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TECHNICAL REPORT

Redesign of the National Hospital Discharge Survey

Conceptual Framework and Feasibility Study Final Report

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Prepared for the Centers for Disease Control and Prevention, National Center for Health Statistics

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Summary

The National Center for Health Statistics (NCHS) is responsible for developing and maintaining a portfolio of nationally representative surveys, referred to collectively as the National Health Care Surveys (NHCS), that is designed to measure utilization of the health care delivery system and is used for a variety of public- and private-sector purposes. A key component in the portfolio of surveys is the National Hospital Discharge Survey (NHDS). Since its inception in 1965, the NHDS has been a principal source of information on inpatient utilization in short-stay nonfederal hospitals in the United States.

Although the NHDS has served the country well, it was formulated in the context of the health care delivery system and hospital and patient universe of previous decades. NCHS therefore undertook an evaluation to determine the role that a redesigned NHDS might play in informing current and future policy and research issues. RAND Health, a division of the RAND Corporation, was selected to assist in developing an approach, including statistical considerations, for the redesign and to identify and test specific data elements to be included in the future survey.

Conceptual Framework for the Redesign

NCHS wanted to have a broad understanding of what a redesigned survey might achieve. The initial question posed to motivate development of a conceptual framework for the redesign was: "In the context of a survey designed to measure inpatient care, what data are currently lacking or limited in their availability that are needed to answer important policy and research questions for the next 10 to 20 years?"

To respond to this question, RAND sought to identify critical health policy research issues that will need to be addressed in the next two decades, and to identify redesign options that add unique value, rather than duplicate information being collected by other surveys or databases. To explore these areas, RAND drew on several sources, including a discussion group of RAND health policy experts; interviews with representatives of government agencies, policy experts, researchers, providers, and other users of data; and a workgroup of nationally recognized health policy experts. RAND also undertook a review of existing surveys to identify gaps that might be filled by a redesigned NHDS.

Key Policy Issues

Results of discussions with stakeholder groups provided insight into the types of important policy issues and related research questions that researchers and policymakers would like to be able to address through a redesigned NHDS. Stakeholders were strongly interested in obtaining more-detailed data on hospital patients than is currently available, including clinical data to facilitate risk adjustment and quality assessment; cost and resource-use data to support increased financial transparency; and patient demographic data to better understand barriers to access.

Stakeholders also expressed a strong interest in being able to understand care at a much greater level of geographic and hospital specificity than is currently available through the NHDS or other surveys, and they also commonly cited the desire to study care longitudinally and the ability to link the NHDS to other datasets (e.g., to the National Death Index, Medicare Provider Analysis and Review [MEDPAR file]).

Input from RAND researchers and other health policy experts was used to develop a list of 13 key policy issues, which were later discussed and validated by the Workgroup as being important for health and health care policy research. The Workgroup also ranked the issues and identified five that should be given the highest priority in the survey redesign. Table S.1 shows the five high-priority issues, together with an illustrative research question for each issue.

Table S.1
High-Priority Policy Issues and Illustrative Research Questions

Policy Issue	Illustrative Research Question
Cost of care and resource use	How much improvement in health is obtained for each dollar spent?
Quality of care and patient safety	What is the quality of care for people across various care settings?
Care delivered throughout the hospital	How consistent are admission and discharge diagnoses?
Continuity of care and transitions	How do patients access the health system over time?
Disparities and access	Are there differences in hospital utilization by different socioeconomic characteristics?

Although the Workgroup felt these five policy issues should be given priority for the redesign, they also agreed with the importance of the full list of policy issues and indicated that a redesigned survey might also provide value in other areas as well. The other issues are:

- Standards against which performance can be measured (benchmarking)
- Use and value of technology and innovation
- Role and value of electronic health records
- Mix and use of labor
- Care migration away from inpatient settings
- Public health and surveillance
- Focused studies
- Impact of globalization.

Limitations of Existing Surveys

To understand how the NHDS might be redesigned to address the high-priority and other issues identified by the stakeholders, RAND evaluated the current NHDS and other existing surveys to assess the extent to which they could be used to answer the research questions cited by stakeholders, particularly at the level of detail required. This review indicated that a significant opportunity exists for the NHDS to offer data at a more granular level—in greater depth—providing better national assessments of hospital-based care.

