Palau Ministry of Health
Executive Summary

Student Consultants, Katie Menzies and Kevin Purtell
Development Partners, Dr. Isebong Asang, Dr. Stevenson Kuartei, and Maireng Sengebau-Kingzio

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I. Background Information

The Ministry of Health (MOH) works to build a "Healthy Palau in Healthful Environment" by promoting its mission statement, which reads as follows:

> The Ministry of Health shall take positive actions to:
>
> 1. attain healthful environment
> 2. promote health and social welfare
> 3. protect family and health safety
> 4. provide health care services throughout the Republic of Palau.

The MOH is subdivided into two bureaus. The **Bureau of Hospital and Clinical Services** provides emergency and special services while the **Bureau of Public Health Services** provides both primary and preventative services.

The consultants worked primarily within two subdivisions of Public Health:

- **Community Advocacy Program (CAP) –** A program responsible for helping other divisions to reach out to the community by promoting healthy practices.
- **Division of Environmental Health (DEH) –** A division responsible for enforcing healthy practices in the environment by inspecting both private homes and business establishments, and preventing the spread of disease by controlling pest populations.

II. Consulting Tasks

The consultants performed two tasks:

- **Improved Database Management at DEH** – DEH had 10 database files which all collected similar information. Because these files were separate and somewhat denormalized, it was very difficult to perform statistical analysis on the data, unless numbers were slowly counted manually. As a result, DEH could not determine which environmental problems were most widespread and so they had more difficulty making Palau a healthier place.

  The consultants helped to build a new database that can aggregate all data previously collected and also perform some statistical analysis.

- **Built a Database to Capture Outreach/Travel Information** – Outreach information used to be captured in paper format, but the Community Advocacy Program's office moved to Palau Community College and communication broke down, leading to disuse of the forms. As a result, MOH could not determine which employees spent how long doing what in which community. All of these extra services were being done with no way to track them or analyze the progress they produced.

The consultants helped to build a database that will allow individual programs and divisions to input where and when outreach occurred, along with the estimated cost.

III. Outcomes Analysis and Recommendations

Outcomes to the consulting tasks are as follows:

- **Improved Database Management at DEH** – The database was completed and data was imported from the old databases, Pam has input data from several forms, and queries were constructed so that Environmental Health can generate useful information from its data, such as restaurants needing a permit. Throughout the process, the consultants tried to ensure that Pam could make changes to the database after the project was complete.

  A risk to sustainability is that the consultants were not able to complete as many queries or reports with Pam as they would have liked, so it is possible that she will not be able to write queries without help from someone else.

- **Built a Database to Capture Outreach/Travel Information** – The database was built such that an outreach event can range from creating a pamphlet to holding a community meeting to going to a conference. Reports were created to view the data from both an MOH administrative view and a CAP view. These reports can be used to estimate funding for different outreach topics based on how much funding these topics have had in previous years. Throughout the process Jane learned database design, and she made a small database to track weights to practice her skills.

  A risk to sustainability is that employees will not use the database. This is a possibility because the consultants were not able to work with any of the other divisions or programs to determine their willingness to input outreaches every time they occur, and the previous set of paper forms went unused.

Two important recommendations are as follows (see full report for all seven recommendations):

- **Repair data in the DEH database and continue to design new queries** – Since not all data in the old database were up to date, the current database would be greatly improved by simply updating everything imported from the old database. To get further use out of the database, Pam should attempt to design 1 or 2 new queries or reports each month, since the database now holds many different types of data.

- **Develop standards for using the CAP database** – Because this database has never been used in any form, it cannot be used until MOH employees create work processes to input outreach information. By creating standards for using the database, people will know who is responsible for data entry, when the deadline for data entry is, and also what the different types of fields are understood to mean.

Community Partners

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About the Consultants

Katie Menzies and Kevin Purtell

Kevin is a senior in Information Systems, and Katie is a senior in Electrical and Computer Engineering.

Palau Ministry of Health
Final Consulting Report

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I. About the Organization

Organization

The Ministry of Health (MOH) works to build a "Healthy Palau in Healthful Environment" by promoting its mission statement, which reads as follows:

The Ministry of Health shall take positive actions to:

5. attain healthful environment
6. promote health and social welfare
7. protect family and health safety
8. provide health care services throughout the Republic of Palau.

The MOH is subdivided into two bureaus. The **Bureau of Hospital and Clinical Services** provides emergency services while the **Bureau of Public Health Services** provides both primary and preventative services. Primary services are the typical day-to-day services that the population needs. The preventative services are aimed at preparing for and preventing illness outbreaks and promoting a healthy living style and healthy environment. The consultants worked primarily within subdivisions of the Bureau of Public Health Services.

Facilities

The Ministry of Health has many scattered offices, with most of them concentrated in the hospital. The hospital is fully equipped for in house patient care, providing beds and freshly cooked meals. The Medical Library at the hospital is used not only as a library but also as a meeting room and as a computer lab.

The only division of Public Health not in the hospital is Environmental Health which has a separate office about a three minute drive away from the hospital, with its own library, desks, and computers. Several programs are not within the hospital, one of which is the Community Advocacy Program (CAP). It is located by the Palau Community College closer to downtown Koror and is about a 10 minute drive away from the hospital.

There is another office for MOH in the Capital Building, but this one is small, is a one hour drive away, and the Minister of Health splits his time equally between the Capital and the Hospital.

Remote medical dispensaries, also known as community health centers, are used to provide healthcare away from the hospital and are staffed by at least one nurse. Four of the eight are called "super dispensaries," since each one is visited by a regularly scheduled doctor. Three are on Palau's largest island, Babeldaob, at North, West, and East, whereas the South dispensary is considered to

serve Peleliu, Anguar, and the Southwest Islands, and is accessible only by boat. Smaller dispensaries are located in Ngaraard, Angaur, Ngiwal, and Kayangel states.

Organizational Structure

The Bureau of Public Health Services is divided into the following four divisions:

- **Division of Environmental Health (DEH)** – Takes preventive measures in the community to control the occurrence of disease. They are responsible for inspecting and licensing business establishments, limiting the growth of disease-spreading pest populations, and responding to sanitation complaints.

  DEH is further subdivided into six programs: (1) Administrative, (2) Food Safety, (3) Community Health, (4) Consumer Protection, (5) Vector, and (6) Emerging Issues.

- **Division of Primary & Preventive Care** – Provides routine preventative medical care such as prenatal check ups and annual doctor exams along with some non-routine treatments for illnesses such as cancer and heart disease. Also responsible for remote dispensaries.

- **Division of Oral Health** – Palau's primary dental care provider. In addition to providing mid to high-level dental services, they work to increase awareness in the community of preventive measures for improving oral health. Through the Well-Baby Clinic, the Head Start Program, and elementary and high school programs, children are encouraged to practice good dental hygiene from an early age.

- **Division of Behavioral Health** – Stresses the importance of self-sufficiency in their dealings with patients. So that patients can be more self-sufficient and do not need to continually visit the Behavioral Health ward, they provide evidence-based therapy for problems such as alcohol and drug abuse.

