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HEALTHCARE COST AND UTILIZATION PROJECT

HCUP Methods Series

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EXECUTIVE SUMMARY

Since 2009, the Healthcare Cost and Utilization Project (HCUP) Nationwide Emergency Department Sample (NEDS)—a national database providing estimates of hospital-owned emergency department (ED) visits that is sponsored by the Agency for Healthcare Research and Quality (AHRQ)—has supported numerous research initiatives. Because of its uniform multistate and all-payer platform, the NEDS can be used as a resource for studies focusing on the quality and effectiveness of ED care, the use of and associated charges for ED services, the impact of health policy changes, and analyses targeting specific clinical or demographic populations. The NEDS was designed almost 10 years ago. AHRQ requested an assessment of the original design to determine whether redesigning the database would lead to improved national estimates of ED utilization and care. The request followed the redesign of the 2012 National Inpatient Sample (NIS), which served as a main motivator behind the NEDS assessment. In fact, a number of key design changes implemented with the 2012 NIS were considered in the redesign of the NEDS. This report discusses considerations for a redesign, evaluates the possible changes, summarizes comparative analyses of the alternative designs to external data sources, and offers recommendations for redesigning the NEDS.

The Nationwide Emergency Department Sample (NEDS)

The NEDS is built using a 20 percent stratified sample of hospital-owned EDs in the United States. The target universe is defined as EDs in community, nonrehabilitation hospitals that report total ED visits to the American Hospital Association (AHA).[1] The sampling frame of the NEDS is limited to a subset of the target universe: hospital-owned EDs in the States for which HCUP ED data are available in the State Emergency Department Databases (SEDD) and State Inpatient Databases (SID). The SEDD include encounter-level information on ED visits that do not result in an admission to the same hospital (e.g., records on patients treated and released, transferred to another hospital, or died in the ED). The SID include discharge-level information on hospital inpatient stays, including patients treated in the ED prior to admission.

The NEDS contains ED visits from the SEDD and ED admissions from the SID for the selected sample of hospital-owned EDs. Hospital characteristics used for sample stratification include U.S. Census region, trauma center designation, urban-rural location of the hospital, ownership, and teaching status. Hospital- and ED visit-level weights for national estimates are calculated after sampling and by strata.

Possible Design Changes

To identify possible alternative designs for the NEDS, Truven Health Analytics conducted the following activities:

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[1] The AHA defines community hospitals as "nonfederal, short-term general, and special hospitals, including special children's hospitals, whose facilities and services are available to the public." https://www.ahadataviewer.com/glossary/. Accessed December 1, 2016.

- Environmental scan of the abstracts from 121 peer-reviewed publications that used the NEDS for analyses and examination of questions from external users that were received through HCUP technical assistance services

- Review of design changes that occurred with the 2012 NIS

- Collection of additional ideas for possible design changes and enhancements to the NEDS based on HCUP-sponsored research.

Information gathered through these activities identified possible changes to the NEDS design (Table ES-1).

Table ES-1. Changes Considered to the Design of the NEDS

NEDS Design Component	Considered Design Change	Current NED Design and Reason for Considering Change
Target Universe	Evaluate the types of hospital-owned EDs used to define the target universe	The target universe for the NEDS includes EDs in community hospitals, excluding community hospitals that also were rehabilitation facilities. The redesigned NIS added the exclusion of LTAC community hospitals from the target universe.
	Calculate total ED visits for the target universe using HCUP data, when available	The target universe for the NEDS uses ED visit counts as reported in the AHA Annual Survey Database™. The redesigned NIS changed to using counts of inpatient stays from HCUP data, when available, and AHA counts only for hospitals not included in HCUP data.
Sampling Strategy	Stratify by the nine Census divisions	The NEDS is stratified by four Census regions. The redesigned NIS changed from using the four regions to the nine Census divisions.
	Draw a sample of ED visits from all EDs in HCUP data	The NEDS includes all ED visits from a sample of EDs. The redesigned NIS changed from a sample of hospitals to a sample of discharges.
	Consider other publicly available sources for the identification of trauma hospitals	The NEDS uses the TIEP data to identify the trauma level of most trauma hospitals in the United States. These data are augmented by an Internet search of stand-alone children's trauma hospitals in the United States. It would be helpful to be able to obtain all the information from one source.
	Examine whether additional stratifiers would be beneficial for sampling	The NEDS includes five stratifiers based on various characteristics: U.S. Census region, trauma-level designation, teaching status, urban-rural location, and ownership. There may be other hospital characteristics that were not available (or considered) in the original design. In addition, there may be patient characteristics that would be beneficial.

NEDS Design Component	Considered Design Change	Current NED Design and Reason for Considering Change
	Eliminate the restriction that removes hospital-owned EDs that are unique in a State from the sampling frame	EDs are removed from the NEDS sampling frame if they are "unique" in the State to ease any concern by the HCUP Partner organizations about their possible identification. *Unique* is defined as the only ED in a NEDS stratum for the State. The NEDS does not include data elements that identify the State, county, or hospital, so exclusion of these hospitals may not be necessary.
	Examine options for reducing the need to collapse strata across trauma level to obtain at least two EDs in each stratum	To protect the identity of EDs in the NEDS, strata are combined if there are less than two EDs in a stratum in the target universe or frame. This results in strata that include EDs with differing trauma levels (e.g., trauma levels I and II). To facilitate research by trauma centers, it would be better not to collapse across trauma levels.
	Increase the sampling rate	The NEDS is a 20 percent sample of EDs in the United States. Increasing the sample size would increase the power to detect small differences for rare conditions.
Identification of hospital entities	Use the Partner-provided hospital identifiers in lieu of the AHA hospital identifiers	The NEDS uses AHA data to identify hospital-owned EDs. According to the NIS redesign report, about 10 percent of the AHA hospital identifiers correspond to two or more facilities as identified by the HCUP Partner. These facilities have common ownership within a hospital system, so the AHA considers them to be one hospital. The redesigned NIS changed to using the Partner-provided hospital identifiers.

Abbreviations: AHA, American Hospital Association; ED, emergency department; HCUP, Healthcare Cost and Utilization Project, LTAC, long-term acute care; NEDS, Nationwide Emergency Department Sample; NIS, National Inpatient Sample; TIEP, Trauma Information Exchange Program.

Possible Enhancements to the NEDS

Information gathered from the environmental scan, the review of the NIS redesign, and HCUP-sponsored research using the NEDS provided valuable insight into its limitations. The following were considered as possible enhancements to the NEDS that do not affect the design:

- Add a data element that indicates patients less than one month old. A similar data element was added to the redesigned NIS.

- Add information on patient race/ethnicity.

- Consider adding data elements that provide information on daily activity in the ED (e.g., fluctuations in the volume of ED visits and ED admission rates).[2]

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[2] ED admission rate refers to the percentage of ED visits that result in an inpatient admission to the same hospital.

- Release NEDS-specific Cost-to-Charge Ratio Files (CCR Files).

Alternative Designs for the NEDS

After our assessment of possible design changes, we developed five alternative NEDS designs using 2013 data and compared them to the 2013 NEDS as well as to various external data sources containing estimates of ED visits. The five alternative designs included one or more of the following three sampling changes:

- **Use eight Census divisions** instead of four Census regions for stratification. Because there was only one State in the West South Central division, it was combined with the East South Central division for a total of eight divisions. All other divisions included at least two States that contribute ED data to HCUP.

- **Revise the definition of the target universe** (1) to include EDs that are part of general, medical/surgical hospitals instead of community, nonrehabilitation hospitals and (2) to define universe total counts for ED visits using HCUP data, when available, instead of AHA data.

- **Retain EDs that are unique in a stratum for a State** in the sampling frame rather than excluding them.

Evaluation of Alternative NEDS Designs

The evaluation included the following four phases:

- Phase 1 – compare the weighted estimates from the alternative designs to the 2013 NEDS design for the outcomes of interest: total number of ED visits by Clinical Classifications Software (CCS) categories, ED admission rate by CCS category, average total charges of ED visits by CCS category, and injury-related ED visits

- Phase 2 – determine whether fewer strata needed to be collapsed in the alternative designs than in the current NEDS design

- Phase 3 – examine whether there is less variation in hospital- and ED visit-level weights in the alternative designs than in the current NEDS design

- Phase 4 – investigate whether estimates of ED utilization from the alternative designs are more similar to external data sources than the current NEDS design.

It should be noted that only one version of each alternative design was created for evaluation, and the 2013 NEDS and external data sources were used for comparison.

Phase 1 demonstrated that there were relatively few differences in the estimates between the NEDS and all the alternative designs. The differences tended to be for estimates specific to pediatric patients (aged 0–17 years) and to patients aged 65 years and older for conditions with either a small sample size or no cases in one of the designs. Most of the differences were for comparisons of average total charges; there were no differences when comparing injury-related estimates.

Phase 2 demonstrated that retaining EDs that were unique in a stratum for a State in the sampling frame improved the 2013 NEDS sample in the South by reducing the number of strata that needed to be collapsed to retain at least two hospitals in each stratum and by reducing the number of strata in the South with an insufficient number of EDs required for a 20 percent sample. No other regions were affected by this change. In contrast, stratifying by Census division instead of region increased the number of collapsed strata from 15 to 26 and increased the number of stratum with an insufficient number of EDs required for a 20 percent sample from 6 to 15 strata. Changing the definition of the target universe did not affect the collapsing of strata.

Phase 3 demonstrated that the distributions of the hospital-level weights were very similar between the 2013 NEDS and the five alternative designs, with the exception of the highest percentiles. Retaining EDs that were unique in a stratum for a State had the smallest maximum hospital-level weight of 8.3, whereas the other designs all had a maximum hospital-level weight of about 18.0. The distributions of the ED visit-level weights also were similar, with the exception of the highest percentiles. Retaining EDs that were unique in a stratum for a State had the smallest maximum ED visit-level weight of 11.6, whereas the other designs all had maximum ED visit-level weights ranging from 18.0 to 24.1.

Phase 4 demonstrated that estimates from (1) the alternative design that retained EDs that were unique in a stratum for a State in the sampling frame and (2) the alternative design that included all three sampling changes both generated estimates of ED utilization that were comparable to 2013 estimates from external data sources. External benchmarks included the annual number of ED visits reported in the AHA Annual Survey Database and the National Emergency Department Inventory, injury-related ED visits reported by the National Electronic Injury Surveillance System All-Injury Program, and visits to health care providers for influenza-like illness from the Centers for Disease Control and Prevention.

Recommendations for Redesigning the NEDS

Collective results from the Phase 1 through Phase 4 evaluations demonstrated that retaining EDs that were unique in a stratum for a State in the sampling frame accomplished three things: (1) it reduced the number of strata in the South that needed to be collapsed to retain at least two hospitals in each stratum; (2) it reduced the number of strata with an insufficient number of EDs required for a 20 percent sample; and (3) it minimized the range of values of the hospital- and ED visit-level weights. Estimates of ED utilization with this one design change were similar to the 2013 NEDS and to the external data sources.

The final recommendation is to pursue retaining EDs that are unique in a stratum for a State beginning with the 2015 NEDS. To increase the research value of the NEDS, the team also recommends pursuing the release of additional data elements (e.g., indicator of neonatal age and patient race/ethnicity) and the creation of CCR Files.

For future NEDS (after data year 2015), we recommend the recruitment of ED data from additional HCUP Partner organizations. When there are sufficient HCUP ED data in all Census

divisions, changing the sampling strategy from region to division and focusing the target universe to EDs in general medical/surgical hospitals should be re-evaluated.

INTRODUCTION

Background on the Nationwide Emergency Department Sample

Since 2009, the Healthcare Cost and Utilization Project (HCUP) Nationwide Emergency Department Sample (NEDS)—a national database providing estimates of hospital-owned emergency department (ED) visits that is sponsored by the Agency for Healthcare Research and Quality (AHRQ)—has supported numerous research initiatives. Because of its uniform multistate and all-payer platform, the NEDS can be used as a resource for studies focusing on the quality and effectiveness of ED care, the use of and associated charges for ED services, the impact of health policy changes, and analyses targeting specific clinical or demographic populations.

The NEDS is built using a 20 percent stratified sample of hospital-owned EDs in the United States. The target universe of hospital-owned EDs is defined as community, nonrehabilitation hospitals that reported total ED visits to the American Hospital Association (AHA) for that year. The AHA defines community hospitals as "all nonfederal, short-term, general, and other specialty hospitals, whose facilities and services are available to the public." Included among community hospitals are pediatric institutions, public hospitals, and academic medical centers.

The main objective of a stratified sample is to ensure that it is representative of the target universe. By stratifying on important hospital characteristics, the NEDS represents a "microcosm" of EDs in the United States. For example, by including *trauma center designation* in the sampling strategy, the NEDS has the same percentage of trauma hospitals as the entire United States.

The sampling frame of the NEDS is limited to a subset of the target universe: hospital-owned EDs in the States for which HCUP ED data are available from the State Emergency Department Databases (SEDD) and State Inpatient Databases (SID). The NEDS contains ED visits from the SEDD and ED admissions from the SID for the selected sample of hospital-owned EDs. The hospital characteristics that have been used for sample stratification are U.S. Census region, trauma center designation, urban-rural location of the hospital, ownership, and teaching status. To obtain nationwide estimates, weights are developed using the AHA-identified EDs and reported ED visits as the target universe. Different weights are developed separately for analyses of hospital-owned EDs and ED visits. Hospital-level weights are used to extrapolate NEDS sample EDs to the universe of hospital-owned EDs. Similarly, visit-level weights are used to extrapolate NEDS sample ED visits to the universe of ED visits. Hospital-level and ED visit-level weights for national estimates are calculated after sampling and by strata.