The review found that data gaps exist in many areas that are critical to addressing the high-priority policy issues cited by the stakeholders. For example, existing surveys do not provide adequate information about costs (e.g., data on actual payment or case-level profit or loss experienced by America's hospitals), medications, patient status (e.g., clinical information, such as vital signs, laboratory and other diagnostic test results, functional status), and outcomes. Nor do most existing surveys offer linkages between maternal and child records, or identifiers to link databases, including patient-, provider-, or facility-specific identifiers, and patient socioeconomic status.

Redesign Options

An understanding of the key policy issues and the limitations of existing surveys to address these issues led to the development of a set of non-mutually exclusive options for redesigning the NHDS. The redesign options illustrate different ways in which the NHDS might address some of the key policy issues. These options were reviewed by the Workgroup, which identified eight high-priority options that were most relevant for the survey redesign.

It should be noted that the option given highest priority by the Workgroup was the possibility of redesigning the NHDS in a way that would allow for better data coordination throughout the Department of Health and Human Services (DHHS) and in particular would allow for better alignment of inpatient data-collection efforts between Healthcare Cost and Utilization Project (HCUP) and the NHDS. Such an alignment could mean that the NHDS would supplement HCUP in the states where there is no State Inpatient Database (SID). However, further consideration of this option was beyond the scope of this project, so this option was not used to guide variable selection.

Eight high-priority options were used to guide the selection of specific variables to be included in the redesigned survey:

- **Increase hospital resource-use information.** Understanding the costs and general resource use associated with delivering care in the inpatient setting can provide information to assist in allocating resources more efficiently and effectively. The NHDS might continue to collect billed charges while adding data on expected and actual reimbursement. Other data of interest include information on resources used in the care of the patient throughout hospitalization, including detail on the number of days the patient spent at various levels of care (e.g., intensive care unit [ICU], observation prior to hospitalization, or general medical/surgical); the

drugs and supplies used; and the types of technology used to care for a patient (e.g., monitored bed, ventilators, endoscopy services).

- **Increase clinical depth.** This option adds clinical variables to facilitate a better understanding of hospital care. Clinical detail is essential for assessing the quality and appropriateness of health care, yet no existing publicly available survey collects in-depth information on clinical services provided to hospitalized patients.

- **Obtain outcome data.** Collection of outcomes of care was highly rated by the Workgroup. The information collected through the NHDS might be expanded to link hospital-related care to specific health-related outcomes. The complexity of this option depends on the outcomes selected for consideration, but in all cases a meaningful assessment of outcomes of care would need to extend beyond the hospital providing care.

- **Increase patient demographic information.** This option would permit a more accurate analysis of socioeconomic status and access to care. In addition to the demographic, administrative, and medical information currently collected, either patient interviews or patient written surveys would be required to collect data on the socioeconomic characteristics of each person sampled through the survey. Variables solicited might include address, Census tract, race, ethnicity, income, wealth, education, occupation, neighborhood socioeconomic characteristics, and past socioeconomic experiences.[1]

- **Track disease-specific care.** There is great interest among researchers in collecting more-detailed information for specific conditions or situations. NCHS could use the trust that has been built with survey hospitals over the past 40 years to collect in-depth clinical (e.g., cancer care, cardiac surgery, diabetes) or operational (e.g., workload, waste) information. The specific issues could be identified either by NCHS or in response to queries or requests from governmental or nongovernmental clients.

- **Incorporate inpatient and short-stay admissions.** Treatment that was traditionally provided for many conditions in the inpatient setting is now provided as outpatient care. This option would address this change in hospital utilization by including some of the spectrum of services that were previously considered to be inpatient admissions. Obtaining information on patients with such conditions should be relatively straightforward, because the encounters will be part of the hospital's billing system. Outpatient care that has moved to non-hospital settings, e.g., physicians' offices and ambulatory centers, is tracked in other NCHS surveys.

