Cybersecurity Risk Assessment-Qualitative Approach

Instructions

1. Please read the case carefully.
2. You will be using NIST's Guide for conducting risk assessment [NIST Special Publication 800-30 Revision 1]. The document is available on Canvas.
3. You are encouraged to read the NIST document so that you have an understanding of the risk assessment approach that they suggest. However-
4. The focus of this assignment is on conducting risk assessment [Starting from Section 3.2 in NIST Publication 800-30 Rev1].

Qualitative Risk Assessment

1. Recall our discussion on cybersecurity trends in Week 1. Identify two threats to AMC at Tier 1 (i.e., the organizational level as described in the document "Article-NIST Qualitative Risk Assessment"), and the risk to AMC from these two threats.
2. List the inventory of AMC's IT assets at Tier 3.
3. Identify the vulnerabilities and threats to these IT assets.
4. Estimate threat likelihood and impact if threat is carried out successfully
5. Estimate cybersecurity risk to these IT assets

A list of tasks and activities within each task is as follows. All tables and appendices referred to in the following guideline are from NIST Publication 800-30 Rev1.

SOURCE: NIST Guide for Conducting Risk Assessments [NIST Special Publication 800-30 Revision 1]
Conducting risk assessments includes the following specific tasks [Section 3.2]:

TASK 1- Identify and characterize threat sources of concern, including capability, intent, and targeting characteristics for adversarial threats and range of effects for non-adversarial threats.

- Identify threat source inputs (see Table D-1, adapt it for AMC).
- Identify threat sources (see Table D-2, adapt it for AMC).
- Determine if threat sources are relevant to the organization and in scope (see Table D-1, adapt it for AMC).
- Create or update the assessment of threat sources (see Table D-7 for adversarial threat sources and Table D-8 for non-adversarial threat sources, adapt it for AMC). [**NOTE**: If a particular type of threat source is outside the scope of the risk assessment or not relevant to the organization, the information in Tables D-7 and D-8 can be truncated accordingly.]
- For relevant adversarial threat sources:
    - Assess adversary capability (see Table D-3, adapt it for AMC).
    - Assess adversary intent (see Table D-4, adapt it for AMC).
    - Assess adversary targeting (see Table D-5, adapt it for AMC).
- For relevant non-adversarial threat sources: - Assess the range of effects from threat sources (see Table D-6, adapt it for AMC)

The information produced in this stage provides threat source inputs to the risk tables in **Appendix I**.

TASK 2- Identify potential threat events, relevance of the events, and the threat sources that could initiate the events.

- Identify threat event inputs (see Table E-1, adapt it for AMC).
- Identify threat events (see Table E-2 for adversarial threat events and Table E-3 for non-adversarial threat events, adapt it for AMC)
    - Create or update Table E-5.
- Identify threat sources that could initiate the threat events (see Table D-7 and Table D-8, adapt it for AMC)
    - Update Table E-5.
- Assess the relevance of threat events to the organization (see Table E-4, adapt it for AMC)
    - update Table E-5.
- Update Columns 1-6 in Table I-5 for adversarial risk (see Table E-5 and Table D-7) OR update Columns 1-4 in Table I-7 for non-adversarial risk (see Table E-5 and Table D-8).

The information produced in this stage provides threat event inputs to the risk tables in **Appendix I**.

TASK 3- Identify vulnerabilities and predisposing conditions that affect the likelihood that threat events of concern result in adverse impacts.

- Identify vulnerability and predisposing condition inputs (see Table F-1, adapt it for AMC).
- Identify vulnerabilities using organization-defined information sources
- Create or update Table F-3.
- Assess the severity of identified vulnerabilities (see Table F-2, adapt it for AMC)
    - Update Table F-3.
- Identify predisposing conditions (see Table F-4, as tailored by the organization)
    - Create or update Table F-6.
- Assess the pervasiveness of predisposing conditions (see Table F-5, as tailored by the organization)
    - Update Table F-6.
- Update Column 8 in Table I-5 for adversarial risk; or update Column 6 in Table I-7 for non-adversarial risk (see Table F-3 and Table F-6).
- Update Column 9 in Table I-5 for adversarial risk; or update Column 7 in Table I-7 for non-adversarial risk (see Table F-2 and Table F-5).

The information produced in this stage provides vulnerability and predisposing condition inputs to the risk tables in Appendix I

TASK 4: Determine the likelihood that threat events of concern result in adverse impacts, considering:

I. **The characteristics of the threat sources that could initiate the events**
II. **The vulnerabilities/ predisposing conditions identified**
III. **The organizational susceptibility reflecting the safeguards/ countermeasures planned or implemented to impede such events.**

- Identify likelihood determination inputs (see Table G-1, adapt it for AMC).
- Identify likelihood determination factors using organization-defined information sources (e.g., threat source characteristics, vulnerabilities, predisposing conditions).
- Assess the likelihood of threat event initiation for adversarial threats and the likelihood of threat event occurrence for non-adversarial threats (see Table G-2 and Table G-3, adapt it for AMC).
- Assess the likelihood of threat events resulting in adverse impacts, given likelihood of initiation or occurrence (see Table G-4, adapt it for AMC).
- Assess the overall likelihood of threat event initiation/occurrence and likelihood of threat events resulting in adverse impacts (see Table G-5, adapt it for AMC).
- Update Columns 7, 10, and 11 in Table I-5 for adversarial risk (see Table G-2, Table G-4, and Table G-5); **OR** update Columns 5, 8, and 9 in Table I-7 for non-adversarial risk (see Table G-3, Table G-4, and Table G-5)

The information produced in this stage provides threat event likelihood inputs to the risk tables in **Appendix I.**

TASK 5: Determine the adverse impacts from threat events of concern considering:

I. **The characteristics of the threat sources that could initiate the events**
II. **The vulnerabilities/predisposing conditions identified**
III. **The susceptibility reflecting the safeguards/countermeasures planned or implemented to impede such events.**

- Identify impact determination inputs (see Table H-1, adapt it for AMC).
- Identify impact determination factors using organization-defined information sources.
- Identify adverse impacts and affected assets (see Table H-2, adapt it for AMC)
    - Create or update Table H-4.
- Assess the maximum impact associated with the affected assets (see Table H-3, adapt it for AMC)
    - Update Table H-4.
- Update Column 12 in Table I-5 for adversarial risk; **OR** update Column 10 in Table I-7 for non-adversarial risk.

