Trends in Opioid-related Inpatient Stays Shifted After the US Transitioned to ICD-10-CM Diagnosis Coding in 2015

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Background: Trend analyses of opioid-related inpatient stays depend on the availability of comparable data over time. In October 2015, the US transitioned diagnosis coding from International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) to ICD-10-CM, increasing from ~14,000 to 68,000 codes. This study examines how trend analyses of inpatient stays involving opioid diagnoses were affected by the transition to ICD-10-CM.

Subjects: Data are from Healthcare Cost and Utilization Project State Inpatient Databases for 14 states in 2015–2016, representing 26% of acute care inpatient discharges in the US.

Study Design: We examined changes in the number of opioid-related stays before, during, and after the transition to ICD-10-CM using quarterly ICD-9-CM data from 2015 and quarterly ICD-10-CM data from the fourth quarter of 2015 and the first 3 quarters of 2016.

Results: Overall, stays involving any opioid-related diagnosis increased by 14.1% during the ICD transition—which was preceded by a much lower 5.0% average quarterly increase before the transition and followed by a 3.5% average increase after the transition. In stratified analysis, stays involving adverse effects of opioids in therapeutic use showed the largest increase (63.2%) during the transition, whereas stays involving abuse and poisoning diagnoses decreased by 21.1% and 12.4%, respectively.

Conclusions: The sharp increase in opioid-related stays overall during the transition to ICD-10-CM may indicate that the new classification system is capturing stays that were missed by ICD-9-CM data.

Estimates of stays involving other diagnoses may also be affected, and analysts should assess potential discontinuities in trends across the ICD transition.

Key Words: administrative data, hospitals, opioid disorders

The opioid epidemic in the US has placed increased burdens on the health care system, including the hospital sector. Between 2005 and 2014, the national rate of opioid-related inpatient stays increased by 64%,[1] and stays for serious infections associated with injection opioid use nearly doubled between 2002 and 2012.[2] Previous analyses to track the impact of the epidemic on hospital utilization have been based largely on diagnosis codes of the International Classification of Diseases (ICD). On October 1, 2015, the US transitioned diagnosis codes from the ICD, Ninth Revision, Clinical Modification (ICD-9-CM) to the Tenth Revision (ICD-10-CM), increasing from ~14,000 to 68,000 codes. Databases that include both ICD-9-CM and ICD-10-CM codes represent a new challenge for trend analyses of opioid-related stays, because discontinuities could emerge solely due to the change in classification systems, independent of true changes in the prevalence of conditions and use of care.

Guidance for working with databases that include both ICD-9-CM and ICD-10-CM codes can be gleaned from previous ICD transitions in other countries. In a study covering 5 ICD revisions in 6 European countries, Janssen[3] recommended grouping individual codes from the different systems into broad, aggregated classes that are clinically meaningful. Aggregation is likely to reduce the impact of discontinuities in individual codes on trend estimates, especially when coding within the broader classes is relatively stable over time.[4,5] In the current study, we aggregated opioid diagnosis codes from the ICD-9-CM and ICD-10-CM systems into the following 5 broad categories: opioid abuse, dependence, adverse effects, poisoning, and a new category of "unspecified use" diagnoses that was introduced with ICD-10-CM. Results were also aggregated into an overall group of stays that included any opioid-related diagnosis. Using inpatient data from 14 states for all quarters of 2015 and 3 quarters of 2016, we produced trends for these diagnosis categories to assess the degree to which the ICD transition in the fourth quarter of 2015 affected estimates of opioid-related stays.

METHODS

This analysis is based on 2015–2016 data from Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases[6] for 14 states, representing ~26% of acute care hospital discharges in the US. Opioid-related stays were identified by principal and secondary ICD-9-CM and ICD-10-CM codes for diagnoses involving opium, methadone, heroin, opiates and related narcotics, and opiate antagonists. Codes from the 2 systems were classified into the following 5 broad types: abuse, dependence, adverse effects, poisoning, and a new category of "unspecified opioid use" diagnoses that was introduced with ICD-10-CM (see Appendix A, Supplemental Digital Content 1, http://links.lww.com/MLR/B468, for a list of ICD-9 and ICD-10 codes used in this analysis).

