

Meeting the Challenges of Converting a Large Establishment Survey from Paper to Electronic Administration

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As technological advances continue to foster the move from paper-based survey administration to computer-based administration, consideration must be given to the potential effect that switching modes may have on a given questionnaire. Issues related to mode and method effect, usability issues, adjustments to question wording and response formats are well documented. However, less documentation exists on the operational considerations for converting an entire study protocol from paper-based to computer-based administration. These are particularly complex issues for establishment surveys, where issues of case ownership, building consistent rapport with respondents, and managing multiple points of contact present additional challenges beyond those that are common to household and individual surveys. Sponsored by the US Department of Health and Human Services' Agency for Healthcare Research and Quality (AHRQ), the Medical Expenditure Panel Survey (MEPS) is a set of large-scale surveys of families and individuals, their medical providers, and employers across the United States. MEPS is the most complete source of data on the cost and use of health care and health insurance coverage. In 2010, the Medical Provider Component (MPC) of MEPS, which covers hospitals, physicians, home health care providers, and pharmacies identified by respondents in the MEPS Household Component, will undergo a major change from paper based administration to computer based administration. This change not only affects the way data will be collected via instrumentation, but also how sample records, case level details, points of contact, problems during data collection, issues of nonresponse and interviewer productivity are managed and tracked. This presentation will share information on some of the challenges presented by such a conversion, along with the unique and customized solutions developed in order to prepare the MEPS-MPC for data collection in 2010.

1. Introduction

In a 1996 article in the *Journal of Official Statistics*, Dillman notes, “Innovation in large survey organizations is as essential as breathing – there is no alternative.” While the difficulties related to innovation in government surveys that Dillman goes on to write about in the same article should be left to debate at another time, the advances made in the survey research industry over the last twenty years dictate that efforts to improve survey protocols through change, no matter how uncertain or challenging, can be beneficial. This is especially true of the technological advances that continue to foster the move from paper based survey administration to computer based administration.

When exploring issues related to switching modes in self-administered questionnaires, or offering mixed mode alternatives to respondents, one need not look far to find literature warning of the potential (and undesirable) changes in measurement and other pitfalls. Issues related to mode and method effect, usability issues, adjustments to question wording and response formats are well documented (deLeeuw, 1992; Presser et al. 2004; Dillman & Christian 2005; Dillman, 2007; Dillman et al. 2008; Christian Dillman and Smyth, 2008).

While a wealth of literature addresses considerations related to measurement issues, documentation on the operational considerations for converting an entire study protocol from paper-based to computer-based administration are difficult to find. Such a change requires critical thought on a number of fronts:

- the way data will be collected via instrumentation; ensuring that new electronic questionnaires are as user-friendly and flexible as their paper based predecessors,
- how sample records are managed; focusing system design on efficient sample management and recordkeeping,
- how case level details are collected and tracked,
- the management of points of contact,
- tracking and resolving problems during data collection,
- combating nonresponse,
- ensuring data comparability across waves in a time series and
- managing and tracking interviewer productivity.

In addressing these issues, further complexity is introduced when the survey being converted is an establishment survey. In such studies, many challenges present themselves in the literature, such as sample management, complexities in selecting proper informants in complex organizations, gaining the acceptance/approval of gatekeepers, building consistent rapport with respondents, managing multiple points of contact and ultimately, the potential for multiple respondents (Christianson and Tortora 1995; Paxson, Dillman and Tarnai 1995, Presser et al. 2004; Dillman 2007; DeRoches 2009; Morrison, Dillman and Christian 2010). These challenges must all be considered in addition to those that are common to household and individual surveys.

While literature on design considerations and best practices for establishment surveys does exist, much of it focuses on best practices for self administered surveys (Dillman, Gertseva and Mahon-Haft 2005; Mulrow, Freedman and Rutchik 2007; Morrison, Dillman and Christian 2010). Interviewer-administered establishment surveys add yet another layer of complexity to

mode conversion and redesign in the need to ensure that protocols work for not only the respondent(s), but the interviewers as well. Here, the ultimate challenge is ensuring that enhanced data quality from traditionally more rigid, well monitored computer based protocols are safely mixed with the flexibility allowed by paper based data collection.

This paper will discuss the challenges presented by converting a large federal study from paper-based administration to computer- based administration; The conversion of the Medical Provider Component (MPC) of the Medical Expenditure Panel Survey (MEPS). The conversion created the need for highly innovative and customized solutions in preparation for the 2010 MEPS-MPC data collection. Details on the approach to and solutions for challenges related to sample and case management, instrumentation, managing data collection operations and linking multiple system components related to are discussed.

2. MEPS Background

The Medical Expenditure Panel Survey (MEPS) is a major program supporting the mission of the Agency for Healthcare Research and Quality (AHRQ) to improve the quality, safety, efficiency, and effectiveness of health care for all Americans. MEPS data describe specific health services used by Americans, the frequency and cost of their use, and how these services are paid for. Each year, the survey collects data from a nationally representative subsample of households that participate in the previous year's National Health Interview Survey (NHIS), conducted by the National Center for Health Statistics of the Centers for Disease Control and Prevention. Data collected in the MEPS Medical Provider Component (MEPS-MPC) are used to impute estimates of medical expenditures not captured in the MEPS Household Component (MEPS-HC). Data from MEPS-MPC are used in tandem with data from the MEPS-HC and are critical to the development of expenditure estimates. The MEPS-MPC data also provide information about physician charges that are associated with hospital care but not billed by hospitals and are a primary source of expenditure information for Medicaid recipients.

Providers for the MEPS-MPC sample for one year are identified based on three rounds of MEPS-HC data collection for two panels. The panel design of the survey, which features five core rounds of interviewing, covers two full calendar years. During household interviews, the MEPS-HC collects detailed information for each person in the household: demographic characteristics, health conditions, health status, use of medical services, charges and source of payments, access to care, satisfaction with care, health insurance coverage, income, and employment. As a part of the MEPS-HC, respondents sign authorization forms indicating their consent for the MEPS-MPC to contact their providers and collect administrative data related to the medical events reported in the MEPS-HC. The shipment of these forms to providers in the MEPS-MPC is a critical component of initializing data collection.

The MEPS-MPC collects data from all hospitals, emergency rooms, home health care agencies, outpatient departments, long-term health care facilities and pharmacies reported by MEPS-HC respondents as well as all physicians who provide services for patients in hospitals but bill separately from the hospital. Office based medical providers in which the clinician is either a doctor of medicine (MD) or osteopathy (DO) or practices under the direct supervision of an MD

or DO are included in the MPC as well. Long-term health care facilities include nursing homes, assisted living facilities, rehabilitation facilities, as well as any health care facility providing medical care to those reporting such care in the MEPS-HC. Jails, prisons, and medical facilities or pharmacies outside the United States are considered out of scope for the MPC.

In each panel, the MEPS-MPC begins with a sample of 77,750 elements representing encounters between patients identified in the MPC-HC and the aforementioned providers. Data collection may be completed either over the telephone or by the provider supplying medical records and/or billing data for abstraction.

Organizing data from the MEPS-HC to track survey production for tens of thousands of both provider and provider-patient pair cases is essential to efficient data collection operations and accurate estimation of health care expenditures. A corollary activity is the maintenance of a provider directory. Many providers are physicians or institutions in complex organizations, and efficient data collection requires accurate contact information for individuals within these organizations, including names, titles, organizational units, telephone and fax numbers, and e-mail addresses. Because the provider named in the MEPS-HC may not be the most appropriate individual to contact about expenditure and other information, a linkage between providers and appropriate organizational respondents are be maintained within this directory. Data requested in the MEPS-MPC may draw from several record systems (medical records, billing, laboratory) and obtaining them often requires contacting several individuals at the provider organization. Because much of the data are derived from records maintained for other purposes, care must be taken to assure that information obtained across providers is comparable. The MEPS-MPC data collection system and procedures must be flexible in accepting and processing data and monitoring survey production from these multiple streams.