HCUP State Emergency Department Databases (SEDD)

The SEDD include encounter-level information on ED visits that do not result in an admission to the same hospital (e.g., records on patients treated and released, transferred to another hospital, or died in the ED). Currently, 35 HCUP Partner organizations provide ED data to HCUP.

HCUP State Inpatient Databases (SID)

The SID include discharge-level information on hospital inpatient stays. All 48 HCUP Partner organizations provide inpatient data to HCUP, encompassing 97 percent of all U.S. community hospital discharges. The SID include records for patients initially seen in the ED who are subsequently admitted to the same hospital (i.e., ED admissions).

Identification of Emergency Department Admissions

Selection of ED admissions from the SID is based on evidence of ED services reported on the record. The HCUP criterion for identifying an ED admission in the SID (HCUP data element HCUP_ED[3]) looks for at least one of the following conditions:

- Revenue center code of 450-459 reported on discharge record, indicating ED services.

- ED charge greater than zero dollars, when revenue center codes were not available.

- Physicians' Current Procedural Terminology (CPT®) code of 99281–99285 reported on discharge record, indicating ED physician services.

- ED identified by admission source (National Uniform Billing Committee [NUBC] preferred coding prior to October 1, 2007), point of origin (NUBC preferred coding from October 1, 2007 through June 30, 2010), or condition code of P7 (NUBC preferred coding for public reporting as of July 1, 2010).

The NEDS contains ED visits from the SEDD and ED admissions from the SID for the selected sample of hospital-owned EDs. Users of the NEDS are able to identify the source of the HCUP record (SEDD or SID) with the NEDS-specific data element HCUPFILE.[4]

Why Redesign the NEDS?

The NEDS was designed almost 10 years ago. AHRQ requested an assessment of the original NEDS design to determine whether redesigning the database would lead to improved national estimates of ED utilization and care. The request followed the redesign of the 2012 National Inpatient Sample (NIS), which served as a main motivator behind the NEDS assessment. In fact, a number of key design changes implemented with the 2012 NIS were considered in the redesign of the NEDS.

This report documents the following components of the evaluation:

- Identify possible changes to the design of the NEDS

- Evaluate possible design changes

- Propose alternative designs

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[3] See Healthcare Cost and Utilization Project (HCUP) Central Distributor SID, Description of Data Elements. HCUP_ED – HCUP Indicator of Emergency Department Record. August 2008. http://www.hcup-us.ahrq.gov/db/vars/siddistnote.jsp?var=hcup_ed

[4] See Healthcare Cost and Utilization Project (HCUP) NEDS Description of Data Elements. HCUPFILE – Source of HCUP Record (SID or SEDD). May 2015. http://www.hcup-us.ahrq.gov/db/vars/hcupfile/nedsnote.jsp

- Compare the proposed alternative designs to the 2013 NEDS.

The report concludes with recommendations for future changes to the NEDS design.

DATA

In addition to the NEDS, the Truven Health Analytics team used the following five data sources for analyses: a multistate analysis file of ED records from the SEDD and SID, the AHA Annual Survey Database, the National Emergency Department Inventory (NEDI), the National Electronic Injury Surveillance System All-Injury Program (NEISS-AIP), and influenza-like illness estimates from the Centers for Disease Control and Prevention (CDC).

Multistate Emergency Department Analysis File

A multistate emergency department (MS-ED) internal analysis file was constructed for each year 2006–2013 by combining ED records from all available SEDD with ED admissions from the SID. The MS-ED analysis files serve as the basis for the NEDS sampling frame.

We used the MS-ED analysis file for 2013 in the early stages of our assessment when identifying potential design changes. The analysis files were particularly useful in the consideration of switching the design from a *sample of EDs* to a *sample of ED visits*—a design change implemented with the 2012 NIS. The MS-ED analysis files were used to examine variation in the number of ED visits from 2006–2013 that were affected by the sampling of EDs.

American Hospital Association Annual Survey Database

The AHA Annual Survey Databases include utilization, financial, service, and personnel information on each of the nation's hospitals. The survey's overall response rate averages approximately 85 percent each year. For hospitals that do not respond, the AHA imputes items based on prior-year information, so that data are available for all hospitals. AHA data are released every year.

The AHA data are used to define the target universe for the NEDS. In addition, the AHA data serve as a standard comparison for the NEDS for estimates on the total number of ED visit counts in the U.S., the total number and percentage of ED visits by U.S. geographic region, and the total number of hospital-owned ED's by ED visit volume.

The 2013 AHA data were critical in the early stages of our assessment when identifying potential design changes, such as limiting the types of hospitals included in the target universe. The AHA data also were used in the latter stages of the evaluation when comparing the alternative designs to external data sources of ED utilization.

National Emergency Department Inventory

The Emergency Medicine Network's (EMNet) National Emergency Department Inventory (NEDI) is an inventory of U.S. ED locations and annual ED visit volume that integrates information from the AHA Annual Survey Database, the Hospital Market Profiling Solution©, Internet searches, and direct communication with hospital staff. The NEDI typically is available every other year.

The NEDI serves as a standard comparison with the NEDS for estimates on the total number of ED visit counts in the United States, the total number and percentage of ED visits by U.S. geographic region, and the total number of hospital-owned EDs by ED visit volume.

For the purposes of this analysis, the 2013 NEDI was used in the early stages of our assessment when identifying potential design changes, such as the consideration of using the NEDI as the primary source to determine total counts of ED visits by stratum. The NEDI data also were used in the latter stages of the evaluation when comparing the alternative designs to external data sources of ED utilization.

National Electronic Injury Surveillance System All-Injury Program

The National Electronic Injury Surveillance System All-Injury Program (NEISS-AIP) is a national probability sample providing counts of injuries seen in the ED. The NEISS-AIP is sponsored by the National Center for Injury Prevention and Control (NCIPC) and the U.S. Consumer Product Safety Commission (CPSC). The NEISS-AIP data serve as a standard comparison with the NEDS for estimates on the injury-related ED visits in the United States. The categorization of the mechanism and intent of the injury is consistent with the classification system used by the CDC.[5] THE NEISS-AIP reports on injuries annually.

The 2013 NEISS-AIP data were used for this evaluation as a point of comparison for alternative designs of the NEDS related to counts of ED visits for various kinds of injury.

Centers for Disease Control and Prevention Influenza-Like Illness Data

Information on influenza-like illness (ILI) was collected from the U.S. Outpatient Influenza-Like Illness Surveillance Network (ILINet). ILINet is a collaborative effort between the CDC, State and local health departments, and health care providers. Data collection began during the 1997–1998 season. The number and percentage of patients presenting with ILI on a weekly basis in 2013 served as a comparison for the alternative designs of the NEDS related to weekly trends in ED visits for ILI.

IDENTIFY POSSIBLE CHANGES TO THE DESIGN OF THE NEDS

We conducted the following activities to identify possible alternative designs for the NEDS:

- Environmental scan of peer-reviewed publications that used the NEDS and examination of questions from external users that were received through HCUP technical assistance services

- Review of design changes that occurred with the 2012 NIS

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[5] Centers for Disease Control and Prevention. Injury Prevention & Control: Data & Statistics (WISQARS™). Matrix of E-code Groupings. Last updated April 29, 2014. https://www.degruyter.com/view/j/dx.ahead-of-print/dx-2016-0014/dx-2016-0014.xml?format=INT

- Collection of additional ideas for possible design changes based on HCUP-sponsored research.

Using the HCUP Publications Search,[6] we identified 121 articles that used the NEDS and were published between 2010 (after the NEDS was released through the HCUP Central Distributor) and December 2015. We reviewed the abstracts of each article to determine how the NEDS was used. We considered the following factors:

- *Focus*: one NEDS data year, pooled data years to obtain larger sample sizes, or trends across multiple data years

- *Conditions*: all ED visits or specific condition(s)

- *Outcomes*: all ED visits, ED visits by disposition (admission, transfer, or discharge from ED), mortality rate, total charges

- *Patient characteristics*: location, income, and expected payer

- *Hospital characteristics*: region, trauma level, location, teaching status, control and ownership, and ED volume.

We reviewed 1,827 questions related to the NEDS that were received by the HCUP Technical Assistance team between January 2015 and February 2016 to identify areas of interest that are not possible to examine with the current design.

We identified the list of changes to the NIS using the Nationwide Inpatient Sample (NIS) Redesign Final Report.[7] The report identified challenges associated with the NIS design prior to 2012, assessed three alternative sample designs, and recommended a revised design for the NIS starting in 2012.

We identified other design changes by speaking with (1) AHRQ and Truven Health researchers who had used the NEDS for HCUP-sponsored studies and (2) the HCUP staff responsible for developing the NEDS each year.

The following sections summarize the potential design changes assembled from the sources described above.

Possible Changes Identified by the Environmental Scan

All abstracts of identified articles noted ED utilization by patient age and sex. Regarding trends analysis, 37 percent of articles used multiple years of the NEDS to examine annual trends; roughly 45 percent used a single year; and 18 percent pooled multiple years of the NEDS in order to get a larger number of cases for a specific condition. Most studies focused on specific conditions (96 percent), such as various types of injuries, poisoning, fractures, respiratory

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[6] Healthcare Cost and Utilization Project (HCUP). Publications Search [Web site]. February 2010. http://www.hcup-us.ahrq.gov/reports/pubsearch/pubsearch.jsp

[7] Houchens R, Ross D, Elixhauser A, Jiang J. Nationwide Inpatient Sample (NIS) Redesign Final Report. 20014. (HCUP Methods Series Report #2014-04 ONLINE) April 4, 2014. U.S. Agency for Healthcare Research and Quality. http://www.hcup-us.ahrq.gov/reports/methods/2014-04.pdf

infections, and dental or periodontal pain or disease. The majority of articles (roughly 98 percent) primarily considered all ED visits, compared with 61 percent that included information on disposition from the ED. The most common measures, outcomes, or characteristics chosen by the authors were total charges (40 percent), expected payer (35 percent), patient mortality (30 percent), and patient income level (22 percent). The most common hospital characteristics were region (19 percent), teaching status (18 percent), urban-rural location (12 percent), and annual ED volume (9 percent). Trauma level was used in only 7 percent of studies. Table 1 provides detail on the number of abstracts by the various measures and characteristics noted above.

Table 1. Number of Articles that Used the NEDS for Different Types of Reporting

Characteristic	Number of Abstracts	Percent of Total
Trends		
Yes	45	37.2
No, single data year	54	44.6
No, pooled data years	22	18.2
Conditions		
All	5	4.1
Specific condition(s)	116	95.9
Outcomes		
All ED visits	119	98.3
ED visits by disposition	74	61.2
Mortality rate	36	29.8
Total charges	48	39.7
Patient characteristics		
Location	6	5.0
Income	27	22.3
Payer	43	35.5
Hospital characteristics		
Region	24	19.8
Trauma level	8	6.6
Location	15	12.4
Teaching status	22	18.2
Ownership/control	5	4.1
Emergency department volume	11	9.1

Only 13 of the 1,827 NEDS-related inquiries identified limitations of the NEDS for research purposes. We categorized each issue identified by the users in terms of possibility for inclusion in a future, redesigned NEDS. The most common issue (5 of 13 inquiries; 38 percent) dealt with the identification of hospitals for various research purposes, such as direct identification of hospitals (e.g., children's hospitals) or information on the location of the hospital for linking to external databases (i.e., American Hospital Association Annual Survey, National Highway Traffic Safety Administration, and National Institute of Population Studies). Identification of hospitals in the NEDS currently is not possible. Four inquires dealt with the inclusion of additional data elements (e.g., race/ethnicity, ED time of departure or arrival, and a measure of

ED volume). The data elements included on the NEDS are dependent on our HCUP Partners in terms of what they provide as well as what they will release through the HCUP Central Distributor. Two inquires expressed interest in calculating costs for ED treat-and-release visits.

The environmental scan did not identify potential changes to the design of the NEDS, but it did identify possible enhancements that would not affect the design. These included the addition of information on the patient's race/ethnicity, the inclusion of data elements that provide information on daily activity in the ED (e.g., daily fluctuations in the ED volume and admission rates), and the interest in NEDS-specific Cost-to-Charge Ratio Files (CCR Files).

Possible Changes Considered Because of the NIS Redesign

Based on the redesign of the 2012 NIS, we identified the following design changes as being relevant to the NEDS:

- Evaluate the types of hospital-owned EDs used to define the target universe, including the inclusion of community hospitals that are long-term acute care (LTAC) facilities

- Calculate the total ED visits for the target universe using HCUP data, when available, instead of information from AHA Annual Survey of Hospitals

- Stratify for sampling by Census division instead of Census region

- Draw a sample of ED visits as opposed to a sample of hospital-owned EDs. This change would eliminate the inclusion of hospital-level weights.

- Use the Partner-provided hospital identifiers in lieu of AHA hospital identifiers, because the AHA considers facilities with common ownership within a hospital system to be one single hospital instead of separate hospitals.

One enhancement to the 2012 NIS that did not affect the sample design was the addition of an indicator for patients less than one month old. This change also was considered for the NEDS.

