HAvBED2

Hospital Available Beds for Emergencies and Disasters

A Sustainable Bed Availability Reporting System

Final Report

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Contents

I. Executive Summary…….……...i

II. Purpose/Objectives…….……..…….5

III. Background ..…….7

IV. Methods...……...8

V. Results…….…….11

A. Hospital Bed Definitions and Data Elements…….11

B. System-to-System Communication Protocol……..14

C. Database and Web Development……15

D. Interface and Manual Data Entry……16

E. Enhancements Made to the Sustainable HAvBED System Compared with the Demonstration System…….……18

F. HAvBED and the National Incident Management System..…...20

G. Demonstration of the HAvBED Production System……..21

VI. Recommendations for Implementation…….……37

A. Conceptual Recommendations……..……37

B Technical Recommendations ……..…..……..37

Appendix. Advisory Group Members.……..39

I. Executive Summary

Purpose: The purpose of this task order was to build upon the initial HAvBED (Hospital Available Beds for Emergencies and Disasters) demonstration project, producing a sustainable bed availability reporting system that would be resident at the U.S. Department of Health and Human Services (HHS) and would be used at a national, regional or local level as a management tool to assist in a system/region's ability to care for a surge of patients in the event of a mass casualty incident. The new system is operational now at https://havbed.hhs.gov/default/login.aspx.

Background: Denver Health, under a previous Agency for Healthcare Research and Quality (AHRQ) task order, developed a demonstration "real-time" national bed availability system (HAvBED), which was completed on August 30, 2005. The need for such a system was clearly demonstrated as a result of lessons observed from recent disasters. With Hurricane Katrina, it was necessary to evacuate patients from compromised hospitals to other remote institutions. This activity could have been facilitated and expedited through the use of a national bed availability system.

The initial HAvBED demonstration system was developed under the guidance of an advisory group from the private, public and governmental sectors who had interest, experience and expertise in the area of hospital bed availability. This demonstration system is described in detail in the *National Available Beds for Emergencies and Disasters Final Report* which is available at www.ahrq.gov/prep/havbed. In addition to the demonstration bed availability system, the final report included recommendations for bed categories and bed availability as well as conceptual and technical recommendations. These were incorporated into the sustainable production system which is the result of this current task order.

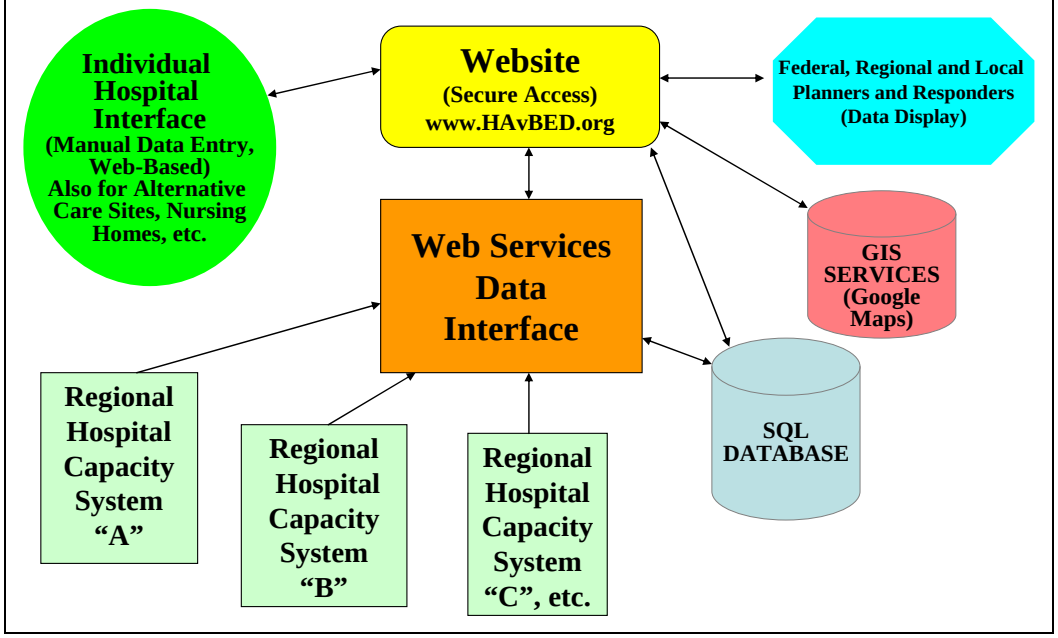
Methodology: An Advisory Group was constituted to provide guidance and feedback to the development group for the duration of this task order. The Advisory Group met four times with the development group at the office of the Assistant Secretary for Preparedness and Response (ASPR) at HHS in Washington, D.C. Denver Health identified a software development subcontractor to assist in the development of the production HAvBED system. The scope, direction and implementation of this system were vetted by the Advisory Group during its meetings.

Results: The production facility bed availability reporting system illustrated in Figure 1 was implemented in test mode and was then transmitted to the Secretary's Operations Center at HHS for installation and operation on their hardware. The functionality of this sustainable system was presented to the HAvBED Advisory Group on October 9, 2007 in Washington, D.C. The completed operational HAvBED system is accompanied by the following documentation:

- User Guide
- Individual Hospital User Guide
- Quick Reference Guide
- Installation (Deployment) Guide
- Operations Guide
- Vision Document

- Requirements Document
- Software Architecture Document
- Online Help Document
- Use Cases Document
- User Acceptance Test Case Document
- Web Service Guide
- Software Delivery Guide
- Project Glossary

Figure 1: HAvBED System Diagram / Data Flow



Recommendations: The HAvBED Project Group, after testing, evaluation, and review of the sustainable production HAvBED system, recommends the following:

Conceptual Recommendations:

- The HAvBED system should be implemented and supported on a national level. This will require that an implementation process and schedule be developed with appropriate HHS support. This process should include education of hospital personnel and local and state health and emergency management personnel about the purpose and utility of the HAvBED system.

- HHS should work with hospitals, state and local departments of health, emergency medical services (EMS) agencies, and emergency managers to inform and educate them of the utility of the HAvBED system. These groups, in turn, will be

instrumental in encouraging participation at the local level. This could be done via a series of conferences or meetings. Additional partners in this effort may include the Department of Homeland Security, the American Hospital Association (AHA), state hospital associations, emergency management professional organizations, and selected medical specialty professional organizations. This approach will allow collaborative efforts at multiple levels as well as provide the greatest opportunity for acceptance and widespread implementation of such a system.

- HHS, in concert with potential state, local, and national users, should develop a mechanism for testing the utility of the HAvBED system at these different levels of operation.

- The HAvBED system should not replace any existing bed availability systems, but rather, whenever possible, should acquire and amalgamate data already being gathered by these pre-existing systems, using the HAvBED web services data interface.

- Careful consideration should be given to the option of having the HAvBED system available for ongoing local and state use, if desired by these entities.

- Hospitals not participating in a multi-institutional bed capacity system should provide necessary data via the HAvBED manual data entry web interface when requested.

- Incentives for hospital participation in the HAvBED system should be developed and implemented.

Technical Recommendations:

- The HAvBED hospital (facility) data base (based upon the AHA hospital data) should be edited and updated:

    1. Active/inactive status of the institutions should be verified, as this status was determined based upon data supplied by hospitals to the AHA. (Such data are sometimes incomplete.)

    2. Individual hospitals should verify (and edit where necessary) their AHA bed survey numbers and institutional contact information, including contact e-mail addresses.

    3. Since the lists of those hospitals that participate in TriCare and the National Disaster Medical System were not made available to the development group, these lists should be obtained and used to indicate the appropriate member affiliations of those institutions in the HAvBED database.

- Additional system augmentation may be considered including:

    1. Enhanced notification of users concerning activation of the HAvBED system, including, but not limited to, all individuals entering individual hospital bed

availability data and state and local emergency managers/emergency operations centers (EOCs).

2. Automatic presentation of facility detail data for validation upon logon by any user who has data entry permission for that facility.

3. Scaling of facility icons based upon map zoom level to avoid congestion over metropolitan areas.

4. Potential improvement of some aspects of system responsiveness by addressing navigation tree refresh issues.

5. Further refinement of what resources are displayed based upon facility category (e.g., not showing “mass decontamination status” for nursing homes).

II. Purpose/Objectives

The purpose of this task order is to refine the demonstration real-time hospital bed tracking system that was developed under AHRQ Contract No. 290-00-0014 Task Order No. 8, titled "National Hospital Available Beds for Emergencies and Disasters (HAvBED) System." On August 30, 2005, Denver Health completed this demonstration project which was to develop, implement, and evaluate a demonstration real-time electronic hospital bed tracking/monitoring system that was to serve as a potential management tool to enhance state, regional, or federal capacity to distribute and care for a surge of patients in the event of a large-scale, mass-casualty incident.

This current task order took the demonstration model and developed it into a maintainable working production system with appropriate documentation for users and those responsible for the system's operation and support. This system could then be used for planning and response by the HHS Assistant Secretary for Preparedness and Response (ASPR) and other Federal, Regional, State, or Local Command Centers.

III. Background

Denver Health, under a previous AHRQ task order, developed a demonstration "real-time" national bed availability system (HAvBED), which was completed in August 2005. The need for such a system was clearly demonstrated in several recent disasters. With Hurricane Katrina, it was necessary to evacuate patients from compromised hospitals to other remote institutions. This activity could have been facilitated and expedited through a national bed availability system.

The initial HAvBED demonstration system was developed under the guidance of an Advisory Group from the private, public, and governmental sectors who had interest, experience and expertise in the area of hospital bed availability. This demonstration system is described in detail in the *National Available Beds for Emergencies and Disasters Final Report*, which is available at www.ahrq.gov/prep/havbed. This report included recommendations for definitions of bed categories and bed availability as well as conceptual and technical recommendations. These elements were incorporated into the sustainable production system which is the result of this current task order.

The creation of this sustainable production system built upon the standardized bed-related definitions and the common EXtensible Markup Language (XML) communication protocol, also created as part of the HAvBED demonstration project. The new system is operational now at https://havbed.hhs.gov/default/login.aspx.

IV. Methods

This project required and involved collaboration and communication among multiple partners. This section describes the process by which this project was completed within the 15-month contract period and the degree to which communication and collaboration were key to its completion and success.

1. This project was conducted by a project team led by Dr. Stephen Cantrill, Associate Director of Emergency Medicine at Denver Health Medical Center and the principal investigator for the demonstration HAvBED project. He was assisted by Dr. Peter Pons, who also participated in the original project, and by personnel from a software development subcontractor which also provided support to the original project. The project manager was Anne Lambert-Kerzner.

2. An Advisory Group for the HAvBED Project was identified with representation from the following (See Appendix):

    - Department of Health and Human Services
        - Agency for Healthcare Research and Quality
        - Office of the Assistant Secretary for Preparedness and Response
        - Health Resources and Services Administration
        - National Disaster Medical System
        - Centers for Disease Control and Prevention
    - Department of Defense
        - Office of the Assistant Secretary of Defense for Homeland Defense
        - Office of the Assistant Secretary of Defense for Health Affairs
        - U.S. Northern Command (USNORTHCOM)
    - Department of Homeland Security
        - Office of the Chief Medial Officer
    - The White House Homeland Security Council
    - Department of Veterans Affairs
    - New York City Office of Emergency Management
    - New York State Department of Health
    - Inova Health System
    - Maryland Institute for Emergency Medical Services Systems

- AHRQ ACTION Network Partner: Weil Medical College
- Denver Health Medical Center

3. Four Advisory Group meetings were held during the course of the project. These meetings were instrumental in guiding the project development team and providing feedback on aspects of project implementation. The results of the project were presented at the final Advisory Group meeting on October 9, 2007. A live demonstration of the sustainable HAvBED computer system was presented during that meeting.

4. The HAvBED hospital database was initialized with the most recent 2007 AHA Annual Survey Database (2005 data) and the Subsidiary Data Base (2005 data).