2.2.1 Past Data Collection Practices

Since 1996, the MEPS-MPC has collected medical records or billing data primarily by telephone, with the flexibility to collect these data by mail or fax based on the preferences of the medical provider. All of the provider-specific instruments, known as Event Forms, were designed for paper-and-pencil administration. In instances in which the medical provider preferred to mail or fax the medical or billing records, data collection staff abstracted the data directly from the records, and recorded the information on the paper forms.

Further, all call records and notes for each provider were recorded on paper forms and retained in a paper case filing system. Case management, tracking and scheduling was also implemented via a manual, paper-based process. The status of each provider was keyed into a data base for reporting purposes.

3. Moving to an Electronic Protocol

3.1.1 Integrated Data Collection System

To improve the overall efficiency in operations, timeliness and quality of data collected, an electronic system, the *Integrated Data Collection System* (IDCS) has been developed to collect data for the 2010 MEPS-MPC cycle. While this system retains some key aspects of the earlier

data collection practices, such as flexibility to collect data based on provider preferences and separate provider-specific protocols; many processes have been re-engineered to further improve operational efficiencies and data quality.

The IDCS supports complex tracking requirements of the MEPS-MPC. Its main purposes are to:

- manage and update medical provider information,
- collect medical records and/or billing data via telephone or hardcopy abstraction into one central database,
- produce reports for production and quality monitoring,
- provide a secure infrastructure to contain confidential information,
- produce data files for the matching process, and
- prepare data files for delivery to AHRQ.

The IDCS consists of two main systems with several subcomponents. The main systems are (1) a single web-based component in which the MEPS-MPC forms are programmed for computer-assisted telephone interviewing or computer-assisted data entry and (2) a central Control System (CS) that manages the medical providers and associated electronic forms for call scheduling, contact information, appointment times, and event/status information. Each of these subcomponents within the CS are further described below.

- *Assignment Transfer:* This subsystem assigns medical provider cases to data collection staff. It also allows for the transfer of these cases to other data collection staff as needed.
- *Case Management:* This subsystem is based on a “case ownership” model whereby data collection staff is assigned specific medical providers to work throughout all steps of the data collection process. The case management system provides the tools and information for data collection staff to navigate a case through initial contacting, delivery of patient authorization forms, confirmation of the receipt of forms, and collecting data.
- *Fax/Mail Review:* This subsystem collects and assembles all contact information (e.g., permission forms, study introduction letters, etc) into one file to be either faxed or mailed to the provider. The process has a built-in check for quality control review prior to transmission or shipping.
- *Receipting:* This subsystem tracks and receipts medical or billing records sent by the provider via fax or mail for hardcopy abstraction. In addition, the system allows the recording of receipt on a patient by patient basis in order to ensure that all expected records for a given provider are received or conversely, that necessary follow-up steps are taken when information may be missing or unusable.
- *Coding:* This subsystem is set up to code for Sources of Payment, Separately Billing Doctors, Drugs, Conditions/Diagnoses, Medical Procedures and Supplies.

The IDCS offers medical providers multiple ways – by telephone, mail or fax - to provide their data. Regardless of the method of data collection, all data are entered directly into a central database to reduce processing time and error rates by eliminating separate steps for keying and

merging data from multiple sources. Point-of-entry data quality checks such as range, skip and consistency checks, are programmed into each Event Form. The CS integrates data collected via telephone or hardcopy abstraction to provide a comprehensive monitoring system across data collection activities.

The IDCS promotes data quality by overseeing and controlling the process of administering the electronic forms, including the selection of providers to contact, the selection of the method of data collection, the outcome or status of the provider, and monitoring reports to aid in study operational administration and supervision. Another data quality component of the IDCS is the flexibility of the data entry features. While staff abstracting records either by telephone or hardcopy are encouraged to follow the logical path of the Event Form, the user interface allows data entry in whatever order items appear in the provider records. This ability to navigate freely within web forms in reaction to respondent needs is described further in *Sections 4.3 and 4.4*.

4. Challenges and Solutions

This section describes the innovative approach and solutions to challenges that came with developing the electronic data collection protocol and system for the 2010 MEPS-MPC. Approaches to case management, case control and instrument design are discussed.

4.1 Case Management

The size and complexity of the MEPS-MPC presents a number of challenges related to case management. Case ownership, a multi-step data collection protocol, the potential for multiple respondents and points of contact and a multi-provider case load all call for customized components developed to support case management. The following sections highlight the development of those components and their purpose and interactions with one another in ensuring the efficient management and control of data collection.

At the heart of successful case management on the MEPS-MPC is the Case Management System (CMS) developed exclusively for the project. Ultimately, the CMS provides oversight and control for working cases by allowing data collection staff, supervisors and project staff access to individual cases. The CMS is designed to give the user a number of features and pieces of pertinent information to help with decision making while working cases, including tracking case history and commentary on activities already conducted with a case. In addition, allowing users to report problems on a case and receive resolution on those problems from supervisors and project staff was of critical importance when developing the CMS.

Along with tracking information, the CMS is also designed to serve as a tool for moving cases through the sequential steps of MEPS-MPC data collection. Further, the CMS serves as a central launching point for a number of processes, including the web-based data collection forms (i.e., Contact Guides and Event Forms).

4.1.1 Managing Individual Caseloads

The Case Ownership Model

Unlike most computer-assisted telephone interviews, the MEPS-MPC does not rely on a scheduling system to route cases to whomever is available to make the next call or take the next step on a given case. The MEPS-MPC is designed so that data collection staff “own” their cases. Under this model, data collection staff use various features of the CMS to track, monitor and work cases as needed. Having a single data collection staff member work a case to completion allows staff to develop rapport with both gatekeepers and respondents which was deemed essential and more important than any advantages of a traditional call scheduler. This model also allows data collection staff to keep a close watch on how a case is progressing through the data collection process, both of which aid in the efficiency of data collection and contribute to mitigating nonresponse.

Accessing the CMS

The multiple moving parts of the MEPS-MPC data collection, the complexity of the work being conducted and the size of the staff require efficient communication and reinforcement. As such, users begin their interaction the CMS at the home screen after every log-in (*Exhibit 1*). The home screen was designed with information sharing in mind, and serves to provide a broad overview of project current events, as well as a repository for training resources and other information. New memos (from project staff, quality control meetings or other QA activities) and messages are posted for staff review on the home screen. As new memos are loaded, staff are required to read them and acknowledge having done so via a button click. After the new information has been reviewed and acknowledged by the staff, access to cases is unlocked.