Possible Changes Identified From Other Sources

AHRQ and Truven Health researchers who had used the NEDS for HCUP-sponsored studies and the HCUP staff responsible for developing the NEDS suggested five possible design changes:

- Consider other publicly available sources for the identification of trauma hospitals

- Examine whether additional stratifiers would be beneficial for sampling

- Eliminate the restriction that removes hospital-owned EDs that are unique in a State from the sampling frame

- Examine options for reducing the need to collapse strata to obtain at least two EDs in each stratum

- Consider increasing the sampling rate.

EVALUATE THE POSSIBLE DESIGN CHANGES

We grouped the possible design changes gathered from the environmental scan, the review of the NIS redesign, and HCUP staff suggestions into the following three categories for evaluation:

- Changes to the target universe
- Changes to the sampling strategy
- Changes to the identification of hospital entities.

Evaluate Possible Changes to the Target Universe

Two changes were considered for the target universe: (1) the types of hospital-owned EDs included and (2) the source of information for total ED visits.

Evaluate the Types of Hospital-Owned EDs Used to Define the Target Universe

Background. The target universe for the NEDS includes EDs in community hospitals, excluding community hospitals that also are rehabilitation facilities. The redesigned NIS added the exclusion of LTAC community hospitals from the target universe.

Results. Using AHA data to examine the composition of EDs in the United States in 2013, we found that 96.3 percent of EDs are part of general, medical/surgical hospitals, and 1.1 percent are in children's general facilities. Less than 1 percent of EDs are in surgical, specialty, and LTAC hospitals.

The general, medical/surgical hospitals, including children's general facilities, account for 99.6 percent of the ED visits in the United States. Surgical hospitals have roughly 0.1 percent of total ED visits. ED visits from OB/GYN and other specialty hospitals additionally represent 0.1 percent of total ED visits. There are 13 LTAC hospitals listed in the AHA as having ED visits, none of which were sampled in the 2013 NEDS.

Considerations for NEDS redesign. We recommend limiting the target universe to EDs in general, medical/surgical hospitals and children's general hospitals. ED visits to specialty hospitals are rare (0.4 percent of all ED visits) and may represent different treatment patterns.

Calculate Total ED Visits for the Target Universe Using HCUP Data, When Available

Background. The target universe for the NEDS uses ED visit counts as reported in the AHA Annual Survey Database. The redesigned NIS uses counts of inpatient stays from HCUP data, when available, and AHA counts only for hospitals not included in HCUP data.

Results. The NEDS currently uses the AHA data to determine total counts of ED visits by stratum. We considered two factors: (1) how often the AHA counts were based on fiscal versus calendar year reporting and (2) how often the AHA counts were estimated rather than reported.

The AHA data were used to determine the number of EDs that report on a fiscal year versus calendar year basis. We categorized any EDs with an ending reporting period in June or September as reporting fiscally (41.3 percent of all EDs in 2013). Thirty-seven percent of EDs reported based on calendar years. In the remaining 21.7 percent of EDs, this information was either missing (17.3 percent) or reported in a month other than June, September, or December (4.4 percent).

In 2013, 76.2 percent of EDs reported total ED visits to the AHA. The remaining 24.8 percent of hospitals did not report total ED visits, so the AHA estimated their counts.

Although there are concerns with the AHA counts not being specific to the calendar year or being estimated, there also are concerns about the completeness of ED records in the SEDD. In 2015, all HCUP Partners contributing ED data were asked about the reporting of records for patients treated in the ED to determine whether these records included patients who receive observation services and are discharged from observation (instead of the ED). Most of the HCUP Partners reported including these records in the ED data provided to HCUP, but a few Partners reported that these types of records were not included.

One possible, but not likely, alternative to the AHA data is the NEDI. The NEDI is not ideal because it is only created every other year. Refer to Table 2 for a comparison of EDs by volume for the NEDS, AHA, and NEDI in 2013.

Table 2. Estimates of the Number of Hospital-Owned EDs by ED Visit Volume From Three ED Data Sources, 2013

Volume of ED Visits in 2013	Data Sources					
	NEDS		AHA		NEDI	
	N (weighted)	%[1]	N	%[1]	N	%[1]
Less than 10,000 visits	1,353	29.26	1,579	34.15	1,483	29.51
10,000 – 19,999 visits	833	18.01	808	17.47	978	19.46
20,000 – 29,999 visits	638	13.80	558	12.07	694	13.81
30,000 – 39,999 visits	481	10.40	465	10.06	591	11.76
40,000 – 49,999 visits	390	8.44	326	7.05	435	8.66
50,000 or more visits	929	20.10	888	19.20	844	16.80
All hospital-owned EDs	4,624	100.00	4,624	100.00	5,025	100.00

Abbreviations: AHA, American Hospital Association [Annual Survey Database]; ED, emergency department; NEDI, National Emergency Department Inventory; NEDS, Nationwide Emergency Department Sample.

[1] Column percent indicates the percentage of the total records in the NEDS, AHA, or NEDI that are in each group of ED visits.

Considerations for NEDS redesign. Our analysis yielded the following conclusions:

- We are concerned about using the HCUP total counts because a few HCUP Partner organizations do not report records for patients treated in the ED if they receive observation services and are discharged from observation (instead of the ED).

- We are concerned about using AHA totals because of uncertainty that hospitals reporting to the AHA use the same definition of total ED visits and because 24.8 percent of EDs are estimated ED total counts.

- We recommend testing the use of the HCUP counts in at least one of the alternative designs.

Evaluate Possible Changes to the Sampling Strategy

We considered various changes for the sampling strategy including changing stratification variables, drawing a sample of ED visits, using alternative data sources for identifying trauma hospitals, and examining options for reducing the need to collapse strata to retain at least two hospitals in the sampling frame.

<u>**Stratify by the Nine Census Divisions**</u>

Background. The NEDS is stratified by four Census regions. The redesigned NIS changed from using the four regions to the nine Census divisions.

Results. Using the MS-ED analysis file for 2013, we examined variations in outcomes for ED visits per population, ED admission rate,[8] and mortality rate by Census division. The 2013 MS-ED analysis file has at least two States in all divisions except the West South Central division. There was some variation in ED outcomes by Census division, which suggests that moving to stratification by division would be beneficial to the ability to estimate these types of ED outcomes in the NEDS. For example, the admission rate in 2013 in New England is 15.5 percent, and the rate in the Middle Atlantic division is 17.3 percent. These two divisions are combined into the Northeast region. In contrast, the admission rates in the East South Central and West South Central divisions are similar at 12.4 percent. Refer to Table 3 for all outcomes by region and division.

Table 3. ED Outcomes by Census Region and Division

Region and Division	Total ED Visits	ED Visits per 100,000 population	ED Admission Rate	Mortality Rate
Northeast	16,592,777	41,164	16.68	0.60
New England	4,887,866	41,089	15.16	0.56
Middle Atlantic	11,704,911	41,196	17.31	0.62
Midwest	24,459,450	42,506	12.84	0.44
East North Central	16,808,115	45,734	12.66	0.43
West North Central	7,651,335	36,801	13.24	0.47
South	29,732,007	46,759	14.04	0.50
South Atlantic	23,134,903	46,503	14.52	0.49
East South Central	5,270,252	48,474	12.37	0.53
West South Central	1,326,852	44,772	12.36	0.55
West	17,403,327	33,592	14.36	0.56
Mountain	4,240,331	34,708	14.67	0.47
Pacific	13,162,996	33,247	14.26	0.59

Abbreviation: ED, emergency department.

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[8] ED admission rate refers to the percentage of ED visits that result in an inpatient admission to the same hospital.

Source: Multistate emergency department internal analysis file created from the HCUP State Emergency Department Databases (SEDD) and State Inpatient Databases (SID), 2013.

Considerations for NEDS redesign. At this time, the NEDS could not be stratified by the nine Census divisions because of having only one State in the West South Central division. That said, ED outcomes are very similar for the two adjacent divisions—West South Central and East South Central. We recommend collapsing these two divisions in at least one of the alternative designs.

Draw a Sample of ED Visits From All EDs in the HCUP Data

Background. The NEDS includes all ED visits from a sample of EDs. The redesigned NIS changed from a sample of hospitals to a sample of inpatient discharges. Results from testing the different sample designs showed that the change to a sample of inpatient discharges improved the precision and stability of the NIS sample estimates when compared with pooled SID discharges.

Results. We looked at the variation in ED visits per 100,000 population by quarter from 2006 through 2013 for the CCS category of the first-listed diagnosis. We compared the NEDS to the MS-ED analysis files created by combining all ED visits from the SEDD and ED admissions from the SID in the data year. We used population-based rates to analyze a consistent statistic for pooled State data versus national estimates. Across all CCS categories, we found that from 2006–2013 there was little to no variation in the rates between the MS-ED analysis file and the NEDS. Figures 1–4 show the comparisons for the four diagnosis categories with highest annual volume—sprains and strains (CCS 232), other upper respiratory infections (CCS 126), abdominal pain (CCS 251), and superficial injury, contusion (CCS 239).

Figure 1. Trends for Clinical Classifications Software Category 232 (Sprains and Strains) for the MS-ED Analysis File and the NEDS, 2013
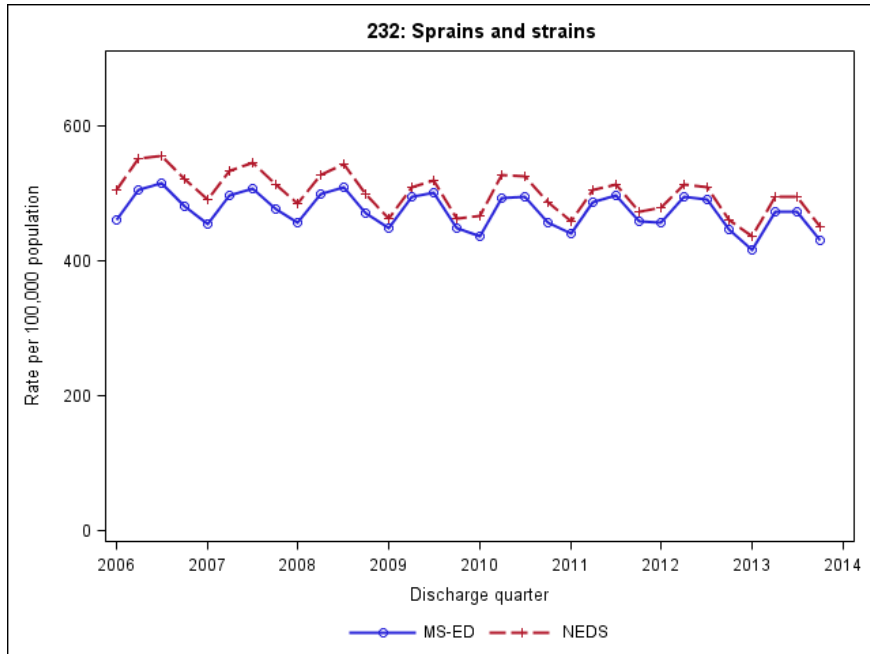
Abbreviations: MS-ED, multistate emergency department analysis file; NEDS, Nationwide Emergency Department Sample.

Figure 2. Trends for Clinical Classifications Software Category 126 (Other Upper Respiratory Infections) for the MS-ED Analysis File and the NEDS, 2013
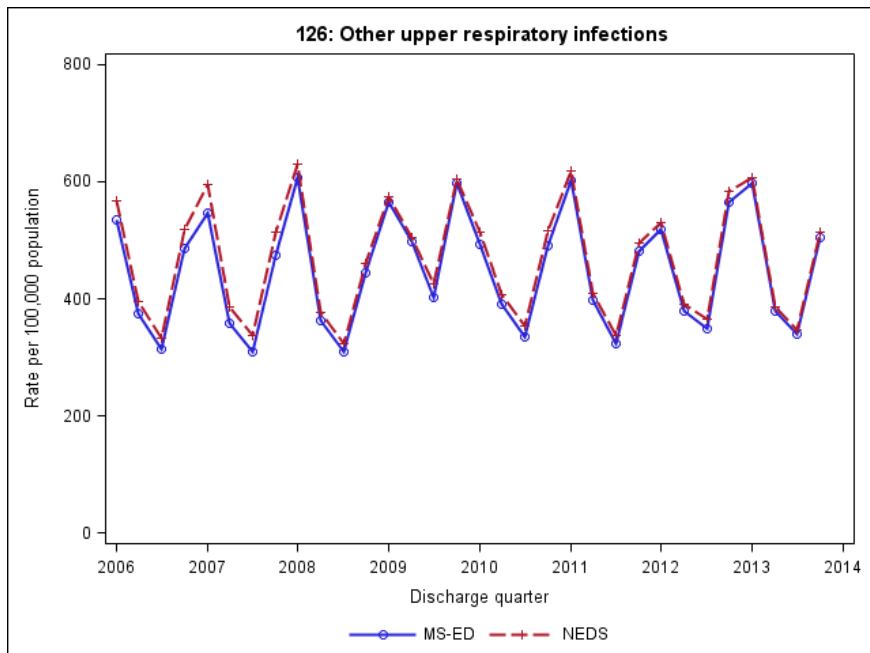
Abbreviations: MS-ED, multistate emergency department analysis file; NEDS, Nationwide Emergency Department Sample.

