4. RESULTS OF PHASE I EFFORT

Time Frame. The Phase I contract with the Centers for Disease Control and Prevention (CDC) titled "WebTB: Improving Tuberculosis Control in the South Pacific" was awarded in September 2006, begun in January 2007, and successfully completed in September 2007.

Context. Once all phases are completed, the goal of this work is to improve the way in which public health officials in the remote U.S. Pacific Island Jurisdictions (USPIJs) collect, transmit, and use data on tuberculosis (TB) cases in their jurisdictions. The product to accomplish this is envisioned as a web service that will be available to all authorized public health staff in the region. The service will improve tremendously the standardization and validation of TB case data collection while reducing the resources allocated to meet mandated CDC reporting. It will also provide immediate access to carefully prepared surveillance, program management, and other analytic reporting using current and historical data. Surveillance data and information from these remote areas that have taken months, even years, to acquire, validate, analyze, and distribute will become far more reliable, timely, and accessible.

Phase I Scope. The Phase I work originally proposed was to 1) design, develop, and implement a prototype web-based TB surveillance reporting tool; 2) design, but not develop, a case management/data collection application capable of online and offline data capture and synchronization; and 3) survey the telecommunications infrastructure of the different USPIJs so that optimal communications solutions for each could be adopted.

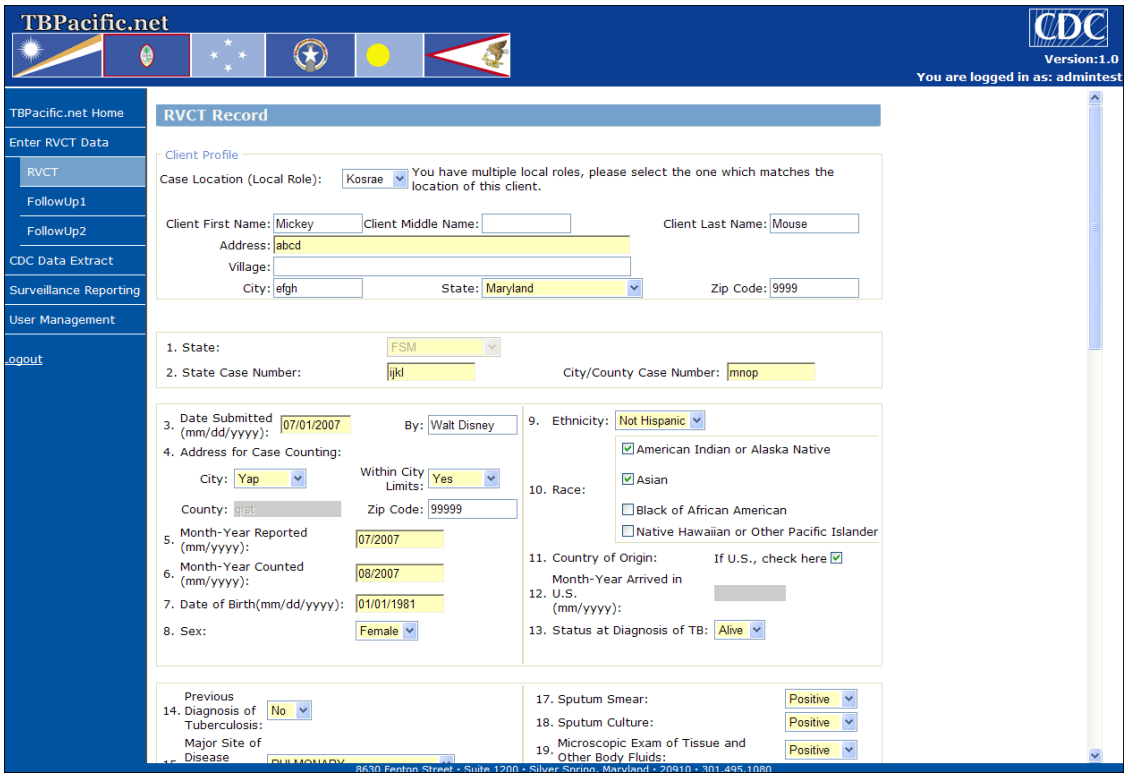
After contract award, however, conversations with CDC program officials led to the decision to focus resources on proving the feasibility of both online components (i.e., reporting and data collection) and postponing the design work on the "smart client" offline application and the assessment of local communications infrastructure. This decision not only focused attention on core project elements, but also avoided spending resources on project elements that turned out to be low priority.

