrease in CDI over time was observed, which is consistent with the literature [2].

The drug treatment trends for overall encounters coded as rCDI vs nrCDI in the present study were consistent with the 2017 IDSA guidelines for CDI that were applicable at the time. Higher proportions of rCDI- vs nrCDI-coded encounters were prescribed fidaxomycin, bezlotoxumab, or FMT, suggesting that clinicians tended to follow treatment guidelines for rCDI, which is important for effective disease management [2, 5, 17–19]. Compared with nrCDI-coded encounters, rCDI encounters were more frequently associated with fidaxomycin and FMT treatment, which are recommended therapy for rCDI in the 2017 IDSA guidelines [5, 19]. Likewise, patients with rCDI also more frequently received bezlotoxumab, which is approved for patients at high risk of recurrences who are receiving antibacterial therapy for their CDI. However, bezlotoxumab was not included in the 2017 IDSA guidelines given that its pivotal phase 3 trials were published after the guideline

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**Table 1. Sample Attrition for the Code Adoption and Concordance Analyses**

| Attrition Criterion                                      | No.   | %    |
|----------------------------------------------------------|-------|------|
| Total number of patient encounters in data set from October 2016 to May 2019a | 246,820,834 | 100  |
| Inpatient encounters                                     | 23,904,732 | 9.69 |
| Age ≥18 y                                                 | 20,662,379 | 8.37 |
| Encounters with CDI-related ICD-10 codes                 | 212,447b | 0.09 |
| Encounters after October 2017                            | 125,632  | 0.06 |
| Encounters not double-coded                              | 124,758  | 0.05 |
| Second encounter with CDI coding after index             | 21,446c  | 0.01 |

Abbreviations: CDI, *Clostridioides difficile* infection; ICD-10, International Classification of Diseases, Tenth Revision; nr, nonrecurrent; r, recurrent.

aNumber of contributing hospitals: 927.

bIntermediate sample used for the trend analysis of encounter frequency.

cCDI encounters for which the time from a previous encounter can be calculated.

fFinal sample used for frequency of nrCDI and rCDI, health care resource utilization and costs, and regression analysis of concordance status.
Figure 1. Encounter frequency by ICD-10 code type pre– and post–October 2017 code update at hospitals contributing to the PHD. Abbreviations: ICD-10, International Classification of Diseases, Tenth Revision; PHD, PINC AI™ Healthcare Database.

Table 2. Frequency of rCDI and nrCDI by Clinical, Facility, and Provider Characteristics