Each division intersects with and is supported by each of four programs:

- **Emergency Health** – This program works to increase the capacity of Palau to deal with emergency situations. They focus on the preparedness and readiness of three different aspects of Palau: (1) Injured people, (2) Injured nation, and (3) Bio-terrorism. In other words, in addition to being prepared for terrorism, individuals should be able to respond to personal emergency whereas the nation should be ready to respond to massive disaster.

- **Health Information Systems** – Works with epidemiologists and existing medical records to create systems which can track the occurrence of disease so that Ministry of Health employees know where to focus their efforts to combat outbreaks, and also so they know general statistics of the population such as causes of death. This program also attempts to improve current medical record systems so that the MOH has more information.

- **Community Advocacy Program** – Works with each of the divisions and the other programs to publish pamphlets and newsletters to educate citizens of Palau about disease, pests, and good health practices. In addition, CAP publishes a weekly newsletter, "Ibetel a Tekoi", which is distributed island-wide as a newspaper insert to highlight happenings at the MOH and to educate the community. CAP also works with Public Health divisions to go out into the community and educate citizens about good practices to maintain a healthy population within a healthy environment.

- **Social & Spiritual Health** – Recently established to promote the importance of social ties and overall wellbeing. This program is part of the effort to recognize that health should not be limited to the definition of "curing and preventing illness," but it should instead be viewed as the overall wellbeing of the individual and community.

Environmental Health Programs

The Division of Environmental Health, where much of the work will be completed, has 6 programs:

- **Administrative** – Staff members usually stay in the office and manage community relations by answering phones and keeping logs of community contact. The administrative unit facilitates the actions of the other programs by performing required data entry, logging complaints, scheduling food safety workshops, printing health permits, and generating a schedule of on-call DEH employees.
- **Food Safety** – Responsible for enforcing healthy practices in establishments which prepare and sell food from a kitchen. They also collaborate in ensuring a safe water supply on the island. For a premises to acquire a health permit from food safety, it must satisfy the following three conditions in the following order: (1) All employees should have been issued a health certificate after being given a physical exam, (2) All employees should have been issued food handler permits after taking the Food Safety Workshop and passing the related exam, and (3) The establishment must have passed a food safety inspection with a score between 96 and 100 percent.

  Food safety is also responsible for responding to complaints, inspecting private households that sell foods, inspecting school foods, monitoring food temperature at markets, and distributing water testing kits to the 2500 households that use cisterns for drinking water.

  Food Safety is also in the process of preparing a lab to be used to test foods for certain bacteria. Lydia, who is living in Palau on contract, was recently hired to both prepare the lab for testing and use the lab for testing.
- **Community Health** – Responsible for ensuring that private homes and public community areas are in a healthy condition. Inspectors from this unit visit sites, inspect them, and after several days return for a follow up inspection to guarantee that the problems they found are fixed. Any problems that have not been solved result in a citation for the homeowners.
- **Consumer Protection** – A smaller and newer unit at DEH, it is charged with fulfilling some previous Food Safety duties. Consumer Protection ensures that foods sold in both large and small markets are safe for consumer consumption by randomly testing foods and condemning those found to be expired or otherwise unsafe. Also responsible for massage parlors, pools, spas, beauty shops, and tattoo parlors, it generally works with products that do not involve cooked food or water.
- **Vector** – Responsible for removing vectors of diseases. A "vector" is an agent such as rats or mosquitoes that spread a disease. Thus they fight diseases by controlling the growth of these animal populations through trapping rats, spraying for mosquitoes, and educating the population on how to destroy breeding grounds for these pests. They also

identify different species of these pests in order to better predict problem areas, since only certain species can carry certain diseases.

When a patient arrives in the hospital with dengue (contracted from a mosquito bite) or with leptospirosis (carried by rats and transmitted by mosquito bites), Vector interviews the patient and visits his or her home to find the source of the problem. In addition to destroying any breeding grounds, Vector also inspects other households in an area around the home of the infected patient. Problems found during inspection should be fixed in 2-3 days or households will be fined.

Vector also manages vessel inspections to make sure that aircrafts and boats do not introduce new species of mosquitoes into Palau. However, actual inspections are rotated amongst DEH staff via a weekly on-call schedule, where on-call members must inspect any vessel that visits any port at any time.

- **Emerging Issues** – A general catch-all to control the spread of new diseases which become a problem. Emerging Issues is composed of staff members from the other programs within DEH who are most appropriate to monitor the growth of the disease. The first disease that was an emerging issue was SARS, and the current one is Avian flu.

Staff

Environmental Health has roughly 20 staff members, most of which are inspectors. Most staff members use computers for simple tasks such as checking email and viewing Word documents, but administrative and database staff have more complicated uses for technology.

Pam Techur works with Microsoft Access to input inspection data, and Ruth Udui uses Microsoft Excel to keep track of food handler permits and health permits.

The Community Advocacy Program currently has only 2 staff members, Jane and Dr. Asang, but they would like to hire 3 or 4 more people. Dr. Asang uses Microsoft Publisher and Word to design CAP's weekly newsletter, and she is comfortable with using computers. Jane is still uncomfortable with computers, but she is moderately comfortable with Word and Excel.

Technical Environment

The Ministry of Health has the following assets:

- 457 PCs (including desktops, tablets, and laptops)
- 362 email accounts
- 18 servers, some of which are in the process of being converted to a new platform. Cobol and Fox-pro servers are moving to SQL Server 2005, while Windows IIS servers are moving to Apache.

  2 servers are used by radiology and are DICOM compatible. Like Adobe PDF's for papers, DICOM is the universal compression algorithm for medical images. This means that the medical images stored on these servers can be viewed by any other hospitals which have DICOM servers.
- 9 wireless access points distributed among the 8 branch offices and the main office. The 8 branch offices receive wireless LAN via POE (power over ethernet).

- 8 dispensaries connected by a dial-up connection

The Division of Environmental Health has only one computer for each of its programs, so employees often have to share computers. Further, internet and email are said to not always work, reducing efficiency.

CAP currently has more computers than employees, but these workstations will be filled when CAP completes the hiring process.

Technical Management

The Ministry of Health is supported by an IT department staffed by two people: (1) Everett Belelai, Information Systems Manager and (2) Mindy Sugiyama, Network Engineer.

Everett and Mindy are responsible for IT upkeep and implementation throughout the hospital, but they do not have enough time to provide assistance throughout the MOH. Because such assistance can range from technical support to implementing technology solutions, some departments are left without the knowledge that they need to work with their technology.

Everett is also responsible for managing the handful of technology-related grants that come from inside and outside of Palau.

Automatic backups of the centralized Health Information System (HIS) are performed at 4am daily. These backups are daily taken offsite by Everett to his home and once a month a backup is taken offsite and stored permanently.

Localized databases are used within different departments of the Bureau of Public Health to track such things as patient encounters and inspection reports. However, not all employees are trained in their use and although they are responsible for the upkeep of their individual databases, they do not always have the knowledge to generate useful information from them.

Technology Planning

There is currently no group in charge of overall technology planning, so most technology decisions are made by Everett. However, the Bureau of Public Health is developing and executing an overall strategic plan which refers to several technology opportunities.