Figure 3. Trends for Clinical Classifications Software Category 251 (Abdominal Pain) for the MS-ED Analysis File and the NEDS, 2013
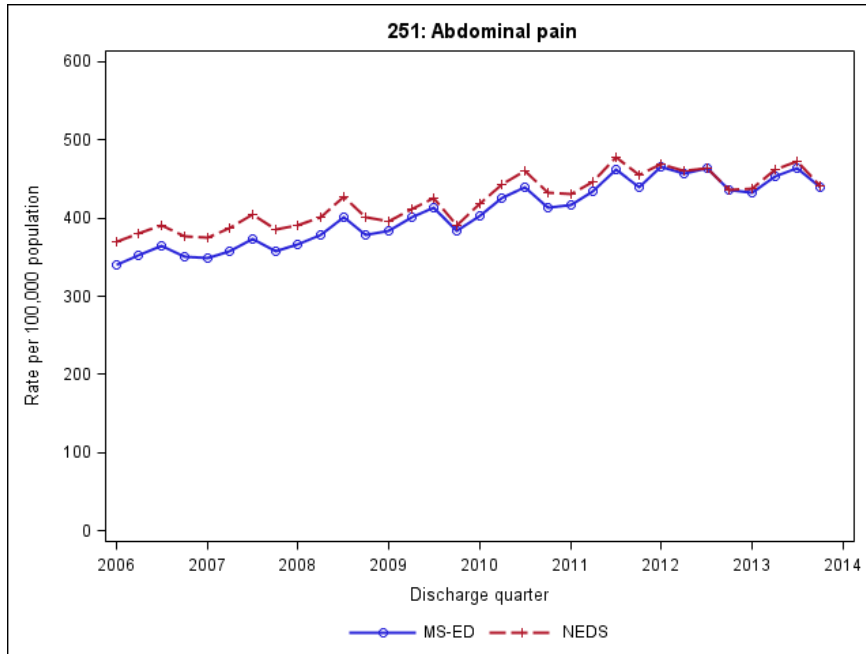
Abbreviations: MS-ED, multistate emergency department analysis file; NEDS, Nationwide Emergency Department Sample.

Figure 4. Trends for Clinical Classifications Software Category 239 (Superficial Injury, Contusion) for the MS-ED Analysis File and the NEDS, 2013
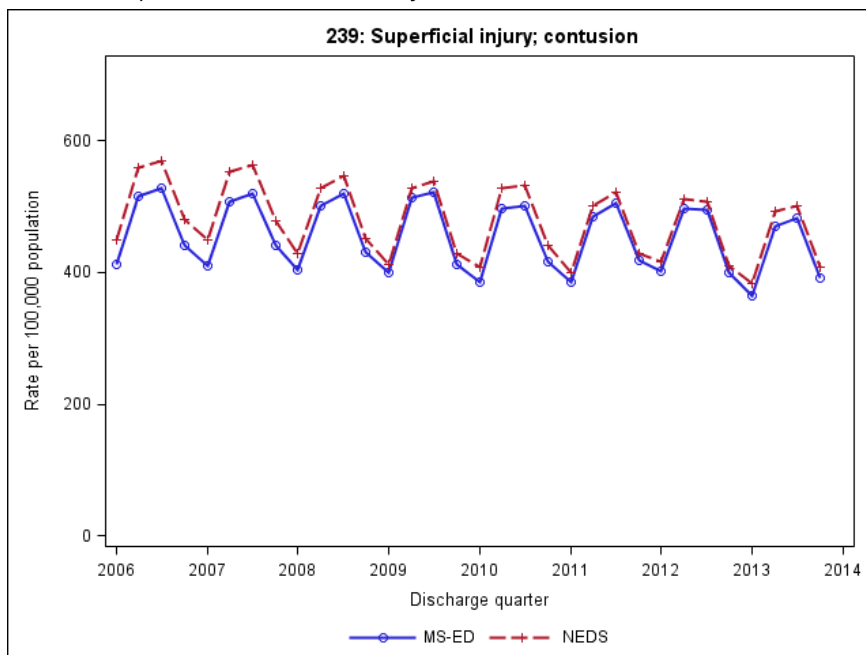
Abbreviations: MS-ED, multistate emergency department analysis file; NEDS, Nationwide Emergency Department Sample.

In the NIS, the change to a discharge-level sample eliminated the inclusion of hospital-level weights. Being able to weight hospital-level statistics to national estimates is a unique strength of the NEDS. For example, the National Hospital Ambulatory Medical Care Survey (NHAMCS) cannot be used for this type of analysis because it does not have hospital-level weights. We know from the environmental scan that about 10 percent of the NEDS articles used information on ED volume.

Considerations for NEDS redesign. One reason for the 2012 NIS redesign to a sample of discharges was to minimize observed variation in national estimates of total utilization for conditions requiring specialty services such as pediatric heart surgery or cancer treatment. From 2006–2013, we found little to no variation in the ED visit rates between the MS-ED analysis file and the NEDS across both common and rare conditions treated in the ED. This probably is because ED services tend to be similar across hospitals and different EDs treat relatively similar case mixes. That is less the case for inpatient services, which can vary considerably if the hospital has certain types of specialty units. In addition, we know that being able to weight hospital-level statistics to national estimates is a unique strength of the NEDS. For these reasons, we recommend continuing to sample EDs for the NEDS.

Consider Other Publicly Available Sources for the Identification of Trauma Hospitals

Background. The NEDS uses Trauma Information Exchange Program (TIEP) data to identify the trauma level of most trauma hospitals in the United States. These data are augmented by an Internet search of stand-alone children's trauma hospitals in the United States. It would be helpful to be able to obtain all the information from one source.

Results. We explored the possibility of using information included in the AHA Annual Survey or identifying trauma level by the type of injuries reported in the NEDS. There was no other publicly available data source of trauma levels for all hospitals in the United States.

We found variations when comparing the TIEP trauma designation to AHA information on trauma level and service codes. The AHA data element indicating the trauma center level often was the same as the TIEP designation of a trauma I, II, and III hospital (92 percent, 85 percent, and 69 percent of the time, respectively). In contrast, 14 percent of hospitals with no trauma designation in TIEP were identified as trauma hospitals in the AHA Annual Survey. An Internet search of these facilities confirmed the TIEP trauma designation.

AHA service codes for medical-surgical intensive care unit (ICU), cardiac ICU, neonatal ICU, and neurological services were indicative of trauma level I hospitals (where 84–94 percent of trauma level I facilities offered these types of services), but the findings were not conclusive. Indicators for burn care were not specific to trauma hospitals, because the majority of trauma level I, II, and III hospitals do not offer burn care at their facilities (55 percent, 87 percent, and 88 percent, respectively). Table 4 shows the number and percentage of trauma hospitals by service.

Table 4. TIEP Trauma Designation Compared With AHA Trauma Designation and Service Codes, 2013

Characteristic	Total	TIEP Trauma Level			
		I	II	III	Non
Number of hospitals	4,624	241	308	419	3,656
		Percent of Trauma Level			
Trauma center service level					
Missing	2,970	5.0	10.1	19.1	77.9
Regional resource trauma center	274	91.7	3.2	0.7	1.1
Community trauma center	407	2.5	84.7	11.2	2.5
Rural trauma center	686	0.8	1.9	69.0	10.6
Other (specific to select States)	287	--	--	--	7.9
Service: medical-surgical ICU					
Missing	806	4.6	7.8	9.1	20.0
Nonmedical-surgical ICU	1,000	11.2	2.3	5.7	25.8
Medical-surgical ICU	2,818	84.2	89.9	85.2	54.2
Service: cardiac ICU					
Missing	804	4.6	7.8	9.1	20.0
Noncardiac ICU	2,568	7.5	25.6	52.3	61.6
Cardiac ICU	1,252	88.0	66.6	38.7	18.4
Service: neonatal ICU					
Missing	803	4.6	7.8	9.1	20.0
Nonneonatal ICU	2,847	10.0	34.7	62.1	67.2
Neonatal ICU	974	85.5	57.5	28.9	12.9
Service: burn care					
Missing	804	4.6	7.8	9.3	20.0
No burn care	3,647	54.8	87.3	88.3	78.7
Burn care	173	40.7	4.9	2.4	1.4

Abbreviations: AHA, American Hospital Association [Annual Survey Database]; ICU, intensive care unit; TIEP, Trauma Information Exchange Program.

Comparing volume of injury visits in the NEDS to the TIEP trauma designation, we found that injury volume did not distinguish trauma hospitals. All types of injuries were treated predominately in nontrauma hospitals, except for firearm-related injuries (46 percent of cases are treated in trauma level I hospitals). We hypothesize that this is because an ambulance transporting an injured patient is likely to take the patient to the nearest facility, regardless of its trauma level.

Considerations for NEDS redesign. We recommend continuing to use the TIEP data to identify trauma hospitals.

Examine Whether Additional Stratifiers Would Be Beneficial for Sampling

Background. The NEDS includes five stratifiers based on the characteristics of U.S. Census region, trauma-level designation, teaching status, urban-rural location, and hospital ownership. There may be other hospital characteristics that were not available (or considered) in the original design. In addition, there may be patient characteristics that would be beneficial.

Results. Two ED outcomes (ED admission rates and mortality rates) were analyzed for four possible additional stratifiers: two hospital characteristics (safety net hospitals [SNHs] and critical access hospitals [CAHs]) and two patient characteristics (age and sex). Designation as a SNH was determined based on the distribution of Medicaid and the uninsured inpatient discharges in the 2013 SID. Hospitals included in the top quartile for the percentage of annual discharges that are Medicaid or uninsured were considered a SNH. Thirty-eight percent of ED visits in the 2013 MS-ED analysis file were from SNHs. CAH designation was derived from the AHA Annual Survey. Five percent of ED visits in the 2013 MS-ED analysis file were from CAHs.

Using the 2013 MS-ED analysis file, we found a slight variation in ED admission and mortality rates by SNH designation. Hospitals not designated as SNHs had an ED admission rate of 14.7 percent and a mortality rate of 0.55 percent. Hospitals designated as SNHs had an ED admission rate of 13.7 percent and a mortality rate of 0.46 percent. Greater variation occurred by CAH designation. Hospitals not designated as CAHs had an ED admission rate of 14.9 percent and mortality rate of 0.53 percent. Hospitals designated as CAHs had an ED admission rate of 2.5 percent and a mortality rate of 0.23 percent.

With regard to the patient characteristics, we found slight variation by patient sex using the 2013 MS-ED analysis file. Males had a higher ED admission rate (15.1 percent) and mortality rate (0.62 percent) compared with females (13.6 percent and 0.43 percent, respectively). ED admission rate and mortality rate increased for each of the five age groups. Patients aged 0–17, 18–30, and 31–45 years had an ED admission rate of 3.6 percent, 5.7 percent, and 9.1 percent, respectively, and a mortality rate of 0.04 percent, 0.06 percent, and 0.13 percent, respectively. Patients aged 46–64 and 65+ years had an ED admission rate of 18.8 percent and 36.7 percent, respectively, and a mortality rate of 0.56 percent and 1.96 percent, respectively. Refer to Table 5 for additional information.

Table 5. Additional NEDS Stratifiers and ED Outcomes, 2013

Patient Characteristics	Total ED Visits	Percent of Total Visits	ED Admission Rate	Mortality Rate
Age				
Missing	4,212	0.0	26.5	3.84
0–17	17,999,402	20.4	3.6	0.04
18–30	18,313,328	20.8	5.8	0.06
31–45	17,130,392	19.4	9.1	0.13
46–64	19,131,316	21.7	18.8	0.56
65+	15,608,911	17.7	36.7	1.96
Sex				
Missing	10,614	0.0	2.8	1.51
Male	39,273,754	44.5	15.1	0.62
Female	48,903,193	55.5	13.6	0.43

Abbreviations: ED, emergency department; NEDS, Nationwide Emergency Department Sample.

Source: Multistate emergency department analysis file created from the HCUP State Emergency Department Databases (SEDD) and State Inpatient Databases (SID), 2013.

We looked for a possible data source for ST-elevation myocardial infarction (STEMI) center certification. The American Heart Association, in partnership with the Society of Cardiovascular Patient Care, identifies hospitals that participate in coordinated systems of care for STEMI. A list is published each year that identifies hospitals meeting certain criteria. Hospitals receiving STEMI patients are ranked as gold plus, gold, or silver depending on adherence to performance achievement indicators over 12 and 24 months.

Annual volume is an important characteristic of an ED, but the number of ED visits also is a common outcome of interest. As an alternative, we considered a stratifier of the number of ED beds or hospital size, but we could not find a source for either type of information. The AHA Annual Survey only includes the number of short-term acute beds. Figure 5 shows the distribution of inpatient beds to ED volume. The correlation coefficient is 0.85.