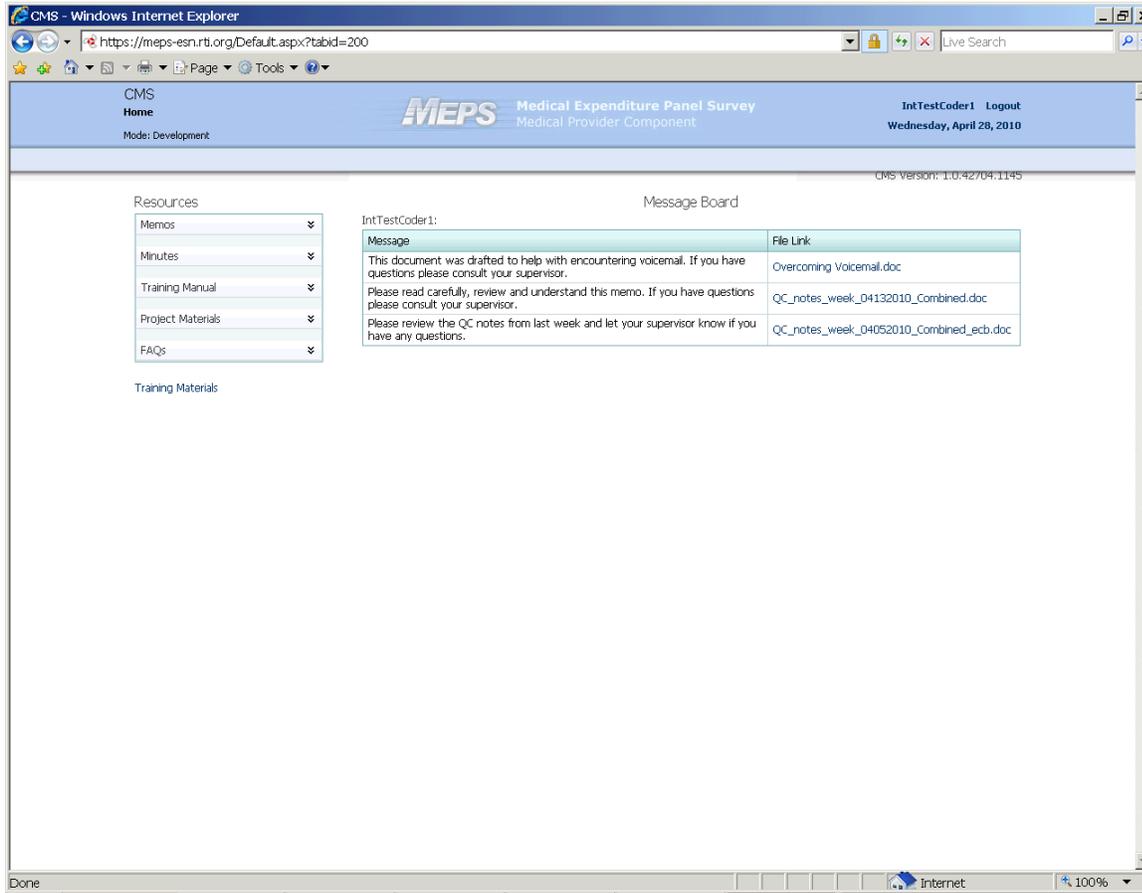
In addition to new memos, staff have constant access to resources such as archived memos, archived meeting minutes/notes, an electronic training manual, electronic project materials, and Frequently Asked Questions (FAQs) about the project.

Viewing Case Assignments

As noted earlier, the MEPS-MPC does not rely on an automated call scheduler. Planning calls and other work on cases can be challenging, and must be supported by a helpful, user-friendly interface. At the heart of managing cases under the case ownership model, is the CMS’s Case Assignment screen (*Exhibit 2*). This screen serves as an interface that allows data collection staff to access all of the active cases that have been assigned to them. The screen provides a wealth of helpful information for managing cases, including:

- **Contact Group ID.** This field also serves as a hyperlink to a Provider Level Information screen which provides, or has additional links to, all the information data collection staff use to familiarize themselves with a particular provider/case.
- **Provider Type.** The specific type of provider, whether an office-based doctor (OBD), separately billing doctor (SBD), home health (HH), hospital (HOSP),

Exhibit 1. MEPS-MPC Home Screen



institution (INST) or pharmacy (PHAR). This information assists the user in preparing for which protocols will be administered, along with anticipating potential issues created by provider specific nuances.

- **Timezone.** The system displays the respondent's time zone to aid in managing caseload. The system was designed to convert respondent time (for appointments or callbacks) to the Eastern time zone.
- **Status and Action Due.** Each case is assigned a status (event code) which is displayed on the case assignment screen (and elsewhere). The current status for the case is always visible in this table along with an associated "Action Due" in the next column (moving left to right). In an effort to aid in case management, a set of action due labels were developed to prompt data collection staff on the next steps needed. Each event code requiring a follow-up action is assigned an action due label. Once an event code is assigned, the system will either immediately present an action due label, or monitor a status code and, after a predetermined duration, present the action due to the staff member, ensuring that action (such as following up on a busy signal) is taken at the proper time.

Exhibit 2. MEPS-MPC Case Assignment Screen

Contact Group ID	Provider Name	Type	Contact	Time Zone	Status	Action Due	# Patients	# Events	Priority	Appointment	Wave
1001450	Chicago Group Practice	OBD	Chicago Group Practice	CST	672 - NR Form Needs more Information	Review comments in call history re: NR Form. Revise and re-submit	1	4	0		1
1001457	City Group	OBD	City Group	EST	599 - Event Form Data Collection in Progress	Continue medical event data collection	1	4	0		1
1001459	Dr. Peter Hu	OBD	Dr. Peter Hu	EST	301 - No Action Taken	New Case	1	3	0		1
1006779	Inner City Group	PHAR	Inner City Group	EST	301 - No Action Taken	New Case	1	4	0		1
1001451	Mercy Hospital	HOSP	Mercy Hospital	EST	324 - Appointment - Hard	Callback to POC on Appointment Date/Time	1	4	0	4/28/2010 6:00:00 PM	1
1001448	New York General	HOSP	New York General	EST	301 - No Action Taken	New Case	1	5	0		1
1006783	St. Vicky's Hospital	INST	St. Vicky's Hospital	EST	301 - No Action Taken	New Case	1	6	0		1
1001456	St. Vincent's Hospital	HOSP	St. Vincent's Hospital	EST	301 - No Action Taken	New Case	1	6	0		1
1001458	University of CA, Santa Barbara	HOSP	University of CA, Santa Barbara	EST	301 - No Action Taken	New Case	1	4	0		1
1001447	University of CA, Santa Cruz Hospital	HOSP	University of CA, Santa Cruz Hospital	PST	327 - Missed Appointment	Call POC and attempt data collection, or reschedule appointment	1	5	0	4/27/2010 3:00:00 PM	1
1006780	West Chicago Group Practice	HH	West Chicago Group Practice	CST	301 - No Action Taken	New Case	1	4	0		1
1001444	Dr. Doris Hernandez	OBD	Test Tester	EST	4013 - Could not generate AF Packet - Fax	Check Mail/Fax history for details	2	5	0		1
1001446	Dr. Matthew Hernandez	OBD	Dr. Matthew Hernandez	EST	301 - No Action Taken	New Case	2	6	1		1
1001445	Dr. Nicole Billing	OBD	Dr. Nicole Billing	EST	301 - No Action Taken	New Case	2	5	1		1

- Appointment Information.** This column is populated from either an appointment set in the Contact Guides or from a CMS screen designed to collect callback and appointment date and times. Staff training focuses heavily on paying careful attention to the appointments that have been set, daily work is arranged around this information. In an effort to assist with the management of this information, all tables in the CMS have been designed to be sort-able by any column title, in ascending and descending order.
- Other information,** such as the number of patients and number of events associated with a case and whether or not the case is a high priority.

4.1.2 Transferring Cases

While the case ownership model facilitates establishing and maintaining rapport with contacts and allows for data collection staff to be aware of and follow through all necessary steps to completion, any number of circumstances can arise that call for a mechanism that allows smooth and efficient transfer of sample between staff members. The sheer volume of sample records in the MEPS-MPC effort demands an automated process for managing sample in order to overcome the burden and potential quality risks

associated with managing paper sample records. As such, the MEPS-MPC Assignment Transfer System (ATS) has been designed to allow programmers, project staff, and supervisors to manage sample by assigning cases to data collection staff based on a number of customizable criteria. The ATS is designed to do the following:

- Initially classify and make changes to data collection staff access levels, which impacts the types of cases that can be assigned to a given staff member.
- Allow supervisors to make case assignments based on access level.
- Allow supervisors to change data collection staff case assignments based on future and missed appointment information.
- Allows supervisors to change data collection staff case assignments due to staffing changes, absences, etc.