5. Extensive testing and development of the enhanced system was performed.

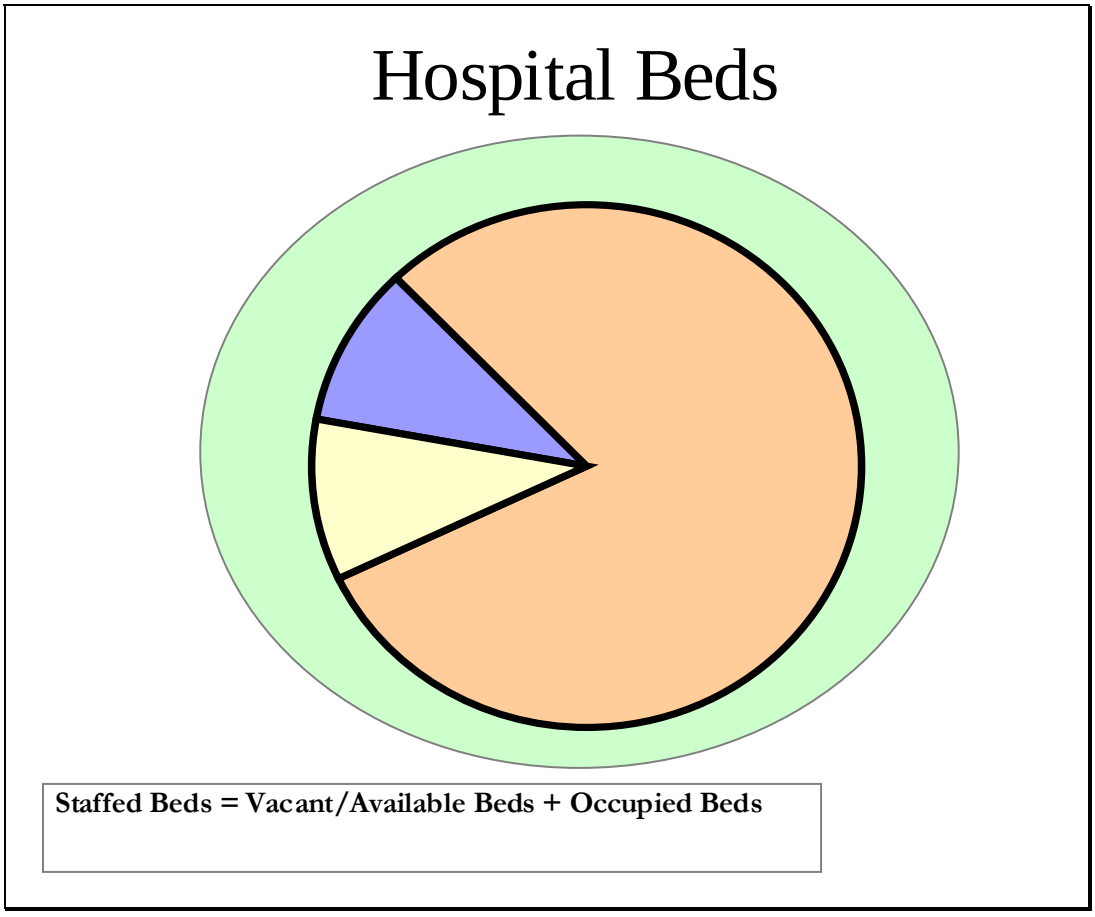
6. Project documentation was developed for implementation, use, and ongoing support of the HAvBED system.

V. Results

A. HAvBED Hospital Bed Definitions and Data Elements

The hospital bed definitions developed as part of the demonstration HAvBED project were included in this project. In the HAvBED system, "Vacant/Available Beds" refers to beds that are unoccupied and to which patients can be immediately transported. To satisfy vacancy/availability criteria, these beds must include supporting space, equipment, medical material, ancillary and support services, and staff. Such beds must be licensed, physically available, and sufficiently staffed to attend to the patients who occupy them. In the HAvBED project, the term "Current Beds Available" refers to "Vacant/Available Beds". The relationship between the different bed statuses is depicted in Figure 2. Note that the HAvBED "Vacant/Available" classification is close to, but not exactly the same as, the National Incident Management System (NIMS) classification of "Available".

Figure 2: The Relationship Between Different Bed Statuses



The categories of beds to be reported to the HAvBED project include:

- **Adult Intensive Care Unit (ICU):** Beds that can support critically ill/injured patients, including ventilator support.

- **Medical/Surgical**: Also thought of as Adult "Ward" beds.

- **Burn**: Thought of as Burn ICU beds, either approved by the American Burn Association or self-designated. (These beds are NOT to be included in other ICU bed counts.)

- **Pediatric ICU**: Similar to Adult ICU beds, but for patients 17 years and younger.

- **Pediatrics**: "Ward Medical/Surgical" beds for patients 17 and younger.

- **Psychiatric**: "Ward" beds on a closed/locked psychiatric unit or ward beds where a patient will be staffed by an attendant.

- **Airborne Infection Isolation**: Beds with negative airflow, providing respiratory isolation. (NOTE: This category may represent available beds included in the counts of other types. In the original HAvBED demonstration, this was called "Negative Pressure/Isolation", but was changed to be consistent with current CDC terminology.)

- **Operating Rooms**: An operating room that is equipped, staffed and could be made available for patient care in a short period of time.

Also, the following hospital characteristics used in the demonstration HAvBED project were included in this project:

- **Emergency Department (Facility) Status:**

  - **Open** – Accepting patients by ambulance.
  - **Closed –** Not accepting patients by ambulance.
  - **N/A** – Not Applicable. (Facility does not have an ED.)

- **Mass Decontamination Facility Availability:**

  - **Available –** The institution has chemical/biological/radiological multiple patient decontamination capability.
  - **Not Available –** The institution is unable to provide chemical/biological/ radiological patient decontamination.

- **Ventilators:**

  - **Available:** The number of ventilators that are present in the institution but are currently not in use and could be supported by currently available staff.

As with the original HAvBED project, the Advisory Group requested that, for the purpose of estimating institutional surge capability when dealing with patient dispositions during a large mass casualty incident, the following bed availability estimates should also be reported for each of the bed categories described above:

- **24-hour Beds Available:** This value represents an informed estimate of how many vacant (staffed, unoccupied) beds for each bed category above the current number could be made available within 24 hours. This would include specially created institutional surge beds as well as beds made available by discharging/transferring patients.
- **72-hour Beds Available:** This value represents an informed estimate of how many vacant (staffed, unoccupied) beds for each bed category above the current number could be made available within 72 hours. This would include specially created institutional surge beds as well as beds made available by discharging/transferring patients.

It should be understood that these numbers represent a "best guess" estimate on the part of facilities and that the actual number of beds available in 24 and 72 hours will vary from these estimates, based upon the demands of the incident as well as the "routine", non-incident-related patient workload.

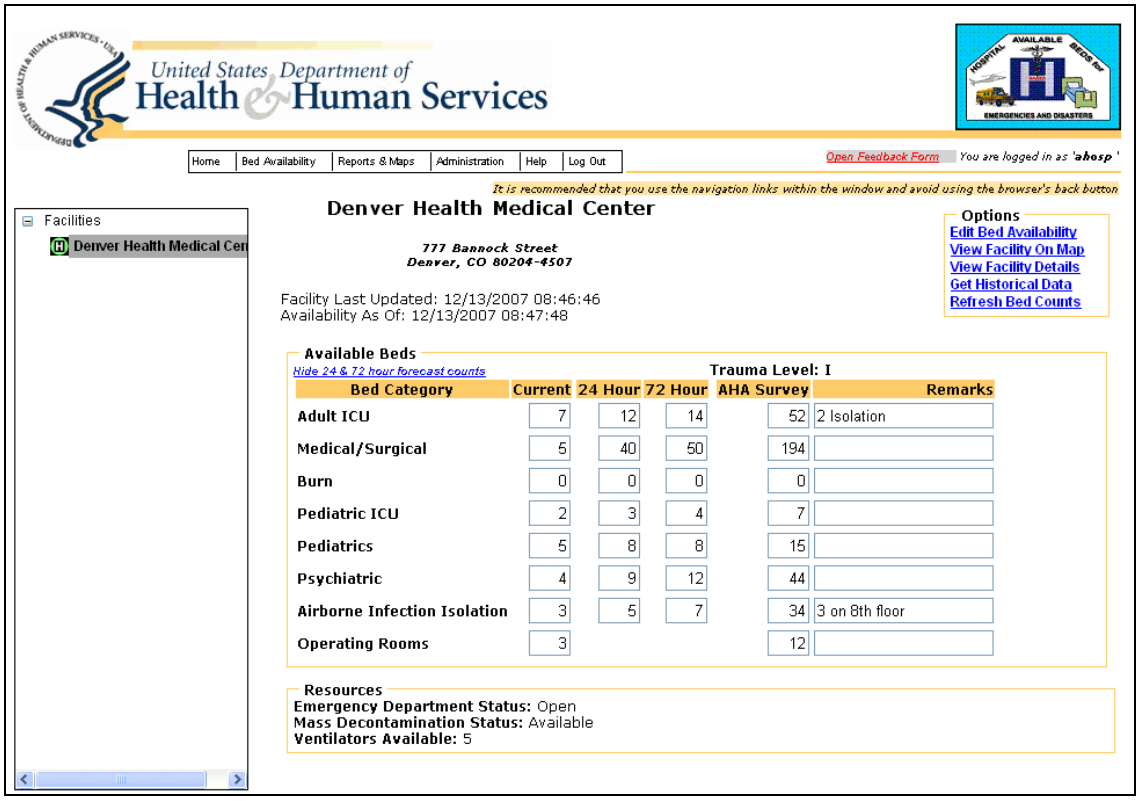
Such beds could be made available by a number of means including:

1. Early discharge of patients.
2. Cancellation of elective admissions.
3. Transfer of patients to alternative care sites and facilities.
4. Creation and opening of institutional surge beds.

Evidence suggests that anywhere from 15 to 25 percent of a hospital's bed capacity could be made available by the early discharge of patients and cancellation of elective admissions. Furthermore, evidence suggests that an additional 5 to 20 percent of a hospital's bed capacity could be made available by transfer of stable patients requiring ward-type care (with the exception of oxygen administration) to a non-hospital alternate care site or facility. (Note that "alternate care site" and "alternate care facility" are used interchangeably in HAvBED.)

Figure 3 summarizes the data elements specified for the HAvBED production system and depicts the HAvBED web form for manual hospital data entry. The "AHA Survey" numbers are preloaded for each institution from their AHA Annual Hospital Survey data, which may be updated, if necessary.

Figure 3: HAvBED Data Elements



B. System-to-System Communication Protocol

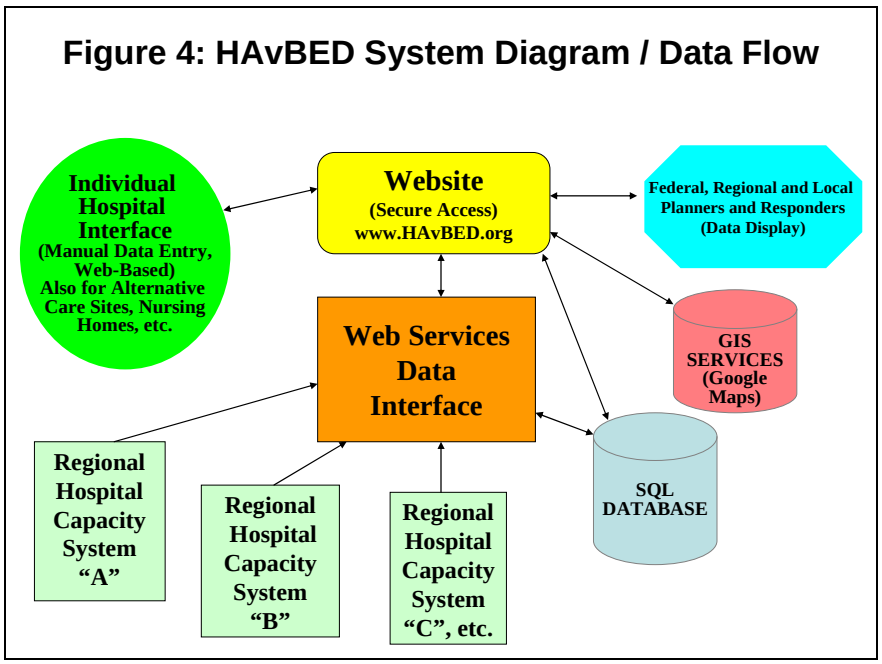
One of the main goals of the original demonstration HAvBED system was to demonstrate the utility of amalgamating data from multiple existing computerized bed availability systems. For this purpose, an XML- and Emergency Data Exchange Language (EDXL)-based schema was developed by a group of interested parties to facilitate such data sharing. This protocol is referred to as Hospital Availability Exchange (HAVE) and allows straightforward web services communication between otherwise incongruent computer systems. The HAVE specification is currently under standards review by the Organization for the Advancement of Structured Information Standards (OASIS). This standardization process is not yet complete, and because of this, the HAvBED schema utilized in HAvBED may vary slightly from the final adopted product due to ongoing minor changes to the proposed standard. The HAvBED data elements, as defined in EDXL, are shown in the HAvBED supportive documentation and discussed in the Web Service Guide, which also gives the full EDXL-HAVE schema. Note that this mode of system-to-system communication is available only to hospital bed availability systems.