Statistical Analysis

We examined changes in the number of opioid-related stays before, during, and after the transition to ICD-10-CM (hereafter referred to as the "ICD transition"). Quarterly ICD-9-CM data from the first 3 quarters (Q1–Q3) of 2015 were analyzed with quarterly ICD-10-CM data from the fourth quarter (Q4) of 2015 and Q1–Q3 of 2016. The number of opioid-related stays was calculated for each quarter in 3 periods: before the ICD transition (Q1–Q3, 2015), during the ICD transition (Q4, 2015), and after the ICD transition (Q1–Q3, 2016). The percentage change in stays during the transition was calculated as the difference between 2015 Q3 and Q4 estimates, divided by the 2015 Q3 estimate. The average quarterly percentage change in the 3 quarters before the ICD transition, and in the 3 quarters after the transition, was calculated as:

$$\text{Average quarterly percentage change}$$
$$= \left[\left(\frac{\text{End value}}{\text{Beginning value}} \right)^{\frac{1}{\text{change in quarters}}} - 1 \right] \times 100.$$

In the period before the ICD transition, the beginning and end values in this equation are, respectively, the number of stays in Q1 and Q3 of 2015. After the transition, the beginning and end values are, respectively, the number of stays in Q1 and Q3 of 2016. For both of these periods, the value for "change in quarters" is 2, which indicates the time difference in quarters between the beginning and end values.

Results were examined by the 5 types of diagnoses and by an overall group of stays that included any opioid-related diagnosis. We stratified trends by patient age group (0–24, 25–44, 45–64, and 65+), and also present results for all ages combined. For each trend (overall and diagnosis specific and age specific), 2-sided χ^2 tests with an unequal variance assumption were used to test for differences in the rate of change between pairs of time periods. The trend before the ICD transition was compared with the trend during the ICD transition. The trend before the ICD transition also was compared with the trend after the ICD transition. To adjust for the number of statistical tests performed, we use a *P*-value of 0.002 as the significance level (exact *P*-values for all tests are provided in Appendix B, Supplemental Digital Content 2, http://links.lww.com/MLR/B469). We created figures displaying quarterly counts for stays with each type of diagnosis before, during, and after the ICD transition. The figures include a vertical line indicating the October 1, 2015 transition date and dotted lines indicating changes in the number of stays over the fourth quarter of 2015. When analyzing results by type of diagnosis, counts were reported as the number of stays. If a given stay had > 1 type of diagnosis code, that stay was included in the count for each type of diagnosis. (~6% of stays in each quarter of the study period had more than one type of diagnosis).

RESULTS

Changes in the number of opioid-related stays before, during, and after the ICD transition are shown in Figures 1–5. For each diagnosis type overall and stratified by age group, results from the significance tests suggest that the changes in the number of stays during the ICD transition were different from the trends before the ICD transition, with 20 of the 25 overall and age-specific comparisons being significant at the *P* < 0.002 level. By contrast, 3 of the 25 comparisons of the trends before and after the ICD transition period were significant at the *P* < 0.002 level (see Appendix B for the results from all statistical tests, Supplemental Digital Content 2, http://links.lww.com/MLR/B469).

Opioid Diagnoses Overall

During the ICD transition, the number of stays with any opioid diagnosis increased by 14.1% (an increase of 7514 stays), which was preceded by a much lower 5.0% average quarterly increase before the transition and followed by a 3.5% average increase after the transition (Fig. 1). Starting in the fourth quarter of 2015, this overall opioid diagnosis category included 14 "opioid use, unspecified" codes from ICD-10-CM, a new subset of codes that have no equivalent in ICD-9-CM. In the fourth quarter of 2015, there were 4041 stays with an unspecified opioid use diagnosis, accounting for 53.8% of the overall increase in all types of opioid-related stays during the ICD transition.