4.1.3 Managing Respondent Contact Information

Viewing and Selecting Points of Contact (POC)

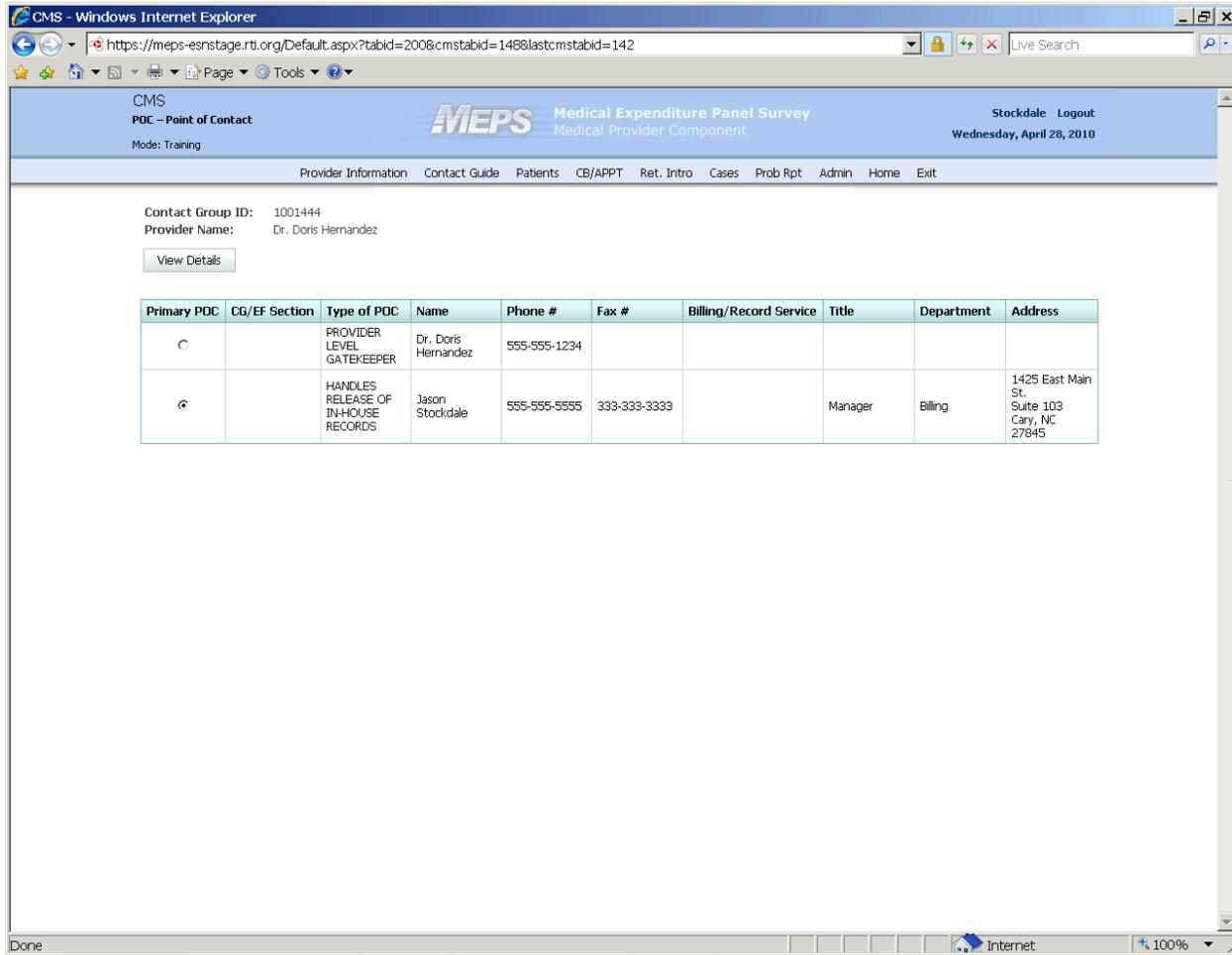
Establishment surveys present a unique challenge when it comes to managing contacts and referrals. Because the providers in the study are often part of complex organizations, referrals and gatekeepers are common, which requires accurate tracking of contacts. The Point of Contact screen (*Exhibit 3*) displays a roster of contact information for all pertinent contacts recorded in the Contact Guide. Each time contact information for a POC is collected in the Contact Guide (*Section 4.3*), a new row is added to the POC table. The Contact Guide also sends updated information to the POC table if and when edits are made to a given POC to ensure that the user sees the most up-to-date information collected. The table also features a column designed to allow the user to select the person to be called at any given time. Once a point of contact is selected from the POC screen, the CMS passes all necessary information into other components, such as the Contact Guides, which allows for proper filling and customization across forms.

Provider Level Information

Because the MEPS-MPC data collection often involves providers who have participated in earlier rounds of data collection, an awareness of provider history (at a high level) can be vital to successful contact. The Provider Level Information screen shows the user various pieces of information about a given provider in the data collection process. The screen displays provider type, number of patients, and a priority indicator. In addition to the information available on the Case Assignment screen, users are also able to view a number of additional pieces of information about the provider that aid in case management and approach:

- Any past refusal history that may have been encountered in the previous year of data collection,
- Whether or not the case is a Veteran's Affairs (VA) facility,
- If payment was made to the provider for records along with the amount paid,
- The last year of completion,

Exhibit 3. MEPS-MPC Point of Contact (POC Screen)



- The number of events and patients completed in the previous year,
- The most recent or final result code and year of final code, and
- The next most recent code and with year of the code.

4.1.4 Automating Supplemental Information and other Data Collection Tools in the CMS

In addition to the case management functions already explained in this section, the CMS is also designed to give the user a number of features beyond basic management, such as supplemental information for review, problem reporting, receipt of resolution on those problems, moving cases through the sequential steps of MEPS-MPC data collection and launching points for a number of data collection related processes.

Overall Case History

The CMS's History screen is designed to help staff track the history of calls and actions for a specific case. The screen is designed to serve as a repository of information to be reviewed before each respondent contact. Because of the multiple system components at

work on the MEPS-MPC, this screen is populated by information from a number of sources inside and outside of the CMS; including the sample file, the Assignment Transfer System, the Control System, the Receipting System and the Call Disposition screen, where staff set event codes after various stages of data collection.

Under this design, integrating subcomponents and allowing them to contribute to the call history allows the user to track the total life of a case, regardless of whether events and actions were triggered by human hands or automated processes. Further, the call history screen is design to pull in contact information collected in the Contact Guide so that specific points of contact for a given case can be associated with a given event or status. As such, users are given information that allows them to associate specific action or follow-up with specific points of contact within a sampled provider as needed.

Mail and Fax History

The Mail/Fax History screen allows a sharpened view for staff, displaying information related to when a mail or fax request was placed and when packages were faxed or mailed. The screen is also designed to show the user who the package was sent to and their role in the data collection process. This information is imported from questions within the Contact Guides.

Contact Group Information

The *Contact Group* screen is designed to provide information about cases in which multiple providers work together (often in a practice) and are lumped together before cases are assigned to data collection staff. This reduces the number of calls to the provider, as staff can gather all needed information for multiple doctor-patient pairs on one call. Reviewing this screen allows staff to prepare their approach, and make any necessary adjustments based on the size of the group.

Viewing Authorization Forms

The Authorization Form screen allows staff to view electronic copies (.pdf files) of each patient's signed authorization form. This screen is designed as a tool to help staff review authorization forms should a provider state that he/she cannot read a form or has some other problem with a form. In being able to review this information, staff are able to problem solve and answer questions on the fly in an effort to inform respondents, reduce burden and mitigate nonresponse.

Viewing Patient Data Forms

The Patient Data Form screen is yet another supplemental screen available to staff specifically for helping providers; in this case by providing information on patients whom the provider may not recognize. The static information provided on this screen fills from the information received in sampling. The information includes a number of background and demographic variables; from address, to date of birth to information about the location at which the patient was treated to aid in patient recognition.