C. Database and Web Development

The high-level system architecture and data flow are shown in Figure 4. The database is comprised of a SQL (Server Query Language) server. This facility database was designed to maintain an historical record of bed availability updates and allows the addition of new institutions to support the concept of creation of alternate care sites (alternate care facilities) and other facilities that could also be tracked by HAvBED. All web access is through a secure Internet server. All programming in the system was written in C# and Microsoft.NET to produce an ASP.NET application.

A detailed description of the database and web services programming is provided in the HAvBED documentation.

Figure 4: HAvBED System Diagram/Data Flow



The hospital database was preloaded with the following information using data from the AHA 2007 Annual Survey Database (2005 data):

- Hospital name.
- Hospital street address, including city, county, state and zip code.
- Hospital phone number.
- CEO (as initial contact individual, subject to hospital edit).
- Main hospital phone number (as initial contact phone number, subject to edit).
- AHA identification number.
- Hospital geographic coordinates (latitude/longitude).
- Total beds in each HAvBED bed category.
- Trauma center level designation (if any).

The algorithm used for extracting these data is outlined in the HAvBED documentation. It is important to note that some institutions do not report their total beds for each

HAvBED category in the AHA survey. Several institutions also left multiple other fields blank, making it impossible for the algorithm to determine whether they should be considered "active" or "inactive" institutions and were therefore left in the database, but were marked "inactive."

We were unable to obtain national listings of NDMS (National Disaster Medical System) -member hospitals or TriCare-affiliated hospitals, so we could not indicate those affiliations in the database. These could be set by the individual hospitals when they review and update their facility data in the HAvBED system or by HHS at the time of system implementation.

As noted below, the HAvBED database supports multiple institution types, including nursing homes. We were unable to locate an appropriate nursing home/extended care facility database for use in initializing the HAvBED database with these institutions.

For improved usability, especially for information retrieval, a GIS mapping component is included in the HAvBED system. This was achieved by integrating the Google Maps utility into HAvBED. This configuration is described in detail in the HAvBED documentation. This functionality permits retrieval and graphic display of information that can be viewed at a regional, state, county, city, or street map level. Specific color-coding of display elements provided rapid visual information of hospital status with mouse-over links to specific facility information.

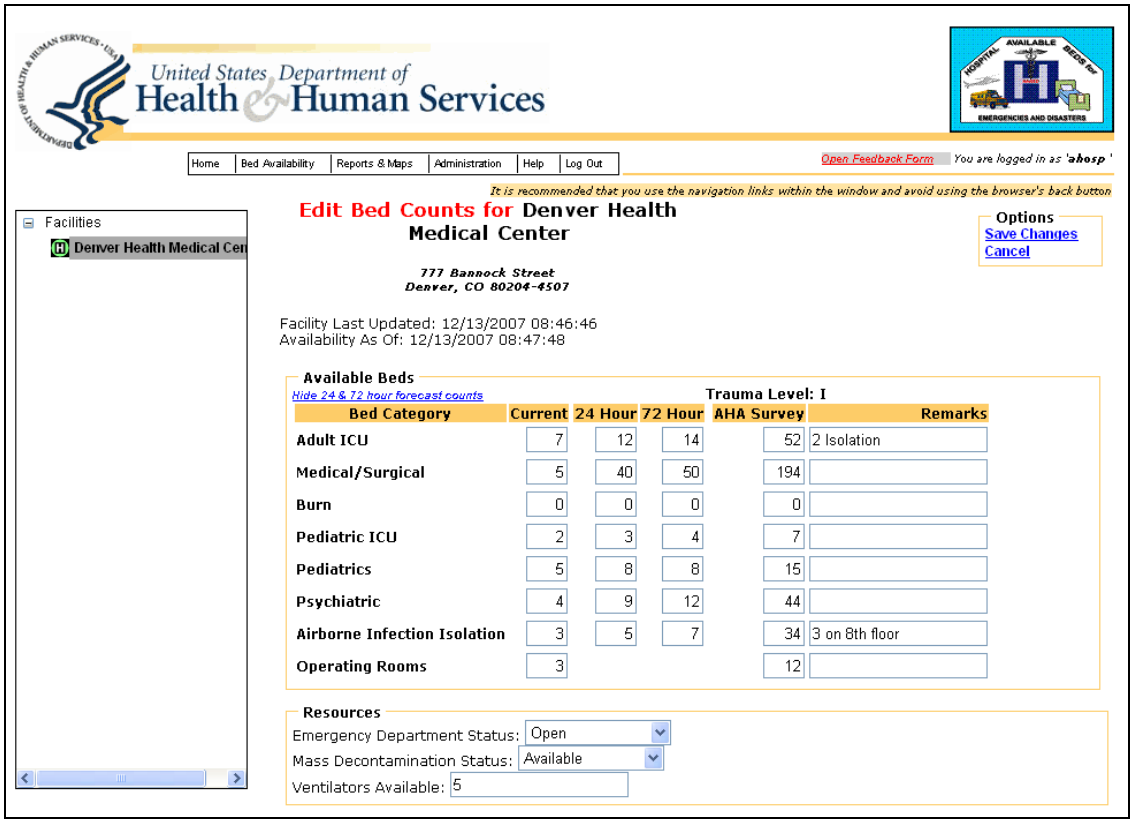
D. Interface and Manual Data Entry

As mentioned above, two mechanisms for hospital data entry were developed:

1) "Automatic" data streaming from preexisting hospital bed availability systems via HAvBED web services communication.
2) A Web-based manual data entry interface for use by those hospitals that are not part of an existing bed availability system and for use by other facility types.

The manual, Web-based data entry screen for a single hospital is shown in Figure 5. The data elements on this screen are identical to the data elements that may be reported via the system-to-system web services interface.

Figure 5. HAvBED Hospital Web Manual Data Entry Screen



The web site is also used to retrieve and display amalgamated data (see demonstration section, below).

PLEASE NOTE: FOR PURPOSES OF INSTITUTIONAL PRIVACY, IN THIS REPORT, ALL INDIVIDUAL HOSPITAL DATA HAVE BEEN ALTERED AND DO NOT REPRESENT ACTUAL HOSPITAL CONDITIONS.

E. Enhancements Made to the Sustainable HAvBED System as Compared with the Demonstration System

Through experience with the initial demonstration HAvBED system and based upon input from our Advisory Group, many enhancements were made to the sustainable production HAvBED system. These enhancements include the following:

- Multiple Institutional Classes are now supported:
    - Civilian Hospitals
    - Department of Defense (DoD) Hospitals
    - Veterans Administration (VA) Hospitals
    - Mental Health Institutions
    - Nursing Homes
    - Federal Medical Stations
    - Alternate Care Sites (Alternate Care Facilities)
        - Basic – capable of providing basic-level care
        - Advanced – capable of providing a higher level of care because of enhanced equipment and/or staff
    - Shelters
    - Hospital Vessels (Navy)
    - Clinics
    - Quarantine Stations
- Improved user interface, especially with map functions: pan, zoom, etc.
- Improved iconography on maps and navigation tree.
- Ability to mark facilities as inactive or decommissioned.
- Additional facility-specific information.
- Dynamic definition of "Metropolitan Areas" encompassing multiple cities and/or counties.
- Hospital data entry optimized for dial-up Internet connections.
- Automatic geocoding of new facility locations.
- Improved granularity of user permissions:
    - **Administrator**: Can perform any function on the HAvBED site for any geographical entity.
    - **Bed Data Display**: Can only display bed availability & summaries for specified geographical entities. No update capability.
    - **Bed Data Entry**: Can update bed counts for specified geographical entities.
    - **Data Display National**: Can only display bed availability & summaries for any geographical entity. No update capability.

- **Web Service User**: Automated data feed to update bed counts.
- **Facility Data Editor**: Can edit contact and location information for an existing facility within specified geographies. Cannot add new facilities.
- **Facility Creator**: Can add new facilities and edit contact and location information only for those facilities.

- Improved facility searching based upon:

  - Facility type (hospital, alternate care site, etc)
  - NDMS or TriCare affiliation
  - Trauma center designation level
  - Distance from a designated point (i.e., miles)

- Able to sort institutions based upon (for example):

  - Number of available ventilators
  - Number of beds, by category (ICU, medical/surgical, etc.)
  - Availability of mass decontamination
  - Emergency department status
  - Data update time

- Automated system to notify facility contacts of system activation/deactivation and of need to enter updated bed data (via e-mail).

- Data export function in spreadsheet format.

- Improved "Help" function and online documentation.

- Ability to alter dynamically the time window of what is considered a "current" update by facilities.

These features are described in detail, with examples, in the HAvBED User Guide.

F. HAvBED and the National Incident Management System (NIMS)

Since the development of the demonstration HAvBED system and the establishment of the HAvBED patient bed categories, recommendations for resource typing have been developed as part of the National Incident Management System (NIMS). Resource typing is defined by NIMS as "the categorization and description of resources that are commonly exchanged in disasters via mutual aid, by capacity and/or capability." One hundred twenty Resource Typing Definitions have been developed to date. However, the NIMS "Health and Medical Resources" specification does not deal with hospitals or hospital beds, but rather is directed towards the resources that are part of Disaster Medical Assistance Teams (DMAT) and related groups.

NIMS has established three status conditions for the NIMS-specified Typed Resources:

- Assigned (personnel, teams, equipment, or facilities that have checked in or have been receipted for and are supporting incident operations).
- Available (resources that have been assigned to an incident and are ready for a specific work detail or function).
- Out-of-Service (resources that have been assigned to an incident but are unable to function).

Unfortunately, these status conditions are not consistent with how civilian hospital personnel think about patient bed status. That being said, it should be noted that the HAvBED "Vacant/Available" bed status is very similar but not identical to the NIMS "Available". The bed categories (ICU, medical/surgical, etc.) established by HAvBED have no corresponding delineation under NIMS.

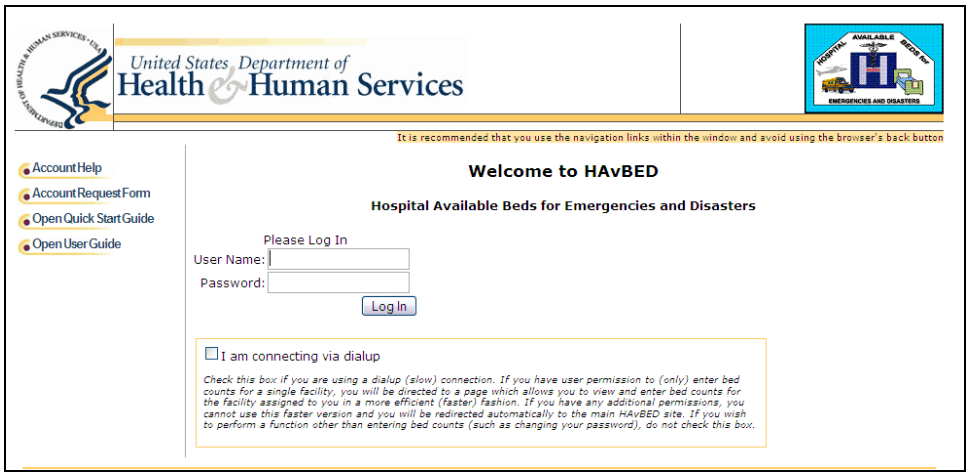
Also relative to NIMS, it should be noted that with the 12 different classes of facilities supported by HAvBED, hospital as well as non-hospital beds are included in the system. In addition, with the specification of its EDXL-HAVE interface, HAvBED establishes the capability of easily interfacing with other computerized bed availability systems.

G. Demonstration of the HAvBED Production System

The most useful approach for education of the reader about many of the capabilities of the HAvBED production system is to provide a brief virtual tour of its operation. A more complete description is available in the HAvBED User Guide.

Immediately upon accessing the HAvBED secure web site, the user is presented with the logon screen depicted in Figure 6.