| Variables* | Overall (N = 21 446) | Concordant‡ (n = 9070) | Discordant* (n = 12 376) |
|------------|----------------------|------------------------|--------------------------|
| ICU admission, No. (%) | rCDI (n = 8712) | nrCDI (n = 12 734) | P Value | rCDI (n = 5828) | nrCDI (n = 3242) | P Value | rCDI (n = 2884) | nrCDI (n = 9492) | P Value |
| No | 7650 (87.8) | 10 633 (83.5) | <.001 | 5100 (87.5) | 2614 (80.6) | <.001 | 2550 (88.4) | 8019 (84.5) | <.001 |
| Yes | 1062 (12.2) | 2101 (16.5) | 728 (12.5) | 628 (19.4) | 334 (11.6) | 1473 (15.5) | |
| AHRQ Elixhauser comorbidity score, mean (SD) | 8.65 (9.23) | 8.33 (9.31) | .009 | 8.70 (9.23) | 8.80 (9.37) | .12 | 8.55 (9.25) | 8.17 (9.29) | .06 |
| Admission type, No. (%) | <.001 | .63 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 |
| Emergency | 7238 (83.1) | 9308 (73.1) | 4813 (82.6) | 2607 (80.4) | 2425 (84.1) | 6701 (70.6) | |
| Urgent | 1058 (12.1) | 1893 (14.87) | 708 (12.2) | 414 (12.8) | 350 (12.1) | 1479 (15.6) | |
| Elective | 350 (4.0) | 1403 (11.0) | 254 (4.4) | 188 (5.8) | 96 (3.3) | 1215 (12.8) | |
| Trauma center | 10 (0.1) | 34 (0.3) | 7 (0.1) | 7 (0.2) | 3 (0.1) | 27 (0.3) | |
| Unknown | 56 (0.6) | 98 (0.8) | 46 (0.8) | 26 (0.8) | 10 (0.4) | 70 (0.7) | |
| Discharge type, No. (%) | <.001 | .56 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 |
| Home | 5480 (82.9) | 7134 (56.0) | 3589 (61.6) | 1955 (60.3) | 1891 (65.6) | 5179 (54.6) | |
| Health care facility§ | 3213 (36.9) | 5548 (43.6) | 2228 (38.2) | 1283 (39.6) | 985 (34.2) | 4265 (44.9) | |
| Died | 5 (0.1) | 32 (0.3) | 3 (0.1) | 1 (0.03) | 2 (0.1) | 31 (0.3) | |
| Unknown/others | 14 (0.2) | 20 (0.2) | 8 (0.1) | 3 (0.1) | 6 (0.2) | 17 (0.2) | |
| Admitting physician specialty, No. (%) | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 |
| Gastroenterology | 27 (0.3) | 27 (0.2) | 14 (0.2) | 11 (0.3) | 13 (0.5) | 16 (0.2) | |
| Hospitalist services | 3533 (40.6) | 4569 (35.9) | 2316 (39.7) | 1196 (36.9) | 1217 (42.2) | 3373 (35.5) | |
| Infectious diseases | 41 (0.5) | 47 (0.4) | 30 (0.5) | 10 (0.3) | 11 (0.4) | 37 (0.4) | |
| Internal medicine | 13 (0.2) | 36 (0.3) | 9 (0.2) | 8 (0.3) | 4 (0.1) | 28 (0.3) | |
| Oncology | 76 (0.9) | 226 (1.8) | 49 (0.8) | 71 (2.2) | 27 (0.9) | 155 (0.2) | |
| Other | 5022 (57.6) | 7829 (61.5) | 3410 (58.5) | 1946 (60.0) | 1612 (55.9) | 5883 (61.8) | |

Abbreviations: AHRQ, Agency for Healthcare Research and Quality; CDI, Clostridioides difficile infection; ICD-10, International Classification of Diseases, Tenth Revision; ICU, intensive care unit; nrCDI, nonrecurrent CDI; rCDI, recurrent CDI.

*CDI diagnosis assessed using ICD-10 codes for rCDI (A04.71) and nrCDI (A04.72).

†Discordant coding defined as new CDI episode within 8 weeks after index CDI episode (rCDI) or after 8 weeks after index CDI episode (nrCDI).

‡Discordant coding defined as new CDI episode within 8 weeks after index CDI episode (nrCDI) or after 8 weeks after index CDI episode (rCDI).

§Hospice, skilled nursing facility, transferred.
update data cutoff period, an omission since rectified in the updated 2021 IDSA guidelines [7].

Approximately one-third of rCDI encounters and three-quarters of nrCDI encounters were coded discordant to the IDSA 8-week time window for identifying recurrence. The lower discordance observed for rCDI-coded patient encounters suggests that rCDI is more likely to be coded accurately compared with nrCDI. These findings highlight an opportunity for better documentation and coding and may indicate a need for further education/training [20]. However, resource utilization did not significantly differ by concordance status in descriptive analyses, suggesting that either the time window is not associated with severity of CDI or a more refined validation method is needed to verify hospitals’ coding accuracy. One possible explanation for these results may be that the PHD only has date information accurate to month and year to protect patients’ privacy, so the exact date of patient readmission is not known; thus, a second CDI episode may have occurred within the IDSA 8-week window but was classified as occurring later. Having the exact date of diagnosis would address this limitation. In addition, the 8-week window may not be an adequate threshold for differentiating recurrence from reinfection. A recent study found it difficult using this cutoff to distinguish between episodes of CDI caused by identical or different genotypes and to identify clinical characteristics that predicted recurrence [21]. The investigators found that a period of 20 weeks was a better cutoff for identifying rCDI episodes [21]. Lastly, while diagnoses made within the hospital and by a validated procedure were coded, other methods of diagnosis, such as clinical observation, may not have been; therefore, some cases of rCDI may have been coded as nrCDI.