- **Incorporate patient-care encounters throughout the hospital.** The NHDS could be expanded to capture data relevant to the entire spectrum of services that are provided in U.S. hospitals, including ambulatory

[1] Socioeconomic experiences are the characteristics that surround a person's life experience, including economic status, discrimination, and optimism about life prospects and opportunities.

surgery, emergency care, hospital outpatient services, rehabilitation, observation, acute inpatient, and hospital-based skilled nursing facilities.

- **Obtain data on pre- and post-hospital care.** The NHDS might also seek to collect information on the care provided to hospitalized patients in the peri-hospital period (e.g., for the 72 hours immediately before admission and 72 hours following discharge). Such information might include ambulatory, emergency, institutional, and home care.

Selection of Variables for Testing in the Feasibility Study

In selecting variables for testing, RAND sought to identify those data elements that could help address the high-priority policy issues identified by the Workgroup, and, to a lesser extent, other important issues cited by our stakeholders. Variables included those abstracted from patient records (Patient Abstract) and information about the facility in which the care was performed (Facility Questionnaire). The selection of variables was also informed by general cost considerations, such as the time required for abstraction or availability of the data element from hospital systems and records; and by Workgroup priorities for the redesign options. Thousands, and perhaps even millions, of questions might be asked about a given practice or condition. The goal was to create a sufficiently robust general-purpose survey that addresses many of the high-priority policy issues while incorporating sufficient depth and flexibility through the use of modules that will be capable of providing data to answer specific questions of interest.

Given the expressed desire by NCHS to retain the ability to trend and track hospital data that have been collected and analyzed over the past 40 years, RAND recommended that variables included in the current NHDS be maintained as part of the redesign. The RAND team also identified many new variables, including some that we considered likely to be easy to obtain, and others that we considered likely to be more difficult to collect, but worthwhile to test, since they mapped to high-priority research domains. A list of key variables selected for inclusion in the feasibility study is shown in Table S.2.

Some variables were deemed to be beyond the scope of the current redesign, either because they would be extremely difficult to collect or because current systems do not reliably collect them. In the Patient Abstract, these include variables related to longitudinal patient care (encounters in other facilities), actual cost of services, and nonphysician professional services (e.g., nursing hours, other allied health hours, consultations). In the Facility Questionnaire, they include volume and capacity by clinical service.

Table S.2
Variables Included in the Feasibility Study, by Variable Category

Patient Abstract	
Variables in Current NHDS	**Variables in Proposed Redesign**
AHA hospital identifier	AHA hospital identifier
Birth date (or age)	Birth date (or age)
Sex	Sex
Marital status	Marital status
Race and ethnicity	Race and ethnicity
	Patient name
	Patient medical record number
	Encounter, billing, or visit number
	Medicare HIC number
	English proficiency
	Occupation
	Education
	Mother's medical record # (newborns)
Zip code	Zip code
	Patient address
Expected source of payment	Expected source of payment
	Payment type (e.g., indemnity, HMO)
	National provider identifier
	ICD-9-CM Diagnosis code
ICD-9-CM Diagnosis codes (Principal/Other)	ICD-9-CM Diagnosis codes (Principal/Other)
ICD-9-CM Procedure codes (Principal/Other)	ICD-9-CM Procedure codes (Principal/Other)
Admission type (elective, emergent, newborn)	Admission type (elective, emergent, newborn)
	Living situation on admission
	Diagnoses present on admission
	Height and weight
	Drug allergies
	Location and dates of initial care (e.g., acute, ICU, observation)
	Vital signs
	Pain assessment
	ASA classification (surgical patients)
	Tobacco use
Date of admission and discharge	Date of admission and discharge
	Date(s) in ED care
Patient location preceding admission	Patient location preceding admission
Discharge disposition and location (partial)	Discharge disposition and location (detailed)
	Palliative care
	Observation/acute (for initial observation patients)
	Vital signs before discharge
Discharge disposition = expired	Discharge disposition = expired