Figure 6: HAvBED Logon Page

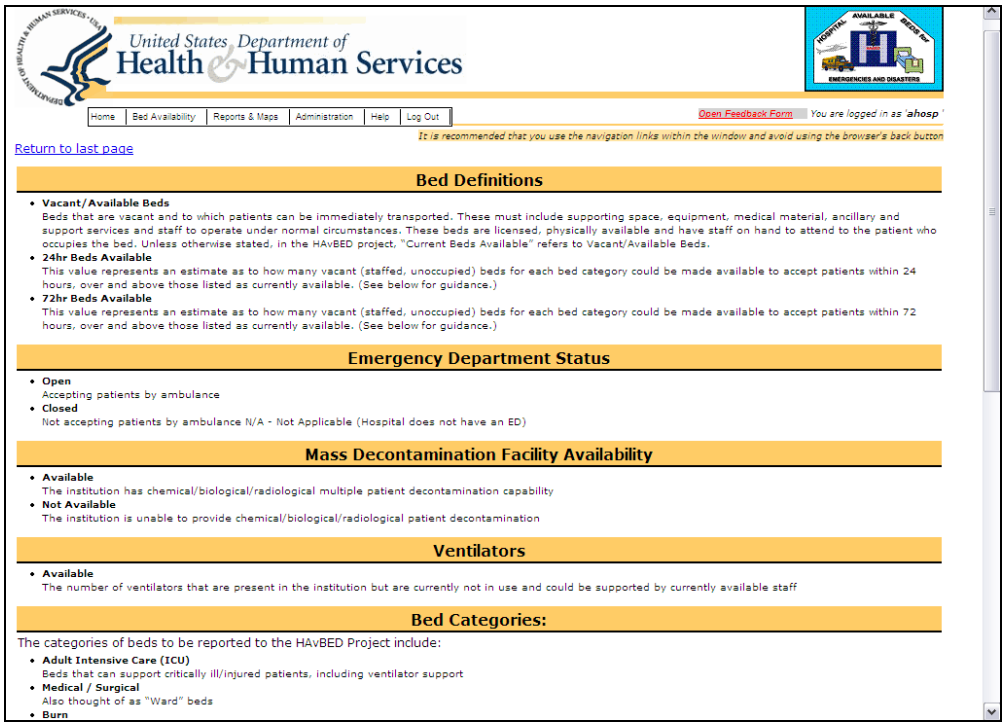


This logon screen allows the system to be password-protected, and, by using predetermined access rights (permissions), limits users to specific sections of the system relevant to their approved access level (e.g. data for a specific hospital, a specific state, a specific region, etc). After logging in, the typical user sees the HAvBED Home Page, shown in Figure 7. (If users only have permission to view or edit data for a single facility, they will instead be taken directly to that facility data, as shown in Figure 9 below.)

Figure 7: HAvBED Home Page for Individual Hospital User

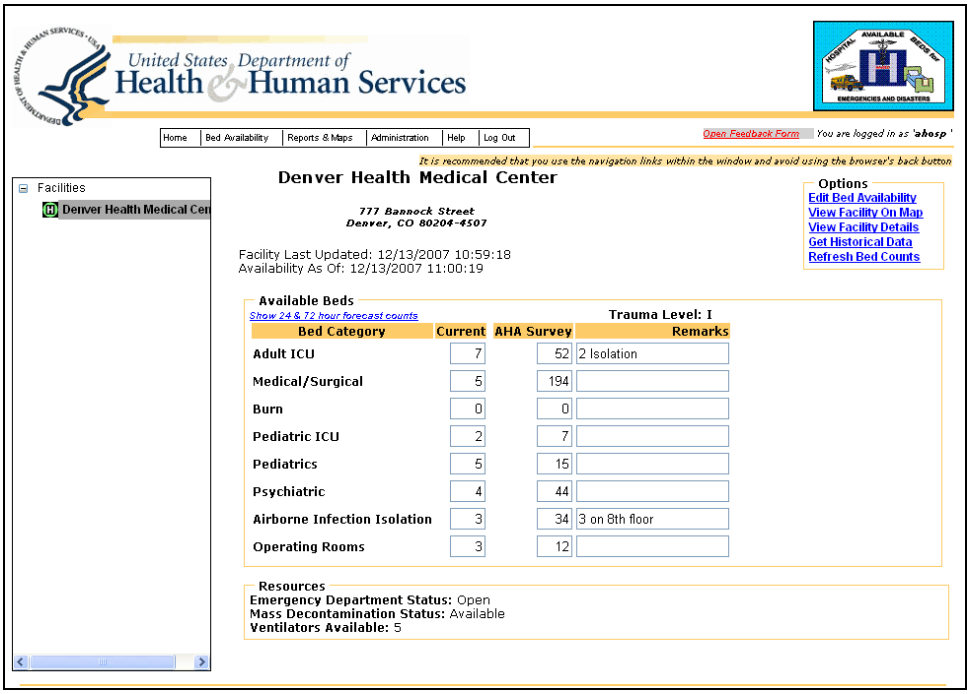
Access to all user functions is from this Home Page. Clicking the "Help" selection on the menu bar on any display takes the user to a context-sensitive help display and to the glossary of HAvBED related terms, a portion of which is shown in Figure 8.

Figure 8: HAvBED Terms Help Display



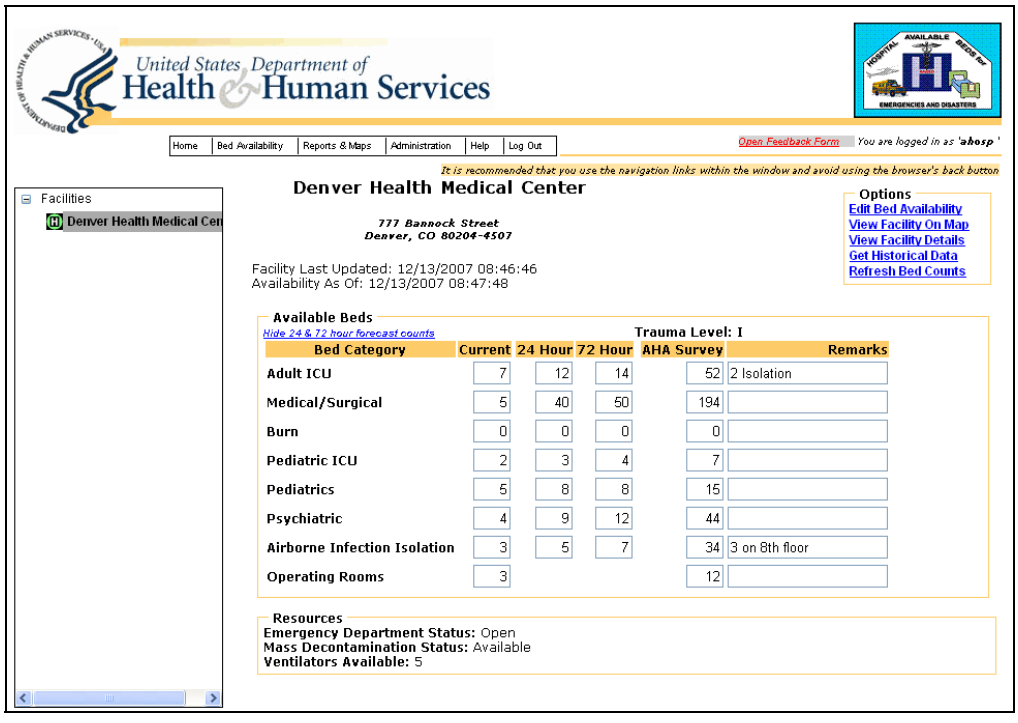
If the user has data entry rights for a single specific institution, clicking on the "View/Edit Bed Availability" selection on the Home Page (Figure 7) would result in the display of data for that specific institution shown in Figure 9.

Figure 9: Data Display for a Specific Institution



Selecting the "Show 24- & 72-hour forecast counts" option above the "Bed Category" title includes the data in the display shown in Figure 10.

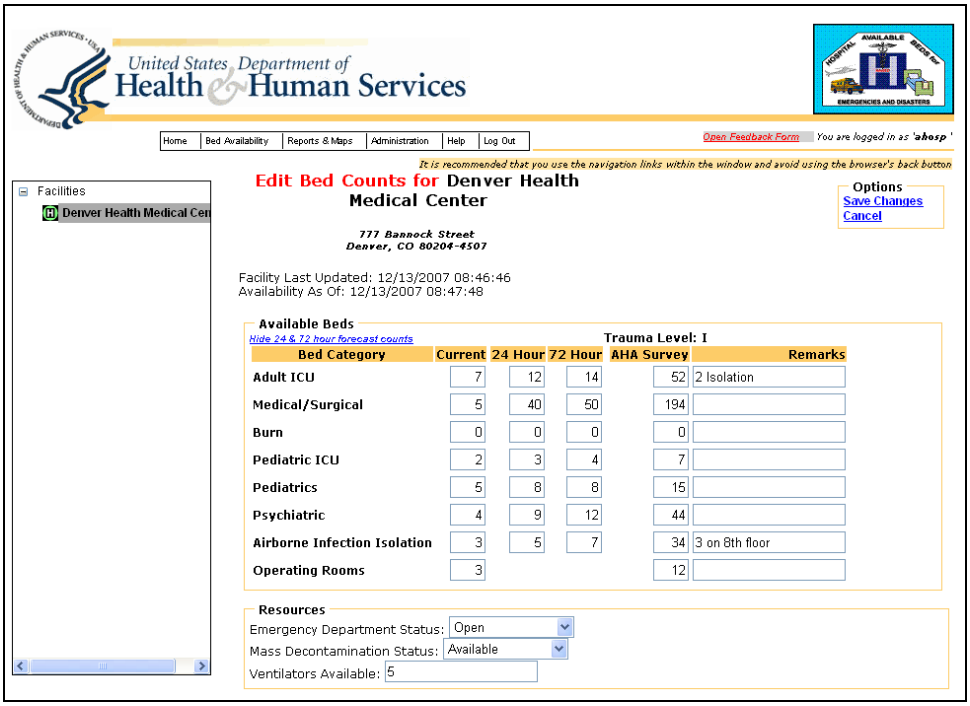
Figure 10: Data Display Including 24- and 72-Hour Bed Projections



Selecting "Edit Bed Availability" in the Options box in the upper right corner of the page causes the display of a similar form that allows updating of current bed availability values and other resources (Figure 11). Data for the specific institution could then be updated in

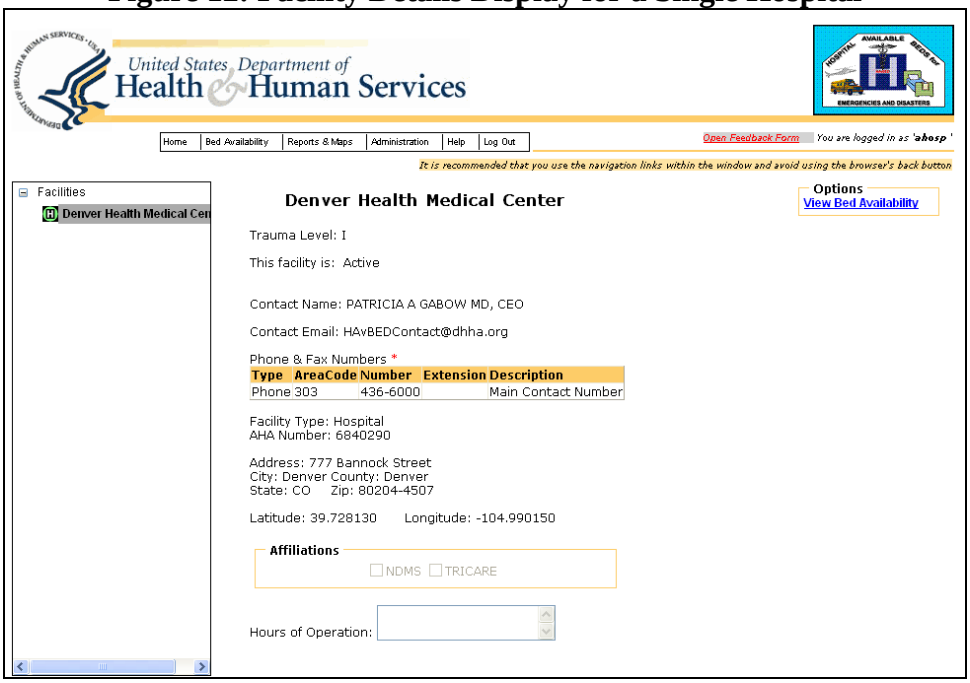
the database. Clicking "Save Changes" in the Options box button then updates that hospital's information in the HAvBED system.