Abuse Diagnoses

Among all patients, the number of abuse-related stays decreased by 21.1% during the ICD transition, as contrasted with an 8.6% average quarterly increase before and a 6.3% average quarterly increase after the transition (Fig. 2). The decrease during the transition was greatest among patients aged 0–24, at 23.8%—which was preceded by a 5.9% average quarterly increase and followed by a 0.5% average quarterly increase.

Dependence Diagnoses

There was a 5.6% increase in stays involving opioid dependence during the ICD transition among patients of all ages (Fig. 3). In addition, there were substantial differences in the size of the change by age. Among patients aged 65 and over, the number of stays with dependence diagnoses increased by 35.8%—which was preceded by a 0.1% average quarterly increase and followed by a 5.1% average quarterly increase after the transition.

Adverse Effects Diagnoses

Of the 5 major types of opioid-related stays, those involving adverse effects showed the largest increase among all patients during the ICD transition, at 63.2% (Fig. 4). Broken down by age group, the increase in the number of these stays during the transition was highest for patients aged 45–64, at 69.5%—which was preceded by a 4.0% average quarterly
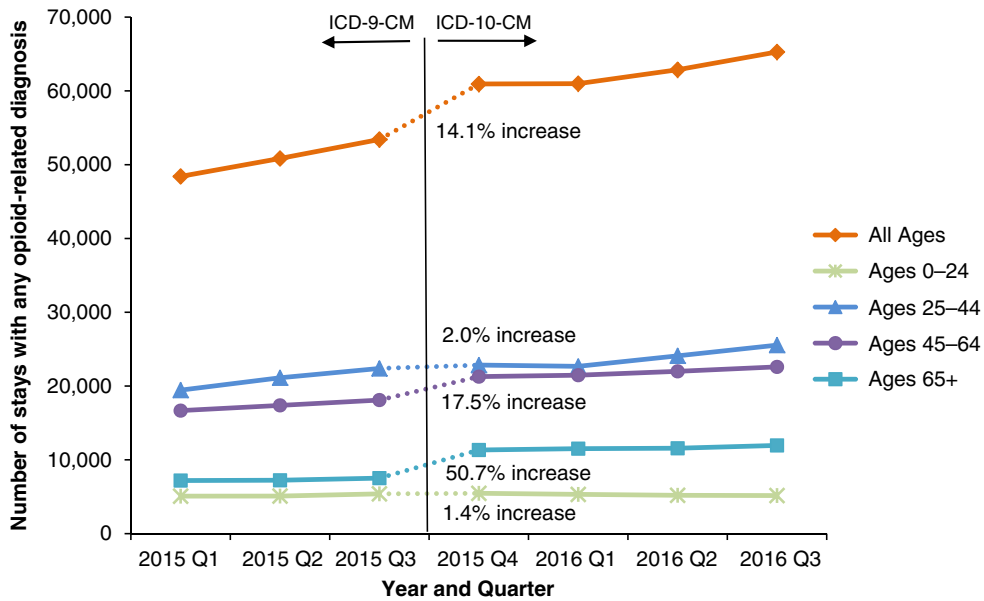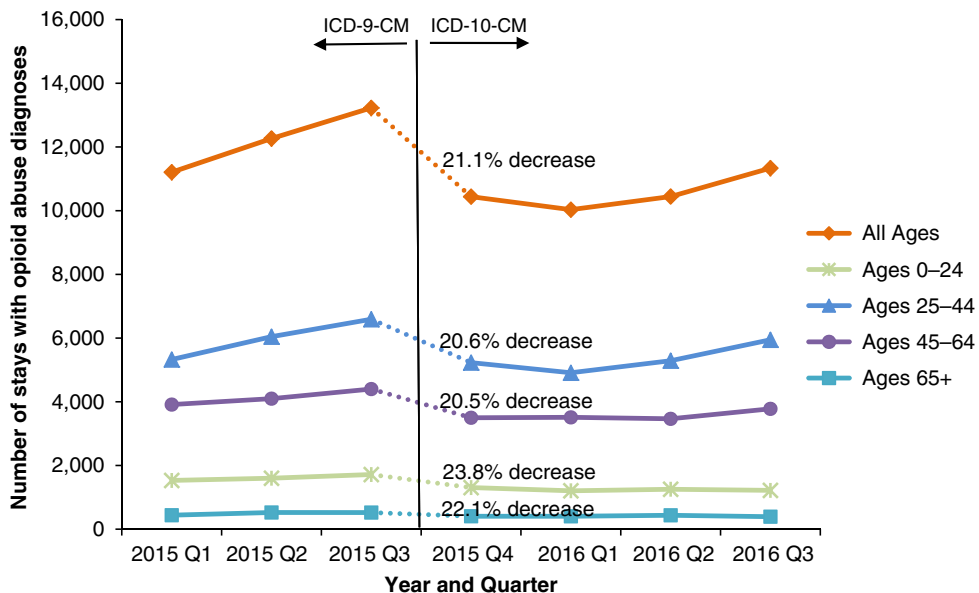
FIGURE 1. Inpatient stays with any opioid-related diagnosis by patient age, 2015 quarter 1 through 2016 quarter 3. *Source*: Agency for Healthcare Research and Quality, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project State Inpatient Databases for 14 states, 2015–2016. Percentage change labels within the graph refer to changes in the number of stays over the ICD transition period (2015 Q3–2015 Q4).