The information produced in Task 5 provides adverse impact inputs to the risk tables in **Appendix I**.

TASK 6: Determine the risk to the organization from threat events of concern considering:

I. **The impact that would result from the events**
II. **The likelihood of the events occurring.**

- Identify risk and uncertainty determination inputs (see Table I-1, adapt it for AMC).
- Determine risk (see Table I-2 and Table I-3, adapt it for AMC);
    - Update Column 13 in Table I-5 for adversarial risk and Column 11 in Table I-7 for non-adversarial risk.

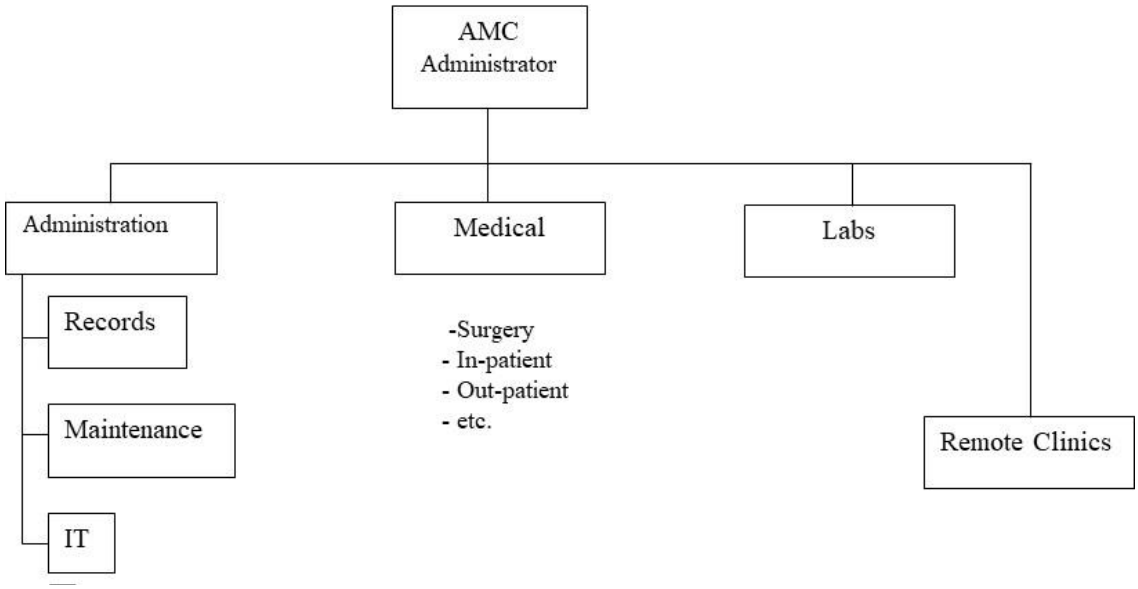
The information produced in Task 6 provides risk inputs to the risk tables in **Appendix I**.

Introduction

Aggieland Medical Center (AMC) is a hospital, located in College Station, TX. It has 2 remote clinics and 2 labs in Bryan and Navasota. It has:

- A permanent administrative organization
- Both permanent and temporary
  - Physicians
  - Surgeons
  - Medical staff
  - Facility staff
  - Maintenance
- A small information technology (IT) department (three people) responsible for on-site computer and network maintenance and upgrades, and handling simple user help requests

Figure 1: AMC Organization Chart (A high-level view)



In January 2023, AMC senior managers decided they wanted a comprehensive review of cybersecurity within their facility with the objectives of:

- Identifying if a remote attacker could penetrate AMCs defenses
- Determining the impact of a security breach on:
  - Confidentiality and Integrity of patient data
  - Availability of AMC's critical servers
- Ensuring compliance with existing laws and regulations governing data protection in the healthcare industry.

After some discussion and consultation with other medical facility managers, they decided to use your consulting firm. They assigned the initial planning and preparation to the assistant administrator, Samantha Dalton, who will coordinate with your team, help you with data collection, and act as the liaison between your team and AMC.

Systems of Interest, Access Paths, and Key Components

Figure 2 shows a high-level map of the organization's IT infrastructure. A brief description of key servers used by AMC is as follows-

- Patient Data Information Server (PDIS) - Database of most of the important patient information. Everyone who needs to, has access (e.g., appointment scheduler, pharmacist, lab technicians, providers, etc.). Within PDIS, all information is cross-referenced. ABC Systems maintains PDIS for AMC.

- Financial Record Keeping Server (FRKS) - All the insurance, billing records, payment schedules, and other related information are stored on this server.

- Personnel Management Server (PMS) – Salary, financial, demographics, work histories, assignments, skills, and disciplinary records of all employees are stored on this server.

- Medical Logistics Server (MLS) – This server has data on supplies, office property, and equipment. It also hosts the procurement application. It can be accessed from outside by pre-certified vendors.

- Emergency Care Data System (ECDS) – The database on this system holds data on patients' diagnosis, the healthcare professionals who examined the patients, procedures and tests performed on the patient, billing support for services provided, patient demographics, types of care, etc.

- Pharmacy System (RxS)- This system supports automated drug dispensing to patients and handling the relevant payment information.

- Email Server- Handles the email communication to and from AMC accounts. Uses Sendmail 8.9.3 running on Red Hat Linux 6.

- Firewall- AMC uses Ciso ASA. (Adaptive Security Appliance).

All the servers can be accessed by authorized employees from their workstations within the AMC network. PDIS can also be accessed by physicians from their home computers. Data can be entered and/or edited on the servers by authorized employees only. Workstations are in all physicians' offices, treatment rooms (including emergency rooms), nursing stations, labs, and administrative offices.

Support for the servers used by PDIS, FRKS, PMS, ECDS, RxS, and MLS is provided by an independent contractor, ABC Systems. In addition, ABC also does network management and maintenance for AMC. AMC also has a small, internal IT staff to provide on-site help desk support and basic system maintenance for the hospital, all clinics, and the labs. AMC's own IT personnel (3 employees) were provided with limited training from ABC Systems in managing the key servers.