Figure 11: Data Edit Display Including 24- and 72-Hour Bed Projections



On the individual hospital data display, selecting "View Facility Details" in the Options box provides additional information about the institution as shown in Figure 12:

Figure 12: Facility Details Display for a Single Hospital

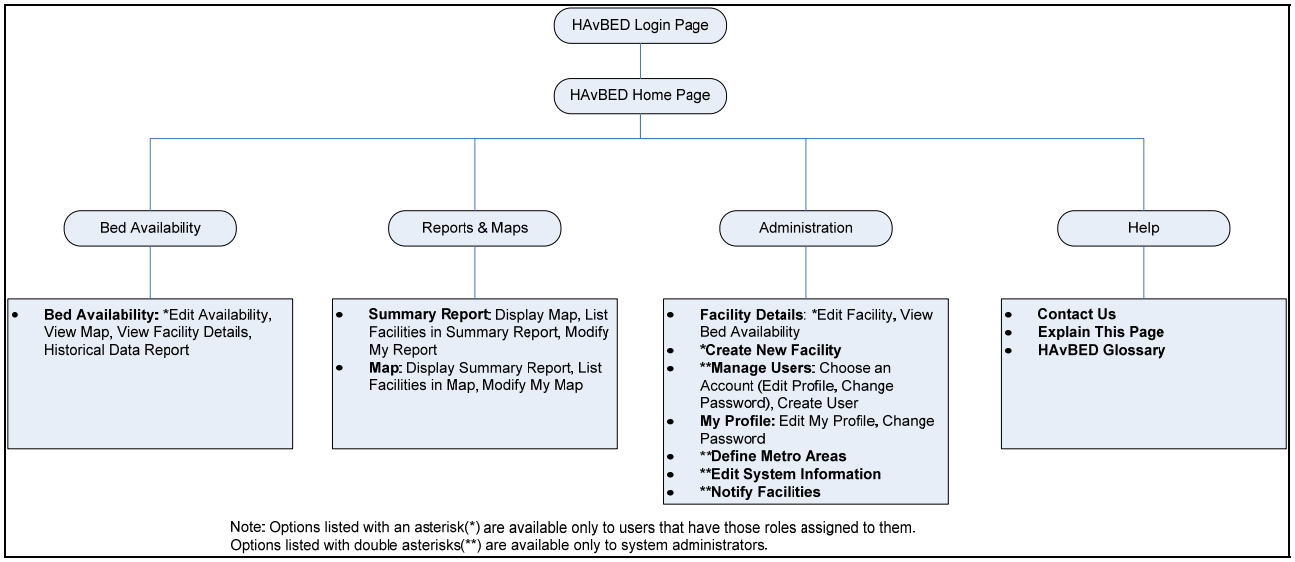


For those users with full administrative privileges, the following display would be shown after logging in (Figure 13). Note that this display provides additional functionality, including the ability to create new facilities, manage users, define metropolitan areas, edit system information, and notify facility contacts via e-mail.

Figure 13: Home Page for User with Full Administrative Privileges

The diagrammatic layout of full administrative user capability is given below (Figure 14).

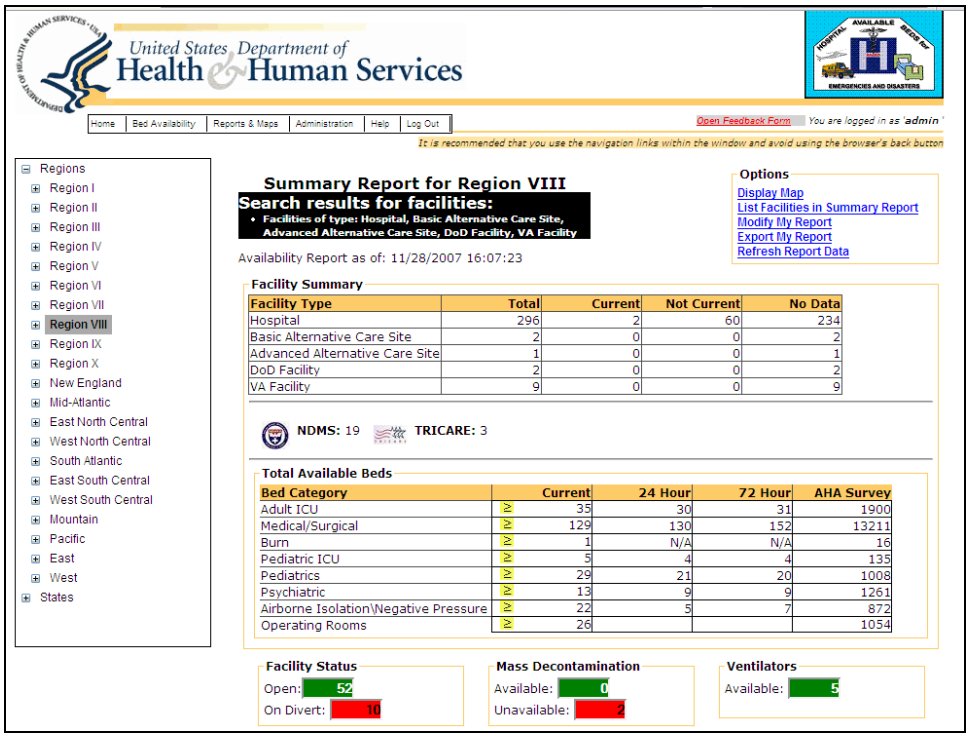
Figure 14: Schematic Representation of Complete HAvBED User Functionality



Selecting the "Summary Report" in the "Reports and Maps" box on the Home Page (Figure 13) allows users to specify a summary report of available beds and other

resources in a geographic area (region, state, county, city, or metropolitan area) to which they are allowed access. If a user is allowed bed display access to Federal Region VIII, the following Summary Report would be displayed (Figure 15):

Figure 15: Summary Report for Federal Region VIII

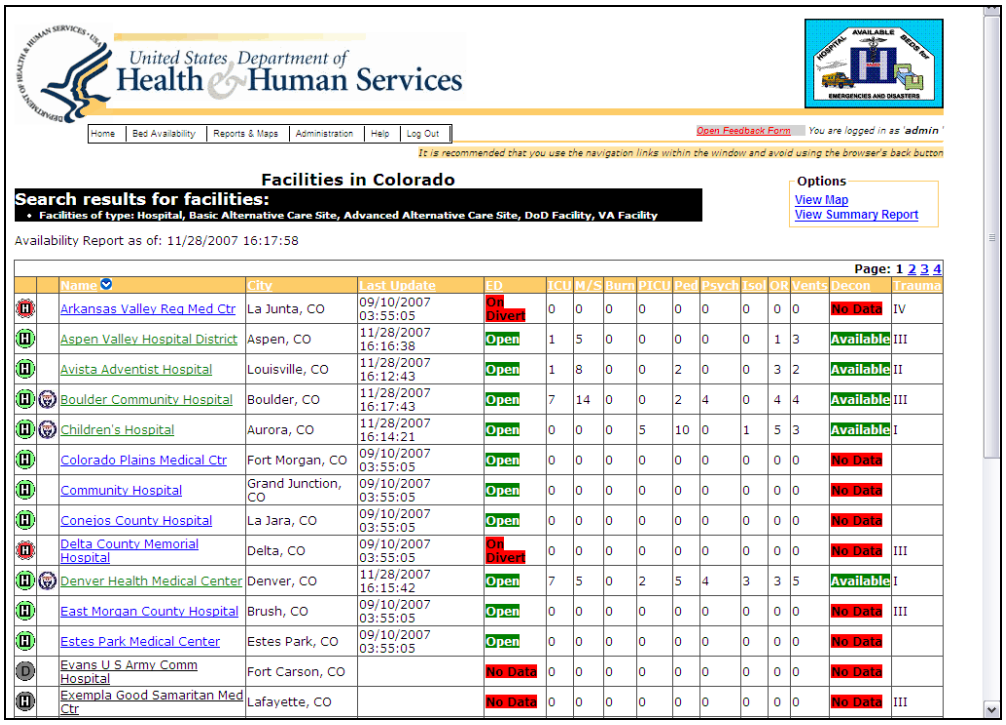


Note the "≥" character in "Current" column. This indicates that one or more hospitals have reported (via the Web services interface) that they have at least one bed (but no specific number given) in each of the bed categories.

A user with access to a specific geographic area (e.g., a region) may also retrieve summary data for any smaller geographic area (e.g., a state, a county, etc.) within that region.

A detailed list by facility can be obtained by selecting "List Facilities in Summary Report" in the Options box (Figure 15). For example, if the Summary Report being viewed was for the State of Colorado, the following display would be presented (Figure 16):

Figure 16: First Page of the List of Facilities for the State of Colorado



United States Department of Health & Human Services

Home | Bed Availability | Reports & Maps | Administration | Help | Log Out

Open Feedback Form You are logged in as 'admin'

It is recommended that you use the navigation links within the window and avoid using the browser's back button

Facilities in Colorado

Search results for facilities:

- Facilities of type: Hospital, Basic Alternative Care Site, Advanced Alternative Care Site, DoD Facility, VA Facility

Options: View Map; View Summary Report

Availability Report as of: 11/28/2007 16:17:58

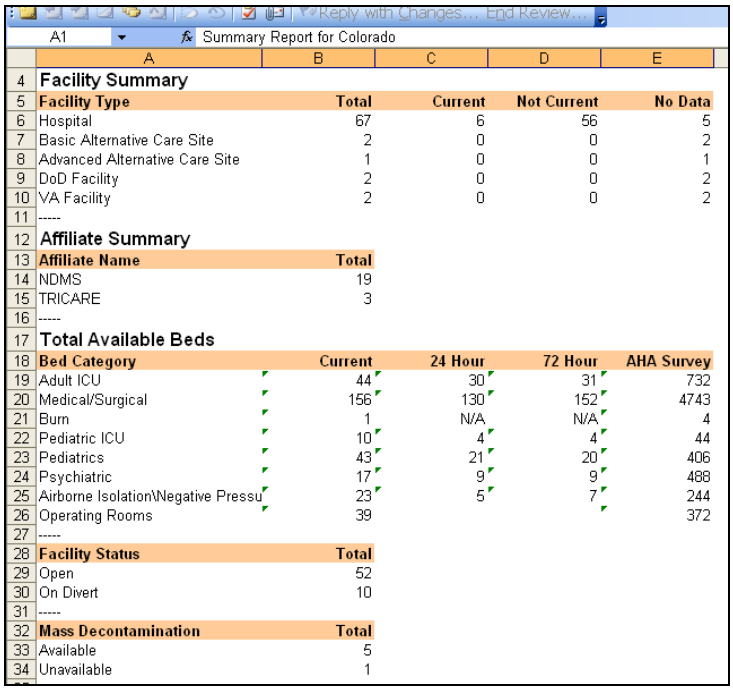
Page: 1 2 3 4

Name	City	Last Update	ED	ICU	M/S	Burn	PICU	Ped	Psych	Isol	OR	Vents	Decon	Trauma
Arkansas Valley Reg Med Ctr	La Junta, CO	09/10/2007 03:55:05	On Divert	0	0	0	0	0	0	0	0	0	No Data	IV
Aspen Valley Hospital District	Aspen, CO	11/28/2007 16:16:38	Open	1	5	0	0	0	0	0	1	3	Available	III
Avista Adventist Hospital	Louisville, CO	11/28/2007 16:12:43	Open	1	8	0	0	2	0	0	3	2	Available	II
Boulder Community Hospital	Boulder, CO	11/28/2007 16:17:43	Open	7	14	0	0	2	4	0	4	4	Available	III
Children's Hospital	Aurora, CO	11/28/2007 16:14:21	Open	0	0	0	5	10	0	1	5	3	Available	I
Colorado Plains Medical Ctr	Fort Morgan, CO	09/10/2007 03:55:05	Open	0	0	0	0	0	0	0	0	0	No Data	
Community Hospital	Grand Junction, CO	09/10/2007 03:55:05	Open	0	0	0	0	0	0	0	0	0	No Data	
Conejos County Hospital	La Jara, CO	09/10/2007 03:55:05	Open	0	0	0	0	0	0	0	0	0	No Data	
Delta County Memorial Hospital	Delta, CO	09/10/2007 03:55:05	On Divert	0	0	0	0	0	0	0	0	0	No Data	III
Denver Health Medical Center	Denver, CO	11/28/2007 16:15:42	Open	7	5	0	2	5	4	3	3	5	Available	I
East Morgan County Hospital	Brush, CO	09/10/2007 03:55:05	Open	0	0	0	0	0	0	0	0	0	No Data	III
Estes Park Medical Center	Estes Park, CO	09/10/2007 03:55:05	Open	0	0	0	0	0	0	0	0	0	No Data	
Evans U S Army Comm Hospital	Fort Carson, CO		No Data	0	0	0	0	0	0	0	0	0	No Data	
Exempla Good Samaritan Med Ctr	Lafayette, CO		No Data	0	0	0	0	0	0	0	0	0	No Data	III

On this display, the list may be sorted by column data values, in ascending or descending order, by clicking on that column header. Detailed data on any facility may be obtained by clicking on the name of that specific institution, taking the user to the institution's data display as demonstrated above (Figure 9).