The strategic plan has 5 points, 3 of which refer to technology:

1. **Collect good data.** Consistent data can be used for decisions. However, there is currently no consistency because (1) Some data is entered multiple times, (2) Most data is not centralized and able to be shared or aggregated, (3) There is no standardization across different types of data for different illnesses, and (4) Different metrics are collected every year.
2. **Use a broad definition of health.** Instead of focusing on illness, the hospital should focus on overall wellness in the individual, family, and community.
3. **Develop a workplace that supports the health of employees.** Once again using a broad definition of health, this goal is to enable employees to reach a healthy state in both body and spirit.

Examples of this would be a work place that provides employees with a place other than their supervisors to vent their frustrations, offers opportunities for career development, and encourages social health in the workplace.

4. **Coordinate outreach.** When one group from the MOH visits the community, other groups should be aware of the outreach opportunity. Instead of showing up multiple times to talk about the same issue, outreach groups should show up together and coordinate their efforts to educate the community. Increased coordination could also save monetary funds by traveling together. It has been suggested that outreach is not always coordinated because of a lack of information sharing among departments.
5. **Become more self-reliant.** Both with fiscal and human resources. 80% of Public Health funding comes from the United States, and the MOH spends much time maintaining these grants. The MOH would like to reduce their dependence on these grants since they will be harder to win once Palau can only ask the US for international, as opposed to domestic, grants. The MOH would additionally like to cultivate more Palauan expertise in healthcare, healthcare analysis, and technology.

Although this plan documents some opportunities to improve overall technology use, it does not provide for the opportunity to improve daily technical management. As described above, different departments require technology support to either improve their database or learn how to use it, but the IT department does not have enough staff to continuously provide technical support.

Internal and External Communication

External:

Day-to-day external communications with patients, inspection clients, and complaint reporters is usually done by phone or in person, but business communications are often done via email.

Employees also attend off-island conferences to discuss health issues and risks, and the MOH cooperates with other south Pacific islands to publish a journal with essays by doctors.

The Community Advocacy Program (CAP) frequently publishes pamphlets and newsletters about health risks and best personal/environmental practices. The purpose of these publications is to educate Palauans about how to avoid disease, stay healthy, maintain a disease-free environment, and recognize signs of particular diseases.

Environmental Health primarily communicates with the public by phone to schedule food safety workshops, notify facility owners that a health permit is ready to be picked up, and plan inspections. DEH also goes out into the community to teach healthy practices, and took advantage of the Belau National Games on June 15 to reach a wide array of people.

Internal:

Ministry of Health employees communicate primarily through either face-to-face discussion or by phone calls. Email is used more rarely but is important when employees want to share documents. There is also a PA system in place where employees can make hospital-wide announcements to summon doctors and nurses to visit specific locations or call given phone numbers. Regularly scheduled meetings are considered important, one of which is a monthly meeting between the chiefs of Public Health divisions and Dr. Kuartei, Public Health's director.

Remote dispensaries regularly communicate with the central hospital by phone, but pharmaceutical orders are placed to the central hospital via fax.

Environmental Health employees spend most of their time in their DEH office (a three minute drive from the hospital) or in the field. They sometimes attend meetings at the hospital's library, and usually drive government vehicles to and from the hospital. As with most employees, they communicate primarily by phone, but with each other they mostly speak face-to-face because of the small size of their office.

It was mentioned that when DEH members discover problems in the field, they aren't always able to communicate these problems to the necessary people in DEH. However, they are able to take steps to solve those problems on their own because of a good amount of cross training.

Because of a limited budget, DEH employees try to share trips to distant locations with other Public Health departments and community partners. These locations include distant spots in Babeldaob, the largest island in Palau, and other smaller islands away from the mainland, like Peleliu. A trip to Peleliu, Anguar, and the Southwest Islands can cost $10,000.

Trip organization within MOH is done by distributing a monthly calendar of trips to other departments, but it is possible that add-ons to the calendar are not shared after initial distribution. DEH organizes trips with their community partners by phone.

Information Management

The Ministry of Health uses a mixture of (1) Microsoft Word documents, (2) Microsoft Excel spreadsheets, (3) Small, isolated databases, and (4) Large, centralized databases to manage information.

Centralized databases include:

- **Primary Health Information System (HIS)** – This database is the central database with the purpose of capturing all patient information required by the hospital. Information is organized into "visits," where a single visit tracks the progress of the patient throughout the hospital. It is currently being moved from a COBOL-based system into one that will be built on SQL Server 2005, and will be given an improved user interface and increased reporting capabilities.
- **Reportable Disease Surveillance System (RDSS)** – This is a database of patients in which doctors or nurses can report patients with symptoms of disease or specific diseases. When symptoms are noticed during a patient "visit" they are entered into the RDSS. Other users in different departments of the hospital can then access this information and follow up on diseases for which they are responsible.
- **EPI Info** – A CDC program that is used in public health to generate statistics related to healthcare. It can pull in data from other Access databases to create graphs and tables, but Everett states that because it works with flat files, it lacks some statistical analysis.

Isolated databases and documents are also common in the Ministry of Health. Various groups within Public Health have different information needs, and most groups have at least one unconnected information source. The Division of Oral Health has a database that was updated 2 years ago by someone from the United States, but it is not user friendly and most employees do not

use it. The Division of Behavioral Health would like to keep track of the number of returning outpatients, but they are not sure how to do this in database form.

Environmental Health used 10 separate databases for different types of inspections. Not all information was captured from inspection forms into the databases, and there was almost no statistical analysis. Pam is primarily responsible for inputting information into the databases and generating statistics that compare a current month's measures to the previous month's measures.

Community Advocacy Program did not have any databases, although Jane was able to use EpiInfo to perform statistical analysis on obesity. However, she had to create a separate database for each exercise group or geographic area that she wanted to analyze.

II. Scope of Work

Task 1. Improved DEH's Database Management

DEH used 10 Access databases, each of which held information from a different type of paper form. Some of these databases were denormalized, all of them depended on a manually-typed primary key, and none of them allowed for useful statistical analysis.

There were several problems associated with these databases:

- **Databases were not used to generate summary reports.** Although it is important to electronically file records, data entry by itself does not maintain a healthful environment. Much of the information entered by Pam was not used for analysis, which resulted in a lost opportunity to focus DEH efforts in historically unhealthy regions of Palau. For example, DEH had no statistical information on where to focus household inspections.

  The statistical analysis Pam did was limited to manually generating a graph of this month compared to last month. It took some effort to do this, resulting in a loss of time that Pam could have used supporting DEH programs in their efforts to foster a healthy environment.

- **Databases were fragmented.** Even if Pam had been using Access's statistical reporting tools, the fragmentation of DEH data into 10 databases would have limited the usefulness of individual reports. It was difficult to see the overall effectiveness and effects of DEH's work, resulting in less informed decisions about how to make Palau healthier. For example, there was no way to link gastro cases from a restaurant back to a particular private home within a hamlet.