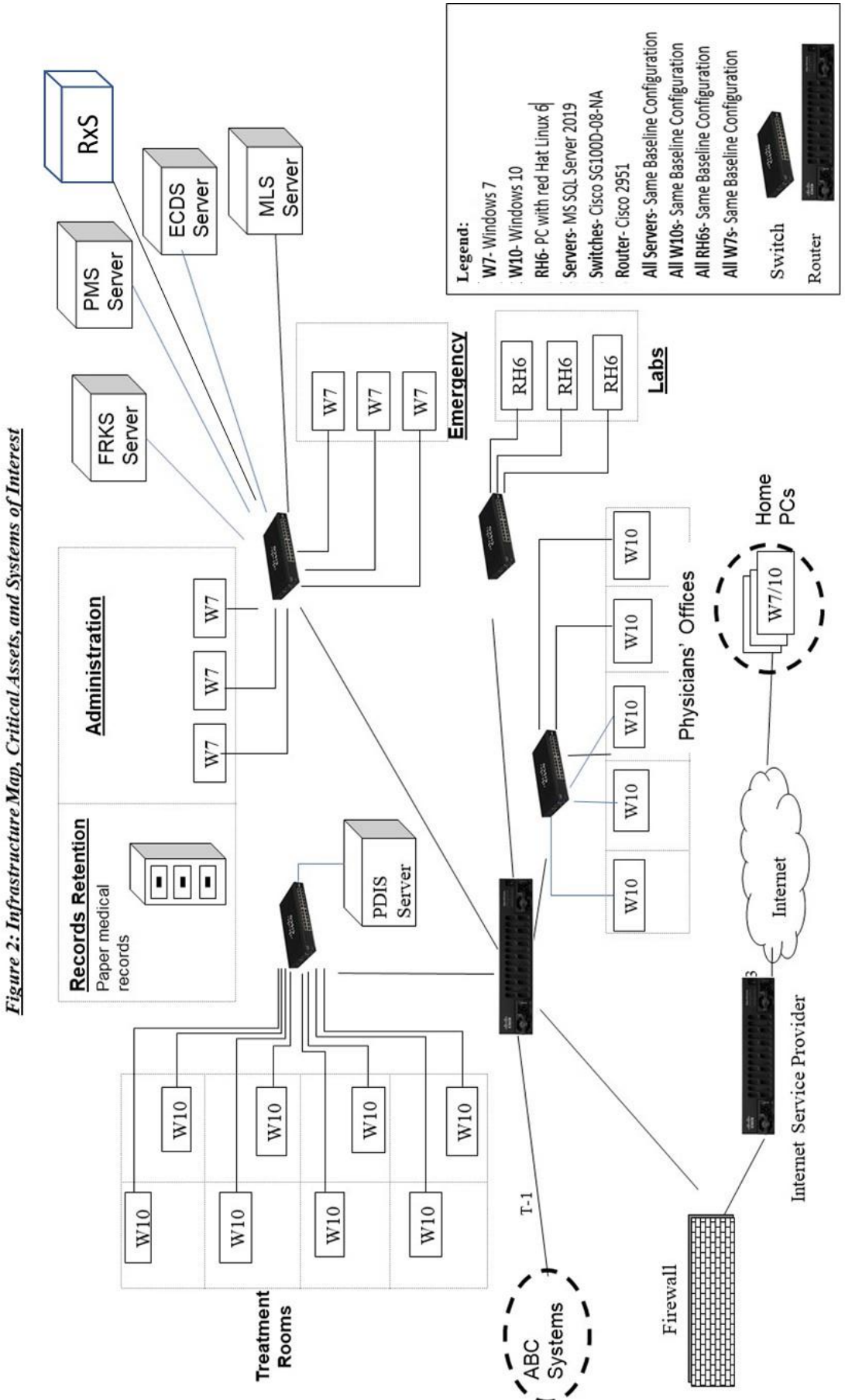


Figure 2: Infrastructure Map, Critical Assets, and Systems of Interest

The Aggieland Medical Center (AMC)
Data Collection for Risk Assessment

The data collection part of the project has already been completed. As part of data gathering, AMC's workstations and servers were scanned for vulnerabilities. The results of this scan are summarized in the following table.

ASSET	VULLNERABILITY
W7	CVE-2015-6131 and CVE-2015-6127
W10	CVE-2022-21851 and CVE-2022-21922
RH6	CVE-2000-0633 and CVE-2000-0219
MS SQL Server	CVE-2022-29143 and CVE-2021-1636
CISCO 2951	No Vulnerabilities
CISCO ASA	No Vulnerabilities
CISCO SG100D-08-NA	Mo vulnerabilities

Information was also collected from the senior managers, general staff, and the IT staff. This information is provided in the following pages.

Data Collection: Senior Management

Table 1 describes some of the assets identified by senior managers. The assets they considered to be important are listed in the left column.

Table 1: Senior Management Assets

Important Assets	Other Assets
Patient Data Information System (PDIS) - Database of most of the important patient information. Everyone who needs to has access (e.g., appointment scheduler, pharmacist, lab technicians, providers, etc.). Within PDIS, all information is cross-referenced. ABC Systems runs PDIS for AMC. Paper medical records – Complete patient records are on paper. If lost, there's no way to re-create it. Patients can come in and pick up their records if going to another appointment within the facility. Financial Record Keeping System (FRKS) - All of the insurance, billing records, payment schedules, and other related information. Providers' credentials - Credentials of medical personnel.	Emergency Care Data System (ECDS) - Diagnosis, who saw patients, what was done, billing support, patient demographics, types of care, etc. Email - A common server with important information, historical data, etc. Personnel Management System (PMS) - Demographics, work histories, assignments, skills, disciplinary records. It has a lot of information that needs to be protected. Internet connectivity - Whatever it is we use to get to the Internet. Medical Logistics System (MLS) - Supplies and real property, equipment. Ordering is done through it. It can be re-created by the vendors.

Areas of Concern

Some of the discussion relative to PDIS is provided below, but it represents only a part of the conversation that occurred between your team and the senior management. *Table 2* shows the

complete list of areas of concern for PDIS and the other important assets identified by senior managers.