It is also possible to export data to a spread sheet format for later analysis and study. For example, selecting the "Export My Report" option in the Options box on Figure 15 from a Summary Report of the State of Colorado would produce the spread sheets shown in Figures 17 and 18.

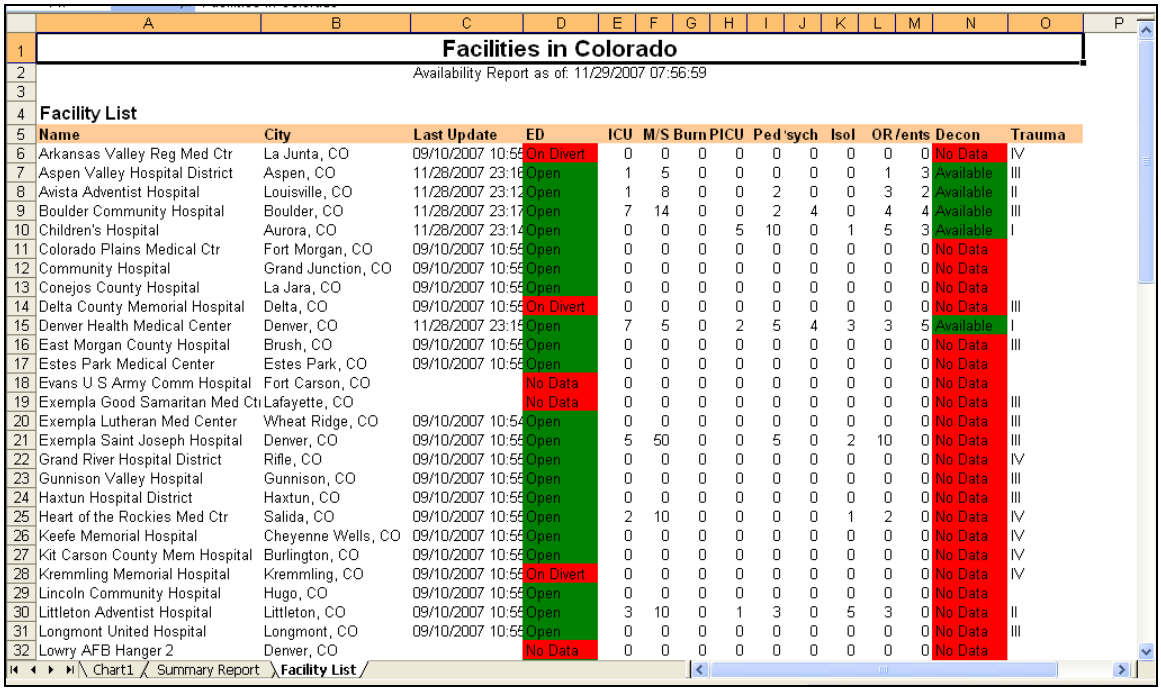
Figure 17: Spread Sheet of Summary Report for the State of Colorado



A1 — Summary Report for Colorado

	A	B	C	D	E
4	**Facility Summary**				
5	**Facility Type**	**Total**	**Current**	**Not Current**	**No Data**
6	Hospital	67	6	56	5
7	Basic Alternative Care Site	2	0	0	2
8	Advanced Alternative Care Site	1	0	0	1
9	DoD Facility	2	0	0	2
10	VA Facility	2	0	0	2
11	-----				
12	**Affiliate Summary**				
13	**Affiliate Name**	**Total**			
14	NDMS	19			
15	TRICARE	3			
16	-----				
17	**Total Available Beds**				
18	**Bed Category**	**Current**	**24 Hour**	**72 Hour**	**AHA Survey**
19	Adult ICU	44	30	31	732
20	Medical/Surgical	156	130	152	4743
21	Burn	1	N/A	N/A	4
22	Pediatric ICU	10	4	4	44
23	Pediatrics	43	21	20	406
24	Psychiatric	17	9	9	488
25	Airborne Isolation\Negative Pressu	23	5	7	244
26	Operating Rooms	39			372
27	-----				
28	**Facility Status**	**Total**			
29	Open	52			
30	On Divert	10			
31	-----				
32	**Mass Decontamination**	**Total**			
33	Available	5			
34	Unavailable	1			

Figure 18: Partial Spread Sheet of List of Facilities for the State of Colorado



Facilities in Colorado

Availability Report as of: 11/29/2007 07:56:59

Facility List

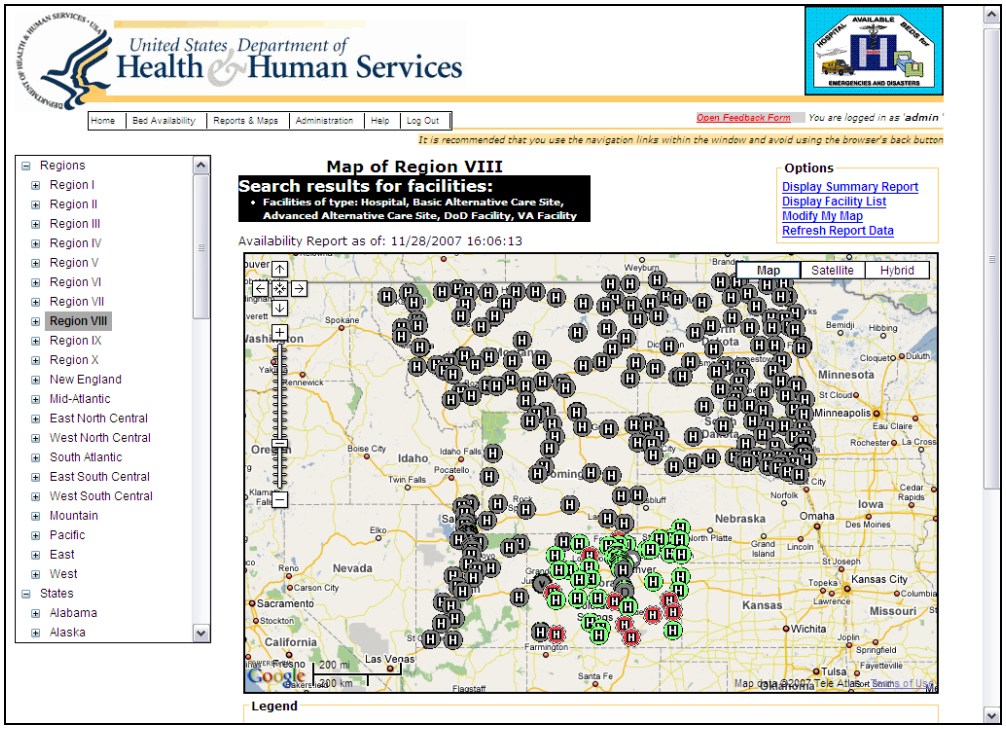
Name	City	Last Update	ED	ICU	M/S	Burn	PICU	Ped	sych	Isol	OR	ents	Decon	Trauma
Arkansas Valley Reg Med Ctr	La Junta, CO	09/10/2007 10:55	On Divert	0	0	0	0	0	0	0	0	0	No Data	IV
Aspen Valley Hospital District	Aspen, CO	11/28/2007 23:16	Open	1	5	0	0	0	0	0	1	3	Available	III
Avista Adventist Hospital	Louisville, CO	11/28/2007 23:12	Open	1	8	0	0	2	0	0	3	2	Available	II
Boulder Community Hospital	Boulder, CO	11/28/2007 23:17	Open	7	14	0	0	2	4	0	4	4	Available	III
Children's Hospital	Aurora, CO	11/28/2007 23:14	Open	0	0	0	5	10	0	1	5	3	Available	I
Colorado Plains Medical Ctr	Fort Morgan, CO	09/10/2007 10:55	Open	0	0	0	0	0	0	0	0	0	No Data	
Community Hospital	Grand Junction, CO	09/10/2007 10:55	Open	0	0	0	0	0	0	0	0	0	No Data	
Conejos County Hospital	La Jara, CO	09/10/2007 10:55	Open	0	0	0	0	0	0	0	0	0	No Data	
Delta County Memorial Hospital	Delta, CO	09/10/2007 10:55	On Divert	0	0	0	0	0	0	0	0	0	No Data	III
Denver Health Medical Center	Denver, CO	11/28/2007 23:15	Open	7	5	0	2	5	4	3	3	5	Available	I
East Morgan County Hospital	Brush, CO	09/10/2007 10:55	Open	0	0	0	0	0	0	0	0	0	No Data	III
Estes Park Medical Center	Estes Park, CO	09/10/2007 10:55	Open	0	0	0	0	0	0	0	0	0	No Data	
Evans U S Army Comm Hospital	Fort Carson, CO		No Data	0	0	0	0	0	0	0	0	0	No Data	
Exempla Good Samaritan Med Ct	Lafayette, CO		No Data	0	0	0	0	0	0	0	0	0	No Data	III
Exempla Lutheran Med Center	Wheat Ridge, CO	09/10/2007 10:54	Open	0	0	0	0	0	0	0	0	0	No Data	III
Exempla Saint Joseph Hospital	Denver, CO	09/10/2007 10:55	Open	5	50	0	0	5	0	2	10	0	No Data	III
Grand River Hospital District	Rifle, CO	09/10/2007 10:55	Open	0	0	0	0	0	0	0	0	0	No Data	IV
Gunnison Valley Hospital	Gunnison, CO	09/10/2007 10:55	Open	0	0	0	0	0	0	0	0	0	No Data	III
Haxtun Hospital District	Haxtun, CO	09/10/2007 10:55	Open	0	0	0	0	0	0	0	0	0	No Data	III
Heart of the Rockies Med Ctr	Salida, CO	09/10/2007 10:55	Open	2	10	0	0	0	0	1	2	0	No Data	IV
Keefe Memorial Hospital	Cheyenne Wells, CO	09/10/2007 10:55	Open	0	0	0	0	0	0	0	0	0	No Data	IV
Kit Carson County Mem Hospital	Burlington, CO	09/10/2007 10:55	Open	0	0	0	0	0	0	0	0	0	No Data	IV
Kremmling Memorial Hospital	Kremmling, CO	09/10/2007 10:55	On Divert	0	0	0	0	0	0	0	0	0	No Data	IV
Lincoln Community Hospital	Hugo, CO	09/10/2007 10:55	Open	0	0	0	0	0	0	0	0	0	No Data	
Littleton Adventist Hospital	Littleton, CO	09/10/2007 10:55	Open	3	10	0	1	3	0	5	3	0	No Data	II
Longmont United Hospital	Longmont, CO	09/10/2007 10:55	Open	0	0	0	0	0	0	0	0	0	No Data	III
Lowry AFB Hanger 2	Denver, CO		No Data	0	0	0	0	0	0	0	0	0	No Data	

Chart1 / Summary Report / Facility List

A map of the facilities summarized on the Summary Report or shown on the pages of the facility list may be obtained by making the "View Map" selection in the Options box. In the case of Federal Region VIII, the map shown in Figure 19 would be displayed. On this map, the grey icons represent facilities for which no data had been received. The

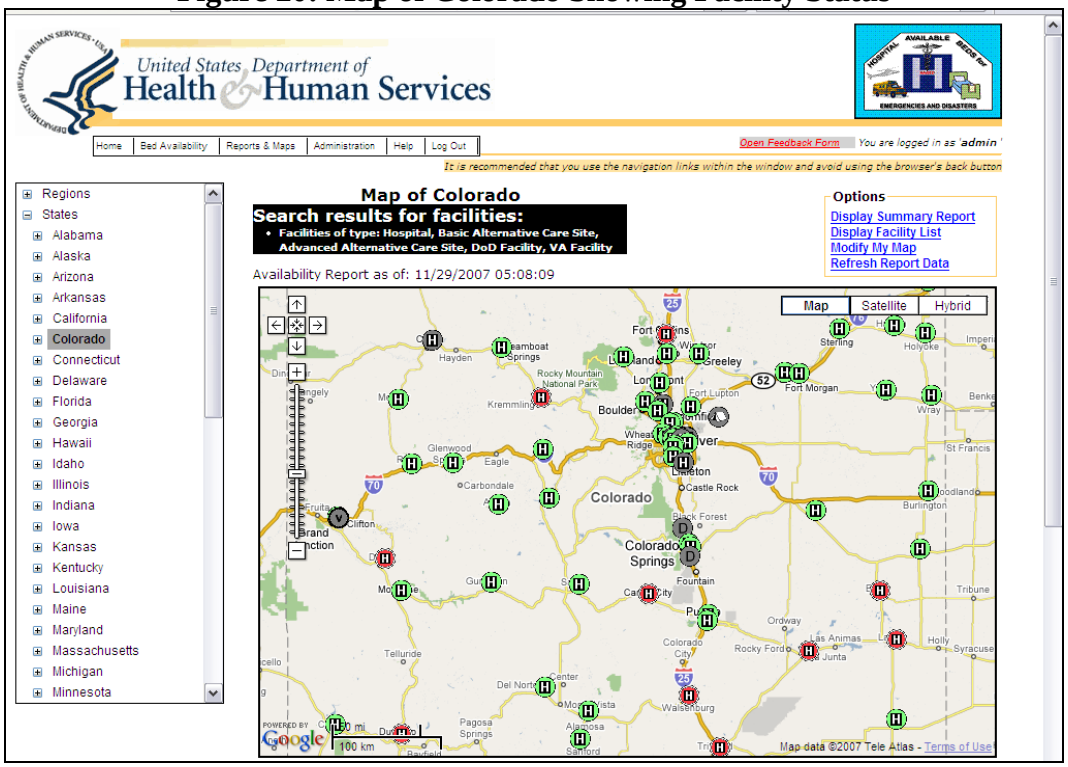
green icons represent institutions accepting patients; the red icons indicate facilities that are not accepting patients (“on divert”).