  Fragmentation also created a stumbling block for communication. Information gathered by one DEH unit could have immensely helped another DEH unit, such as when a Community Health inspection discovers a mosquito breeding ground for Vector to follow up on. Before, Community Health would have made a referral note to Vector on the paper inspection form, but if the form got filed before communication of the referral, then the referral was rarely retrieved.

- **There was no backup of the databases.** They existed only on Pam's computer and her flash drive, and she knew the most about the databases, so if she was gone, the system was generally not accessed. Further, if disaster had struck the DEH building, both hard copies and electronic copies could have been lost, resulting in the inability to make decisions about inspections, outreach, and pest control, all which are needed for a healthy environment.

- **Accessibility of databases is limited.** Since there was only one copy of the database on Pam's computer, employees were forced to request her assistance or share the computer. DEH Employees who cannot access necessary data would have had difficulty improving environmental health, especially if Pam were not available for some reason.

The consultants worked with Pam and the rest of DEH to build the new, centralized database. Pam was heavily involved in construction so that she can replicate some of the work on her own in the future.

Expected Impacts

Expected impacts to the overall organization were and are as follows:

- **Programs** – Because all environmental data will be consolidated and useful reports will be able to be created, programs within Environmental Health should be able to make informed decisions about what problems to focus on. Overall, Environmental Health will become more effective at making Palau a healthy environment to be in.
- **Technical Management –** Since Pam will have a better understanding of database design, it should be easier for her to create new queries, reports, and databases when necessary. Further, if there are problems with existing ones, she should be able to solve them. As a result, DEH will not have to rely so much on the overburdened IT department.
- **Information Management –** The largest impact will be in the area of information management, since it will become easier to generate useful information. Pam will be able to create more useful summaries in a smaller amount of time.

Task 2. Capture Outreach/Travel Information

Community encounter information used to be captured in paper format, but the Community Advocacy Program's office moved to Palau Community College and communication broke down, leading to disuse of the forms. As a result, MOH could not determine which employees spent how long doing what in which community. All of these extra services were being done with no way to track them or analyze the progress they produced.

Because there was no information management of outreach encounters:

- **It was difficult to understand where outreach occurred and what impact it had.** Individual programs frequently go into the community as part of a regular schedule or in response to a particular health risk, such as a Dengue outbreak or case, but it was difficult to track trends of where everyone was going. As a result, the teaching efforts of MOH could be too little in one area while another received multiple outreach events on similar topics. Because MOH could not understand what effect its outreach encounters were having, it could not accurately plan for future outreach encounters. As a result, teaching in the community is less effective.
- **Was sometimes difficult to determine who knew what.** When employees travel abroad to a conference or when they visit the community regarding a specific topic, they are expressing an interest in one particular area of knowledge. Because there was no way to track this knowledge, MOH employees could not always determine who would be the most knowledgeable for a specific subject. As a result, the most effective employees were not always sent to conferences or outreach in the community. If employees are under-utilized, then MOH is not getting optimal returns on the money it spent sending employees to conferences.
- **Could not track traveling expenses.** When employees attend conferences or visit the community, the MOH spends money to pay for that trip. In addition to tracking the impacts of outreach encounters, the MOH wanted to know the overall costs of encounters. Because there was no way to understand the overall costs, too much funding might have been spent on outreach when instead it should have been used to make Palau healthful in some other way.

The consultants planned and created a database that allows CAP to keep track of outreach efforts. In addition, a process was planned to allow other divisions and programs to use this database to enter information.

Expected Impacts

Expected impacts to the overall organization were and are as follows:

- **Programs** – Individual programs will begin to understand where their outreach is occurring. As a result, they will be able to focus their efforts in specific regions and modify them as needed in order to obtain a healthier environment.
- **Technical Management –** It is not currently clear who will be charged with managing the database, but it will likely be someone from CAP (and maybe Jane), where the database was developed. As a result, this person or persons will have more knowledge of database management and will be able to better use technology to suit their needs.
- **Information Management –** Specific information regarding outreach will begin to be collected and analyzed. When before there was a small amount management of outreach information via little-used paper forms, there will now be a conscious management of outreach information.
- **Communication –** When CAP moved to its Palau Community College office, it coordinated outreach opportunities with other programs to a smaller extent. With the outreach database, CAP will be able to examine overall outreach opportunities and take a more active role in coordinating outreach to different areas.

III. Outcomes and Recommendations

Task 1. Improve DEH's Database Management

Outcomes:

The consultants worked with Pam to create a database that could aggregate all of the types of inspection, food handler, health permit, and disease surveillance information that Environmental Health uses. Data was imported from the old databases, Pam has input data from several forms, and queries were constructed so that Environmental Health can generate useful information from its data. Throughout the process, the consultants tried to ensure that Pam could make changes to the database after the project was complete.

The outcomes of this project are:

- **Access database –** An Access database that aggregates most data collected by DEH now exists. It includes 48 tables, 40 forms, and 7 queries which can be used for reporting, and 2 reports.
- **Paper forms in database –** Almost every paper inspection form and application used at DEH has an associated form in the database.
- **Queries –** The database has 7 queries which can help direct Environmental Health's work schedule. For example, inspectors can visit buildings whose health permits will soon expire.
- **Imported records –** Records from previous databases have been imported. These include 2600 people, 2000 food handler permits, 600 vessels, 800 buildings, and 4700 inspections.
- **Pam's new database knowledge –** Pam has built 3 Entity Relationship Diagrams, 8 tables in Access with primary keys and 15 connections, 13 forms, and 10 queries. She has also fixed several queries and forms, and designed 5 additional queries to help DEH inspectors plan their work more efficiently.

  She now understands one-to-many and many-to-many relationships, and how they affect the implementation of subforms. Pam has also stated on several occasions that she never realized how much went into database design, and that she's happy to now understand.

  The consultants estimate that she now has the ability to create a simple database with 10 or so tables and several subforms, beginning with an Entity Relationship Diagram and culminating with a collection of queries that provide useful information.
- **Database design manual –** Pam has written and is in the process of improving an instructional manual to aid others in learning about database design. It includes information about analyzing the organization, producing the Entity Relationship Diagram, creating the data model and database tables, and designing queries and forms.
- **Database has been tested –** 7 inspection forms and 3 applications for health permits have been entered into the database by Pam.

Before Implementation:

Before the new database was developed:

- **Duplicate data –** Data for different buildings was duplicated among several databases, and old databases were de-normalized and not used to provide information.
- **Some inspection forms not captured –** Not all types of inspections had an associated database where information could be input.
- **No data analysis –** Databases were used primarily for bookkeeping, but Pam used to create reports for each program by manually filtering types of inspections and counting how many were done.
- **Pam did not yet understand database design –** Pam did not understand one-to-many or many-to-many relationships, and she was under the impression that every primary key had to be determined by the user. Because she never learned database design, she was not able to create a database with 1 subform to store Site Inspections.
- **No useful queries existed –** Because Pam was not familiar with database design, she could not create queries that could summarize inspection statistics or provide a list of tasks that need to be completed.

Capacity Not Yet Reached:

Because the database project was unexpectedly complicated and large amounts of time were spent on user interface, some tasks were not fully completed. Further, there is capacity that the consultants chose not to focus on, but might still be useful to develop.