Conversation about PDIS

- "As far as our security strategy, PDIS and the other systems require unique user IDs and passwords, for which everyone receives training. Everyone knows patient information must be kept private. If patient information were revealed to someone who shouldn't have it, we could get sued."
- "I think our security training for all of our personnel is sufficient, although it could probably be improved."
- "The contract with ABC Systems requires the system to be up 24/7. It usually is, but apparently we have problems accessing it sometimes. I'm not sure why. I have heard complaints from the administrative group. They seem to have the most trouble."
- "PDIS is now central to our operations - we just can't function well without it. It provides access to all the information we need. If it's down or people can't get logged on, then data entry backs up and we run the risk of physicians not having the latest lab results or even changes in insurance coverage. We could get an incorrect patient diagnosis or treatment, with injury or illness as a result."
- "We're always looking for ways to improve the systems we use here. We've gotten quite efficient with TSPs at the management level for non-PDIS functions, and we'd like to extend that technology to the physicians and perhaps the nursing staff. We've asked ABC Systems to propose a plan for upgrading PDIS to allow TSP access. We asked them to include security concerns in their proposal."
- "Our IT staff does the day-to-day maintenance on PDIS. That's because ABC Systems' main office is 60 miles away and they're not large enough to keep people on site here. It was more cost-effective for us. ABC does provide adequate training for our IT people."

Areas of Concern for Important Assets

Table 2 shows the areas of concern for those assets that the senior managers considered to be important.

Table 2: Senior Management Areas of Concern for Important Assets

Asset	Areas of Concern
PDIS	Personnel access information that they are not authorized to use: access is used inappropriately or legitimately accessed information is distributed inappropriately.
	Staff could intentionally enter erroneous data into PDIS.
	It's difficult to get and retain qualified personnel to help maintain PDIS.
	PDIS is not compatible with newer systems, leading to system crashes.
	The risk of an outside intrusion into PDIS is much higher than newer systems because of the need to bypass the firewall.
	Power outages, floods, and other external events can lead to a denial of access to PDIS. This essentially shuts the hospital down.
	Accidental loss of any important information is a concern.
Paper Medical Records	Medical reports are signed out to patients. Anyone can potentially view, alter or lose records.
	Medical records are left where they shouldn't be (in offices and labs).
	Data in medical records (e.g., physician SSN, credentials, etc.) could be used to "forge" a prescription.

Table 2: Senior Management Areas of Concern for Important Assets	
Asset	**Areas of Concern**
	Roof leaks, water, fire, etc., could destroy the physical medical records.
	Accidental mishandling by staff can lead to the destruction of physical medical records.
FRKS	Staff could inadvertently or intentionally disclose confidential patient financial information to family or friends.
	Staff could change or delete the information for any patient once they've logged into the system. We could get the wrong bills sent or never send any at all. We could file incorrect insurance claims.
	Power outages can lead to a denial of access to FRKS. We'd have to deal with a potentially large backlog of data entry and verification to do billing and insurance.
	There's no physical security for the room where staff log on to FRKS. Anyone could wander in and see confidential information displayed on the workstations.
Provider Credentials	Deliberate modification of the records could result in our using an unqualified provider.

Security Requirements for Important Assets

The security requirements for the important assets as defined by senior managers are provided in *Table 3*. The security requirement that is the most important for the asset is shown in **bold**.

Table 3: Security Requirements from Senior Management Perspective	
Asset	**Security Requirements (Relative Ranking)**
PDIS	AVAILABILITY System availability is required 24/7. CONFIDENTIALITY Information should be kept confidential. Federal compliance with Privacy Act of 1974 – Anyone accessing can be prosecuted for passing data to others. INTEGRITY Only authorized users should be able to modify information.
Paper Medical Records	AVAILABILITY Records must be available 24/7. **INTEGRITY** Only authorized users should be able to add information to the files. CONFIDENTIALITY Information should be kept confidential. Federal compliance with Privacy Act of 1974 – Anyone accessing can be prosecuted for passing data to others.
FRKS	INTEGRITY Only authorized users should be able to add, modify, or delete information. **AVAILABILITY** System availability is required during regular administrative office hours. CONFIDENTIALITY Patient financial information should be kept confidential.
Provider Credentials	**INTEGRITY** Only authorized users should be able to modify information. CONFIDENTIALITY Information should be kept confidential. **AVAILABILITY**

	It's needed on an as needed basis to verify new, transferred, or temporary providers or to provide information for insurance purposes.

Administrative Data Collection: Operational Area Management

Asset Information

Table 4 describes the assets identified by the operational area managers. The assets are divided into what were considered to be important assets and all other assets.

Table 4: Operational Area Management Assets	
Important Assets	**Other Assets**
Paper Medical Records - all patient information, lab results, etc. These are paper for now, but some data is now also in PDIS. PDIS - has everything: pharmacy, appointment history, patient history, billing, admissions, and all the ancillary stuff. 400 modules in it, a massive system. ECDS (Emergency Care Data System) - tracks what patient encounter was and the diagnosis; runs reports, trends, and population demographics; contains raw information for trending accidents; used for insurance and billing.	Pharmacy System - supports automated drug dispensing Medical Logistics System Providers' Credentials 32 or 33 other automated systems – not as important

Areas of Concern

Some of the discussion relative to PDIS is provided below. *Table 5* shows the complete list of areas of concern for PDIS and the other important assets identified by operational area managers.

Conversation about PDIS

- *"Everyone gets the same basic security training, but it only covers passwords. We should probably know something about managing security breaches or attacks. I wouldn't know what to do if I saw something out of the ordinary. My staff certainly wouldn't. I suppose we'd call our IT folks, but what they would do, I don't know."*
- *"We've got a lot of workstations out in the open, and they're not always watched. It wasn't too bad two years ago when they were fairly big, but now we're talking about going to these streamlined, lightweight TSPs with wireless connections so physicians can carry them around with them. That's to get around the fact that we can't get them to remember to log out, and PDIS won't let them log on from multiple workstations. The physicians complain they have to try and back track their patient schedule and figure out where they were last logged in. So what happens when they leave the TSP in the treatment room?"*
- *"All new employees get set up with new accounts. I did ask our IT people to check that process because I noticed when I started three months ago that I had a lot of privileges that I didn't think I was supposed to have. Apparently I inherited everything my predecessor had, and she had moved around a lot in AMC and picked up quite a few privileges. I really fouled up some of the records."*

- *"ABC Systems did a really good job setting things up, but I don't think they really understand what we're dealing with. PDIS is usually up and running, but the network seems to have problems. It drops connections on a daily basis. ABC says the connection can be reestablished within the contracted amount of time by our IT folks, but still, it's a continual annoyance, and sometimes the most recent patient data don't get to the physician in time. I mean, with the tight patient appointment schedule, you can't ask someone to sit in the corner and wait five minutes for data on drug allergies to come up. The physician will go with the record they have and move to the next patient. If necessary, the patient will have to wait a few hours for things to get caught back up and for the prescription to be verified."*

Areas of Concern for Important Assets

Table 5 shows the operational area managers' areas of concern for the important assets.