Figure 19: Map of Federal Region VIII



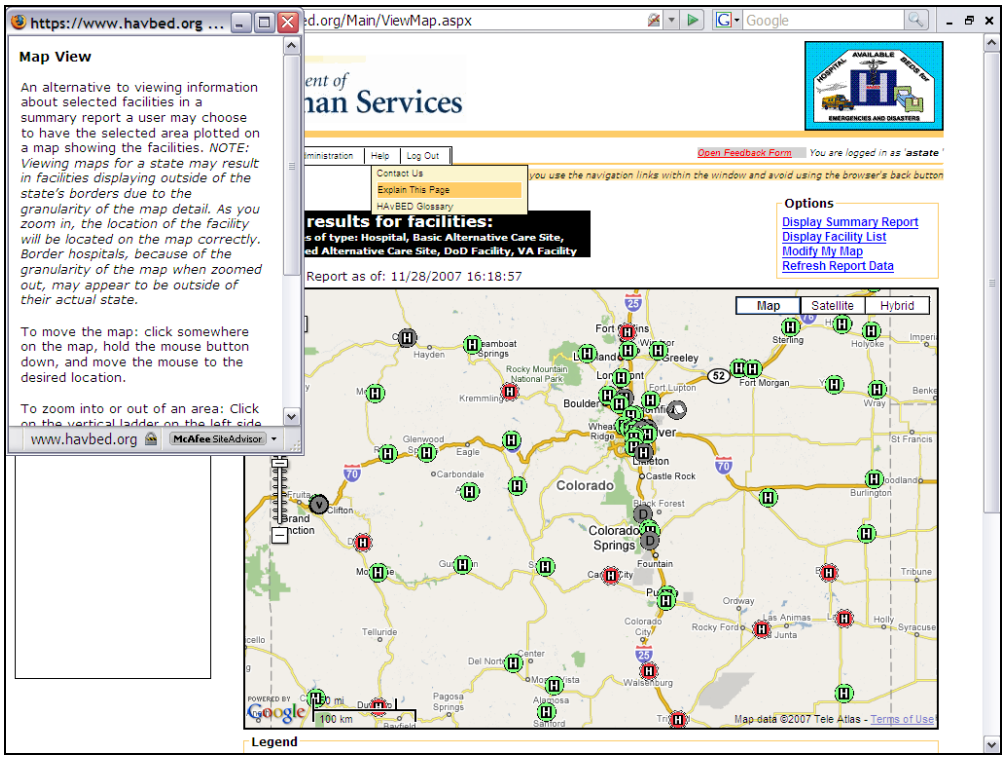
Maps may also be generated via the "Display Map" selection on the Home Page. For a user who has bed availability retrieval rights for a state (e.g., Colorado), the following data map could be retrieved (Figure 20):

Figure 20: Map of Colorado Showing Facility Status



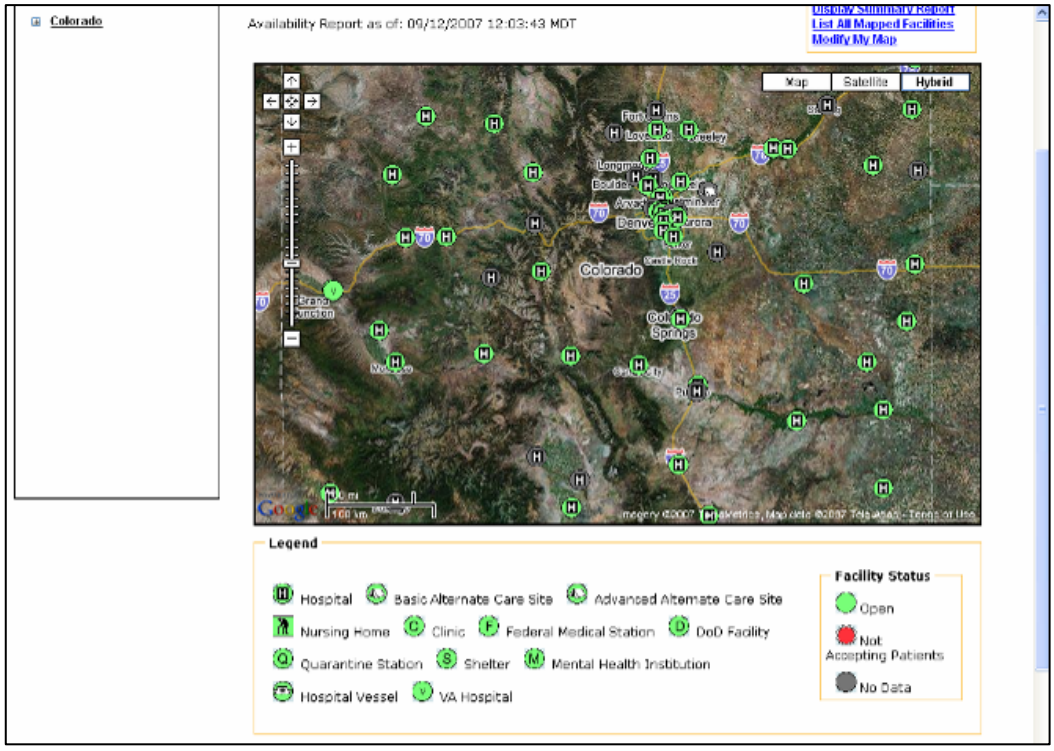
By selecting the “Explain This Page” option under “Help” on the menu bar, the user will see a textual description of the display (Figure 21).

Figure 21: “Explain This Page” Help Display



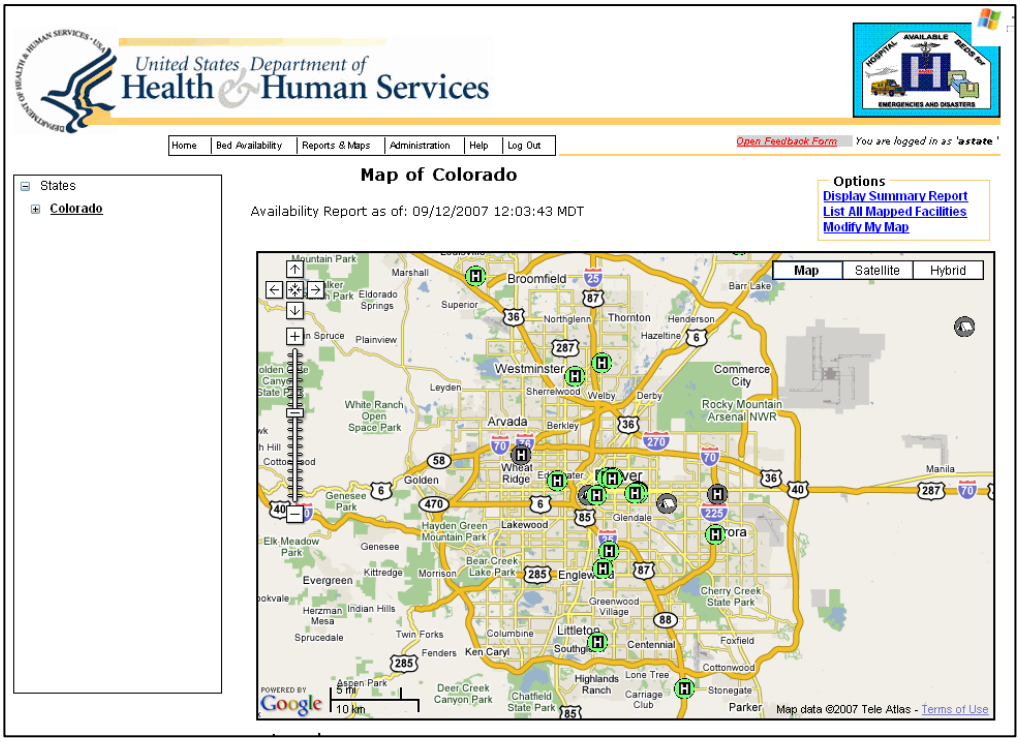
By clicking the “Hybrid” selection on the upper right corner of the map, the facilities and other map features will be superimposed upon the appropriate satellite image as shown in Figure 22.

Figure 22: Summary Map of Colorado in "Hybrid" Display Mode



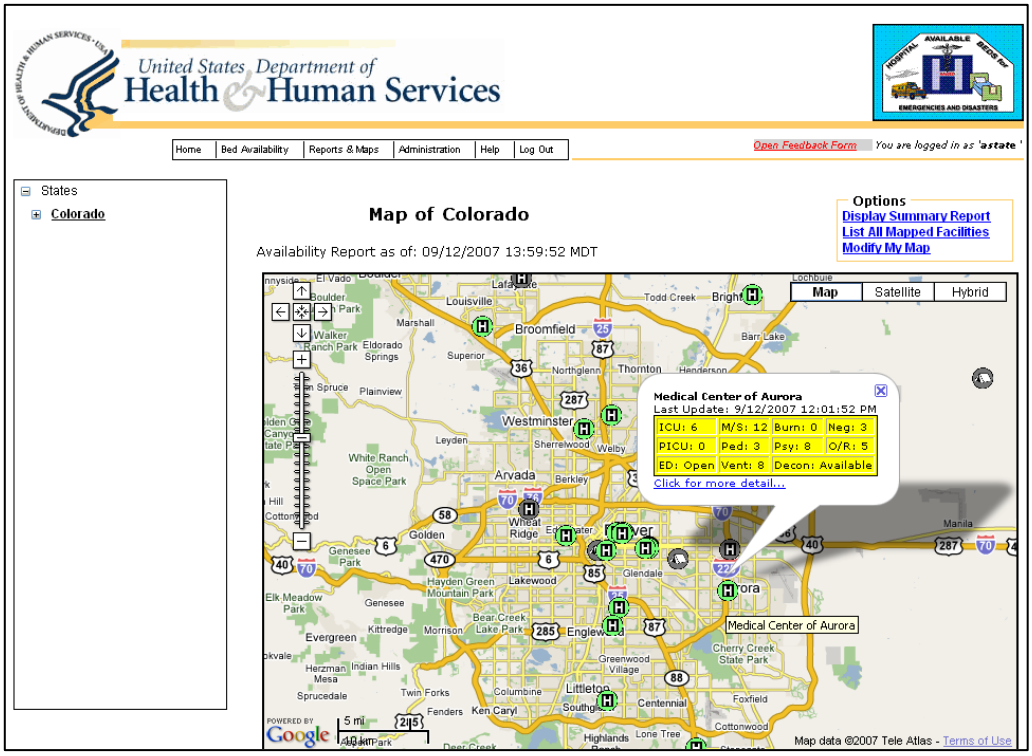
Note the legend section on the lower part of the display. It specifies the icons that are displayed for the different facility classes and the icon color that indicates the facility status. Full pan and zoom map functionality is available by clicking on the appropriate function pads on the left upper portion of the map. A double left-click on the map will also produce a zoom-in; double right-click yields a zoom-out. Successive zoom-in operations over Denver will show the following (in "Map" display mode) (Figure 23):