increase and followed by a 1.7% average quarterly increase after the transition.

Poisoning Diagnoses

Opioid poisoning diagnoses decreased by 12.4% during the ICD transition among all patients (Fig. 5), with the largest decrease among patients aged 0–24 years (27.7%). In contrast to the decreases among all other age groups, patients aged 65 and older showed an increase of 22.0% in poisoning-related stays during the transition, with a 0.2% average quarterly increase before and a 1.1% average quarterly increase after the transition.

FIGURE 2. Inpatient stays with opioid abuse diagnoses by patient age, 2015 quarter 1 through 2016 quarter 3. *Source*: Agency for Healthcare Research and Quality, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project State Inpatient Databases for 14 states, 2015–2016. Percentage change labels within the graph refer to changes in the number of stays over the ICD transition period (2015 Q3–2015 Q4).
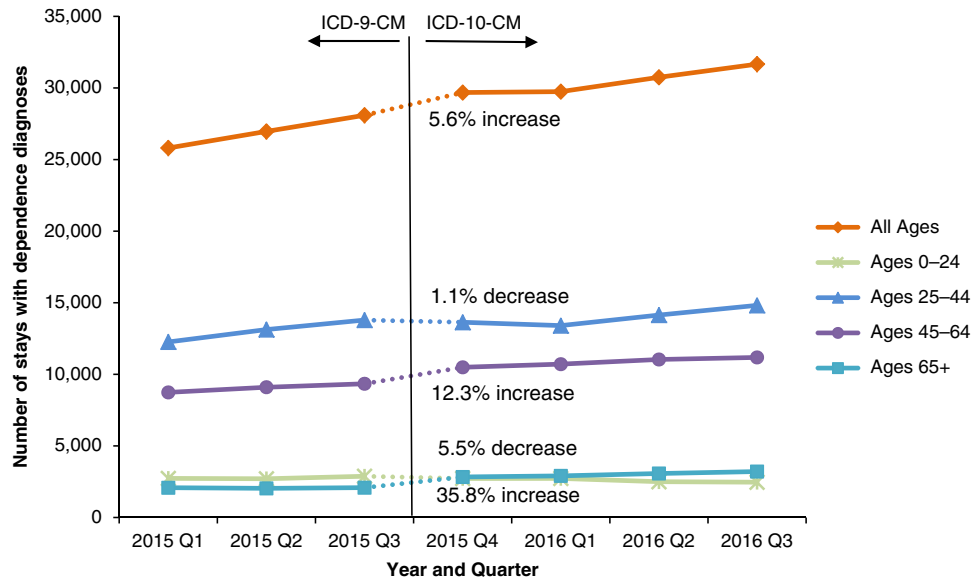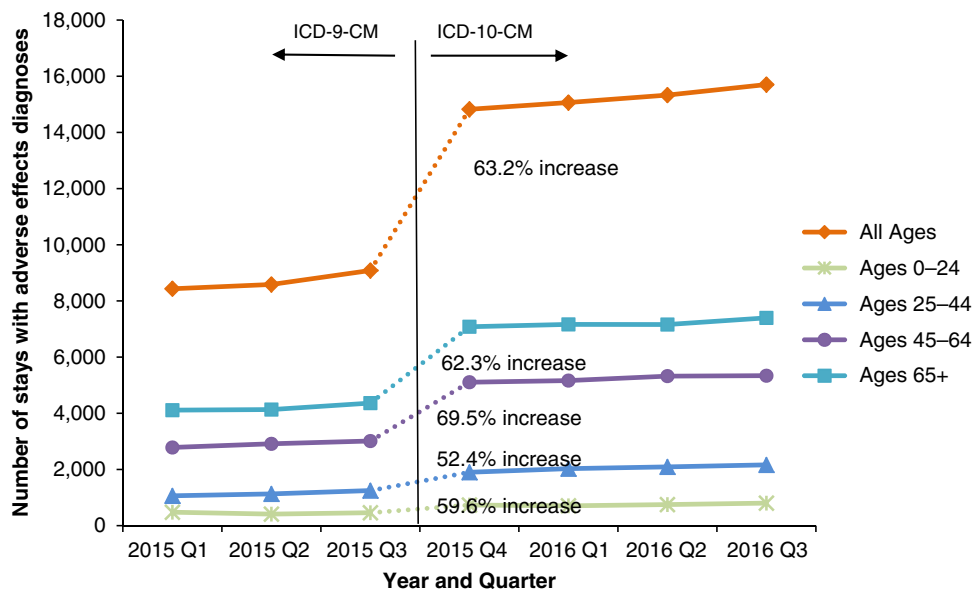
FIGURE 3. Inpatient stays with opioid dependence diagnoses by patient age, 2015 quarter 1 through 2016 quarter 3. *Source*: Agency for Healthcare Research and Quality, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project State Inpatient Databases for 14 states, 2015–2016. Percentage change labels within the graph refer to changes in the number of stays over the ICD transition period (2015 Q3–2015 Q4).

CONCLUSIONS

The current analysis shows that trends in stays involving opioid-related diagnoses shifted markedly during the transition to ICD-10-CM diagnosis coding in October 2015. Even after aggregating individual ICD codes into broad diagnosis types, we identified shifts in the number of stays during the ICD transition that appear attributable largely to the coding change rather than true changes in the prevalence of opioid-related conditions. During the ICD transition in the fourth quarter of 2015, there were 7514 more opioid-related stays overall (all diagnosis types and all ages combined) than there were in the third quarter of 2015 (60,936 vs. 53,422); of these additional 7514 stays in the fourth quarter, 4041 (53.8%) included one of the new ICD-10 "unspecified use" codes. These results may indicate that the new classification system is more sensitive for identifying opioid-related conditions, with these "unspecified