Table 5: Operational Area Managers' Areas of Concern

Asset	Areas of Concern
Paper Medical Records	Too many people are entering the wrong data, resulting in incorrect records, and/or multiple files and records may exist for an individual.
	"Loose" control over records – No process to stop the patient from taking or modifying them. No mechanism to copy and release just what's needed. Integrity of record is compromised.
	Could get poor quality of care or patient death if contradictory medications are prescribed or allergies are not accounted for.
PDIS	Too many people have access to too much information. Role-based access builds over time and replacements inherit all of those access privileges.
	Too many people are entering the wrong data, resulting in incorrect records, and/or multiple files and records may exist for an individual.
	Connectivity is an issue, including problems with availability of and access to PDIS. The uptime requirement in the contract is for the servers, not for our connectivity.
	Loss of Internet connectivity. Systems are susceptible to malicious code and virus activity (in part due to the location/configuration of the firewall).
	Firewall limits connectivity. Timeliness of firewall support can affect system performance.
	ABC Systems fails to recognize the importance of the Internet to the medical staff to access current best practice information.
	Could get poor quality of care or patient death if contradictory medications are prescribed or allergies are not accounted for.
	ABC Systems has many customers. They do not recognize the importance of the hospital. Priorities of the hospital are not understood. They do not respond in a timely manner.
ECDS	Loss of Internet connectivity. Systems are susceptible to malicious code and virus activity (in part due to the location/configuration of the firewall).
	ABC Systems does not recognize the importance of the hospital/health care organization. Priorities of the hospital are not understood.
ECDS	Could get poor quality of care or patient death if contradictory medications are prescribed or allergies are not accounted for.
	Too many people are entering the wrong data, resulting in incorrect records, and/or multiple files and records may exist for an individual.

Security Requirements for Important Assets

The security requirements for the important assets identified by operational area managers are provided in *Table 6*. The security requirement that is the most important is shown in **bold**.

Table 6: Security Requirements for Important Assets

Asset	Security Requirements (Relative Ranking)
Paper Medical Records	AVAILABILITY Access to records is required 24/7. Records must be available for patient encounters. INTEGRITY Must be complete. All information should be available for patient encounters. Accuracy CONFIDENTIALITY Can be viewed only by those with "need to know." Patient information is subject to the Privacy Act.
PDIS	INTEGRITY Must be complete and all information should be available for patient encounters. Accuracy AVAILABILITY Access to records is required 24/7. Records must be available for patient encounters. **CONFIDENTIALITY** Can be viewed only by those with "need to know." Patient information is subject to the Privacy Act.
ECDS	INTEGRITY Must be accurate and complete. **AVAILABILITY** Access to records is required 24/7. All information should be available for patient encounters. CONFIDENTIALITY Can be viewed only by those with "need to know." Patient information is subject to the Privacy Act.

Administrative Data Collection: Staff

This section includes the knowledge elicitation workshops held with general staff and information technology (IT) staff. Information from IT staff is labeled as "IT Staff." *Tables 7* and *8* describe some of the assets identified by general and IT staff. The assets are divided into what each considered being important assets and all other assets.

Table 7: General Staff Assets

Important Assets	Other Assets
Paper Medical Records - "that's what we are and what we do." Paper is currently more important. Outpatient Records has the most control – that's where they're stored and where they come back to. Otherwise, control is by whoever has them at the moment. PDIS - same type of data as paper medical records, lab results, mobility, admissions history, etc. External Relations – group of people that control the release of information. They ensure there's no compromise to data being released to the public or insurance companies. They use PDIS a lot for the information being released. Email (PDIS and General) - LAN and PDIS. LAN is for patient data email, but it is not as secure as PDIS email.	Medical Logistics System Internet access

Table 8: IT Staff Assets

Important Assets	Other Assets
ABC Systems – manages all major changes, maintenance, and upkeep. We can't create a new network user without them. Our help desk calls their help desk if something major goes wrong. Connectivity (to Internet) - commercial ISP. AMC Help Desk - five PC technicians (not part of core IT staff). Users call in problems and we troubleshoot them. Critical AMC Servers – All are on site. AMC IT personnel does day-to-day management.	Mr. Mishra - senior IT person PDIS Personal computers - For access to all systems, email, etc. People can always move to another PC. There are 30+ functional systems

Staff Areas of Concern

Some of the discussion relative to PDIS is provided below. *Tables 9* and *10* show the complete list of areas of concern for PDIS and the other important assets identified by general and IT staff members.

General Staff Conversation about PDIS

- *"Office space is very tight and we do share workstations. It takes forever to log on/log out. We found it was easier for one person to log on and just stay logged on all day."*
- *"I know we were told not to share passwords, but everyone knows and trusts each other so there's no problem. It's a little hard to keep patient information private because visitors can see the screens on the workstations. But that doesn't matter too much as*

the physicians and nurses all discuss their patients out in the open anyway. It's not as if we don't all know what's going on or who's here for what reason."

- *"Actually, I've heard that certain staff members like to check out the medical records of people they're dating. And there was this one patient who got into the computer in the treatment room and looked up his wife's record. The doctor probably forgot to log out. They're always doing that. Logging out is even more complicated than logging in."*
- *"PDIS drops off at least four times a day. I don't know why. I just get dropped and get a message about the connection. I call IT and it's usually back up in 10 minutes, if IT answers. But then you have to do the whole log-in routine and meanwhile there's paperwork to be entered, patients calling, physicians asking questions about this or that, and we get behind."*
- *IT Staff Conversation about ABC Systems and PDIS*
- *"ABC Systems does run vulnerability assessment tools on PDIS. I know because we get all those long lists every other week. I don't know what they do with them, though. I mean, we're just trained to set up new user IDs and fix minor problems. The last three people that got a lot of training left for a job that paid four times as much. So management quit authorizing any training for those of us in IT. I used to be a medical administrator. Last month, they told me I was now in IT. Go figure."*
- *"I've never seen or heard of anyone sharing passwords. They were all told not to do that, although I'm not sure what we would do if we did catch them sharing passwords. I think I'm supposed to tell their boss."*
- *"PDIS actually got hacked last week. Well, at least I think it did. Something strange sure was going on. We called ABC Systems and they sent someone over a few days later. They said there was a problem with the firewall and they fixed it. We were supposed to have kept the logs for them, but no one ever told me that. We've started keeping those now, just in case. I've got a drawer full of disks."*

Areas of Concern for Important Assets

Table 9 shows the areas of concern for some of the staff's important assets. Note that the IT staff listed ABC Systems as an important asset, but did not identify any areas of concern. The analysis team sensed some resistance from the IT staff and did not pursue this during the workshop.