Figure 5. Inpatient Beds Versus Annual Emergency Department Visits, 2013

0.8497
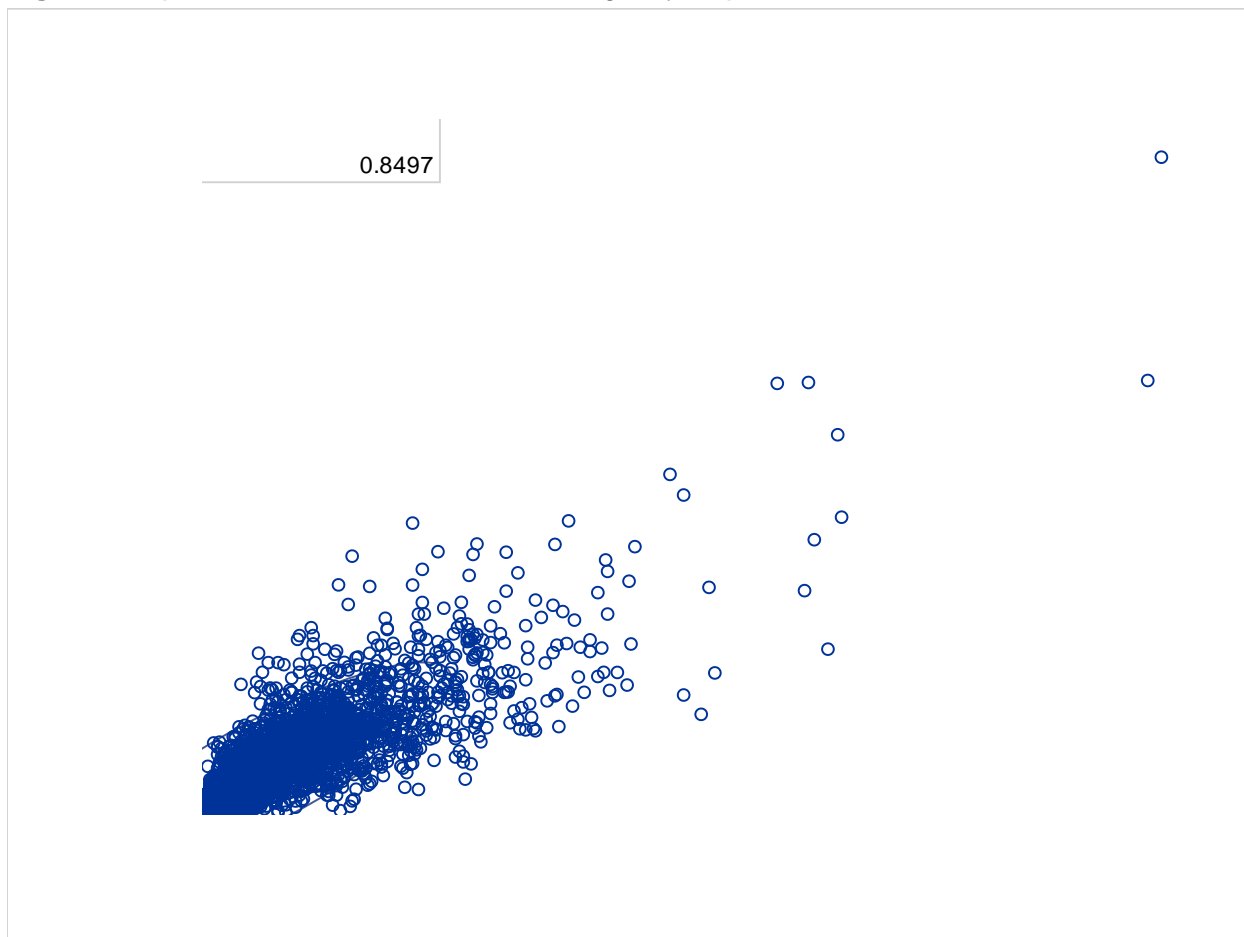
Note: Beds-H is the number of short-term acute beds in the hospital.

Considerations for NEDS redesign. Our analysis yielded the following conclusions:

- Although there were differences in ED outcomes for CAHs versus non-CAHs, only five percent of ED visits were from CAHs. Given the rarity of their occurrence, we probably would need to collapse strata based on CAH because we require at least two HCUP hospitals per stratum. We do not recommend including CAH in the strata.

- The designation of SNH changes annually and is based on HCUP data. In fact, the designation can change depending on which States were included in the analysis. In addition, ED outcomes were similar for SNHs and non-SNHs. For these reasons, we do not recommend SNH designation as a stratifier.

- Using the American Heart Association list of STEMI receiving centers as a stratifier would take some work. We would need to map the list to AHA hospital identifiers. This would add an additional data source to track each year. We also do not know how well this designation relates to the HCUP data. For these reasons, we do not recommend using STEMI receiving center as a stratifier.

- Using patient characteristics as stratifiers is difficult because the universe counts that come from the AHA are not available by age-sex groups. For the HCUP Nationwide Readmissions Database, we use the distribution of inpatient stays in all SID (47 States and the District of Columbia) to distribute the AHA inpatient counts into age-sex groups. For the NEDS, we would need to use the data from more limited number of NEDS States to disaggregate the AHA counts and then apply these same ratios to the NEDS data. For this reason, we do not recommend using age-sex groups as stratifiers for the NEDS.

- There is no publicly available source for the size of EDs in the United States. It is useful to know that AHA inpatient bed counts are highly correlated with ED volume, but it is conceptually difficult to argue for using inpatient-specific information for stratification and weighting of an ED database. For these reasons, we do not recommend using AHA bed counts as a stratifier.

Eliminate the Restriction That Removes Hospital-Owned EDs That Are Unique in a State From the Sampling Frame

Background. EDs are removed from the NEDS sampling frame if they are "unique" in the State to ease any concern by the HCUP Partner organizations about their possible identification. *Unique* is defined as the only ED in a NEDS stratum for the State. However, the NEDS does not include data elements that identify the State, county, or hospital, so the exclusion of these hospitals may not be necessary. The NIS had this requirement for some States prior to 2012, but AHRQ eliminated this restriction when State identification was removed in the redesign.

Results. In 2013, we had to exclude 99 hospitals from the NEDS sampling frame because the ED was unique in the State.

- Of the 99 EDs, 81 were trauma hospitals (14 were trauma level I, 36 were trauma level II, and 31 were trauma level III).

- Overall, the 99 EDs accounted for only 2.1 percent of all EDs, but this percentage was higher by trauma level. Within trauma level I, 6 percent of EDs were excluded; within trauma level II, 12 percent were excluded; and within trauma level I III, 9 percent were excluded.

If we consider EDs that are unique within the division rather than the State, 66 EDs would need to be excluded (12 at trauma level I, 21 at trauma level II, and 19 at trauma level III). If we consider EDs that are unique within the region, 47 EDs would need to be excluded (8 at trauma level I, 14 at trauma level II, and 15 at trauma level III).

This exclusion also affects how many strata need to be collapsed, because we require at least two HCUP hospitals in every stratum. For example, if a stratum had two EDs and each was unique for a State, then both EDs were excluded and the stratum would need to be collapsed with another stratum. If we had not excluded the two hospitals, we could keep the stratum intact. In the 2013 NEDS, 6 of 32 collapsed strata were the result of excluding unique EDs, and 4 of the 6 collapsed strata involved collapsing across trauma level.

Considerations for NEDS redesign. Given that the NEDS does not identify hospitals or the State, we recommend eliminating the restriction of removing EDs from the sampling frame if they are the only ED for a State in a sampling stratum. It is important to remember that if there is only one HCUP hospital in a stratum, then the stratum is collapsed with another.

Examine Options for Reducing the Need to Collapse Strata Across Trauma Level to Obtain at Least Two EDs in Each Stratum

Background. To protect the identity of EDs in the NEDS, strata are combined if there are less than two EDs in a stratum in the target universe or frame. This results in strata that include EDs with differing trauma levels (e.g., trauma levels I and II). To facilitate research by trauma centers, it would be better not to collapse across trauma levels.

Results. In 2013, about 25 percent of EDs were in a collapsed trauma category. This was better than the 44 percent of EDs in a collapsed trauma category in 2012. Most of the collapsed categorization involved trauma level III and nontrauma hospitals (23 percent in 2013).

There were 13 collapsed strata for trauma level III and nontrauma hospitals in 2013 (two in the Northeast, six in the South, and five in the West). In 10 of the strata, there were no trauma level III hospitals included in HCUP States, and the universe had a small number of hospitals (five or less). The other three strata had to be collapsed because of the NEDS-specific requirement to exclude EDs that are unique in a State from the sampling frame. *Unique* is defined as the only ED in a NEDS stratum for the State.

Considerations for NEDS redesign. Our analysis yielded the following conclusions:

- Removing the exclusion of EDs that are unique in a State from the sampling frame will help but not eliminate the need to collapse strata across trauma level.

- One option is to release the actual trauma levels but then remove the identification of region to protect the identity of the ED. This is not recommended because we know that 20 percent of articles using the NEDS reported results by region.

- A long-term solution is the recruitment of more EDs in States in the South and West that will report data.

Increase the Sampling Rate

Background. The NEDS is a 20 percent sample of EDs in the United States. Increasing the sample size would increase the power to detect small differences for rare conditions.

Results. The NEDS 20 percent sample is about 30 million records and 14 gigabytes per year. A 40 percent sample would be large (60 million records and 28 gigabytes), but manageable for many users because of the very low cost of data storage.

One issue with increasing the sample size is a possible shortage of HCUP hospitals for sampling in certain strata. In 2013, there were 36 strata for which we did not have enough HCUP hospitals for a 20 percent sample. The number varied by region: five strata in the

Northeast and Midwest and 13 strata in the South and West. If there were less than two hospitals in a stratum, then strata were collapsed. Even after collapsing, the 2013 NEDS had six strata that had an inadequate number of EDs (less than two EDs within strata).

If we increase the sample size to 30 percent, there would be 42 strata (six more strata than with a 20 percent sample) that would have an insufficient number of hospitals for sampling. Four additional strata in the South would not have enough EDs, as well as two additional strata in the West.

If we increase the sample size to 40 percent, there would be 50 strata (14 more strata than a 20 percent sample) that would have insufficient hospitals for sampling. Ten additional strata in the South and four additional strata in the West would not have enough EDs for sampling. About half the strata in the South will have an insufficient number of EDs for sampling.

Considerations for NEDS redesign. Although there may be some gain in the accuracy of the national estimates with a larger sampling rate, we do not recommend increasing the sample size because of the increased risk of strata with an insufficient number of EDs for sampling in the South and West.

Evaluate Possible Changes to the Identification of Hospital Entities

Use the Partner-Provided Hospital Identifiers in Lieu of the AHA Hospital Identifiers

Background. The NEDS uses AHA data to identify hospital-owned EDs. According to the NIS redesign report, about 10 percent of the AHA hospital identifiers correspond to two or more facilities as identified by the HCUP Partner. These facilities have common ownership within a hospital system, so the AHA considers them to be one hospital. The redesigned NIS changed to using the Partner-provided hospital identifiers.

Results. For the vast majority of EDs in NEDS States in 2013 (96 percent), the Partner-provided hospital identifiers are in one-to-one correspondence with the AHA hospital identifiers. Roughly 4 percent of AHA identifiers correspond to two or more Partner-provided hospital identifiers (i.e., one-to-many correspondence).

Out of the 32 States included in the 2013 NEDS, 10 States include strictly one-to-one matching of AHA identifiers to Partner-provided identifiers. Of the remaining States with one-to-many matching, five States were found to have instances where one or more of the Partner-provided hospital identifiers had no ED admissions in the SID, but they had positive counts for ED treat-and-release visits from the SEDD. This information indicates that for some of these multiple matches, we are seeing instances where one or more of the Partner-provided hospital identifiers are attributed to facilities that strictly deal with ED treat-and-release visits, such as satellite emergency departments. There were no instances in which the converse was true—that is, positive counts for ED admissions and no records for ED treat-and-release visits.

Considerations for NEDS redesign. We recommend continuing to use the AHA hospital identifier to identify an ED. The criteria for the NEDS sampling frame requires that a hospital includes data for both ED admissions and ED treat-and-release visits, and that no more than 90

percent of the total ED visits result in admission. If we moved to using the Partner-provided hospital identifiers, the facilities that appear to be satellite EDs would be excluded.

EVALUATE ADDING ADDITIONAL DATA ELEMENTS TO THE NEDS

Add a Data Element That Indicates Patients Less Than One Month Old

Background. Beginning with the 2012 NIS, a neonatal age indicator (AGE_NEONATE) replaced the HCUP data element for age in days (AGEDAY). Because the NEDS only includes age in years, the addition of this data element was considered.

Results. In the 2013 NIS, about 12 percent of the file included discharges for patients with an age of zero years, and roughly 11 percent of the file had an age that was less than 28 days indicated by AGE_NEONATE=1. In the 2013 NEDS, these percentages were much smaller (2.4 and 0.3 percent, respectively).

For ED admissions with an age less than 28 days, the top five most common principal diagnoses included other perinatal conditions (CCS 224), hemolytic jaundice and perinatal jaundice (CCS 222), liveborn (CCS 218), acute bronchitis (CCS 125), and digestive congenital anomalies (CCS 214). For ED visits that do not result in an admission, the top five most common first-listed diagnoses for this age group were other perinatal conditions (CCS 224), hemolytic jaundice and perinatal jaundice (CCS 222), other upper respiratory infections (CCS 126), administrative/social admission (CCS 255), and other gastrointestinal disorders (CCS 155).

Considerations for NEDS redesign. We recommend working with the HCUP Partners to add the neonatal age indicator to the NEDS.

Add Information on Patient Race/Ethnicity

Background. Information on patient race/ethnicity is not available in the NEDS. Data users frequently request this information when they contact HCUP technical assistance.

Results. Four of the 30 States in the 2013 NEDS either do not report patient race/ethnicity to HCUP or are missing the data on a majority of ED visits.

Considerations for NEDS redesign. Adding patient race/ethnicity to the NEDS is not advisable at this time because of the bias caused by missing data, but this would be a viable option in the future when a sufficient number of our NEDS Partners make this information available and approve it for release.