FIGURE 4. Inpatient stays with opioid adverse effects diagnoses by patient age, 2015 quarter 1 through 2016 quarter 3. *Source*: Agency for Healthcare Research and Quality, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project State Inpatient Databases for 14 states, 2015–2016. Percentage change labels within the graph refer to changes in the number of stays over the ICD transition period (2015 Q3–2015 Q4).
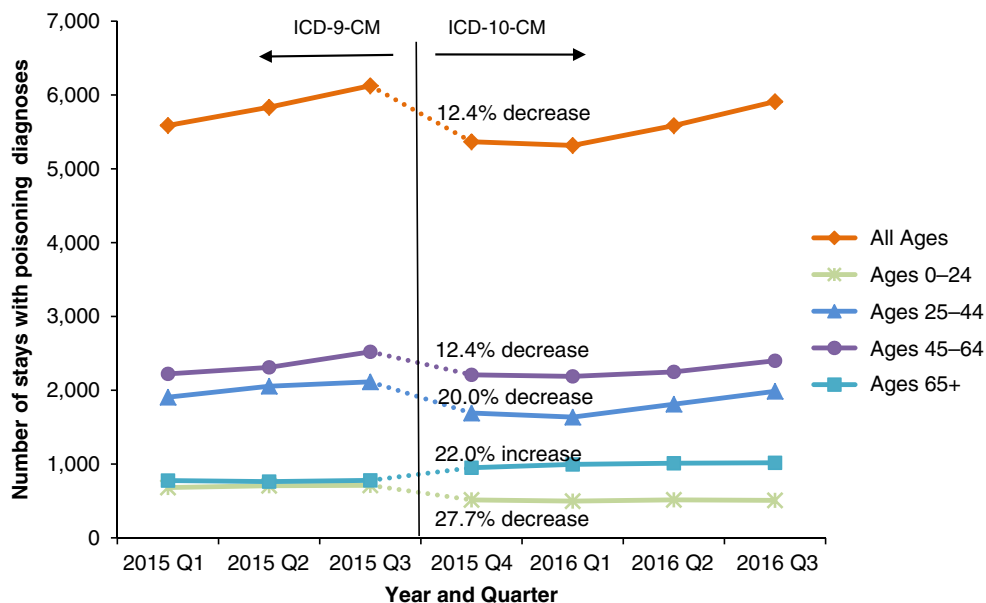
FIGURE 5. Inpatient stays with opioid poisoning diagnoses by patient age, 2015 quarter 1 through 2016 quarter 3. *Source*: Agency for Healthcare Research and Quality, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project State Inpatient Databases for 14 states, 2015–2016. Percentage change labels within the graph refer to changes in the number of stays over the ICD transition period (2015 Q3–2015 Q4).

use" codes capturing stays that were not included in estimates based on data collected before October 2015. It is possible that hospital claims coders are more likely to use these general ICD-10 "unspecified use" codes, because they are able to indicate that a given patient had an opioid diagnosis without having more specific diagnostic information from the medical record.

Differences in the magnitude of the shifts by diagnosis type and age group during the ICD transition have implications for monitoring the impact of current federal and state efforts to reduce the epidemic.[7,8] For example, 40 states have Good Samaritan laws that legally protect individuals who seek emergency assistance for someone experiencing opioid overdose (ie poisoning).[8] Analysts who do not examine their data for any unusual shifts in opioid poisonings during the ICD transition may draw misleading conclusions about the effects of such policies on poisoning-related stays. In the current study, stays for patients aged 65 and older showed the greatest shift during the ICD transition for all diagnoses combined. Concerns about the misuse of opioids among Medicare beneficiaries[9] underscore the importance of monitoring opioid-related stays for patients aged 65 and older; the age-specific differences in trend shifts that we identified indicate that analyses of opioid-related stays spanning the fourth quarter of 2015 for this population subgroup need to be conducted carefully.

Given the discontinuities in trends by diagnosis type and patient age, we recommend that trend analyses of opioid-related stays present quarterly data in ways that highlight the ICD transition. This approach is illustrated in Figures 1–5 of this report, with a vertical line indicating the October 1, 2015 transition date and dotted lines indicating changes in the number of stays over the fourth quarter of 2015. The HCUP Fast Stats

online tool[10] also includes figures that visually separate information on trend lines crossing over the 2 classification systems, an approach that is advisable for trend analyses of other clinical conditions beyond opioid use disorders. Depending on the requirements of the analysis, researchers may opt not to combine data on stays before and after the ICD transition in the same analysis, but rather report results separately. In any case, researchers should carefully review the codes they are using to define their study samples and examine the frequencies of individual codes under each system. The Agency for Healthcare Research and Quality has established a webpage on ICD-10 coding with frequent updates for researchers using HCUP and other administrative databases.[11] In the next several years, as modifications to the ICD-10-CM diagnostic codes are released and clinicians and researchers become increasingly familiar with the new codes, continued monitoring of trends for any further shifts in estimates will be necessary.

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