Table 9: Staff Areas of Concern

Asset	Staff Areas of Concern
PDIS	Doctors leave PDIS screens on after they have left treatment rooms. Patients and others could have access. Passwords, logouts, timeouts, and screen savers are inconsistently used.
	The configuration of facilities/layout allows inappropriate viewing of systems and medical records by patients and visitors.
	Inherent flaws and vulnerabilities in critical applications could be exploited.
	Doctors and staff discuss patient issues and information in public areas.
	There are networking/connectivity issues. Access to PDIS is often restricted due to system crashes.
	Instability of the local area network affects access to numerous systems and creates backlog.

Table 9: Staff Areas of Concern	
Asset	**Staff Areas of Concern**
	Access to the majority of systems is supported by ABC Systems. They are responsible for hardware and software maintenance. We're concerned about our lack of control.
	Hurricane evacuation procedures require movement of assets off of the first floor of all facilities due to flooding concerns.
External Relations	Unfamiliarity with all the regulations and legal issues sometimes results in confidential information being released to insurance companies and the press. Insurance representatives aren't above trying to trick information out of the staff.
	Someone from the insurance companies could use appointment records to see who keeps up with routine, preventative care as well as to look for confidential test results.
Paper Medical Records	Staff personnel could view medical records in unauthorized or inappropriate manner.
	Information is deliberately released to outside personnel.
	Misfiled paperwork could allow unauthorized personnel to view another's records.
	Accidental problems with data entry can affect the integrity of information.
	Loss of paper record can mean permanent loss of critical information.
Email	Medical personnel use email to discuss treatment plans for patients.
	Personnel might think that PDIS email is more secure – information is released because they believe it can't be viewed by unauthorized personnel.
	Instability of the LAN affects access to email. Medical personnel now rely heavily on email to schedule appointments, exchange patient information, and transmit records from home machines.
Connectivity to Internet	Connection fails frequently. This affects the medical personnel trying to research new treatments.
	Connections have been getting slower over the past six months.
Help Desk	Lack of adequate training for help desk personnel. ABC Systems trains them from the ground up – medical administrators are turned into computer technicians.
	There is a very small IT budget. There aren't enough of us to staff the help desk 24/7, which is what they seem to want.

Staff Security Requirements for Important Assets

The security requirements for important assets defined by general staff are provided in *Table 10*. The security requirement that is the most important is shown in **bold**.

Table 10: General Staff Security Requirements for Important Assets	
Asset	**Security Requirements (Relative Ranking)**
Paper Medical Records	AVAILABILITY Access to information is required 24/7. **INTEGRITY** They should be modified only by those with appropriate authority. CONFIDENTIALITY Privacy Act "need to know"

Table 10: General Staff Security Requirements for Important Assets	
Asset	**Security Requirements (Relative Ranking)**
PDIS	AVAILABILITY Access to information is required 24/7. CONFIDENTIALITY "need to know" Privacy Act - Privacy statement is the first thing you see when you log in. INTEGRITY Information can only be modified by those with appropriate security keys.
External Relations	AVAILABILITY Be able to access information during regular office hours.
Email	AVAILABILITY Access to information is required 24/7. CONFIDENTIALITY Should only be seen by authorized or intended recipients.
ABC Systems	AVAILABILITY Support is required 24/7.
Connectivity to Internet	AVAILABILITY Access to information is required 24/7.
Help Desk	AVAILABILITY It's needed only during regular business hours, except for emergency room support, which is 24/7.
Critical Servers	AVAILABILITY Access to information is required 24/7. **INTEGRITY** The integrity of the information on the servers must be maintained. **CONFIDENTIALITY** The confidentiality of patient information and other confidential data must be supported.

Current Strategic Practices (SP) of AMC

The following tables summarize the survey information for each area of strategic practices. The information for each area is provided in two tables. First, a summary of the answers to the survey questions from each level of the organization is provided. Then, contextual information from each level relative to the area is provided. The comments sometimes contradict the survey answers. This can be expected as discussion can clarify the meaning of a question or counter any effort at white-washing the issue. Note that AMC did not feel it was necessary to remove attribution to the level of the organization. AMC personnel believe that their organization is open and honest enough not to misuse the information.

The following legends apply to the contents of the tables.

Legend
As perceived by personnel at this level:
yes – The practice is most likely used by the organization.
no – The practice is most likely not used by the organization.
unclear – It is unclear whether the practice is present or not.
blank – The question was not asked of this level.

Criteria:
Yes: 75% or more of respondents replied yes.

No: 75% or more of respondents replied no.

Unclear: Neither the yes nor no criteria were met.

Strategic Practices- Security Awareness and Training (SP1): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
Staff members understand their security roles and responsibilities. This is documented and verified.	Yes	No	No	Unclear
There is adequate in-house expertise for all supported services, mechanisms, and technologies (e.g., logging, monitoring, or encryption), including their secure operation. This is documented and verified.	Unclear	Yes	Unclear	Unclear
Security awareness, training, and periodic reminders are provided for all personnel. Staff understanding is documented and conformance is periodically verified.	Unclear	Unclear	Unclear	Unclear

Strategic Practices- Security Awareness and Training (SP1): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
Senior Management	We have training, guidance, regulations, and policies.	Personnel understand systems, but not incident management and/or recognizing and reporting anomalies.
Operational Area Management	Awareness training is required to gain account/access.	Lack of training for IT personnel Staff does not understand security issues

Strategic Practices- Security Awareness and Training (SP1): Survey Results					
Survey Statement		**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
Staff		Who do you call with a problem? Who is responsible? Weakness in the training as it relates to PDIS, Medical Records, and other systems No understanding of my role or responsibility for security			
IT Staff	100% security awareness training is done.	Awareness training is inadequate.			