Add a Data Element That Provides Information on Daily Activity in the ED

Background. Previous technical assistance inquires have suggested that there is some interest in information on daily volume in the ED. It is not possible to calculate daily activity because information on date of service is not included in the NEDS.

Results. AHRQ developed two HCUP data elements for intramural research that contain information about daily fluctuations in the ED:

- Daily volume was calculated for each ED using the patient's admission date; this measure then was assigned to a quintile specific to the ED in the data year (e.g., quintile 1 = 0–20 percent, quintile 2 = 21–40 percent). Thereby, quintile 5 indicated that the daily volume in the ED that day was in the highest quintile for that ED in the year.

- Daily admission rate also was calculated for each ED and then assigned to a quintile specific to the ED in the data year.

Although the two data elements are related, they are not highly correlated. Using the 2013 MS-ED analysis file, the correlation coefficient for these two data elements is –0.37.

Three published HCUP studies have used these data elements. A study of missed diagnosis of acute myocardial infarction (AMI) showed that days of high ED volume had higher odds of missed diagnoses of AMI.[9] A study of missed diagnosis of stoke showed that the ED admission rate on the day of the ED visit was inversely related to missed stroke (i.e., higher admission rates correlated with lower odds of misdiagnosis).[10] A third study showed a relationship between daily ED volume on patients treated in the ED for chest pain who returned for cardiac-related inpatient care in 30 days (note that daily ED admission rates showed no relationship).[11]

Considerations for NEDS redesign. Data elements that inform data users about daily volume would increase the research value of the NEDS.

Release NEDS-Specific Cost-to-Charge Ratio Files

Background. For each of the HCUP inpatient databases, there are CCR Files that can be used to convert total hospital inpatient charges to costs. These files are not available for the NEDS.

Results. CCR Files were created for the SEDD in 2012 for intramural research, but they were not publicly released or updated for future data years because of some concern about the accuracy of the ratios.

Considerations for NEDS redesign. The creation of NEDS-specific CCR Files is possible in the future, but more work is needed to resolve any concerns about the accuracy of the ratios.

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[9] Moy E, Barrett M, Coffey R, Hines AL, Newman-Toker DE. Missed diagnoses of acute myocardial infarction in the emergency department: variation by patient and facility characteristics. Diagnosis. 2015;2:29-40

[10] Newman-Toker DE, Moy E, Valente E, Coffey R, Hines AL. Missed diagnoses of stroke in the emergency department: a cross-sectional analysis of a large patient-based sample. Diagnosis. 2014;1(2):155-66

[11] Moore BJ, Coffey RM, Heslin KC, Moy E. Admissions after discharge from an emergency department for chest symptoms. Diagnosis. 2016;3(3). Epub ahead of print. https://www.degruyter.com/view/j/dx.ahead-of-print/dx-2016-0014/dx-2016-0014.xml?format=INT

PROPOSE ALTERNATIVE DESIGNS

After considering the results of the environmental scan, the NIS redesign changes, and issues specific to the current design of the NEDS, we decided to include the following factors in the redesign options for the NEDS:

- **Use eight Census divisions** instead of four Census regions for stratification. Because there was only one State in the West South Central division, it was combined with the East South Central division for a total of eight divisions. All other divisions included at least two States that contribute ED data to HCUP.

- **Revise the definition of the target universe** (1) to include EDs that are part of general, medical/surgical hospitals instead of community, nonrehabilitation hospitals and (2) to define universe total counts for ED visits using HCUP data, when available, instead of AHA data.

- **Retain EDs that are unique in a stratum for a State** in the sampling frame rather than excluding them.

We decided to test five alternative designs, each of which includes one or more of the possible changes:

- *Alternative Design 1 used Census division.* This design used eight Census divisions (with the West South Central and East South Central collapsed because of limited availability of HCUP data) instead of four Census regions.

- *Alternative Design 2 used a revised target universe.* This design had two changes to the definition of the target universe:

  o It limited the target universe to EDs in general, medical/surgical hospitals.

  o For target universe totals, it used HCUP counts for total ED visits in the HCUP States, and it used the AHA totals only for EDs not included in HCUP.

- *Alternative Design 3 retained unique EDs in the sampling frame.* This design included EDs that are unique within a stratum and State.

- *Alternative Design 4 used Census division and a revised target universe.* This design applied change 1 (eight Census divisions) and change 2 (redefine the universe).

- *Alternative Design 5 used all three changes.* This design implemented eight Census divisions, the redefined target universe, and inclusion of EDs that are unique within the stratum and State.

These five different designs allowed us to examine the impact of each individual change in addition to the preferred combinations. We used the 2013 MS-ED analysis file to build one version of each of the five alternative databases.

COMPARE THE PROPOSED ALTERNATIVE DESIGN TO THE 2013 NEDS

The evaluation of the alternative designs included the following four phases:

- Phase 1 – compare the weighted estimates from the alternative designs with the current NEDS design for various outcomes of interest

- Phase 2 – determine whether fewer strata need to be collapsed in the alternative designs than in the current NEDS design

- Phase 3 – examine whether there is less variation in hospital- and ED visit-level weights in the alternative designs than in the current NEDS design

- Phase 4 – investigate whether estimates of ED utilization from the alternative designs are more similar to external data sources than the current NEDS design.

Methods for Each Phase of the Comparison

Phase 1: Compare Weighted Estimates of Common Outcomes of Interest

We calculated point estimates and 95 percent confidence intervals for the six designs (the 2013 NEDS and five alternatives) for the following outcomes of interest:

- Total number of ED visits by first-listed CCS

- Admission rate by first-listed CCS

- Average total charges of ED visits by first-listed CCS

- Percentage of ED visits that involve an injury by total number, by mechanism of injury (cut, drown, fall, fire, firearm, machinery, motor vehicle, natural environment, poison, and struck), and by intent (assault, self-harm, and unintentional). The mechanism and intent of the injury were determined by the External Cause of Injury Codes and were consistent with the classification system used by the CDC.[12]

Comparisons were considered for total records and by three age groups:

- ED visits for patients aged 0–17 years (20 percent of NEDS)

- ED visits for patients aged 18–64 years (63 percent of NEDS)

- ED visits for patients aged 65 years and older (17 percent of NEDS).

In total, there were over 3,200 individual comparisons (262 CCS categories * 4 age groups * 3 outcomes [ED visits, admission rates, average total charges] + 16 types of injury * 4 age groups). Differences were defined by nonoverlapping confidence intervals.

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[12] Centers for Disease Control and Prevention. Injury Prevention & Control: Data & Statistics (WISQARS™). Matrix of E-code Groupings. Last updated April 29, 2014. https://www.degruyter.com/view/j/dx.ahead-of-print/dx-2016-0014/dx-2016-0014.xml?format=INT

Phase 2: Compare Strata Considerations

To ensure the confidentiality of hospitals in the NEDS, we require that at least two hospitals are included in every stratum. If either the target universe or the frame (from HCUP EDs) does not include at least two hospitals, then strata are collapsed until there is a sufficient number in both the target universe and frame. The NEDS stratum is defined by five digits:

1. Region

     o (1) Northeast, (2) Midwest, (3) South, (4) West

2. Trauma

     o (0) Not a trauma center, (1) Trauma level I, (2) Trauma level II, (3) Trauma level III

     o Collapsed categories are (4) Trauma level III and nontrauma, (8) Trauma level I and II

3. Urban-rural location

     o (1) Large metropolitan, (2) Small metropolitan, (3) Micropolitan, (4) Nonurban

     o Collapsed categories are (7) Small metropolitan and micropolitan, (8) Metropolitan (large and small), (9) Nonmetropolitan (micropolitan and nonurban location)

4. Teaching

     o (0) Metropolitan nonteaching, (1) Metropolitan teaching, (2) Nonmetropolitan (teaching and nonteaching)

5. Control

     o (1) Public – government, non-Federal, (2) Voluntary – private, nonprofit, (3) Proprietary – private, investor-owned and for-profit

     o Collapsed categories are (0) All and (4) Private nonprofit and for profit

The order for collapsing is first to collapse on control; second, if needed, collapse on urban-rural location; and third, if still necessary, collapse the trauma level. We do not collapse across Census region or teaching status. There are three types of collapsed categories that have been necessary but are undesirable:

- Collapsing trauma level III with nontrauma is undesirable because it limits research that investigates differences in care at trauma versus nontrauma centers.
- Collapsing small metropolitan with micropolitan is undesirable because it limits research that investigates differences in care at EDs in metropolitan versus nonmetropolitan areas.
- Collapsing metropolitan nonteaching and nonmetropolitan is undesirable because it limits research that investigates differences in metropolitan versus nonmetropolitan areas.

Another consideration when comparing sample designs is strata that have an insufficient number of EDs in the frame to meet the threshold of 20 percent of the universe for that stratum.

Phase 3: Compare Hospital-Level and ED Visit-Level Weights

Hospital weights were calculated after sampling and the collapse of strata for each of the alternative designs. Within each stratum, s, each ED in the NEDS sample received a weight:

$$HOSPWT = Ns(universe) \div Ns(sample)$$

Where Ns(universe) and Ns(sample) were the number of hospital-owned EDs within stratum s in the universe and sample, respectively. Thus, each hospital's universe weight (HOSPWT) is equal to the number of universe hospitals it represents during that year. Because 20 percent of the hospitals in each stratum were sampled when possible, the ED weights usually were close to five. If a stratum has an insufficient number of EDs in the frame to meet the threshold of 20 percent of the universe, then the weight is greater than five. To examine the variation of the hospital-level weights between the 2013 NEDS and the five alternative designs, we compared the distribution of the weights.

ED visit weights also were calculated after sampling and the collapse of strata. Within each stratum, s, for hospital, i, the universe weight for each visit in the NEDS sample was calculated as the following:

$$DISCWT = [DNs(universe) \div ADNs(sample)] * (4 \div Qi)$$

Where DNs(universe) represented the number of ED visits from community, nonrehabilitation hospitals in the universe within stratum s; ADNs(sample) was the number of adjusted ED visits from sample hospitals selected for the NEDS; and Qi represented the number of quarters of ED visits contributed by hospital i to the NEDS. ED visits counts are adjusted for missing quarters of data, unless the hospital is closed during the year. Qi usually is four unless the hospital closed during the year. We compared the distribution of the weights to examine the variation of the ED visit-level weights between the 2013 NEDS and the five alternative designs.

Phase 4: Compare Weighted Estimates to External Data Sources

First, we compared estimates of ED visits by Census *region*, ED visits by Census *division*, and number of EDs by ED volume to the AHA Annual Survey Database and to the NEDI. We compared 95 percent confidence intervals for ED visits counts and percentages, and we defined differences by nonoverlapping confidence intervals.

Next, we compared counts of ED visits for various kinds of injury with those from the NEISS-AIP. We compared 95 percent confidence intervals for ED visits for injuries by mechanism and intent and defined differences by nonoverlapping confidence intervals.

Finally, we compared the percentage of weekly ED visits that were for influenza-like illness (ILI) with estimates from the CDC percentage of weekly visits to health care providers for ILI in 2013. ILI was chosen because it can be identified by the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnoses codes included in the NEDS, and it also is reported on the basis of clinical findings via the CDC Influenza Sentinel Providers Surveillance Network. Table 6 includes a list of the diagnosis codes.

Table 6. ICD-9-CM Diagnosis Codes Used to Identify Influenza-Like Illness

ICD-9-CM Code	Description
079.89	Viral Infection, not elsewhere classified
079.99	Viral Infection, not otherwise specified
460	Acute nasopharyngitis (common cold)
462	Acute pharyngitis
464.00	Acute laryngitis, without obstruction
464.10	Acute laryngitis and tracheitis, without mention of obstruction
464.20	Acute laryngotracheitis, without mention of obstruction
465.0	Acute laryngopharyngitis
465.8	Acute upper respiratory infections of multiple sites, not elsewhere classified
465.9	Acute upper respiratory infections of multiple sites, not otherwise specified
466.0	Acute bronchitis
466.19	Acute bronchitis and bronchiolitis due to other infectious organisms
478.9	Other disease of upper respiratory tract, not elsewhere classified/not otherwise specified
484.8	Pneumonia in other infectious diseases classified elsewhere
485	Bronchopneumonia, organism not otherwise specified
486	Pneumonia, organism not otherwise specified
487.0	Influenza with pneumonia
487.1	Influenza with other respiratory manifestations, not elsewhere classified
487.8	Influenza with other manifestations, not elsewhere classified
490	Bronchitis, not otherwise specified
780.6	Fever
784.1	Throat pain
786.2	Cough

Abbreviation: ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification.

Results From Each Phase of the Comparison

Results are presented only for Alternative Design 3 (retaining unique EDs in the sampling frame) because the testing demonstrated that the inclusion of EDs unique in a stratum for a State improved the NEDS design. The alternative designs that used Census division for stratification were hindered by a lack of data in some divisions. Revising the target universe resulted in only minor improvements to the design.

Phase 1: Compare Weighted Estimates of Common Outcomes of Interest

There were relatively few differences in the estimates between the NEDS and Alternative Design 3. The differences tended to be for estimates specific to pediatric patients (0–17 years old) and older adults (65 years and older) in CCS categories with either a small sample size or

no cases in one of the designs. Most of the differences were for comparisons of average total charges; there were no differences when comparing injury-related estimates.