Figure 23: Zooming In on a Summary Map of Colorado in "Map" Display Mode



Mousing over any facility icon will provide the institution's name. Clicking on the facility icon provides a summary of available beds for that facility (Figure 24):

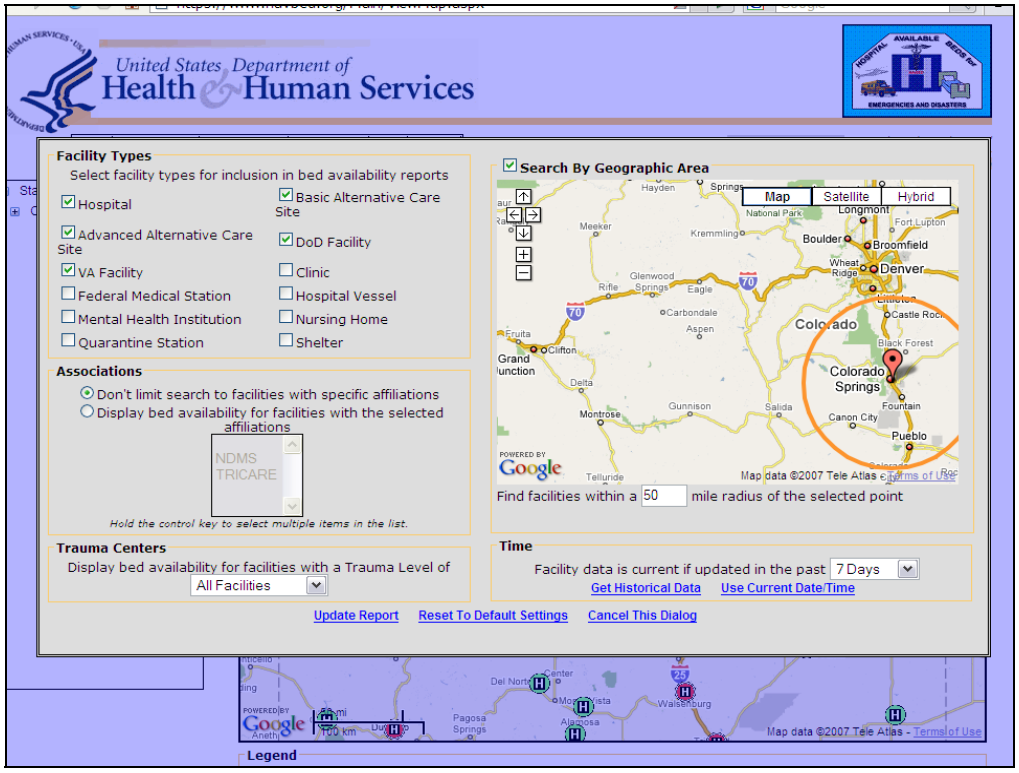
Figure 24: Summary of Available Beds by Clicking on Facility Icon



The full display of bed availability for the facility can be obtained by clicking on the "Click for more detail" selection.

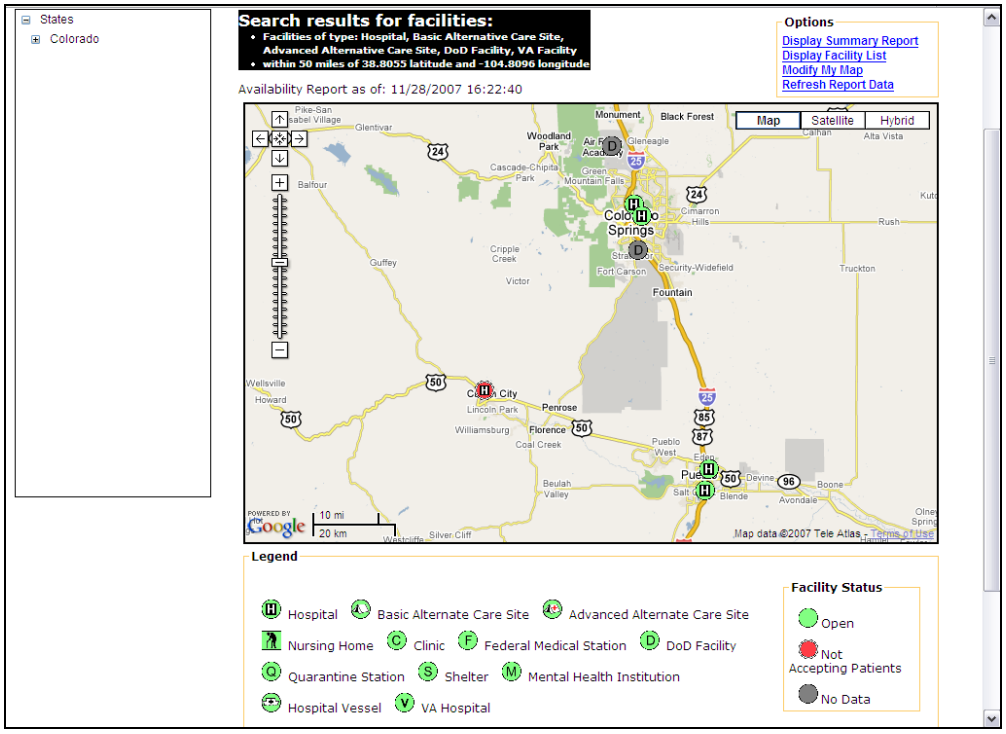
By selecting "Modify My Map" in the Options box, the user is able to selectively display institutions on the map based upon facility class, NDMS- or TriCare-affiliation, Trauma Center Designation Level, or facilities within a user-specified mileage radius from a selected point on the map. The display used to select these options is shown in Figure 25, which is set to retrieve facilities within 50 miles of Colorado Springs, Colorado.

Figure 25: "Modify My Map" Options Set to Retrieve Facilities Within 50 Miles of Colorado Springs, Colorado



After selecting "Update Report," the resulting map is shown in Figure 26.

Figure 26: Map of Facilities Within 50 Miles of Colorado Springs, Colorado

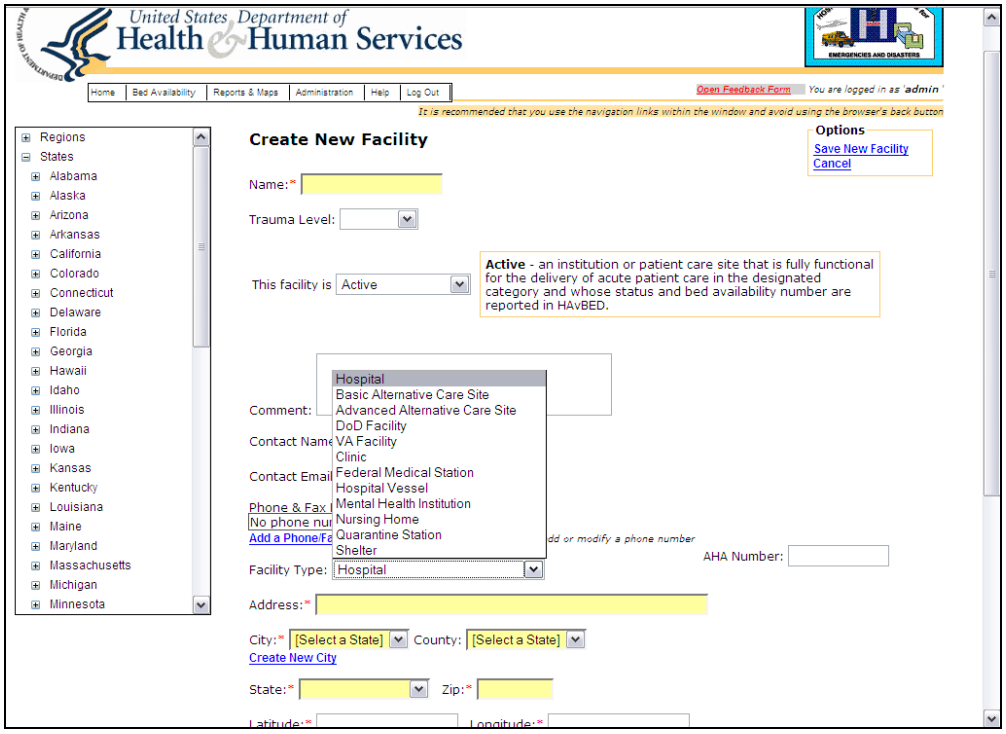


The "Modify My Map" function may also be used to construct the map based upon historical bed data at a specific date and time in the past. These capabilities are elucidated in more detail in the HAvBED User Guide. All of this report modification functionality is also available for the textual Summary Reports.

Since many facility bed availability data retrievals of interest may cross city, county or state boundaries (such as the National Capital Region), we have made it possible for users with appropriate permissions dynamically to create "Metropolitan Areas" which facilitate these retrievals both in Summary Reports and Maps. These areas are a preselected collection of counties and/or cities. This capability is fully described in the User Guide.

The sustainable production HAvBED system also provides a full suite of functions to create new facilities; manage user names, user passwords and user permissions; and notify selected facility contacts of HAvBED system activation via e-mail. These capabilities are fully described in the HAvBED User Guide. A sample display used in creating a new facility in the HAvBED system is shown in Figure 27. Note that it allows creation of an institution in any of the 12 classes of facilities.

Figure 27: "Create New Facility" Display



Both the "Create New Facility" display and the "Edit Facility Details" display (HAvBED documentation) allow a facility to be set to one of three possible statuses:

Active - an institution or patient care site that is fully functional for the delivery of acute patient care in the designated category and whose status and bed availability number are reported in HAvBED.

Inactive - an institution or patient care site that does not provide acute patient care, but which could be made an active site through the addition of appropriate personnel, supplies, and equipment. (Inactive facility status and bed availability are not reported in HAvBED.)

Decommissioned - an institution or patient care site that is no longer physically available and which cannot be made active for the delivery of patient care. Decommissioned facility status and bed availability are not reported in HAvBED.

VI. Recommendations for Implementation

The HAvBED Project Group, after testing, evaluation, and review of the sustainable production HAvBED system, recommends the following:

A. Conceptual Recommendations

- The HAvBED system should be implemented and supported on a national level. This will require that an implementation process and schedule be developed with appropriate ongoing HHS support. This process should include education of hospital personnel and local and state health and emergency management personnel about the purpose and utility of the HAvBED system.

- HHS should work with hospitals, state and local departments of health, EMS agencies, and emergency managers to inform and educate them about the utility of the HAvBED system. These groups, in turn, will be instrumental in encouraging participation at the local level. This could be done via a series of conferences or meetings. Additional partners in this effort may include the Department of Homeland Security, the AHA, state hospital associations, emergency management professional organizations, and selected medical specialty professional organizations. This approach will offer and provide collaborative efforts at multiple levels as well as the greatest opportunity for acceptance and widespread implementation of such a system.

- HHS, in concert with potential state, local, and national users, should develop a mechanism for testing the utility of the HAvBED system at these different levels of operation.

- The HAvBED system should not replace any existing bed availability systems, but rather, whenever possible, should acquire and amalgamate data already being gathered by these pre-existing systems using the HAvBED web services data interface.

- Careful consideration should be given to the option of having the HAvBED system available for ongoing local and state use, if desired by these entities.

- Hospitals not participating in a multi-institutional bed capacity system should provide necessary data via the HAvBED manual data entry web interface when requested.

- Incentives for hospital participation in the HAvBED system should be developed and implemented.

B. Technical Recommendations

- The HAvBED hospital (facility) data base (based upon the AHA hospital data) should be edited and updated to:

    1. Verify Active/Inactive status of the institutions, which was determined based upon hospital-supplied data to the AHA. (These data are sometimes incomplete.)

2. Individual hospitals should verify (and edit where necessary) their AHA bed survey numbers and institutional contact information.

3. Since the lists of those hospitals that participate in TriCare and the NDMS were not made available to the development group, these lists should be obtained and used to indicate the appropriate member affiliations of those institutions in the HAvBED database.

- Additional system augmentation may be considered including:

1. Enhanced notification of users concerning activation of the HAvBED system, including, but not limited to, individuals entering individual hospital bed availability data and state and local emergency managers/EOCs.

2. Automatic presentation of detailed facility data for validation upon logon by any user who has data entry permission for that facility.

3. Scaling of facility icons based upon map zoom level to avoid congestion over metropolitan areas.

4. Potential improvement of some aspects of system responsiveness by addressing navigation tree refresh issues.

5. Further refinement of what resources are displayed based upon facility category (e.g., not showing “mass decontamination status” for nursing homes).

Appendix
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