Product. The end product of Phase I became a fully functional interactive web application called TBPacific that:

1) accommodated data entry of the CDC's Reported Case of Tuberculosis (RVCT) form and the RVCT Follow-up 1 and Follow-up 2 forms, the primary instruments for collecting surveillance data on TB (see screen shots in Figure 1) and

2) allowed users to create surveillance reports, graphs, and maps of TB in their jurisdictions using historical data obtained from CDC (see map example in Figure 2, time series in Figure 3, and Tuberculosis Information Management System (TIMS) Demographics report in Figure 4)

Figure 1. Upper and lower screen shots of TBPacific web form for RVCT data entry. A planned improvement in Phase II is to separate the form into multiple sections to eliminate the need to scroll.



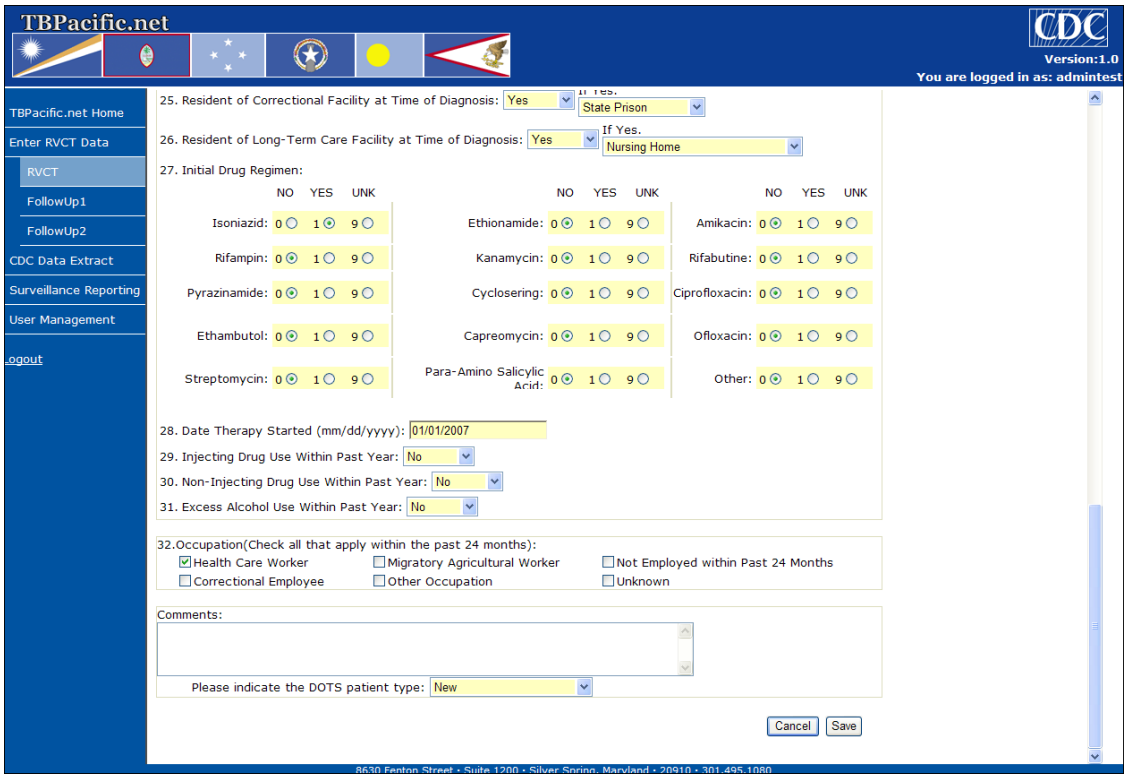


Figure 2. PDF output of TBPacific surveillance report and map of TB cases and rates in the Federated States of Micronesia (FSM). Statistics include populations, rate calculations, and breakout by FSM States and Case Verification Criteria. Breakouts are also available by Year of Case Report, Gender, Race, Previous TB, and TB Location in body.