Capacity not yet reached includes:

- **Not all queries and reports originally envisioned have been created.** The purpose of the database is to extract information that can help DEH to make Palau healthier, but there are currently only 7 queries and 2 reports. The consultants believe that Pam will be able to create additional queries and reports, even after they leave.
- **Pam has not had a chance to help build the Emerging Issues database.** To solidify Pam's knowledge and pass it on to someone else, the consultants had hoped that Pam could help Losii, another DEH computer employee, create a database for Emerging Issues. However, Losii was on leave and there was not enough time.
- **Only Pam has enough knowledge to change the database.** Pam is currently the only employee who has worked with the database. Unless she passes her knowledge to someone else, Environmental Health won't be able to enhance the database in her absence.
- **Only Pam has viewed and added data to the database.** Not all employees at DEH know how to use Microsoft Access, and even the ones that do might not be skilled enough to easily navigate the database.
- **Not all imported data is consistent.** Because the old databases had missing data, inconsistent formatting, and denormalized structures, there are duplicate buildings, inspectors, and people with slightly different spellings of names, resulting in skewed data analysis.

- **It is not yet stored on the server.** The database is not currently stored on the MOH server, but this is expected to change as soon as the consultants copy the finished database file to Everett. Afterwards, Pam and Ruth will have full access while other employees have read-only access.
- **Pam has not learned to use Visual Basic.** Most forms in the database have at least a small amount of Visual Basic code behind them, but Pam has not written any and has only had it shown to her by the consultants. As a result, some forms could be difficult to add functionality to—for example, creating a new type of inspection would require knowledge of Visual Basic.

Effect on Mission:

Because the database is not yet being used daily, there is currently no observed effect on the mission. However, Pam and the consultants have produced evidence that there will be an effect: one query shows all of the buildings with expired health permits that are still marked as "Active." Pam could not determine whether these buildings were actually operating without health permits, so Palau will be healthier when inspectors check up on these buildings.

Sustainability of Outcome:

Continued use and development of the database by Pam can be sustained for these reasons:

- **Pam is already skilled at Microsoft Access.** Before the consultants began the database project, Pam had a good amount of knowledge with using Access. Because she is well-practiced at finding records by searching fields, filtering by criteria, and sorting data, she can apply her existing skills to using the new database efficiently.
- **Pam took part in most of the design and development process.** Because Pam created a significant number of database elements and made decisions on many others, she will be able to continue entering data after the consultants leave.
- **Pam wrote a manual that describes the process of database development.** By writing the manual, Pam was able to articulate her knowledge of database design in printed format. Many gaps in her knowledge were then filled after the consultants reviewed the manual and offered suggestions. If she forgets any part of the database design process, she will be able to refer to her manual in order to recall what happened.
- **Pam has designed 5 queries that produce useful information.** By writing queries to output the information that she needs to provide the inspectors to perform their duties, Pam has (1) Learned the importance of a normalized data model that can provide information, (2) Learned to join information from different tables in order to produce information, and (3) Begun to conceptualize other types of queries that she wants to write.

Risks to Sustainability:

Despite the above signs of sustainability, there are several risks to DEH's ability to make good use of this database:

Pam may have difficulty continuing to write new queries.

Description: Because the consultants could only help Pam to write 5 queries to gather information from the database, Pam might not yet be able to write a query without help.

If this becomes the case, the database would go back to being used only for bookkeeping purposes.

Mitigation: If Pam runs into this difficulty she has several options open to her. The first is to try the Microsoft Help function, activated by pressing F1. She can also look at the book which the consultants left her on Access (See Resources for Recommendation 2). Another option is a Google search on Access queries to see if there are any web pages that might help her. A fourth option is to talk to a coworker also knows about Access. Mindy, Everett, or Toshi can be consulted in this eventuality.

Pam might not be able to make significant changes to the database.

Description: If Pam has to change the database by adding a new form or table, she may have difficulty for two reasons: (1) The heavy use of Visual Basic code to drive functionality on some forms could make it difficult to add to those forms and (2) Because Pam did not design every aspect of the database, the forms that the consultants worked on might be difficult for her to change.

Mitigation: It is recommended that Pam start to learn code before she needs to modify the database. If she were to start learning code now, she would be able to manipulate the code which drives the forms. Pam can consult Everett's books on both Visual Basic and "Power Programming in Access." The book on VB is an easy read and the consultants found it helpful. The "Power Programming" is a much slower read and would be more educational if it was consulted much later in the learning process. Most of the code which drives the forms can be found in one of these two books.

Another way to understand how the code drives the forms is to read the comments which the consultants wrote in the code specifically to help her understand it. She can also search the Microsoft Help function to find a description of Access methods and how they are commonly used.

She can also ask IT for help with both learning to code and making modifications to the database.

In addition to studying the code which drives the forms, Pam should also study the way the consultants designed their forms. She can look at the default properties and how queries are used. An interesting example of this is the logic behind the query for Dropdown Hamlet. The more she familiarizes herself with the database and Access in general the easier modifying the consultants' forms will become.

If Pam were to leave, other employees might not be able to use the database.

Description: Because Pam is the only DEH employee who has worked directly with the database, her absence could result in its disuse, especially since most DEH employees are not familiar with Access.

Mitigation: The sooner Pam starts teaching others how to use the database, the sooner this risk will disappear. It is recommended that she start teaching other DEH members who work with the Environmental Health Information System or who manage administrative activities. She might teach data entry, querying, and reporting.

It is also recommended that Pam practice her skills at creating databases by teaching others how to make them. Pam has already proposed a database that Administration

would find useful. Another teaching opportunity is the Emerging Issues database. This teaching will help Pam remember how to create databases in Access and will provide her with people with whom she can discuss database problems with. Also, this teaching would allow others to troubleshoot the DEH database if an issue were to arise while Pam was out of the office.

The user interface could potentially stop or slow Pam's work.

Description: The consultants are not user interface specialists, and they were not able to test Pam's use of the database with repetitive data entry. When Pam begins to use the database daily with multiple forms, she might find that data entry is tedious and annoying, and she may also encounter a programming error that prevents use of the database.

Mitigation: Before Pam tries to change the interface, she should back up the database and the old interface. If the interface problem does not involve code, her experience in creating forms with the consultants should help her modify the forms.

If it does involve code, then the mitigation steps are the same as for the coding mitigation of "Pam might not be able to make significant changes to the database."

New Vision of Technology:

Although the consultants have not yet observed a new vision for technology at Environmental Health, Pam has already begun to think about what else technology can do for her organization. For example, she mentioned that she would like to create a database with a subform for Ruth to help her perform some administrative work regarding employee salaries.

Recommendation 1: Review all inspection forms and update them for consistency

With the design of the new database, Environmental Health has the ability to generate different types of statistics by using queries. One feature of the database is that it stores how many of each problem occurred during inspections, and the category of that problem.

For example, in the Food Safety program, *Lack of food protection* and *Cross contamination* problems both fall under the category *Food Preparation*, so by summing these, Environmental Health could determine the rate of *Food Preparation* violations so that they could decide whether or not to focus public education on better food preparation practices.