Strategic Practices- Security Strategy (SP2): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
The organization's business strategies routinely incorporate security considerations.	No	Unclear		No
Security strategies and policies take into consideration the organization's business strategies and goals.	Unclear	Unclear		No
Security strategies, goals, and objectives are documented and are routinely reviewed, updated, and communicated to the organization.	Yes	Unclear		No

Strategic Practices- Security Strategy (SP2): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
Senior Management		Lack the business sense, a proactive philosophy
Operational Area Management		Current protection strategy is not effective.
IT Staff		Lack of exposure to end-user activity

Strategic Practices- Security Management (SP3): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
Management allocates sufficient funds and resources to information security activities.	Yes	Yes	Unclear	No
Security roles and responsibilities are defined for all staff in the organization.	Yes	Yes	Unclear	Unclear
The organization's hiring and termination practices for staff take information security issues into account.	Unclear	Yes	Unclear	Unclear
The organization manages information security risks, including assessing risks to information security taking steps to mitigate information security risks	No	No	Unclear	Unclear
Management receives and acts upon routine reports summarizing security-related information (e.g., audits, logs, risk and vulnerability assessments).	No	Unclear		No

Strategic Practices- Security Management (SP3): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**

Strategic Practices- Security Management (SP3): Survey Results					
Survey Statement		**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
Senior Management	We are doing this risk evaluation, so that's a start.	I don't think we actually get those kind of reports; maybe we should.			
Operational Area Management		Concerned about complacency – we've been very lucky so far.			
IT Staff		Inadequate budget and staff Out-of-date equipment and software			

Strategic Practices- Security Policies and Regulations (SP4): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
The organization has a comprehensive set of documented, current policies that are periodically reviewed and updated.	Yes	Yes	Unclear	Yes
There is a documented process for management of security policies, including Creation, Administration (including periodic reviews and updates), and Communication	Yes	Yes	Unclear	Unclear
The organization has a documented process for evaluating and ensuring compliance with information security policies, applicable laws and regulations, and insurance requirements.	Yes	Yes		No
The organization uniformly enforces its security policies.	Unclear	No	No	No

Strategic Practices- Security Policies and Regulations (SP4): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
Senior Management	Policies and procedures exist. Training guidance and regulations exist.	Consequences, or lack thereof, for violating policies and procedures are not well-known; we're not enforcing our own policies.
Operational Area Management	People know whom to call when a security incident occurs.	People don't always read or follow policies and procedures.
Staff		Poor communication of policies
IT Staff	There are established incident-handling policies and procedures.	Lack of follow-up on reported violations of security procedures Inability of IT staff to enforce procedures

Strategic Practices- Collaborative Security Management (SP5): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
The organization has policies and procedures for protecting information when working with external organizations (e.g., third parties, collaborators, subcontractors, or partners), including protecting information belonging to other organizations understanding the security policies and procedures of external organizations ending access to information by terminated external personnel	Yes	Yes	Unclear	Yes
The organization has verified that outsourced security services, mechanisms, and technologies meet its needs and requirements.	Unclear	Unclear		No

Strategic Practices- Collaborative Security Management (SP5): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**

Strategic Practices- Collaborative Security Management (SP5): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
Senior Management		Distributed management of PDIS; lack of centralized control
Operational Area Management		Reliance on multiple organizations to support our networks
IT Staff	ABC Systems is responsible for security on their systems and networks; they are using good security practices (have a firewall, running Crack, etc.)	Lack of a single focal point for connectivity. Things get confused sometimes.

Strategic Practices- Contingency Planning/Disaster Recovery (SP6): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
An analysis of operations, applications, and data criticality has been performed.	Yes	Unclear		Unclear
The organization has documented, reviewed, and tested business continuity or emergency operation plans disaster recovery plan(s) contingency plan(s) for responding to emergencies	No	Unclear		Unclear
The contingency, disaster recovery, and business continuity plans consider physical and electronic access requirements and controls.	No	No		No
All staff are aware of the contingency, disaster recovery, and business continuity plans understand and are able to carry out their responsibilities	Yes	Unclear	No	Unclear

Contingency Planning/Disaster Recovery (SP6): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
Senior Management	We do have a disaster recovery plans for natural disasters and some emergencies.	We don't have a business continuity plan.
Operational Area Management		Lack of business continuity and disaster recovery plans
Staff		I'm sure we have them, but I've never seen them and I'm not sure what I'm supposed to do.
IT Staff		Lack of contingency plans if the network stays down or we lose the servers

Current Operational Practices (OP) of AMC

The following tables summarize the survey information for each area of operational practices. The information for each area is provided in two tables. First, a summary of the answers to the survey questions from each level of the organization is provided. Then, contextual information from each level relative to area is provided. The comments sometimes contradict the survey answers. This can be expected as discussion can clarify the meaning of a question or counter any effort at white-washing the issue. Note that AMC did not feel it was necessary to remove attribution to the level of the organization. AMC personnel believe that their organization is open and honest enough not to misuse the information. The following legends apply to the contents of the tables.

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Operational Practices- Physical Security Plans and Procedures (OP1.1): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
Facility security plans and procedures for safeguarding the premises, buildings, and any restricted areas are documented and tested.	Unclear	Unclear	Unclear	No
There are documented policies and procedures for managing visitors.	Yes	Yes	Unclear	Yes
There are documented policies and procedures for physical control of hardware and software.	Yes	Yes	Unclear	Yes

Operational Practices- Physical Security Plans and Procedures (OP1.1): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
Senior Management		Not sure how often the plans are tested
Operational Area Management		Little challenging of people after hours Once sensitive data is printed and distributed, it's not properly controlled or handled.
Staff		If someone enters through the emergency room entrance, they can get anywhere. Storage space for sensitive information is insufficient.
IT Staff	Hardware security is very good.	

Operational Practices- Physical Access Control (OP1.2): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
There are documented policies and procedures for controlling physical access to work areas and hardware (computers, communication devices, etc.) and software media.	Yes	Yes	Unclear	Unclear
Workstations and other components that allow access to sensitive information are physically safeguarded to prevent unauthorized access.	Yes	Yes	No	Yes

Operational Practices- Physical Access Control (OP1.2): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
Staff	We are required to lock up our offices at the end of the day.	Physical security is hampered by location/distribution of terminals need to share terminals shared office space sharing codes to cypher locks multiple access points to rooms
IT Staff	Hardware security is very good.	