Reported TB Cases, Case Rates and Case Verification Criteria

Federated States of Micronesia, 2005

PIJ	2005 Cases	Population	2005 Rate	Verification Method: Culture N	Culture %	Smear N	Smear %	Clinical N	Clinical %	Provider N	Provider %
FSM	78	108,000	72.2	23	29%	19	24%	23	29%	13	17%
Chuuk	23	50,000	46.0	0	0%	18	78%	4	17%	1	4%
Pohnpei	44	38,000	115.8	20	45%	0	0%	14	32%	10	23%
Kosrae	4	12,000	33.3	0	0%	0	0%	4	100%	0	0%
Yap	7	18,000	38.9	3	43%	1	14%	1	14%	2	29%

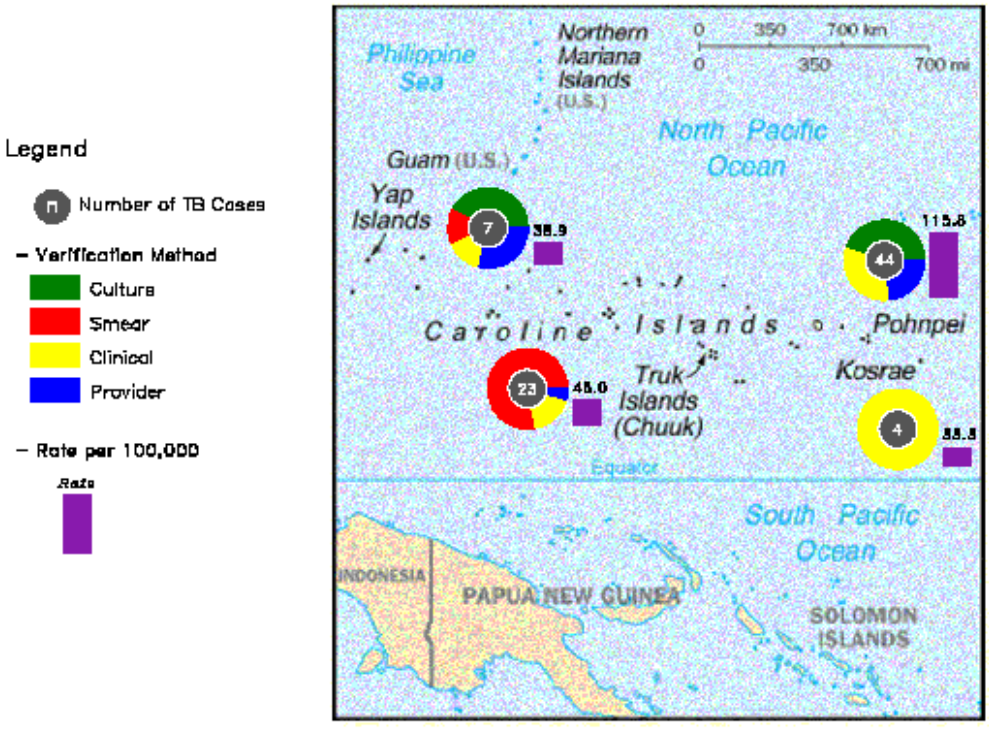
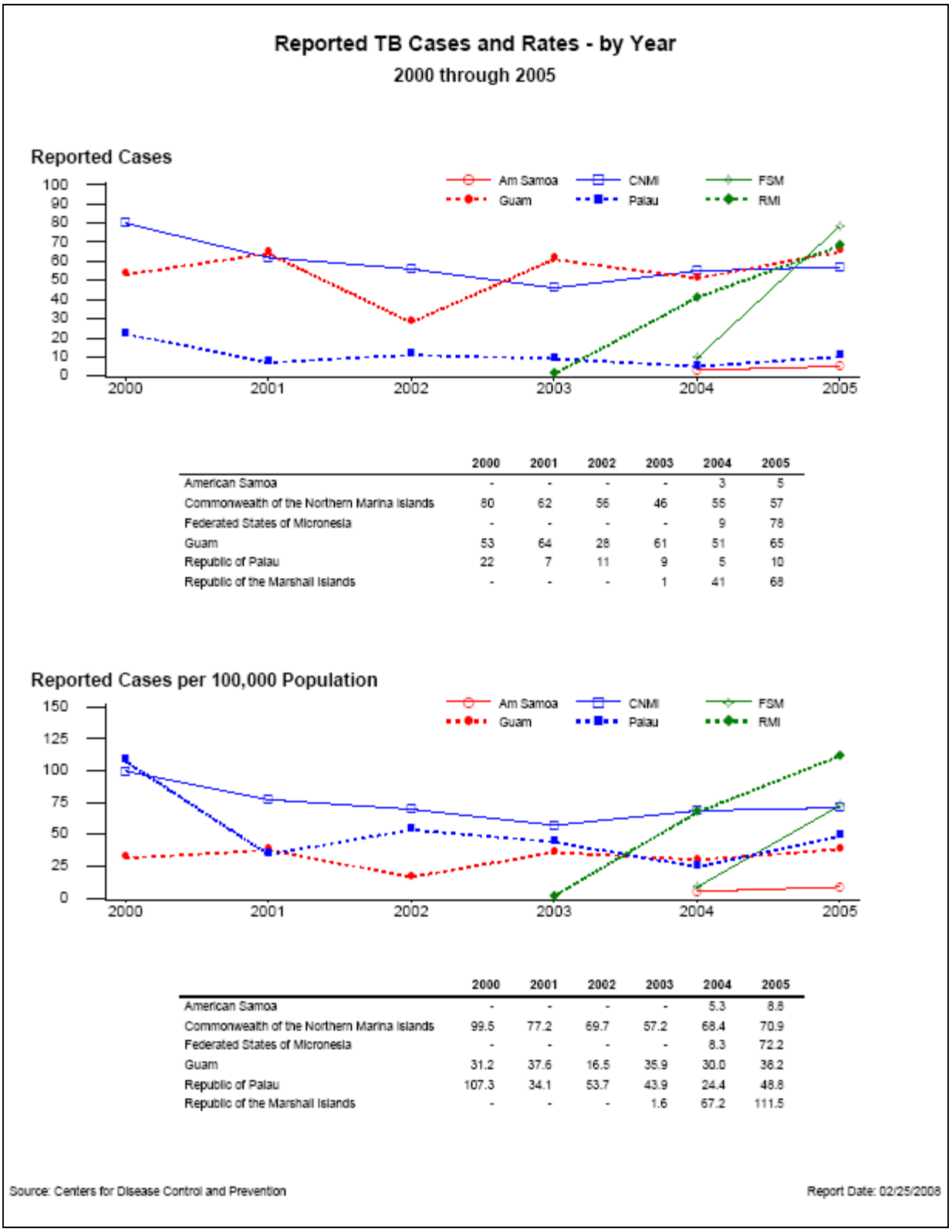