Some inspection forms, however, are not divided into categories, so statistical analysis would be limited to individual problems instead of overall categories.

Further, some establishment types do not have associated inspection forms, so inspectors instead fill out a "Site Inspection Report" which contains only a textual description. Because it is not feasible for the database to analyze textual descriptions, inspectors cannot determine what sorts of problems frequently occur with these establishments.

In both cases, improved analysis could result in a healthier environment in Palau when inspectors are able to focus on the problems that they know occur most frequently.

Steps for completion:

1. *Revise forms that currently have no categories*. Forms like the Beauty Shop / Massage Parlor Inspection and the Fish Plant Inspection should be revised to include categories for the problems, similar to the Food Inspection Report.
2. *Enter the new category names into the database*. After the forms are revised, Pam should update the database by adding the category names to tbl_categories and then associating the problems to them from tbl_building_problems.
3. *Find out which categories are the same across different forms*. Some forms have similar categories with different names. Data analysis would be more useful if these different names were made the same. For example, Household Catering establishments and business establishments both have cooks that prepare food, so they could both have a Food Preparation category.
4. *Update the database to reflect category changes*. Pam should then combine the category names in the database by deleting extra ones from tbl_categories and connecting problems from tbl_building_problems to the revised category names.
5. *Gradually phase out the use of the Site Inspection Report*. Environmental Health should try to create one new inspection form each month for those establishments which currently have no inspection form.
6. *After each new form is created, update the database*. Pam should first add the name of the new form to tbl_inspection_types, and then add each problem from that form into tbl_building_problems.

Resources:

Because this recommendation involves inspection forms and the database used to analyze inspection data, the only required resources would be the database and the inspection forms.

Recommendation 2: Repair data in the database and continue to design new queries

The purpose of the database project was to create a system which could provide Environmental Health inspectors with useful information upon which to base decisions regarding a healthier environment. However, when data was imported from the old database, it was inconsistent and contained some errors. For example, one inspection was performed by an inspector named "B+".

It is also important to continue to design new queries that can help Environmental Health inspectors in decision making.

Steps for completion:

1. *Add a list of baits to tbl_bait and a list of pesticides to tbl_pesticide*. When Pam starts entering data about rat trappings and pesticide sprayings, she will need to be able to select which bait or pesticide was used.
2. *Remove unnecessary entries in tbl_building_types*. Importing from multiple databases caused duplicate types of buildings with slightly different names. Pam should first choose which ones to delete, edit out their foreign keys in tbl_buildings, and then delete them.
3. *Remove duplicate inspectors from tbl_inspectors*. Some inspectors exist multiple times with different names, and others are simply typos.

4. *Update building information in tbl_buildings*. There are currently a large number of unknown states, hamlets, and phone numbers which must be updated, and each building must be marked as private or business. Further, there are a large number of "Active" buildings which have expired health permits from before 2007. Lastly, try to make sure that a building doesn't exist with two different names in the database.
5. *Update people information in tbl_people*. Some people are listed in the database more than once and first and last name formatting is not always the same. Since there are 2700 people, Pam should focus most strongly on the records that do not have Food Handler Permits, since these are less well-formed. Lastly, Pam should consider making a query to give a list of first and last names that are in the database more than once.
6. *Input data that could not be imported*. Some data could not be imported into the new database because of missing fields. They are listed in spreadsheets, and Pam should input whichever ones she can.
7. *Design 1 or 2 new queries per month*. The new database stores a large amount of different types of data, and there are many useful queries that Pam could write to improve the effectiveness of Environmental Health.

   The consultants suggest that she begin with the following queries:

   - List inspection referrals that haven't been followed up on yet
   - Summary of public education
   - The number of condemned items this year vs. # of condemned items last year
   - Produce statistics on community health household inspections

   For assistance, Pam should consult the Microsoft Access book left by the consultants.

Resources:

Microsoft Access book left by the consultants – This book is valuable for people who are new to Access, and it includes information on how to perform calculations in queries.

Task 2. Capture Outreach/Travel Information

Outcomes:

A consultant worked with Jane to create a small, user-friendly database that could hold information about outreach in the Palau community and abroad. An outreach event can range from creating a pamphlet to holding a community meeting to going to a conference. Reports were created to view the data from both an MOH administrative view and a CAP view. Throughout the process, Jane was taught about creating databases, and to practice these skills she converted a series of her Microsoft Word documents tracking weights into a small database. This database speeds up data entry, allows for infinite weightings of participants in her weight-loss program, and allows all information to be kept in one database instead of many documents. Also, using concrete example with a simple design helped make designing reports easier and more understandable.

The outcomes of this project are:

- **CAP Database.** An Access database that can hold outreach information now exists. It includes 14 tables, 1 main form with two sub-forms, and 7 different reports which focus on funding, type of outreach, location, and subject.
- **Jane's participation.** In the CAP database, Jane has made 8 Entity Relationship Diagram connections and 2 Access connections. She helped modify the database design to include the names of media types (E.g. newspaper names) and outreach reasons (E.g. Belau Fair).
- **Better database understanding.** Jane says that she has a better understanding of the databases that she was creating with the help of EpiInfo.
- **Information entered.** The divisions and programs with their subdivisions have been entered into the database. The names of the newspapers, radio stations, and TV stations have been entered in preparation of outreaches being done through these media types. One outreach event has been entered.
- **Created weighting database.** In her small database on weights, Jane created 1 Entity Relationship Diagram. With assistance she created 1 data model, 4 tables in Access with primary keys and 3 connections, and 1 form with 1 sub-form.

Before Implementation:

- **Outreach info not recorded –** Outreach information could not be recorded in electronic form, nor was it being recorded in paper form.
- **Public Health's travels not stored –** There was no database to store information about all of public health's travel.
- **Lack of database understanding –** Jane did not understand how EpiInfo stored data nor how tables in a database relate to one another.
- **Slow to produce stats on weightings –** Jane stored the information on weightings in Microsoft Word in Excel-like tables and used EpiInfo only to analyze the data she collected.

Capacity Not Yet Reached:

For the database to be used and potentially modified in the future, more capacity can be built:

- **Training of other programs and divisions not complete.** Dr Kuartei has not been shown how to use the reporting functions that were designed with him and Public Health administration in mind. Also, only Jane has seen how to enter information into the database. For this database to be used by all of Public Health training sessions need to be held.
- **Possibility of future modifications.** Since this database is a melding of the old paper forms and new ideas, the current database was designed to be a base from which to work. It should be used as a point to start collecting data, but modifications may be necessary to the database as the needs of Public Health change.

  It currently holds information on funding by outreach event, but later versions may choose to pair funding with subject matter. Another useful modification could be to allow the names of the workers to be attached to the outreach event. Also, there is

potential to separate travel off-island and outreach events. This separation could allow for a more useful analysis. Information from this database could be paired with information from other databases to try to correlate outreach with its effects.

- **Further database training for CAP.** Currently Jane is not able to make future modifications to the database. If CAP is expected to maintain this database, having a person on staff that is comfortable with computers and databases would be useful. Jane has potential to be this staff member, but would need classes on Access in order to be effective in this role.