Re-sending Authorization Forms

The Re-send Authorization Forms screen is used when a POC indicates that he/she did not receive one or more of the authorization forms that were sent. Because project protocols call for the need to resend these forms before patient level data can be collected, it was necessary to design a screen to initiate that process.

The screen provides a suggested script and instructions on addressing questions, along with a hyperlink to the Patient Data Form mentioned earlier. From this screen users can select one or more patients for which authorization forms will be resent. Once patients have been selected, the process of resending forms is triggered automatically.

Provider Verification

The Provider Verification screen is designed to ensure that information received in the sampling stage of the project is in fact correct. When multiple providers are bundled as a group, it is important to verify, that all providers are in fact appropriately included. Because each provider is associated with one or more patients, removal of providers who should not be associated with a group is critical, as it ensures that information contained in authorization forms for patients associated with that provider are not sent to a POC in error. After exiting the Contact Guide, users are presented this screen (only once) and are able to review each provider with the POC and remove any provider as needed. Once individual providers are removed from a group, the MEPS IDCS will, after review by sampling staff, create a new case identification number for those providers and re-introduce them to the data collection process.

Patient Confirmation

The Patient Listing screen provides the user with detailed instructions on how to confirm/verify each patient associated with a provider, walk through a disavowal process for a patient (collecting information on why a patient may not appear in a provider's records), and close out the call. Once confirming or disavowing each patient via dropdown menus, the screen presents hyperlinks to either a screen that allows for the launch of Event Form data collection for each patient, or a web application designed to collect detailed information about a patient's disavowal.

Launching Event Forms

The Patient Level Information screen is presented to the user after a patient has been confirmed on the Patient Listing screen. On this screen, the user is prompted to request information on any medical events associated with this patient. Upon exit from each web based Event Form, users arrive back at this screen, where a dynamic message will enquire about whether or not any additional events exist. This screen is designed to track the number of events reported for each patient in real time, and compare the number of events reported by the medical provider to the number of events reported by the patient during the household data collection. Should a provider indicate that the number of patient events on record is less than the number reported by the patient, the system will trigger a Patient Event Form Reconciliation screen. There, users are prompted to provide information on why a discrepancy exists between the number of events expected to be reported, and the number that were actually collected. If data for all events has

been recorded, the system returns the user to the Patient Listing screen for collecting data on additional patients.

4.2 Case Control

Eventing and Case Flow

Cases are also managed through the eventing process, assignment of case-specific codes by data collection staff or through automated processes that describe the current status of the case, and next action due. The event scheme basically follows the life of a case from initial sample loading through completion of the case. At any point in time, data collection and project staff can see where a case is in its lifecycle.

The Call Disposition screen is perhaps one of the most critical screens in the CMS. After each call or activity during data collection, staff and supervisors use this screen to disposition cases appropriately. Because of the number of processes involved in MEPS-MPC data collection, event codes are many. Further, the automation of processes hinges on proper selection of codes, many of which trigger automated processes and “behind-the-scenes” activity to keep a case moving through the data collection flow. In an effort to reduce error and aid in proper code selection, codes are broken in categories. Prior to assigning a code to a case, users must first select a category from a drop down list. Once a category is selected, a second drop-down list is populated with only the codes found in that category.

In addition to assigning event codes, the call disposition screen allows the user the opportunity to associate a point of contact with a specific mail or fax packet, if one is to be selected by the assignment of a code. Information about all POCs that have been collected for a case collected fill a table on the disposition screen. All of this information in the table is imported from the Contact Guide and aids the user in selecting the POC that should be associated with the disposition being assigned. Once a POC is selected and a disposition is assigned, the system passes the information associate with the selected POC to other processes, generating address labels. Populating name and number fills on fax cover sheets, etc.

Finally, users can enter open ended comments about the case in a text box. These comments are saved when the disposition code is assigned, and written to the case history table.

Linking Processes via the Control System (CS)

The MEPS-MPC systems design and architecture is complex requiring components to talk to each other efficiently and accurately. The CS serves as the central database from which all other subcomponents interact. Case control is managed through interactions between the CS and each subcomponent. The CS processes events set by a given subcomponent and then triggers actions in other subcomponents that are needed. For example, the CS receives information from the CMS that study materials should be sent to a provider via the selection of a disposition code on the Call Disposition Screen. The CS in turn sends an action to the Fax/Mail Review subcomponent to process that action.

4.3 Redesigning Contact Guides

At the outset of MEPS-MPC data collection, providers are contacted with the aid of a Contact Guide. Through the Contact Guide, users contact providers, introduce the study, explain what is required, arrange for the delivery of authorization forms and identify the respondent(s) who will eventually provide medical records or billing data over the telephone or via mail or fax. A fully programmed web instrument, the Contact Guide is also used to verify receipt of authorization forms and arrange for the resending of said forms if necessary. Contact Guides were developed specifically for different provider types. Given the nature of provider offices, multiple contacts with multiple gatekeepers is commonplace. Moreover, for Hospital and Institution based providers, at least two respondents are necessary to collect all data that is required from medical records department, a patient accounts department and an administrative office.

In addition to meeting the technical requirements described above, the redesign of the Contact Guide for electronic-administration requires conversational flow, maximum flexibility for the user, and minimized burden on gatekeepers and respondents.

4.3.1 Identifying the Best Respondent

The nature of contacting complex organizations dictates that data collection protocols must be flexible enough to accommodate different organizational structures and arrangements. For example, the uncertainty of how an office-based doctor manages their billing records (either in house, or perhaps through an outside billing service) requires that users be equipped with the tools that allow them to ask the right questions of the right people, and be able to process referrals quickly and seamlessly. As such, the Contact Guide was redesigned to collect and store contact information electronically from multiple points of contact (POC) at a given provider. Among the various POCs, data collection staff are able to administer specific questions based on an informant's role in the organization in order to identify the "best respondent," that is the person best able to send study materials to or provide the records data.

4.3.2 Maintaining Flexibility

Paper Contact Guides allow data collection staff the flexibility to navigate to various sections and questions in a quick and efficient manner while on the phone with gatekeepers or respondents. Minimizing time and burden for the respondent are important factors in gaining and maintaining cooperation from the respondents. Developing a computer-assisted form that mimicked the ability to jump back and forth to various sections on paper without regard to logic and skip patterns and at the same not affect data quality was a design challenge.

To address this design challenge, a tool, referred to as the Navigation Tree within Hatteras, the proprietary web-based application that serves as the engine for our web based forms, was developed. The Navigation Tree is designed to allow the user to view the Contact Guide at various levels: by section and question by question within each section. Data collection staff are able to follow the predetermined sequence of the Contact Guide, or navigate to various sections or items as needed based on respondent or informant feedback. While this "on the fly"

navigation is possible and useful, intra-section quality is maintained via logic and skip patterns; ensuring that once the proper section is being administered, the item level data collected is accurate.

As needed, on-screen routing instructions are also used to guide data collection staff efficiently through the Contact Guide. Finally, the Contact Guides are designed so that they are available and accessible for users to add or delete Points of Contact (POCs), edit existing POCs, or return to a previously administered sections in the Contact Guide if the information initially collected was incorrect.

Exhibit 4 displays both the collapsed and expanded Contact Guide Navigation Tree showing the Contact Guide both by section and question. The section names and are truncated to conserve space on the screen. Further, section and items names are replicated across each provider based version of the Contact Guide. **Exhibit 5** shows a full computer screen display for the Contact Guide. It illustrates how a question selected in the Navigation Tree on the left panel displays the question in the right-center area of the computer screen.