Figure 3. PDF output of TBPacific surveillance time series report of TB cases and rates for all six USPIJs.



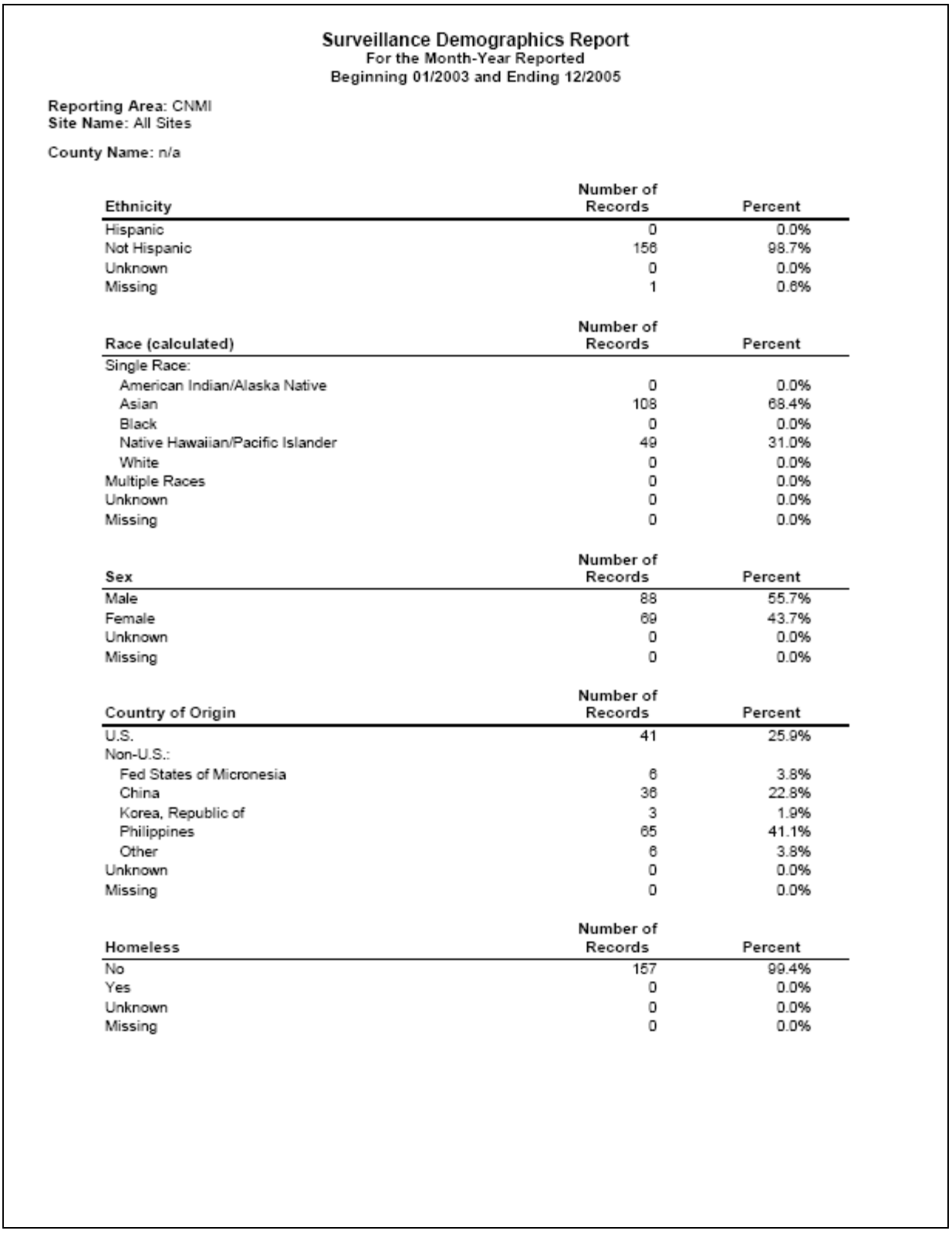
	2000	2001	2002	2003	2004	2005
American Samoa	-	-	-	-	3	5
Commonwealth of the Northern Marina Islands	80	62	56	46	55	57
Federated States of Micronesia	-	-	-	-	9	78
Guam	53	64	28	61	51	65
Republic of Palau	22	7	11	9	5	10
Republic of the Marshall Islands	-	-	-	1	41	68

	2000	2001	2002	2003	2004	2005
American Samoa	-	-	-	-	5.3	8.8
Commonwealth of the Northern Marina Islands	99.5	77.2	69.7	57.2	68.4	70.9
Federated States of Micronesia	-	-	-	-	8.3	72.2
Guam	31.2	37.6	16.5	35.9	30.0	38.2
Republic of Palau	107.3	34.1	53.7	43.9	24.4	48.8
Republic of the Marshall Islands	-	-	-	1.6	67.2	111.5

Source: Centers for Disease Control and Prevention

Report Date: 02/25/2008

Figure 4. PDF output of TBPacific TIMS-replicate report on case demographics in the CNMI.



Surveillance Demographics Report

For the Month-Year Reported
Beginning 01/2003 and Ending 12/2005

Reporting Area: CNMI
Site Name: All Sites

County Name: n/a

Ethnicity	Number of Records	Percent
Hispanic	0	0.0%
Not Hispanic	156	98.7%
Unknown	0	0.0%
Missing	1	0.6%

Race (calculated)	Number of Records	Percent
Single Race:		
American Indian/Alaska Native	0	0.0%
Asian	108	68.4%
Black	0	0.0%
Native Hawaiian/Pacific Islander	49	31.0%
White	0	0.0%
Multiple Races	0	0.0%
Unknown	0	0.0%
Missing	0	0.0%