The number of differences by age group (0–17, 18–64, and 65 years and older) and type of outcome (total ED visit counts, ED admission rate, average total charges, and injury-related ED visits) between the 2013 NEDS and Alternative Design 3 are summarized in Figures 6 and 7. Figure 6 demonstrates differences by age group; Figure 11 demonstrates differences by type of outcome.

Figure 6. Number of CCS Categories for Which the 2013 NEDS and Alternative Design 3 (Retaining Unique EDs in the Sampling Frame) Differ in Their Estimates of Total ED Visits, ED Admission Rate, Average Total Charges, and Injury-Related ED Visits by Age Group
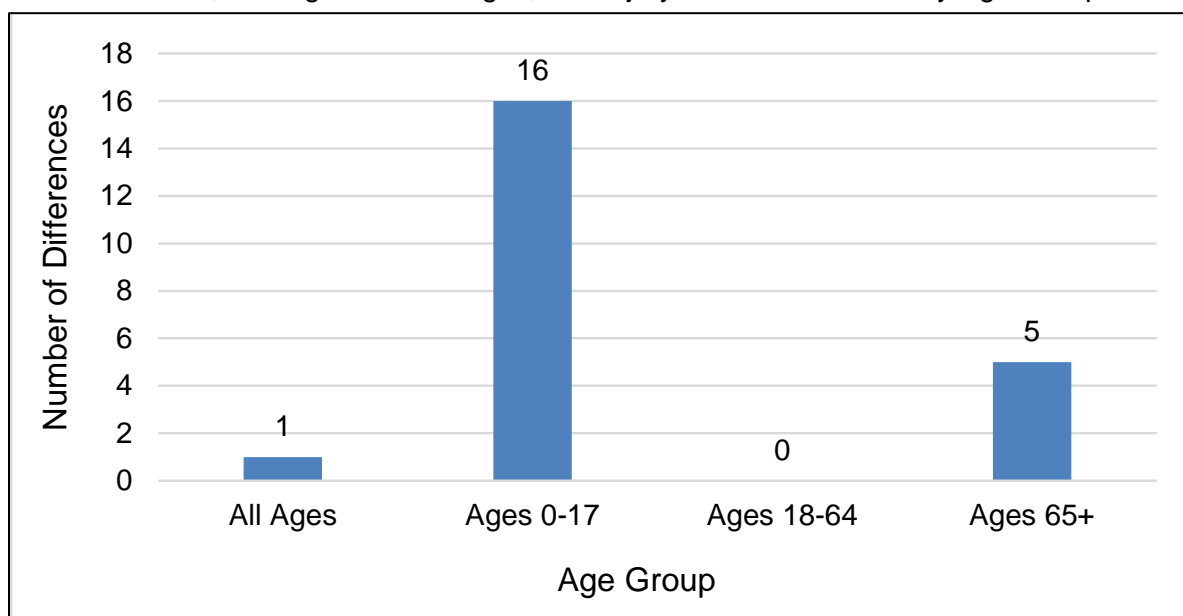
Abbreviations: CCS, Clinical Classifications Software; ED, emergency department; NEDS, Nationwide Emergency Department Sample.

Figure 6 indicates that 16 CCS categories demonstrated a difference between estimates for patients aged 0 to 17 years for one of the outcomes of interest (total ED visits, ED admission rate, average total charges, or injury-related ED visits) between Alternative Design 3 and the 2013 NEDS. There also were five CCS categories that demonstrated a difference between estimates for patients aged 65 years or older. There was only one CCS category that demonstrated a difference between estimates for patients of all ages.

Figure 7. Number of CCS Categories for Which the 2013 NEDS and Alternative Design 3 (Retaining Unique EDs in the Sampling Frame) Differ in Their Estimates of ED Outcomes Across Age Groups (0–17, 18–64, 65 Years and Older, and All Ages Combined)
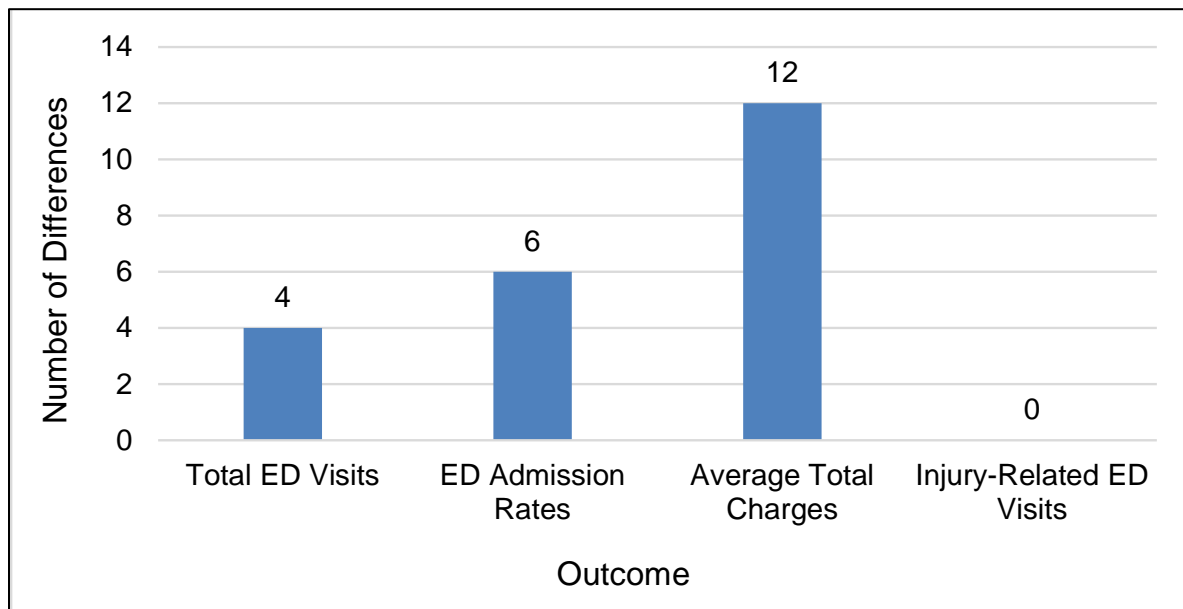
Abbreviations: CCS, Clinical Classifications Software; ED, emergency department; NEDS, Nationwide Emergency Department Sample.

Figure 7 indicates that four CCS categories demonstrated a difference in the total number of ED visits between Alternative Design 3 and the 2013 NEDS across the age groups 0–17, 18–64, 65 years and older, and all ages combined. Six CCS categories demonstrated a difference in the ED admission rates between Alternative Design 3 and the 2013 NEDS across the age groups. Twelve CCS categories demonstrated a difference in average total charges between Alternative Design 3 and the 2013 NEDS across the age groups.

Phase 2: Compare Strata Considerations

The 2013 NEDS had 83 strata, of which 15 strata (18.1 percent) involved undesirable collapses and 6 strata (7.2 percent) had an insufficient number of EDs in the frame to meet the threshold of 20 percent. Most of the undesirable collapses (13 of 15) involved the collapsing of trauma level III and nontrauma and about half (8 of 15) occurred in the South. All of the short strata were in the South or West region.

We compared the 2013 NEDS with Alternative Design 3, retaining unique EDs in the sampling frame. This design had two more strata for a total of 90 strata:

- Eleven strata (12.2 percent) involved undesirable collapses.

- Three strata (3.3 percent) had an insufficient number of EDs in the frame to meet the threshold of 20 percent.

- The retention of unique hospitals eliminated four undesirable collapses of strata and three of the short strata in the South.

Phase 3: Compare Hospital-Level Weights and ED Visit-Level Weights

The distributions of the hospital-level weights (Figure 8) were very similar between the 2013 NEDS and Alternative Design 3. The only notable differences were seen in the highest percentiles. Compared with the 2013 NEDS, alternative Design 3 had a smaller maximum (hospital weight 8.3).

The distributions of the ED visit-level weights (Figure 9) were very similar between the 2013 NEDS and Alternative Design 3. The only notable differences were seen in the highest percentiles. Compared with the 2013 NEDS, Alternative Design 3 had a smaller maximum (hospital weight 11.6).

Figure 8. Distribution of the Hospital-Level Weights for the 2013 NEDS and Alternative Design 3, Retaining Unique EDs in the Sampling Frame
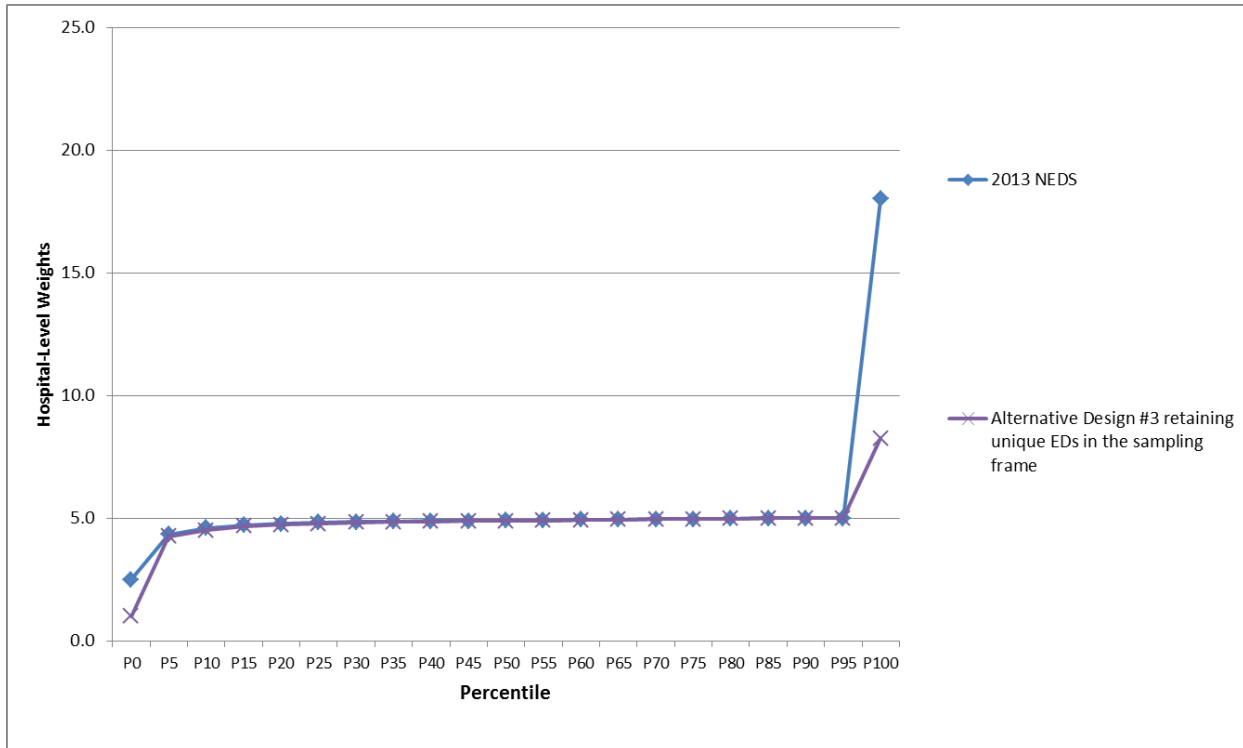
Abbreviations: ED, emergency department; NEDS, Nationwide Emergency Department Sample.

Figure 9. Distribution of the ED Visit-Level Weights for the 2013 NEDS and Alternative Design 3, Retaining Unique EDs in the Sampling Frame
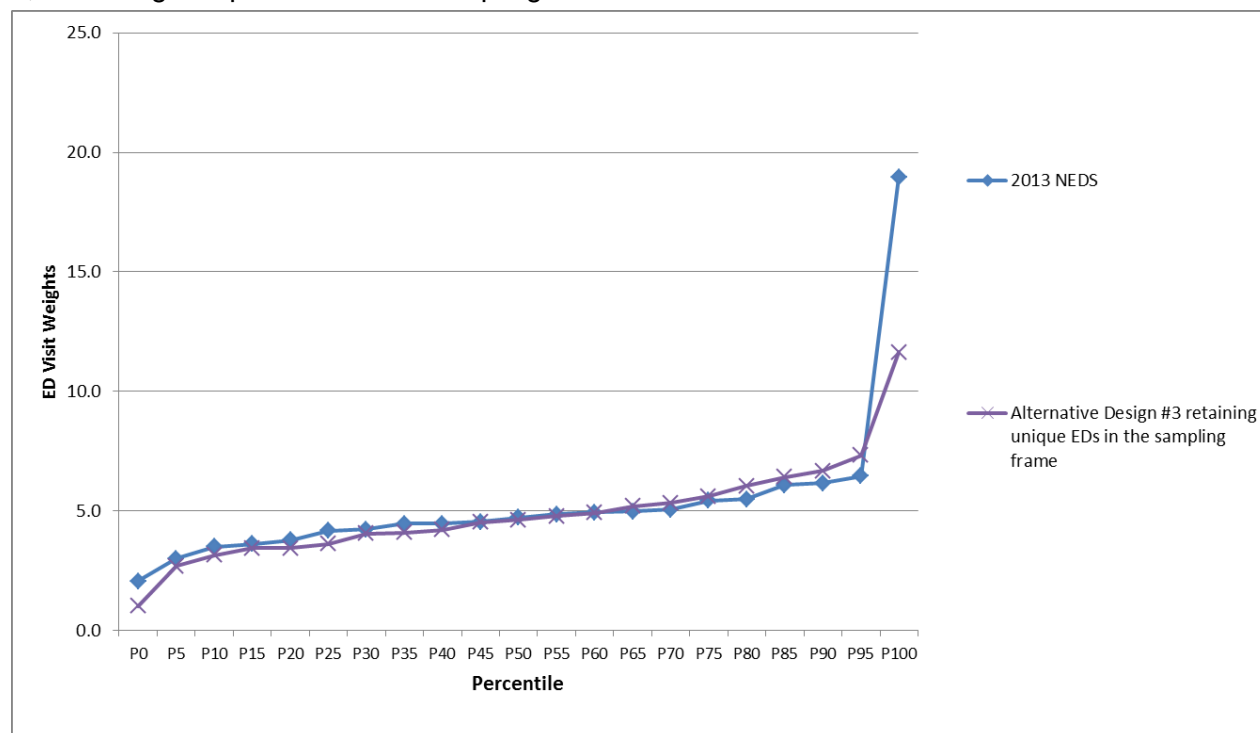
Abbreviations: ED, emergency department; NEDS, Nationwide Emergency Department Sample.