Exhibit 4: Contact Guide Navigation Tree – Collapsed and Expanded View

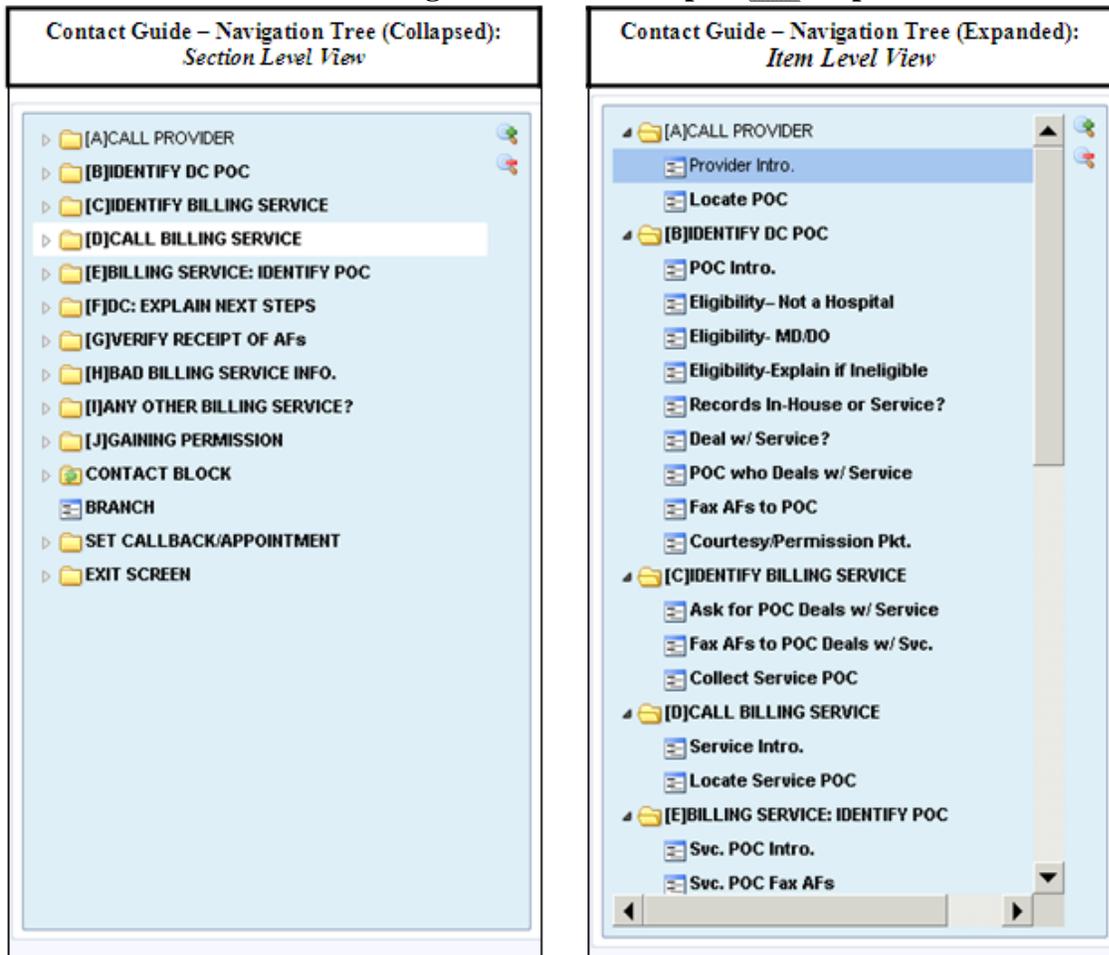


Exhibit 5: Contact Guide Full Screen Display

Contact Guide: OBD **MEPS** Medical Expenditure Panel Survey
Medical Provider Component **1012859**

Dr. Doris Hernandez ([Open Patient List](#))

Section A/A1

A1. (READ IF NOT OBVIOUS: (Hello) Have I reached Dr. Doris Hernandez?)

PHONE NUMBER: 555-555-1234

- IF YOU REACH AN IVR OR MENU, SELECT THE OPTION THAT WILL MOST LIKELY CONNECT YOU TO A PERSON (SUCH AS AN OPERATOR), -OR- SELECT A DEPARTMENT THAT SOUNDS LIKE IT HAS THE INFORMATION WE NEED.
- IF THE PERSON ON THE PHONE SAYS NO, VERIFY THAT YOU DIALED THE CORRECT NUMBER.
- IF THE NUMBER IS CORRECT, ASK IF THE PERSON ON THE PHONE KNOWS OF ANOTHER NUMBER FOR THE PROVIDER. IF THEY DO, GO TO THE CONTACT BLOCK AND EDIT THE INFORMATION FOR THE PROVIDER.
- IF NO BETTER NUMBER IS AVAILABLE, SELECT "NO" BELOW.

1 YES
 2 NO

Accounting for Collection of Multiple Contacts within a Single Provider

For large health care providers, such as Hospitals, more than one POC is required to collect all of the data needed. The Contact Guide is designed to allow the user to collect multiple contacts within a single provider. Contacts for different departments and for different data collection protocol purposes can easily be added via the Contact Block. The Contact Block has been developed as a central hub that collects and displays all relevant information for the roster of POCs for a given provider, such as: all relevant contact information, the POC data collection staff should contact next and send study materials to, the POC's preference for receipt of materials, etc. In addition, the contact block allows users to edit preexisting POCs or add new POCs as needed.

4.4 Redesigning Event Forms

The MEPS-MPC previously employed paper questionnaires printed on legal size paper that were subsequently reviewed and edited before data entry. Data collection staff completed one “booklet” for each medical event that a provider reported for a given patient. A medical event is defined as a visit or stay with a provider and may be simple or complex.

The booklets were used in various ways to capture detail about charges and payments and relationships between events. As such, the use of booklets to link data, capture supplemental information, could be cumbersome. For example, if an event was covered by a payment that was also applied to additional events, partial booklets were completed to record the date, location, and charges information of each associated event and booklets were cross-referenced by numbering their cover pages. Similarly, two discrete events at a hospital (such as an emergency room visit and subsequent hospitalization) could be linked by having all charges and payments listed on the latter event. Booklets for such events would be similarly linked for quality review and subsequent data entry.

Further, data collection staff used an abstraction notes form to record key data elements and to attach hardcopy receipts for the total charges and payments summed on a calculator. Those forms were kept with the completed booklet. Data collection staff highlighted key data elements on the hardcopy records, some of which appear once in an event (such as date of event) and others may appear in multiples (such as diagnoses or procedures).

The 2010 redesign thus needed to account for the varied nature of medical events and provide real-time checking wherever possible to increase data quality and reduce data retrieval calls to providers. While the Event Forms are customized according to provider type, they share many questions and employed basic processes used in typical computer-assisted interviewing (CAI) applications. They also employ advanced processes that addresses specific needs of the study to collect data as was done in prior waves.

4.4.1 Basic Features

The Event Forms are programmed to capture data elements for the respective provider types – office-based doctors, separately billing doctors, hospitals, home care health agencies, home care non-health agencies, institutions, and pharmacies. For the most part, data elements are shared across providers, but varied in format. For example, institution and home care agencies are asked to report on care provided for specific periods of care. In such cases, a single event collects services, charges, and payments for each period of care. Similarly a hospital event that is inpatient or long term (institutional) care reports a span of time during which care is provided.

By contrast, outpatient or emergency room visits to the hospital, office-based doctors and separately billing doctors are asked to report about care provided on discrete days, rather than spans of time. Pharmacies are asked to report each specific prescription. The electronic instruments need to reflect not only discrete events but their potential relationships, such as lump payments applied across events and linkage in hospital events. The instruments are customized

for provider type to capture necessary data but are designed with similar functionality to facilitate programming, troubleshooting, and cross training.

Event Form Customization

When users report in the case management system that a given patient has an event (or another event when several occurred during the reference year), a new Event Form opens that reflects questions needed for that provider type.