In regression analyses, encounters for rCDI with ICU admission, longer hospital stays, and treatment with fidaxomicin or FMT were more likely to be coded concordantly. It is likely that the 8-week time window is more strictly observed when coding cases that are more severe. Patients with rCDI, those in the ICU or in the hospital for a longer period of time, and those treated with fidaxomicin or FMT tend to have more severe disease, which may have incentivized accurate and timely coding to ensure appropriate care. This finding is consistent with studies that evaluated the accuracy of ICD-10 coding in stroke and found that concordance was lower for mild

### Table 3. Health Care Resource Utilization and Costs Associated With rCDI and nrCDI

| Variables     | Overall (N=21,446) | nrCDI (n=9,070) | rCDI (n=12,376) |
|---------------|--------------------|----------------|-----------------|
|               | P Value            | P Value        | P Value         |
| Length of hospital stay, No. (%) |                    |                |                 |
| 1–2 d         | 1068 (12.3)        | 1918 (15.1)    | 714 (12.3)      | .55  |
| 3–7 d         | 4487 (51.3)        | 6130 (48.1)    | 2939 (50.4)     | .52  |
| >7 d          | 3177 (36.6)        | 4686 (36.8)    | 2175 (37.3)     | .50  |
| Overall median (interquartile range) | 6 [4–9]            | 6 [3–10]       | 6 [4–10]        | .57  |

**Table 3.**

**Variables**

- **Length of hospital stay, No. (%)**
- **Single agent**
  - FDX only
  - MTZ only
  - Oral VAN only
  - Combination regimens, No. (%)<.001
    - FDX and MTZ
    - Oral VAN and FDX
    - Oral VAN and MTZ
    - Adjunctive therapies, No. (%) 31 .62
- **Bezlotoxumab** 15 (0.2) 6 (0.2) 4 (0.04)
- **FMT** 206 (2.4) 140 (2.4) 66 (2.3) 23 (0.2)
- **Medical procedures** 633 (4.6) 634 (8.3) 88 (2.4) 220 (7.6) 201 (2.1)
- **Service and equipment** 83.62 88.85 166.44 1918 (15.1) 1020 (27.3) 1291 (44.8) 4952 (52.2)
- **Hospital services** 6572.97 6652.00 4686 (36.8) 573 (6.0)
- **Supply and equipment** 3730 (42.8) 2439 (41.9) 1644 (43.9) 1291 (44.8) 4952 (52.2)
- **Drugs** 3730 (42.8) 2439 (41.9) 1644 (43.9) 1291 (44.8) 4952 (52.2)
- **Diagnoses** 3730 (42.8) 2439 (41.9) 1644 (43.9) 1291 (44.8) 4952 (52.2)

**Abbreviations:** CDI, Clostridioides difficile infection; FDX, fidaxomicin; FMT, fecal microbiota transfer; IDSA, International Council of Diseases, Tenth Revision; MTZ, metronidazole; nrCDI, nonrecurrent CDI; rCDI, recurrent CDI; VAN, vancomycin.

**Concordant**<sup>a</sup> defined as new CDI episode within 8 weeks after index CDI episode (nrCDI) or after 8 weeks after index CDI episode (rCDI). Concordant<sup>b</sup> defined as new CDI episode within 8 weeks after index CDI episode (nrCDI) or after 8 weeks after index CDI episode (rCDI).