Phase 4: Compare Weighted Estimates to External Data Sources

First, we compared estimates of ED visits by Census region. Table 7 provides the ED estimates by Census region. Confidence intervals of ED visit counts and percentages by Census region for the AHA and NEDI were similar to the 2013 NEDS and Alternative Design 3, with a few exceptions. The 2013 NEDS and Alternative Design 3 had lower counts of total ED visits in the South than the NEDI. There were no differences in the percentages of ED visits by Census region.

Table 7. Estimates of ED Visits by Census Region

Source		Total U.S.	Northeast	Midwest	South	West
AHA	N	134,869,015	25,758,251	30,767,113	53,817,056	24,526,595
NEDI	N	139,922,560	25,295,058	30,903,541	58,624,567	25,099,395
2013 NEDS	N	134,869,015	25,758,251	30,767,113	53,817,056	24,526,595
	95% LCI	129,380,313	23,487,947	27,912,074	50,117,111[a]	22,757,208
	95% UCI	140,357,717	28,028,555	33,622,152	57,517,001[a]	26,295,982
Alternative Design 3[b]	N	134,869,015	25,758,251	30,767,113	53,817,056	24,526,595
	95% LCI	128,637,551	23,502,350	27,678,905	49,330,801[a]	22,507,056
	95% UCI	141,100,479	28,014,152	33,855,321	58,303,311[a]	26,546,134

Abbreviations: AHA, American Hospital Association [Annual Survey Database]; ED, emergency department; LCI = lower confidence interval; NEDI, National Emergency Department Inventory; NEDS, Nationwide Emergency Department Sample; UCI = upper confidence interval.

[a] Indicates confidence interval does not include NEDI estimate.

[b] Alternative Design 3 retains unique EDs in the sampling frame.

Table 8 provides the estimates of the number of EDs by ED volume. Differences between the 2013 NEDS and Alternative Design 3 occurred in the intervals of ED visit counts by ED volume in four of the volume categories. For EDs with less than 10,000 visits, the 2013 NEDS and Alternative Design 3 had lower counts of total ED visits compared with the AHA and NEDI. For EDs with between 10,000 and 19,999 visits, the 2013 NEDS and Alternative Design 3 had lower counts of total ED visits compared with the NEDI. For EDs with between 20,000 and 29,999 ED visits, Alternative Design 3 had lower counts of total ED visits compared with the NEDI. For EDs with between 30,000 and 39,999 ED visits, the NEDS had lower counts of total ED visits compared with the NEDI.

Table 8. Estimates of the Number of EDs by ED Volume

Source		Total U.S.	Less than 10,000 visits	10,000 - 19,999 visits	20,000 - 29,999 visits	30,000 - 39,999 visits	40,000 - 49,999 visits	50,000 or more visits
AHA	N	4,624	1,579	808	558	465	326	888
NEDI	N	5,025	1,483	978	694	591	435	844
2013 NEDS	N	4,624	1,353	833	638	481	390	929
	95% LCI	4,624	1,247[a,b]	723[b]	534	393[b]	312	838
	95% UCI	4,624	1,459[a,b]	942[b]	742	569[b]	468	1,021
Alternative Design 3[c]	N	4,624	1,368	838	585	520	387	925
	95% LCI	4,624	1,268[a,b]	731[b]	489[b]	429	307	830
	95% UCI	4,624	1,469[a,b]	946[b]	680[b]	610	468	1,020

Abbreviations: AHA, American Hospital Association [Annual Survey Database]; ED, emergency department; LCI = lower confidence interval; NEDI, National Emergency Department Inventory; NEDS, Nationwide Emergency Department Sample; UCI = upper confidence interval.

[a] Indicates confidence interval does not include AHA estimate

[b] Indicates confidence interval does not include NEDI estimate

[c] Alternative Design 3 retains unique EDs in the sampling frame.

Table 9 provides the estimates of injury-related ED visits. Injury counts for the NEISS-AIP were consistently higher than the 2013 NEDS and Alternative Design 3 for injuries related to cutting, firearms, machinery, motor vehicle traffic, the environment, poisoning, and being struck. Counts for the NEISS were lower than the 2013 NEDS and Alternative Design 3 for injuries related to drowning. Counts for the NEISS were no different from the 2013 NEDS for falling and suffocation, but counts for Alternative Design 3 were different.

Table 9. Estimates of the Injury-Related ED Visits

| Measure	NEISS-AIP	2013 NEDS			Alternative Design 3[a]		
	N	N	95% LCI	95% UCI	N	95% LCI	95% UCI
Total No. of ED Visits for Injuries	30,888,063	29,631,148	28,517,263[b]	30,745,032[b]	29,711,578	28,441,241	30,981,914
Injury Intent							
Unintentional	28,649,449	27,147,300	26,012,474[b]	28,282,127[b]	27,351,939	26,107,248[b]	28,596,631[b]
Assault	1,643,801	1,221,999	1,143,804[b]	1,300,195[b]	1,240,277	1,160,690[b]	1,319,864[b]
Self-harm	494,169	453,573	423,598[b]	483,548[b]	457,876	426,829[b]	488,922[b]
Injury Mechanism							
Cutting/piercing	2,329,422	2,188,783	2,097,782[b]	2,279,783[b]	2,171,389	2,074,999[b]	2,267,779[b]
Drowning/ submersion	5,539	12,900	11,336[b]	14,465[b]	13,906	12,048[b]	15,764[b]
Falling	8,790,337	9,166,311	8,777,459	9,555,163	9,245,139	8,830,603[b]	9,659,676[b]
Fire, flame or hot object	405,327	389,082	370,228	407,937	399,499	376,450	422,547
Firearms	84,258	68,141	59,395[b]	76,887[b]	69,640	61,277[b]	78,004[b]
Machinery	186,432	120,150	113,394[b]	126,906[b]	122,531	115,823[b]	129,239[b]
Motor vehicle traffic	3,887,356	3,147,200	2,976,087[b]	3,318,312[b]	3,179,366	2,993,585[b]	3,365,148[b]
Natural/ environmental	1,616,438	1,438,613	1,370,528[b]	1,506,699[b]	1,463,738	1,390,287[b]	1,537,190[b]
Poisoning	1,316,874	936,603	887,829[b]	985,376[b]	939,473	888,419[b]	990,527[b]
Struck by or against	5,661,201	4,011,572	3,818,588[b]	4,204,556[b]	4,091,779	3,885,781[b]	4,297,778[b]
Suffocation	59,444	56,169	52,271	60,067	53,770	49,533[b]	58,008[b]

Abbreviations: AHA, American Hospital Association [Annual Survey Database]; ED, emergency department; LCI, lower confidence interval; NEDI, National Emergency Department Inventory; NEDS, Nationwide Emergency Department Sample; UCI, upper confidence interval.

[a] Alternative Design 3 retains unique EDs in the sampling frame.

[b] Indicates confidence interval does not include NEISS-AIP estimate.

Figure 10 displays the percentage of weekly visits to health care providers for ILI from the CDC with the percentage of weekly ED visits from the 2013 NEDS and Alternative Design 3. Although the percentages themselves differ, the trend over the 12-month period is similar not only when compared with the CDC, but also between the two NEDS designs (2013 NEDS and Alternative Design 3).

Figure 10. Percentage of Weekly Visits to Health Care Providers and ED Visits for Influenza-Like Illness
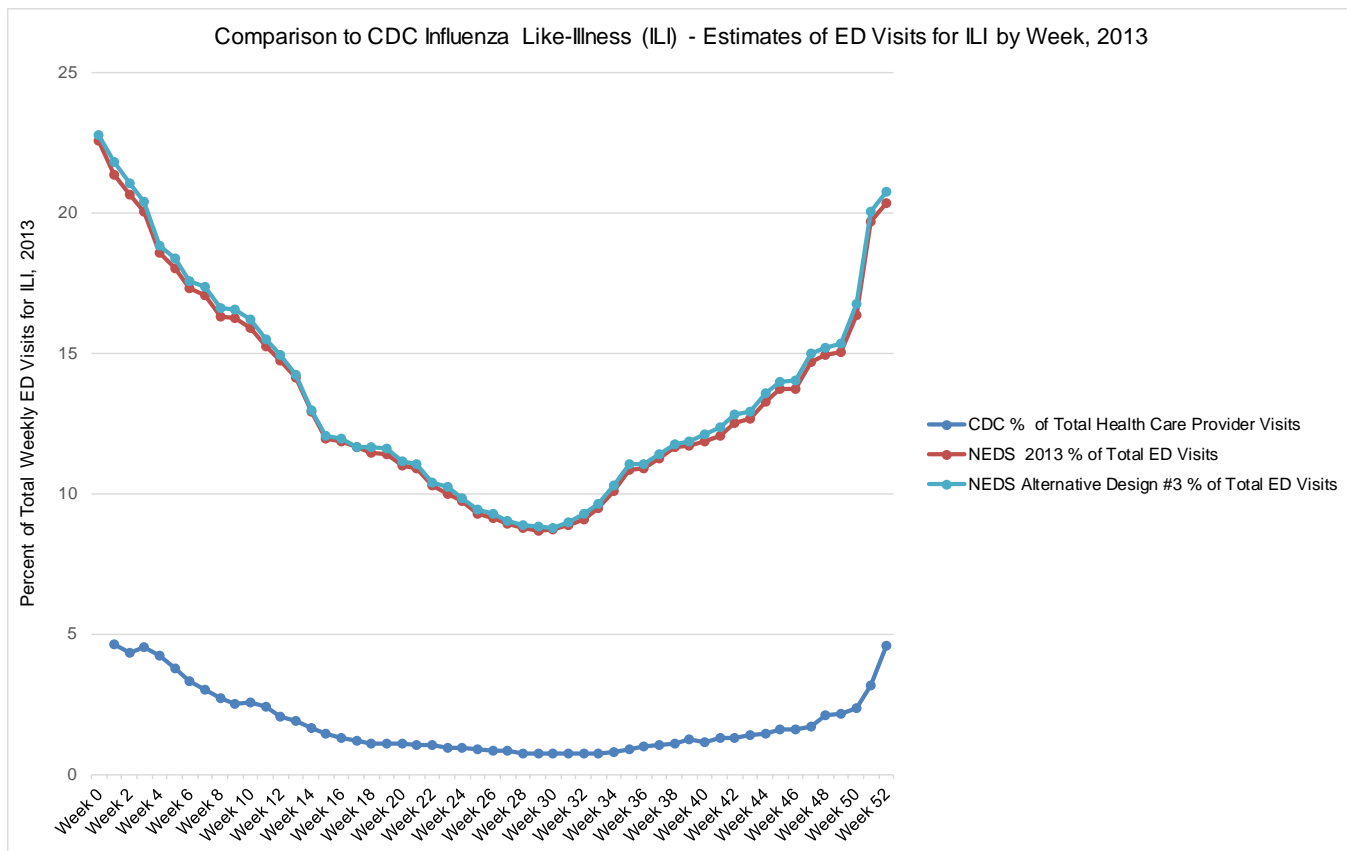
Abbreviations: CDC, Centers for Disease Control and Prevention; ED, emergency department; NEDS, Nationwide Emergency Department Sample.

Note: Alternative Design 3 retains unique EDs in the sampling frame.

RECOMMENDED CHANGES TO THE NEDS DESIGN

Collective results from the Phase 1 through Phase 4 evaluations demonstrated that retaining EDs that were unique in a stratum for a State in the sampling frame accomplished three things: (1) it reduced the number of strata in the South that needed to be collapsed to retain at least two hospitals in each stratum; (2) it reduced the number of strata with an insufficient number of EDs required for a 20 percent sample; and (3) it minimized the range of values of the hospital- and ED visit-level weights. Estimates of ED utilization with this one design change were similar to the 2013 NEDS and to the external data sources.

Our final recommendation is to pursue retaining EDs that are unique in a stratum for a State beginning with the 2015 NEDS. To increase the research value of the NEDS, we also recommend pursuing the release of additional data elements (e.g., indicator of neonatal age and patient race/ethnicity) and creation of CCR Files.

For future NEDS (after data year 2015), we recommend the recruitment of ED data from additional HCUP Partner organizations. When there are sufficient HCUP ED data in all Census divisions, changing the sampling strategy from region to division and focusing the target universe to EDs in general medical/surgical hospitals should be re-evaluated.