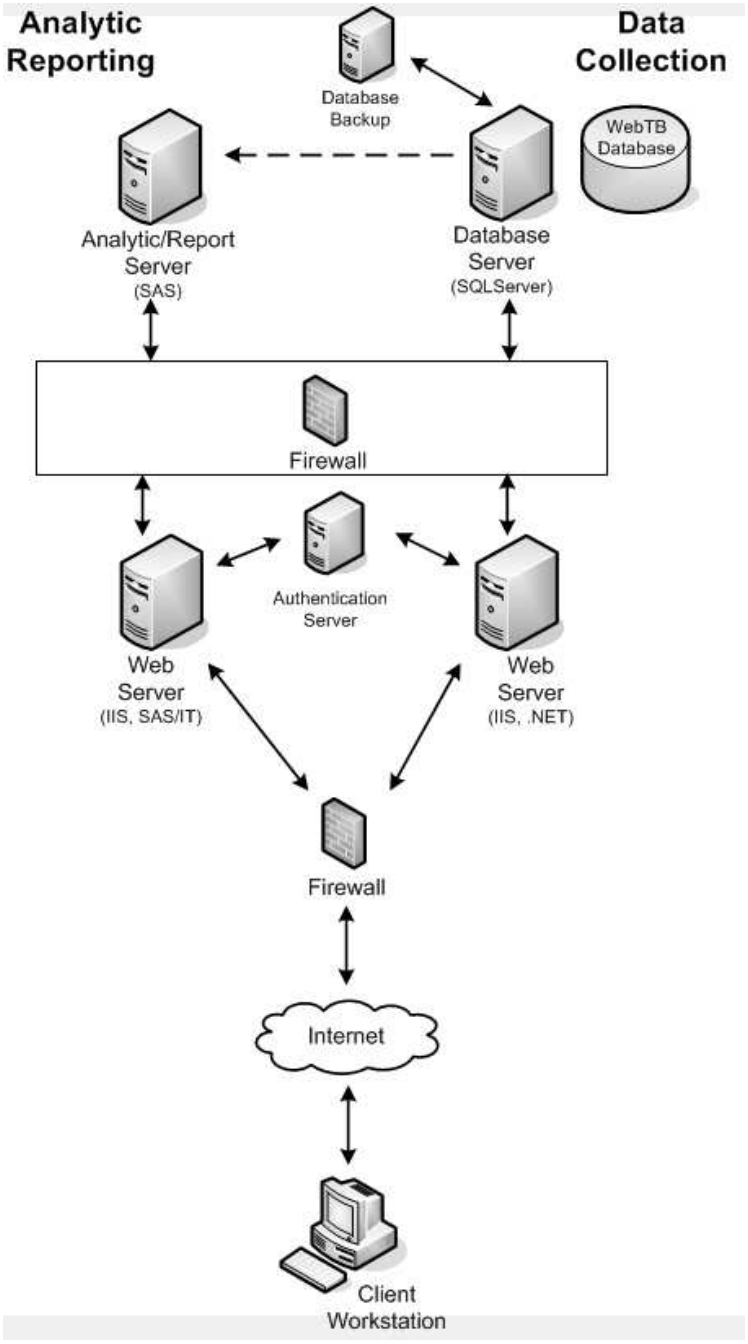
Sex	Number of Records	Percent
Male	88	55.7%
Female	69	43.7%
Unknown	0	0.0%
Missing	0	0.0%

Country of Origin	Number of Records	Percent
U.S.	41	25.9%
Non-U.S.:		
Fed States of Micronesia	6	3.8%
China	36	22.8%
Korea, Republic of	3	1.9%
Philippines	65	41.1%
Other	6	3.8%
Unknown	0	0.0%
Missing	0	0.0%

Homeless	Number of Records	Percent
No	157	99.4%
Yes	0	0.0%
Unknown	0	0.0%
Missing	0	0.0%

Architecture. A sophisticated architecture was implemented in Phase I consisting of two seamlessly integrated web applications: the data collection component and the surveillance reporting component. Figure 5 offers a system diagram showing the separate system paths to the analytic reporting and the data collection. Authentication is handled at login, and transfer to the reporting tool is transparent to the user. The dotted line represents Phase II work to accomplish real-time updates from the data collection repository to the analytic database.

Figure 5. TBPacific System Architecture. The dotted line represents real-time updates of the analytic server planned for Phase II.