Facility Questionnaire	
Variables in Current NHDS	**Variables in Proposed Redesign**
AHA hospital identifier	AHA hospital identifier
Hospital name, address, phone, fax	Hospital name, address, phone, fax
	Hospital key contact
	Days open during reporting period
Staffed beds by hospital unit	Staffed beds by hospital unit (detailed)
	Licensed observation unit beds
	Licensed other outpatient beds
	Total Emergency Dept. (ED) beds/bays
	ED beds/bays (adult, pediatric, psych)
	Number operating rooms
	Level of care provided by
Trauma level of ED	Trauma level of ED
Total discharges	Total discharges
	Total admissions
Number of live births	Number live births
Average length of stay	Average length of stay
Total surgeries – and by inpatient and outpatient	Total surgeries – and by inpatient and outpatient
Total outpatient visits	Total outpatient visits
Total ED visits	Total ED visits
	No. admitted from ED to hospital, transferred, seen & discharged
	Total observation stays (and Medicare only)
	Total outpatient stays
Accreditation and certification – Joint Commission, CMS	Accreditation and certification – Joint Commission, CMS
	Ownership type
	Subsidiary of larger company
	Affiliated with organized physician practice
Medical school affiliation	Primary teaching hospital
Offer residency training	Offer residency training (Y/N)
COTH Member	COTH Member
General description of services (e.g., gen'l acute care, cancer)	General description of services (e.g., gen'l acute care, cancer)
	Clinical capabilities and services
	% of patients by patient insurer
	% of facility total revenue by patient insurer
	% insurance type (e.g., HMO, PPO, fee-for service) by insurer
	Receipt of Medicaid Disproportionate Share Funding
	Capital investment plans
	Number of Licensed Independent Practitioners (LIP), Tele-LIP, Locum-Tenens by specialty type
	Number hospitalists and medical service
	Number other employed inpatient staff
	Number Certified RN Anesthestists
	Number of open nursing positions
	Unionization of staff
	Avg. monthly number of trainees by discipline
	Health information functionality by hospital unit & degree of linkage between units
	Medical coding – software & avg, median, mean no. diagnoses and procedures per patient

RAND also recommended that, in addition to the variables shown in Table S.2, brief focused modules be included in the feasibility study to determine whether limited modular components could be "added on" to the general-purpose survey. For the feasibility study, we included modules on acute myocardial infarction, psychiatric inpatient care, and asthma, based on the recommendations of the National Heart, Lung, and Blood Institute (NHLBI), Substance Abuse and Mental Health Services Administration (SAMHSA), and the Agency for Healthcare Research and Quality (AHRQ), respectively. Condition-specific variables included diagnostic tests (e.g., radiology), medications, treatments, and admission and discharge criteria specific to the condition being studied.

The results of this effort led to the development of a Patient Abstract Form to be tested in the feasibility study. This form consists of 70 questions (54 included in the general module) and over 500 data fields to be field-tested for feasibility, compared with the 19 questions and just over 100 data fields in the current NHDS. To provide more in-depth information about the hospitals participating in the abstraction process, RAND and NCHS also developed a Facility Questionnaire, which was designed to leverage and build on the information hospitals already provide to the American Hospital Association (AHA) hospital database on an annual basis. Variables were added to allow NCHS to track and trend issues raised in the conceptual framework, including the types of providers caring for patients in hospitals and trends in HIT adoption. The current NHDS does not collect facility-specific data from hospitals, with the exception of a commercially provided file used for sampling hospitals and information obtained relevant to the abstraction process.

Feasibility Study

With input from NCHS, RAND selected and recruited hospitals for the feasibility study. Hospitals that agreed to participate were provided with a *Field Manual* (Hilborne, Meili, Berry, et al., 2007) to guide them through the sampling and abstraction process, and relevant personnel were also trained by RAND. Seven of eight hospitals that agreed to participate in the feasibility study ultimately completed it over a period of three months. Rural and urban, large and small, and for-profit and nonprofit hospitals were included.

Results of Abstraction

On the whole, hospitals were successful in abstracting the vast majority of data elements without difficulty. Moreover, hospitals were also successful in abstracting some variables that we had anticipated would be more challenging (e.g., English proficiency, mother's medical record number for newborns). Hospitals did face challenges in abstracting some variables, which in many cases were anticipated. We briefly highlight a few of those points here:

- **Protected health information.** Although abstractors had no difficulty obtaining protected health information (PHI) from the medical record and billing forms, these data were not always fully removed from the patient records, which is necessary to ensure that patient confidentiality is maintained. This did not have an effect on the feasibility study, since all records were left at the hospitals; however, subsequent NHDS redesign

phases that actually remove PHI from the facility should confirm that hospital administrators, legal staff, and privacy officers are satisfied with the process used to protect the confidentiality of this information.