In order to customize each Event Form, every screen header displays the patient's name, imported from the sample file via the CMS. Further, when a user enters an event date, the date appears underneath the patient's name along with the form's enumeration (Event Form 1, Event Form 2, etc.). This customization helps orient data collection staff to where they are in the data collection process for the patient. Other fills appearing in the header include a unique identifier for the Event Form created by the CMS and a fixed label for provider type. Fills are displayed on several screens to summarize source and dollars for charges and payments respectively, so that component amounts can be reviewed on the screen that confirms the summed total.

Data Entry

The shift to electronic forms has brought about the ability to ensure that any data entered by the user in any given field is of the appropriate length and format. For instance, questions that capture dollars may record any integer value or an entry with dollars recorded to the hundredths place with no commas permitted (e.g., 20, 1320, 25.15). Checks ensure that entry errors, such as text entries in dollars fields produce an error upon attempting to leave the screen where the error takes place. Ranges are provided for by programmed field widths and numeric checks for high values. In providing these automated checks, the instruments simulate in real-time what was done by editors who in previous waves were responsible for reviewing codes and values for length and format after data was collected.

If a data point is not available during the survey administration, the user may enter "hotkey" values with designated function keys. The available responses are Don't Know (F6), Refused (F7), and Data Retrievable (F8). Data retrieval is a discrete step in the MEPS-MPC whereby providers are called back to re-ask any designated critical questions marked as retrievable during the initial interview or abstraction. The systems provide additional support for this process by marking the Event Form navigation tree with color coded marks for the various types of missing data, by validation (described later), and by CMS codes flagging providers for data retrieval.

In the case of service charges and payments questions that are designed to loop and record repeated data elements in succession, the system sums them and presents a screen for the user to confirm the total with the respondent or against the printed calculator receipt for the abstracted record. If a component charge or payment is marked with a hotkey, its contribution to the sum is zero. If all the component charges or payments are entered as hotkey values (such as may occur with an illegible record) the verification question indicates the value is undetermined and the user marks that critical question F8 for subsequent retrieval.

4.4.2 Advanced Processes

Navigation

Each screen in the Event Form displays up to four questions; with the number of items appearing on different screens being a result of logical grouping or what Couper describes as “Semantic Chunking” (2008). Although Hatteras allows for help screens activated by a button click, the study design allows for the display of instructional text on screen in a lighter font color. The primary action for the user is therefore navigation that can be accomplished in one of several ways. Users can navigate forward or backward by mouse click (using “Next” or “Previous” buttons), pressing hotkeys F9 or F12, or by clicking on the section of interest in the Navigation Tree on the leftmost section of the screen, similar to the navigation discussed in **Section 4.3**. The Navigation Tree sections are named identically across Event Forms that share content in an effort to aid in interviewer usability and comfort. For example, all Event Forms except Pharmacy and Home Care Non-Health ask whether the payment scheme is capitates or fee for service. All of them have a section labeled SOURCES OF PAYMENT that the user can access by clicking on that label to skip forward or back.

Another form of implied navigation reflects the need to record certain data elements in succession, such as multiple diagnoses, multiple procedures/charges, and multiple other-specify responses. For this sort of question, the screen offers a prompt asking “Any more?” above the Next and Previous buttons. When the user answers the prompt “Yes,” the screen refreshes so that the data fields are blank for new data entry, and the previous entry appears in a growing grid or table atop the screen (*see Exhibit 6*). The number of iterations may be unlimited as when recording all services and associated costs, or fixed as when recording no more than five diagnoses. When iterations are fixed, the user may record “Yes, more” but the instrument instead moves to the next appropriate question.

Beside each entry in the grid are buttons to edit or delete a previous entry (*see Exhibit 5*). By clicking on edit, the screen refreshes to display the data fields for that former entry. Pressing Next takes the user to the subsequent entry for that question or to the next question, depending on which item from the grid was selected.

The responses to such looping questions also appear in the Navigation Tree, so that later during an Event Form’s administration, a user can click on the branch labeled “v72.0” to re-visit the specific screen that recorded such a diagnosis (*see Exhibit 6*). This is helpful in discussions with the respondent, during records abstraction, verification calls to the provider, or verification (entry of data by a second, independent keyer). If a user changes a response to a looping question, the grid atop the screen and the Navigation Tree are updated to reflect that new entry after pressing “Next.”

Exhibit 6: Navigation – Multiple Data Elements

Event Form: OBD

MEPS Medical Expenditure Panel Survey
Medical Provider Component

4009707
LEVI Samples
Event Form 1: November 12, 2009

Provider 30050344 (1000482)

DIAGNOSES/B4a

ICD 9 Code	Description
v72.0	
V23.0	

B4a.
I need the diagnoses for this visit. I would prefer the ICD-9 codes or the DSM-4 codes, if they are available.

IF CODES ARE NOT USED, RECORD DESCRIPTIONS. RECORD UP TO FIVE ICD -9 CODES OR DESCRIPTIONS.

Code: F8 F7 F8

Description: F8 F7 F8

CHECK HERE IF THIS IS AN ICD-10 CODE F8 F7 F8

Any more diagnoses?