Effect on Mission:

The databases have not been deployed yet, so there is no observable effect on the mission.

Sustainability of Outcome:

This database is sustainable within CAP because:

- **Motivation for use** Jane and Dr Asang are very excited about the database and how it allows them to see report how much time and overtime they have spent on their job. They are also excited about the reporting features of database and how they can see the cost per person for funding. This excitement means that they will be more likely to enter information into the database and generate reports.
- **Entering Information** Jane has been shown how to enter information into the database both in the table and form views. She has also assisted in the design of the database and has seen it evolve. This knowledge and familiarity should allow her to be comfortable with adding reasons or "special events" to the database in the table view as well as entering outreach information in the form view.
- **Report Generation** Dr Asang has been shown how to use the reporting function in the database and has helped critique it. This should allow her to generate reports in the future.

Risks to Sustainability:

Despite the above signs of sustainability, there are several risks to sustainability within Public Health:

Data entry might be inconsistent.

Description: The first time Jane entered information into the database she had a lot of questions surrounding the correct way enter it (E.g. if she should list her participation in an event by her program or by the division that organized the event). This suggests that different interpretations of the data fields could lead to inconsistent data. Also, the more time that passes between an event and data entry, the more people could forget about the outreach. This would lead to inaccurate data.

Mitigation: In order to ensure consistent interpretation of data fields, training sessions should be held to explain how to enter data and what information the different fields are asking for (for more information on training, see Recommendations).

To prevent inaccurate data, it is suggested that a time frame be imposed on data entry. There is currently a restriction of 30 days programmed into the database. Jane or Everett

can remove this line of code. Equally the time frame can be changed by either of them if it is so desired. However, this change should be made soon so that Jane does not forget how to modify the 30 day restriction.

Another protection that the consultant added to the database is data cannot be edited in the form view (it can only be viewed and added). This design is to force workers to be careful about their data entry and allow checking of past data entry. It is suggested that if this protection is not needed, Everett remove it when he adds the database to the MOH server. If this protection is kept, a way to request editing needs to be created (see Recommendations).

A single event might be entered twice.

Description: Once a large number of users are allowed to enter data, multiple workers who went on an outreach could enter information on the same outreach. The database is designed for each department to only once enter information about the outreach they attended. If an event is entered twice, this will inflate the numbers in the report and make them less reliable (For example, number attendees, hours spent working, total amount of funding).

Mitigation: This problem should be addressed in the training on how to use the CAP database. Suggesting a work flow to the division in which one person per division enters data should help to limit how many times this problem occurs. Also, when a report is generated, it should be checked for events that occurred on the same day in the same locations. This human check for duplicates will allow them to be deleted.

Data might not be entered.

Description: Since most of Public Health was not involved in the process of creating the CAP database and are not involved in trying to keep track of outreach events, they have very little motivation to enter information into the CAP database other than executive mandate.

Mitigation: When the training on the database is being done, positive rewards should be offered for data entry. A friendly competition between the divisions to see who can do outreaches to the largest number of people could be one such positive motivation.

New Vision of Technology:

It is evident that Dr. Asang is thinking about what else technology can do for her, since she is now hoping to combine the CAP database with other information in order to help predict what subjects should be covered on an outreach and how effective outreaches are being.

Recommendation 1: Develop standards for using the CAP database

In order to ensure accurate data, there should be a control flow for entering, editing, and deleting data. Having one data flow from the beginning will allow the database's reports to be useful, telling which topics were most frequently requested (and thus are of a concern to the community), which hamlets were not visited in the past time frame (and thus which areas of Palau are not getting proper attention from health care), and which countries are the most expensive to travel to (and thus which require more funding).

Steps for completion:

1. *Determine a deadline for entering data*. Decide how large of a time frame in which to allow sections to enter information. The current standard seems to be one month since this is the amount of time travelers have to submit their travel expenses.
2. *Decide on whether to allow users to edit data*. The consultant's suggestion is that the partner does not allow this. Allowing edits to be made at any time could lead to forms only being half filled out or incorrectly filled out on the assumption that they will continue entering data or correct the data later. This is a dangerous practice to allow and could lead to poor data quality.
3. *Establish a process for correcting erroneous data*. It must be possible to request a change if a deadline is missed or an error is made. The consultant suggests that these requests have to be submitted in a paper format with an explanation as to why the mistake was made. If the explanation is not satisfactory, the request can be refused. This paper trail would allow changes to be backtracked, problem areas to be spotted, and discourage requests to change data.

   The consultant further suggests that all data changes be made in one central place. This could be CAP once they have more employees. Alternately, they could borrow a data entry worker from another division to help them out. This editing person could also check once a week for duplicate entries and file a request with the section that created the duplicate to explain why there is an apparent duplicate. If a satisfactory reason is not given, either both entries could be assumed to be incorrect and thus deleted or the most recent one could be assumed to be correct and the old one could be deleted.
4. *Compile a recommended way for sections to enter information*. Users should be told to check for possible duplicate entries before creating a new event. (This can be done by searching for events done on the same date.) Preferably, if the section already has someone who does data entry this person would fill out the CAP database form. Having one person in each section responsible for entering data would help prevent duplicate entries and could also lead to more accurate information about funding.

Resources

No extra resources are needed.

Recommendation 2: Train employees to use the CAP database

Training on how to use the CAP database should be done in order to ensure accurate interpretation of data fields, prompt data entry, and accurate data entry with no duplicates. Useful data is a key goal as to why training is necessary. Without useful data, time spent entering data will be wasted time. Inaccurate data will render the database useless and all the benefits that it could give Public Health, such as being able to tell which topics are being requested and where outreach is being done, will be lost. In order for the database to help ensure health care outreach throughout the Republic of Palau, Public Health must know how to use it.

Steps for Completion:

1. *Determine the meaning of each field.* Discuss with people who will be using the reports (probably CAP and Public Health administration), what they want each of the data fields to mean. The consultant makes the following suggestions:

- Date should be the date on which the event was completed. For a business trip this would mean the day of return. For making a pamphlet this would mean the day of sending it to the printer.
- Division/Program is the section that pays the worker's salary. This way the count of hours planning, working, and overtime directly correlates to the section which is named.
- Total hours planning, working, and overtime should be the total number of staff hours spent on each. For example if there are two workers and they spend 2 hours planning the outreach, then the total hours planning is 2*2 or 4. Also, these hours should only be hours spent on the outreach. For off-island travel this would mean only hours spent attending the conference, not sleeping.
- When the form is being used to record off-island travel, the size of the audience should be the same as the number of workers. This mode of data entry is not necessary, but would allow the funding per person field in the reports to reflect the funding needed to send one worker to off-island to a country. This could be useful information for Public Health to have, allowing the partner to better plan off-island travel and funding.