- **Dates and times.** Dates, and especially specific times (e.g., admission and discharge times, transition times from emergency department to observation), were problematic for both hospital and RAND abstractors. Charts often contain multiple, conflicting times for these events, and times in the hospital information systems generally do not agree with the specifics documented by health care practitioners in the record.

- **Demographics.** Some of the demographic information requested on the abstraction form was not readily available. Problematic items include patient occupation and education.

- **Clinical variables.** Although clinical variables were available from all hospitals, the entries made by hospital abstractors and RAND abstractors did not always agree, particularly when a variable required unit calculation (e.g., weight in pounds and ounces converted to kilograms or grams, daily smoking use as pack years), clinical interpretation (e.g., functional status, asthma management plan), or the first value recorded (e.g., pain assessment, vital signs).

- **Provider identification.** Hospitals could usually identify the attending physician and operating physician, but were typically unable to provide the Unique Physician Identification Number (UPIN) for other types of providers.

- **Diagnoses and procedures.** Although hospitals provided discharge abstracts listing coded diagnoses and procedures as paper printouts, they did not abstract this information onto the Patient Abstract Form, and less-significant diagnoses (e.g., noncontributory chronic conditions), procedures (e.g., minor surgical procedures), and external causes of injury (i.e., E-codes) were infrequently recorded.

- **Medications.** Although admission and discharge medications were available from most records, information on medications received during hospitalization, when available, typically was not transferred to the abstraction form, but rather sent on a hard copy.

- **Financial information.** Hospitals used hard-copy printouts for financial data. There was variation in the types of financial information provided: All hospitals provided information on charges, four of seven provided expected and actual payment information.

- **Newborns.** Most of the clinical data either were not applicable to newborns (e.g., English proficiency) or required unit calculations (e.g., weight in pounds and ounces converted to kilograms or grams).

- **Clinical modules.** Hospitals were able to abstract the clinical modules. However, in a few cases, persons without clinical expertise performed the abstraction.

Completion of Facility Questionnaire

Hospitals were successful in completing the Facility Questionnaire. However, hospitals reported that, overall, completion of the form was time-consuming and burdensome. Very little of the requested information is readily available from routinely produced reports; therefore, manual analysis and assembly were required. Data elements that we anticipated would be particularly difficult (detailed hospital unit and clinical service capacity and volume) indeed were not available. Other elements were particularly time-consuming (staffing). Financial elements are generally available in financial systems but would require programming to extract.

Procedural Issues

The feasibility study provided several insights relevant to the sampling and abstraction process. It should be noted that all hospitals approached sampling and abstraction as a one-time event and noted that, had this been an ongoing process, they would have invested time in programming and other processes to simplify the extraction of the desired variables.

Sampling. Despite the complexity of the sampling plan, none of the hospitals considered sampling to be a difficult task. RAND provided sampling assistance to one of seven hospitals, and only four errors were identified in the sampling overall.

Abstraction. Hospitals were able to abstract the majority of the elements included as part of the abstraction form. Abstractors noted that they had limited need for the *Field Manual* because they thought the questions as stated in the abstraction form were self-explanatory. Most sites used one or two individuals to conduct the abstraction; however, two sites subdivided the task among six people, intending that each would assume responsibility for the accuracy of the content of specific sections. Neither of these two sites designated one person to look at each case in its entirety.

Substantial time was required to conduct the abstraction. It is likely that even more time would be required in the normal survey than in the feasibility study, which excluded hospital stays exceeding ten days from the sample (approximately 10 percent of admissions) and did not require full abstraction of in-hospital medications.