1 YES
 2 NO

Previous Next Breakoff Validate Path Validate

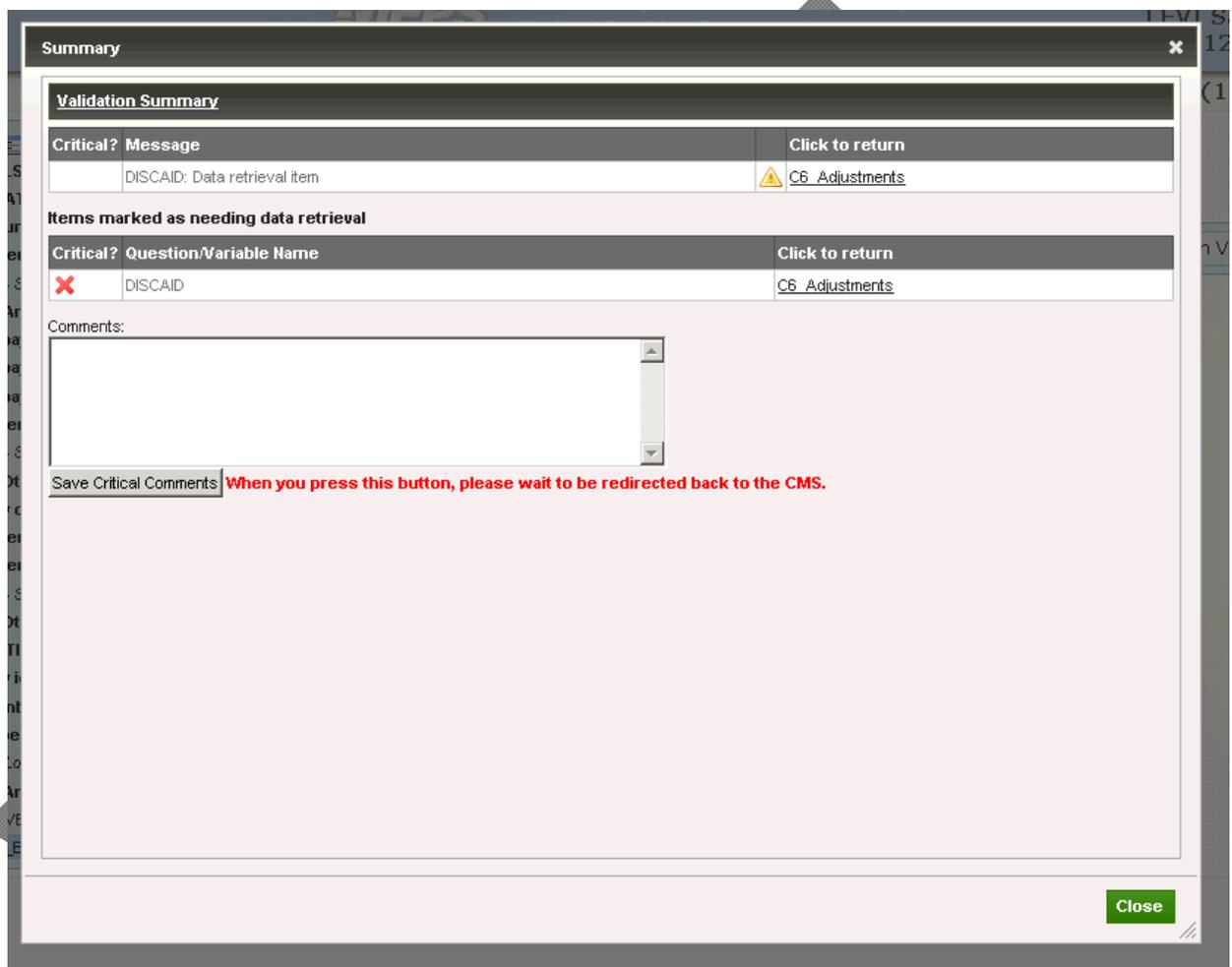
Validation

While flexibility is crucial to the study, data quality is as well. As such, the Event Forms are programmed to administer appropriate questions by virtue of skips and logic checks. If a field is left blank and a user attempts to move forward, a prompt appears indicating the question needs a response. Similarly a prompt appears if two mutually exclusive questions are answered on the same screen. The prompt in such a situation asks the user to enter one value but not both, and to retain the preferred value when possible. Upon navigating forward from a screen, a soft check may appear informing the user they have entered an unusually high number or unexpected event date. Upon reconciling a message administered for the given screen, a user may move forward.

Upon finishing an Event Form, an instruction appears informing the user that the “Validate” button (a button on screen that triggers a real time check of entered data for completeness) should be pressed. Once validation is run via button click, entries that are marked as F8/Retrievable appear in a Validation Summary screen with special designation of critical items (See Exhibit 7). A hyperlink beside each question allows the user to immediately skip back to the affected question for review or revision. If expected questions on the instrument’s path are left blank -- as would occur if a user pressed Validation before arriving at the Finish screen -- those unanswered questions would appear in the Validation screen. A comment box, in which the user must record an entry when one or more of the missing items are critical, appears in the Validation Summary screen. If no items were marked retrievable or the items so marked are not critical, then recording a remark is optional. Pressing a finalization button in the Validation Summary closes the Event Form and sends a code to the control system that the form is validated. This process provides real-time assurance of data quality without a separate data

review step. Further, any comments recorded on the summary screen are exported to the CMS and attached to the individual Event Form, so that subsequent attempts to finalize data collection can be carried out in an informed manner. Presenting this information on the Patient Level Information screen in the CMS allows the user a concise view of past history without the burden of reviewing paper forms and tracing through handwritten notes.

Exhibit 7: Validation Summary Screen, Displaying Single Critical Item That Requires Data Retrieval



Another form of real-time validation occurs in relation to diagnostic codes and descriptions collected in the Hospital and Institution Event Forms. A gateway question asks whether separately billing doctors were associated with the current event. If the answer is yes, a custom form linked to the Event Form collects name, specialty, role, and service provided by that SBD. Real-time checks occur in the background such that when specific diagnoses implying radiology, anesthesiology, pathology, or surgery are recorded in the absence of such an SBD, successive prompts are administered to the respondent or abstractor to determine why such a doctor was not recorded in the custom form (*see Exhibit 8*). In prior waves this process was done with a separate data review by editors and required separate follow-up calls. It is expected

Exhibit 8: Validation Check for Diagnostic Codes and Descriptions

Event Form: Hospital
Medical Records

MEPS Medical Expenditure Panel Survey
Medical Provider Component

4009711
CALHOUN Samples
Event Form 2: June 19, 2009

Provider 40018310 (1000666)

MEDICAL RECORDS/SBD_CheckPoint/SBDPR1

SBDPR1
A diagnosis that you mentioned often involves a pathologist . We did not record such persons in the earlier questions about separately billing doctors. Did you not mention them for this patient event because they were residents or interns?

IF SPECIALTY RECORDED IN COMMENTS, ANSWER "NO" HERE.

1 YES
 2 NO

F6 F7 F8

Previous Next Breakoff Validate Path Validate

that the evolution of this process; administering real-time questions to data collection staff will reduce the need for follow-up calls to providers.

Finally, the electronic Event Forms have been developed with the ability to conduct path validation. In path validation, users invoke a routine they must skip backwards from a later screen such as one confirming payments in order to revise the response to an earlier question about charges, and skip forward again via the Navigation Tree instead of paging forward with the Next button. In these situations, the revised dollars do not refresh in the fills. By clicking a button (Path Validate), the user triggers automatic updates to fills, calculations, and skips that would otherwise have been accomplished by paging forward and making changes manually.

Growing Provider Databases

In prior waves, staff completed paper forms in order to indicate that SBDs were associated with a given provider. Doing so required a separate data entry process and de-duplication, which took time and resources. By deploying an automated custom form where users record SBDs within an Event Form for Hospital or Institution providers, a dynamic database grows with every added SBD. In subsequent Event Forms, a user may select in the custom form a dropdown menu for previously entered SBDs. This feature reduces data entry time, since the name fields and specialty are pre-filled in the custom form and the only entries required are for service provided and role. This also reduces duplication of SBDs.

Further, a separate batch query is run on completed Event Forms to evaluate whether procedures reported in the later questions imply even more SBDs than were captured with real-time prompts based on diagnoses. A separate query is necessary because the real-time prompts are administered with medical records staff who report diagnoses and involvement of SBDs. Another interview or abstraction is needed with the Patient Accounts department that maintains records on procedures, costs, and payments. Therefore it will require a separate call to the initial, medical records respondent to pursue reports of additional SBDs based on the batch query. In that separate call, the user can return to the custom form and enter describe new SBDs or select them from the dynamic database.

Data Retrieval and Finalization

When an Event Form has one or more questions marked as retrievable, Hatteras immediately assesses those items upon validation. It generates a display such as the one illustrated earlier in *Exhibit 7*. Any and all items marked retrievable are displayed in the upper Validation screen; all critical items **requiring** data retrieval activity appear in the lower. Items whose data were marked as don't know or refused are reported in the validation process.

The save instructions vary according to the summary status: one "Save a critical comment" or "Mark as complete." The corresponding summary status is applied to the Event Form. A form with critical items marked as retrievable is saved with a specific status code that in turn rolls up to the provider when all patients have been accounted for with completed Event Forms or disavowal (if patient is unknown to the provider). An Event Form without critical items marked is saved with a specific status code indicating it is completed.

Data retrieval calls are made to providers to collect data wherever possible for Event Forms with one or more critical items marked retrievable. In the course of such calls for the affected Event Forms, we attempt to collect data for each item marked retrievable, even those that are noncritical. Users re-open the affected Event Forms at the Finish screen, press Validation, and by means of a hyperlink in the summary display, return to the retrievable question. Questions are answered with substantive responses or codes for don't know or refused. Pressing Validate iteratively as one closes out successive items reduces the number of retrievable items in the summary screen until all are resolved.

5. Closing

As evidenced throughout, advances in technology have afforded researchers the opportunity to change and innovate the ways in which data is collected. Such changes can improve both the efficiency of data collection operations and the quality of data that is collected. While such conversions may be challenging, difficult and time consuming, the improvements that can be made should, in most circumstances be the ends that justify the means. All that being said, while perceived protocol and data quality improvements are something to strive for, researchers must not assume that a move to the newest available technology will provide instant or guaranteed

results. Close attention must be paid to data collection operations and the data that are ultimately collected in order to ensure that the intended results are in fact taking place.

DRAFT

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