Local Infrastructure: Internet Connectivity. Two sites were chosen as representing two different levels of technical sophistication—U.S. Commonwealth of the Northern Mariana Islands (CNMI), which has a well-orchestrated local TB program and substantial access to stable broadband internet services, and Federated States of Micronesia (FSM), which has more significant public health challenges because of the greater dispersion of population centers, greater diversity of cultures, and less reliable access to high-speed internet.

Since 2004 when CDC first issued a request for this work, access to high speed internet has increased substantially among the USPIJs. In fact, high-speed internet is available now in the public health headquarters locations in all USPIJ capital cities. Most (perhaps all) RVCT data entry will be done in those central locations. The higher reliability of broadband internet access reduces the immediate need for offline capacity for data entry.

Training/Feedback. Developing both online components during Phase I allowed testing of the entire web application by several CDC staff in the Division of Tuberculosis Elimination and by actual users on the islands of Saipan, CNMI, and Pohnpei, FSM. CDC representatives evaluated the initial version before the onsite trainings in Saipan and Pohnpei. Two days in both Saipan and Pohnpei were spent training users on TBPacific and receiving feedback on strengths and shortcomings. The regional representative for CDC, Mr. Alstead Forbes, attended the interactive sessions with users as well. Users and Mr. Forbes responded very positively to the concept and the application and were anxious to begin using the service as soon as possible.

The list below identifies some examples of feedback and resolutions that led to iterative improvements in the application.

Issue: Place a “warning notice” on the home page of TBPacific that puts the prospective user on notice that the system has private and confidential information and that there is a penalty for unauthorized entry, and so on. *Resolution:* Text from the TIMS login screen was adapted and placed on the TBPacific login page.

Issue: Different users will have different rights to enter or edit data and to access reports. The system must allow and control for that. *Resolution:* In Phase I, user roles differentiated between those with “data entry only” and “data entry and edit.” Users could be restricted to entry and edit access to a single population center, single Jurisdiction, or any combination of population centers and Jurisdictions across the six USPIJs. All test users had access to aggregated reporting for all areas. There were no case-specific records in the reporting.

Issue: Users must login once for data entry and again to access surveillance reporting. *Resolution:* This was streamlined so that login credentials authenticated upon login to the data entry application were securely transferred to the reporting component so that the user experiences a seamless product once inside.

Issue: Data fields that can be carried forward from the RVCT form to follow-up forms should do so and remain inactive on the follow-up forms. *Resolution:* Accommodated.

Issue: Add a non-mandatory field “Village” to RVCT next to “Address” to reflect local culture. *Resolution:* Accommodated.

Issue: After a screen refresh, return to the same page position. *Resolution:* Accommodated.

Issue: How can CDC obtain surveillance data? *Resolution:* Phase II will include a module specifically for that purpose accessible only by CDC users.

Issue: What is the plan for adding additional TIMS reports? *Resolution:* Additional TIMS reports and a more powerful ad hoc query than available in CDC TIMS will be added in Phase II.

Issue: Users should be able to see the left-side navigation menu at all times. It disappears when in the reporting component. *Resolution:* Fixed.

Issue: Add new options (student, farmer, etc.) for "occupation" to reflect local culture. *Resolution:* Accommodated.

Issue: Concern about whether CDC or the Jurisdictions should be identified as the "Source" on the reports. *Resolution:* CDC deferred this discussion to Phase II.

Issue: RVCT data entry validation logic needs to be in place. *Resolution:* A number of frontend checks on data entry were implemented in Phase I, but there are many more to implement in Phase II.

Issue: The data entry screen required users to scroll right-left and up-down to access the entire form. *Resolution:* The need to scroll right-left was eliminated. Phase II work will eliminate most, possibly all up-down scrolling.

Summary of Phase I Results

Our Phase I prototype demonstrated the feasibility of a web-based data collection and analysis system to support TB reporting and surveillance in the USPIJs. We learned about important characteristics of the USPIJs, which will enable us to better focus resources in designing and building a fully functional system. We established contacts that will ease eventual implementation and continue to provide us with valuable advice. We conclude that pursuing a full build out of TBPacific is a worthwhile public health objective and a potentially viable business, as set forth in our Phase II proposal.