Recommendations for Sampling, Variables, and Abstraction

The findings of the feasibility study led to some specific recommendations for changes to the abstraction form, including the deletion of some items and modifications to others. We offer these additional recommendations to guide pilot-testing and future applications of the redesigned survey:

- Although most hospitals were able to complete a stratified sample independently, future studies must be able to accommodate the needs of organizations for which such a complex sampling plan could be a potential obstacle. Based on our findings, the instructions provided by RAND in the *Field Manual* (Hilborne, Meili, Berry, et al., 2007) should adequately meet the needs of facilities for assistance.

- Depending on the strategy selected for data abstraction and collection (i.e., by facilities or by NCHS contract staff), the length of the form may discourage some organizations from participating on an ongoing basis. The data contained in the abstraction form include a combination of data available in the Uniform Billing (UB) form and other clinical data elements. With this in mind, we redesigned the abstraction form after the feasibility study to group the subset of data elements that are contained in the UB-04 (used by hospitals beginning in March 2007). As hospitals adopt the UB-04, it will be important to validate the reliability of the data elements it contains and the validity of our recommendations to rely on it for many data elements.

- As hospitals adopt electronic health records that are increasingly based on standardized data, it may be possible to use electronic transmission to extract some data elements that are difficult to abstract at this time (e.g., medications administered). Migrating to a computer-assisted abstraction tool that selects subsequent questions based on data already entered is more amenable to complex skip patterns, which ask for more-detailed clinical information that is appropriate for a given patient type, than are the current paper-based tools.

Recommendations for Facility Questionnaire

Because we obtained results from only four hospitals, we were reluctant to recommend sweeping changes to the form. However, the burden of collection made it clear that simplification of the form is required. Specific recommendations for simplification include linking to the AHA hospital database to receive hospital demographic, bed-capacity, and general utilization statistics; and elimination of residency staffing statistics that must be obtained from other sources. Some variables that hospitals reported as being challenging (e.g., median and maximum number of diagnoses and procedures per patient and other hospital staffing) have been retained and recommended for further testing.

Statistical Considerations

RAND assessed the statistical implications of the redesign to inform the discussion regarding trade-offs between statistical power and the burden of data collection when questions are posed by those desiring to use the redesigned survey.

The NHDS has great value as a national probability sample of discharges, but it must adapt to a changing environment to offer the most value to potential users. The NHDS' major strength relative to the National Inpatient Sample (NIS), the largest all-payer inpatient database in the United States, is that it is a representative sample of discharges in the United States and thus yields unbiased national estimates. In addition, the NHDS is clearly preferable in the geographic areas where NIS does not collect the data. Although NIS is a biased estimator of the national population, the current structure of the NHDS makes it imprecise for some outcomes, so that it is an empirical question as to which survey currently yields more-accurate estimates for a given measure when considering both bias and precision.

The NHDS can substantially improve precision by dropping a third tier of sampling hospitals within primary sampling units (PSUs) and may be able to realize some additional gains by reducing disproportionate sampling. Such an improved NHDS would probably have higher statistical accuracy than NIS for the many measures the surveys have in common at current NHDS sample sizes, and perhaps even at reduced sample sizes. It will be important for the NHDS to educate its potential users about the situations in which the NHDS outperforms other surveys with larger nominal sample sizes because bias is invisible to standard statistical software, and sample size (and variance) is not.

The greatest potential for the NHDS to increase its utility is to achieve greater clinical depth of elements, allowing more-sophisticated health services and health policy analyses than are currently possible. Such an expansion of depth would be more costly as sample size increases, so that the current NHDS size of approximately 300,000 discharges annually would probably have to be reduced. Analyses of 16 sample designs suggest that, with a less disproportionate two-stage sampling approach, as few as 50,000 discharges annually, if drawn from 500 hospitals, might provide appealing measurement precision that would support many such analyses ("good" measurement precision for most scenarios and "acceptable" for others). If this cannot be afforded, 12,500 discharges from 250 hospitals should probably be considered minimum targets, although they provide notably less precision than 50,000 discharges from 500 hospitals.

Conclusions

RAND believes that it is essential to maintain those properties of a general-purpose survey that have served NCHS so well over the past 40 years. We have demonstrated, however, that it is possible to incorporate depth and breadth into the survey without compromising the basic premise on which the NHDS was founded.