2. *Write down what each data field means in an easy to read format*. Preferably this would include a list of all field names as they appear on the form, in the order which a user would enter them (the tab order), with a clear description of what to enter in each field. Examples of an outreach and a travel event partnered with screen shots of the form after being filled out for these events would also help clear up confusion.
3. *Add to these instructions recommendations about data entry in divisions/programs*. Also include the restrictions on data entry (time frame) and data editing that the partner wants to establish. Add any other information the partner thinks is important for using the database. This is now a complete set of instructions on how to use the CAP database.
4. *Make the database instructions easy to access*. Possibly put them on the MOH web page or another commonly accessed server.
5. *Hold training sessions*. At least one person from each division/program should be in attendance. In order to achieve 100% attendance of divisions and programs, this might require several sessions held at different times. At the sessions, pass out the instructions on how to enter data. Run through the travel and outreach examples. Do at least one impromptu example of an outreach or travel event from the gathered crowd. Thoroughly explain the restrictions on data entry/editing.

Resources:

Besides the database, no resources are necessary.

Recommendation 3: Maintain and expand the database as necessary

Since this database is hopefully only a pilot to establish a baseline, plans should be made from the beginning to ensure that the database continues to grow with Public Health and fulfill the partner's needs. The easiest example of this is that the database is designed to capture reasons for outreach and then generate a report that details topics, locations, and funding grouped by reason. As new reasons arise (such as an emerging issue like avian flu or a dengue outbreak) these reasons should

be added to the database so that statistics on them can be generated. This continual evolution will allow the database to provide the best information on health care in the Republic of Palau.

Steps for Completion:

1. *Establish a person who will maintain the database*. This would include adding new media types, new reasons, and other additions to the current database structure. This job could also fall to the person who edits data and deletes data entries. Jane currently has the most experience with the CAP database. However, she already has many duties and it may be best for one of the new hires at CAP to maintain the database instead.
2. *Establish a way for all of Public Health to request an addition or change to the database*. This might, for example, become necessary if the organizational structure of Public Health changed, leaving the database out of date. It could be something as simple as putting the email address of the person in charge of maintaining the database and directions to email them with requests at the bottom of the form. This information should also be included on the directions for database use that are passed out at the training.
3. *Establish a person who will be able to modify the database in the future*. If this person does not currently have the training to deal with databases, arrange for them to either take a class on Access at Palau Community College or be tutored by one of several people with database knowledge at the Ministry of Health (listed in Resources below).

   Also note that this person might be the same as the person in charge of maintenance.

Resources:

Possible resources for tutoring on databases include Pam at Department of Environmental Health, Toshi at Emergency Health, or Everett or Mindy from IT.

Additional Recommendation 1. Create a simple Lab Information Management System

DEH is currently setting up a new lab to test for bacteria in food samples for outbreak investigations, inspections, and random sample taking. They have yet to start using the lab and are looking for a way to manage inventory, tests, and establish good lab practices so that results are verified and can be trusted. Karen, an epidemiologist at DEH who built much epidemiological capacity before returning to Australia, suggested a LIMS as a solution.

Reasons for Need:

- **Statistical analysis of results difficult or not possible.** The purpose of testing foods for bacteria is to determine how abundant it is in the foods on the island. With proper results, the Food Safety program in DEH will know where to focus their efforts for controlling bacteria growth in foods. Without an easy way to analyze the results, staff members might waste time fiddling with manually generated results, and the results that they do generate might not be comprehensive.
- **Difficult to verify the accuracy of test results.** In working with the hospital lab, Karen has noticed that some of the results sent back to her cannot be accurate. For example, a certain culture of bacteria should be incubated for at least 12 hours, but she would receive a result regarding that bacterium in only 8 hours.

There should be some mechanism at the DEH lab by which results like this are strongly discouraged. Otherwise, inaccurate results will distort analysis of results and Food Safety's decisions about what problems to focus on will be skewed.

- **Difficult to manage inventory at the lab.** Karen has also noticed that poor results are generated at the hospital lab because certain testing reagents go out of date and are still used. If the DEH lab does not provide an easy way to recognize out of date reagents that should be discarded, then results will be distorted in the same manner as described above.

Steps for Completion:

1. *Determine who will develop the system*. Because Pam gained database experience while the Environmental Health Information System was being built, it might be useful if she played a part in LIMS development. Further, the person that is chosen to lead development of the LIMS should work with a different DEH employee that might benefit from additional database knowledge.
2. *Prioritize Karen's suggestions for the food lab*. Karen left a document of specifications for a food LIMS, but her requirements generally boil down to fixing the 3 "Reasons for Need" listed above. According to Lydia, the most important reason might perhaps be the inability to generate statistical data, since grants depend on lab results.
3. *Determine the feasibility of each of Karen's suggestions, and ways to implement them*. Some of Karen's specifications would be too complicated for someone at Pam's skill level to implement, but others are easier. The consultants recommend that this person implement easy specifications that provide a great amount of benefit.

   Note that although a database will probably be necessary, the developer should ensure that there are no easier alternatives that would require less development time and less of a commitment to data entry by employees.
4. *Implement the system*. After determining a time-effective solution that fits the lab's needs, DEH should build whatever system was determined to be necessary. If the system happens to be a database, it would help sustainability if a second employee was taken through the process of Entity Relationship Diagramming, Data Modeling, and developing in Access.

Resources:

Because it is not clear what type of system will be implemented, no additional resources are necessary.

Additional Recommendation 2. Assess data and training needs for all sections in Public Health

While the consultants were meeting with all of the divisions and programs, they encountered several problems with databases. In general, these problems harm the ability of Public Health to make Palau healthier because employees are either spending too much time manually counting data or are not sure how to collect the data in the first place.

Known Problems:

- **Behavioral Health has difficulty tracking returning patients.** Behavioral Health wants to increase the self-sufficiency of patients. To make sure that they are actually doing so, they require a way to track the number patients that continue to return for the same problem.
- **Behavioral Health has an old Paradox database.** The consultants were not able to get too much information about the problems here, but it seems that the Paradox database is not user friendly and does not provide the statistical analysis needed by Behavioral Health.
- **Oral Health has a database which employees cannot use.** Someone from off-island helped to build a database for Oral Health, but most employees do not know how to use it. The database was described as user unfriendly, but it may be an issue of employee training.

Steps for Completion:

1. *Determine who can visit each division to improve data management*. It is recommended that someone be appointed to dedicate a large portion of their time to finding and fixing the above problems. It is preferable that this person is already within MOH since it would require less funding. However, if someone with enough time cannot be found, the partner could hire an outside consulting firm.
2. *Visit each division and program to compile a list of projects*. Such projects might range from database development to employee training. These projects should be prioritized by cost and importance to Public Health. If necessary, additional employees should be assigned to carry out these projects.
3. *Focus on sustainability*. For each project, make sure that when the project is complete, employees in the division or program will be able to carry on the work product or at least continue to use it. If necessary, consider offering employees the opportunity to take classes at Palau Community College or participate in workshops offered by other MOH employees.

Resources:

Because some problems and most solutions are largely unknown, no additional resources are yet necessary.

About the Consultants

Katie Menzies is currently a senior at Carnegie Mellon about to graduate with a major in Electrical and Computer Engineering with a double major in Biomedical Engineering. She likes to spend her free time reading books and dreaming about Spring Carnival.

Kevin Purtell is a senior in Information Systems and is working on an accelerated Masters in Information Systems. As a TCinGC student, he learned to communicate in the type of complex environment that is inherent in a large organization.