**Discordant**<sup>c</sup> defined as new CDI episode within 8 weeks after index CDI episode (nrCDI) or after 8 weeks after index CDI episode (rCDI).
Table 4. Regression of Concordance Status of ICD Coding on Clinical, Facility, and Provider Characteristics

| Variable                                      | OR (95% CI) | P Value |
|-----------------------------------------------|-------------|---------|
| ICD-10 code for CDI                          |             |         |
| Nonrecurrent                                  | Reference   |         |
| Recurrent                                     | 5.67 (5.32–6.03) | <.001  |
| Admission type                                |             |         |
| Elective                                      | Reference   |         |
| Emergency                                     | 1.69 (1.49–1.91) | <.001  |
| Urgent                                        | 1.42 (1.23–1.64) | <.001  |
| Trauma center                                 | 1.35 (0.68–2.68) | .40     |
| Unknown                                       | 2.21 (1.53–3.19) | <.001  |
| ICU admission                                 | 1.17 (1.07–1.27) | <.001  |
| Length of stay                                | 1.01 (1.00–1.01) | <.001  |
| Treatment                                     |             |         |
| Vancomycin                                    | 1.09 (1.00–1.19) | .06     |
| Fidaxomycin                                   | 1.11 (1.01–1.23) | .03     |
| Metronidazole                                 | 1.05 (0.99–1.12) | .13     |
| Bezlotoxumab                                  | 0.54 (0.22–1.36) | .19     |
| FMT                                           | 1.29 (1.17–1.42) | <.001  |

Abbreviations: CDI, Clostridioides difficile infection; FMT, fecal microbiota transfer; ICD-10, International Classification of Diseases, Tenth Revision; ICU, intensive care unit; OR, odds ratio.

Compared with more severe ischemic strokes [22, 23]. Coding tends to be more accurate when detailed and precise documentation is required, as is needed in cases of severe conditions [24, 25]. For example, in 1 study of patients with septic shock, greater accuracy of clinician documentation, and subsequently coding, was associated with more severe illness [24]. Another study found that coding was more accurate for major procedures than for most diagnoses [25].

The current study also found that having nonelective admission types was associated with an increased likelihood of concordant coding. Patients admitted to the hospital owing to an emergency are known to be at greater risk of CDI [26] and, therefore, may be specifically monitored, such that recurrences are detected in a timelier manner.

Study findings should be interpreted within the context of a number of limitations. Coding errors are possible in claims data, and some patients may have been misclassified [27, 28]. Also, given the retrospective nature of the study, it is possible that data for each encounter may not be complete and important confounders may be missing [29]. In addition, while all hospitals mandated implementation of the ICD-10 codes for CDI in October 2017, the current study did not assess how accurately the codes were implemented, as the database did not include the instructions provided for coding rCDI vs nrCDI, nor information regarding who was responsible for coding. Patients admitted to Premier hospitals could have been readmitted to hospitals not in the Premier network, which might have impacted calculations of overall rates of rCDI. However, this should have minimal impact on the current study given that its aim was to describe the usage of ICD-10 codes for CDI and not to evaluate the overall rates of rCDI.

As mentioned previously, admission date was listed only by month and year, which may have impacted coding concordance rates. In addition, the data set does not include details regarding specialty consults (eg, gastroenterology, infectious disease) placed by the admitting providers. The current findings were generated in the absence of these background factors. Lastly, CDI laboratory test results were not used to validate true rates of CDI in the current study because of challenges of doing so with Premier data.

In conclusion, study results offer some important considerations for stakeholders. Our findings suggest that there was no delay in transition to the updated CDI-related ICD-10 codes across hospitals in the PHD. Moreover, important for disease management, there was a trend toward drug treatments consistent with guideline recommendations for rCDI vs nrCDI, although progress is still needed. Lastly, coding concordance status based on the IDSA 8-week time window for identifying rCDI in descriptive analyses did not appear to affect morbidity or resource use.

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Patient consent. This study does not include factors necessitating patient consent.

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