Although the proposed redesign is clearly ambitious, its implementation offers an opportunity for the survey to continue to be invaluable to the health policy and research communities in the decades to come. The proposed redesign introduces new classes of variables that, in combination, will allow researchers to address a broad range of policy and research questions that will be important to guide health and health care policy decisions in the future. It also offers opportunities to better inform current research by providing greater depth than is currently available from existing surveys and provides a structure for incorporating modules that can focus in detail on selected issues of interest (e.g., appropriateness of care, management of HIV). The addition of the Facility Questionnaire further offers the opportunity for insights into differences in clinical care based on the type of hospital organization in which that care was provided.

Research and Policy Questions That Can Be Examined Through the Redesigned Survey

The redesigned survey will allow for a range of new research and policy questions to be explored. Below, we highlight a few examples relevant to the five high-priority policy issues identified by the Workgroup.

Cost of Care and Resource Use. New variables related to reimbursement for care will supplement existing cost information and allow for examination of more-complex issues, such as cost shifting among different payers and patients, and the relationship among costs, charges, and actual reimbursement. By introducing information on both expected and actual reimbursement, the survey will allow for better understanding of the allocation of resources and the need for greater transparency in cost and pricing. Cost data from the survey can be used in conjunction with data from the Facility Questionnaire to explore such issues as whether individual patient encounters are profitable or unprofitable. The NHDS dataset can also be used to generate models to predict expected costs and to identify facility characteristics that result in higher or lower costs and lengths of stay than expected.

The general survey will not have sufficient depth to answer very focused questions related to cost of care (e.g., the cost of laboratory services for patients admitted for treatment of thyroid cancer). However, special modules designed specifically for such analyses can be used to answer more detailed questions.

Quality of Care and Patient Safety. Drawing meaningful inferences regarding quality of care requires a clinical context in which that care is provided. The proposed redesign dramatically expands the survey's clinical information by incorporating laboratory data, vital signs, medications on admission and discharge, American Society of Anesthesiologists (ASA) physical status classification and other clinically relevant variables. The redesign also captures whether diagnoses existed on admission, an important determinant in differentiating between adverse situations that led to hospitalization and complications that resulted from the care provided. The redesigned survey begins to define variables that will link facility structure, processes, and outcomes of care. The richness of the data contained in the redesigned survey could also facilitate policy analyses to determine strategies for incorporating additional, non-administrative variables that better adjust for patient severity.

The survey also provides the opportunity to look beyond the hospital care received to evaluate the mortality impact of the care through linkage to the National Death Index. By capturing the attending and operating physicians' National Provider Identifiers (NPIs) as part of the discharge abstract, it offers the ability to link the individual patient's care with the specialty of the providers from whom care was received. Moreover, our discussions with national patient safety leaders suggest that the additional proposed clinical variables will facilitate strategies to improve the specificity of AHRQ's Patient Safety Indicators (AHRQ, 2006).

The general survey lacks sufficient detail to adequately address issues related to appropriateness of care or to fully respond to the wide range of quality indicators either being used or developed. However, because appropriateness criteria are specific to patient condition and procedure, this type of assessment is uniquely amenable to focused modules.

Care Delivered Throughout the Hospital. By incorporating data on patients with "observation" status, the redesigned survey provides a more complete picture of care delivered throughout the hospital than has been possible in recent years. Incorporating short-stay or observation "outpatients" into the NHDS will help to reconstitute the patient composition of the survey of previous decades, thereby

making possible, for the first time, an understanding of the impact this practice shift has had on the services, intensity of care, costs, reimbursement, and outcomes. Future studies may wish to explore whether all patients occupying hospital beds, whether considered observation patients or simply outpatients occupying a hospital bed, should be included in the NHDS.

Continuity of Care and Transitions. Continuity of care, particularly as patients transition from the hospital environment to lower levels of care (e.g., home, assisted living, hospice, intermediate care), is frequently cited by patients as a major weakness. Health policy experts also frequently noted the lack of longitudinal data. Although practical considerations limited the extent to which longitudinal data could be included in the redesigned survey, the redesign will allow for examination of the impact of patients' discharge arrangements on their use of hospital services (e.g., using variables such as discharge location, length of stay, and 30-day readmission).

Disparities and Access. The redesigned survey will facilitate studies of equity in care by providing additional detail by which to identify patient personal characteristics (e.g., English proficiency) unrelated to their clinical condition. A better understanding of patient socioeconomic status will be possible because the new address variable in addition to zip code will facilitate sophisticated geocoding, thus allowing for better estimates of patient and family income, race and ethnicity, and education. Relating patient socioeconomic status (SES) to insurance status and hospital type (e.g., rural or urban), particularly after adjusting for acuity at discharge, will offer insight regarding the extent of differences in care that patients of different SES receive.

Costs of Data Collection

Adding a requirement for primary data collection does not come without a substantial increase in per-record cost. RAND acknowledges this reality; however, we strongly believe the additional investment in this survey will give it the ability to address policy and research questions that will ensure that future health care investments–which are orders of magnitude more costly than the added cost of the survey–are well spent. The actual cost of the survey will vary depending on a number of elements, which we briefly describe here:

- **Number of participating hospitals.** The number of hospitals affects induction and training requirements, as well as the sampling and abstraction process.
- **Number of records abstracted per facility.** Although it may be possible to reduce the number of records per facility if the number of facilities and their geographic dispersion increases, it is important to maintain collection of a sufficient number of records at each facility to ensure that the facility makes a substantive contribution to the survey. Abstracting a sufficient number of records per facility increases incentives to develop electronic approaches to data collection.
- **Number of data elements abstracted per record.** We anticipate that the current abstraction form will require an average of 45 minutes per record to complete, although the time requirement may decrease with

experience. Additional hospital costs include computer programmer time, record-pulling time, and facility form completion. The marginal cost of data collection might be reduced by shortening the abstraction.

There are options for reducing the costs of abstraction. Over time, the average per-record abstraction cost should be reduced by upfront programming of hospital computer systems (high initial fixed cost), followed by electronic means of data collection and submission (lower marginal per-record cost). In addition, the introduction of focused modules minimizes the nonproductive collection of data elements that results when static survey designs cannot restrict data collection to those patients for whom specific elements are relevant. The statistical analysis presented in Chapter 10 offers redesign considerations that minimize the number of records required, with minimal loss of statistical power to draw significant observations.

Future Considerations

In moving forward with the pilot study, NCHS should also keep other considerations in mind:

Abstraction Tools. Future pilots using computerized data abstraction tools should have the ability to better incorporate skip patterns and contextually relevant questions (e.g., disease- and age-specific branching logic). This ability will both expedite data collection by minimizing irrelevant data abstraction and allow the survey to be used to probe more-detailed questions when clinically relevant (e.g., cardiac enzymes in the setting of chest pain or myocardial infarction).

Creating Files for Public Use. The proposed redesign survey collects additional patient-identifiable data that must be deleted before survey files are made available for public use. The NHDS will require the infrastructure to create necessary linkages to external files (e.g., Social Security number and the National Death Index, National Provider Identifier and provider type), obtain the requisite demographic and other data, and then delete sensitive information before public release.

National Statistical Hospitals. The Workgroup recommended that NCHS focus on identifying and developing a network of National Statistical Hospitals through which they could explore alternative data-collection strategies. Strategies discussed in this document could streamline data collection by, for example, prospectively incorporating patient consent to use patients' PHI in their admission forms. National Statistical Hospitals partner with NCHS to electronically collect data and perhaps extend data collection longitudinally.

Limitations

Before a full survey can reach the field, a number of limitations imposed on the feasibility study must be explored. The study timeline did not permit us to randomly select participating facilities. This was a one-time data collection, so hospitals did not have the incentive to undertake the necessary programming to electronically extract data that would be more likely to facilitate ongoing data collection. By using a convenience sample, we did not fully test hospitals' recruitment and approval

processes and timelines. The limited nature of the feasibility study and the retention of PHI within the hospital may have limited the scrutiny required by hospital institutional review boards (IRBs). Finally, there was not sufficient time to formalize and conduct rigorous training, an activity that could have reduced misunderstandings and discrepancies observed during the feasibility study.