Operational Practices- Monitoring and Auditing Physical Security (OP1.3): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
Maintenance records are kept to document the repairs and modifications of a facility's physical components.				Yes
An individual's or group's actions, with respect to all physically controlled media, can be accounted for.				No
Audit and monitoring records are routinely examined for anomalies, and corrective action is taken as needed.		Unclear		No

Operational Practices- Monitoring and Auditing Physical Security (OP1.3): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
Operational Area Management		Never actually seen an overall audit report on maintenance/repairs
IT Staff		We track repairs and modifications. Audit records are spotty. Not sure we ever review them.

Operational Practices- System and Network Management (OP2.1): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
There are documented and tested security plan(s) for safeguarding the systems and networks.	Yes	Unclear		No
Sensitive information is protected by secure storage (e.g., backups stored off site, discard process for sensitive information).				Yes
The integrity of installed software is regularly verified.				Yes
All systems are up to date with respect to revisions, patches, and recommendations in security advisories.				Unclear
There is a documented and tested data backup plan for backups of both software and data. All staff understand their responsibilities under the backup plans.	Yes	Unclear	No	Yes
Changes to IT hardware and software are planned, controlled, and documented.				Yes
IT staff members follow procedures when issuing, changing, and terminating users' passwords, accounts, and privileges. Unique user identification is required for all information system users, including third-party users. Default accounts and default passwords have been removed from systems.				Yes
Only necessary services are running on systems – all unnecessary services have been removed.				Unclear

Operational Practices- System and Network Management (OP2.1): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
Senior Management	There is a security plan. ABC Systems has one.	
Operational Area Management		Not sure everyone outside of IT understands they have responsibilities
IT Staff	We know what we're supposed to do. ABC Systems does all of the virus and vulnerability checking. They send us the results. Systems are protected well with passwords, authorizations, etc. We force users to change passwords regularly. ABC Systems has reported very few intrusions.	There's no documented plan. ABC Systems must keep up to date with security notices, but I'm not sure. I don't think we clean up inherited access rights very well. One of the managers brought a database system down last week with access rights he should not have had. We are looking into that.

Operational Practices- System Administration Tools (OP2.2): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
Tools and mechanisms for secure system and network administration are used, and are routinely reviewed and updated or replaced.				Unclear

Operational Practices- System Administration Tools (OP2.2): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
IT Staff	ABC Systems is supposed to run most of these tools from their site.	We run some of them and we're supposed to get updated versions and training, but that hasn't happened lately.

Operational Practices- Monitoring and Auditing IT Security (OP2.3): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
System and network monitoring and auditing tools are routinely used by the organization. Unusual activity is dealt with according to the appropriate policy or procedure.				Unclear
Firewall and other security components are periodically audited for compliance with policy.				Yes

Operational Practices- Monitoring and Auditing IT Security (OP2.3): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
IT Staff	ABC Systems does all of the audits. ABC Systems runs monitoring tools.	I don't think ABC Systems reports unusual activity to anyone here – not sure if the response is according to our policy or theirs.

Operational Practices- Authentication and Authorization (OP2.4): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
Appropriate access controls and user authentication (e.g., file permissions, network configuration) consistent with policy are used to restrict user access to information, sensitive systems, specific applications and services, and network connections.		Unclear		Yes
There are documented policies and procedures to establish and terminate the right of access to information for both individuals and groups.	Yes	Yes		Yes
Methods or mechanisms are provided to ensure that sensitive information has not been accessed, altered, or destroyed in an unauthorized manner. Methods or mechanisms are periodically reviewed and verified.				Yes

Operational Practices- Authentication and Authorization (OP2.4): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
Senior Management		
Operational Area Management	There are polices for access control and permissions.	But, we're not using role-based management of accounts and people inherit far too many privileges.
Staff		
IT Staff	Systems are protected well with passwords, authorizations, etc.	

Operational Practices- Vulnerability Management (OP2.5): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
There is a documented set of procedures for managing vulnerabilities, including selecting vulnerability evaluation tools, checklists, and scripts keeping up to date with known vulnerability types and attack methods reviewing sources of information on vulnerability announcements, security alerts, and notices identifying infrastructure components to be evaluated scheduling of vulnerability evaluations interpreting and responding to the results maintaining secure storage and disposition of vulnerability data				Unclear
Vulnerability management procedures are followed and are periodically reviewed and updated.				Unclear
Technology vulnerability assessments are performed on a periodic basis, and vulnerabilities are addressed when they are identified.				Unclear

Operational Practices- Vulnerability Management (OP2.5): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
IT Staff	ABC Systems does all of the vulnerability management and assessment activities. They do a good job.	We haven't been trained on what to do with those vulnerability reports. We usually file them in a drawer.

Operational Practices- Encryption (OP2.6): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
Appropriate security controls are used to protect sensitive information while in storage and during transmission (e.g., data encryption, public key infrastructure, virtual private network technology).				Yes
Encrypted protocols are used when remotely managing systems, routers, and firewalls.				Yes
Operational Practices- Encryption (OP2.6): No Contextual Information				

Operational Practices- Security Architecture and Design (OP2.7): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
System architecture and design for new and revised systems include considerations for security strategies, policies, and procedures history of security compromises results of security risk assessments				Unclear
The organization has up-to-date diagrams that show the enterprise-wide security architecture and network topology.				Yes

Operational Practices- Security Architecture and Design (OP2.7): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
IT Staff		They're already building PDIS II and no one ever talked to us about what it should have for security. Maybe ABC Systems already knows.

Operational Practices- Incident Management (OP3.1): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
Documented procedures exist for identifying, reporting, and responding to suspected security incidents and violations.	Yes	Unclear	Unclear	Yes
Incident management procedures are periodically tested, verified, and updated.	Unclear	No	Unclear	No
There are documented policies and procedures for working with law enforcement agencies.	No	No	No	Unclear

Operational Practices- Incident Management (OP3.1): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
Senior Management		Never even considered dealing with law enforcement for security problems until just now.
Operational Area Management	Procedures exist for incident response.	Not everyone is aware of the procedures.
Staff		I don't know if I'm supposed to do anything or what to look for. Who do we call?
IT Staff		I suppose we should call law enforcement if the system really gets attacked. But who calls – us or ABC Systems?

Operational Practices- General Staff Practices (OP3.2): Survey Results				
Survey Statement	**Senior Managers**	**Operational Area Managers**	**Staff**	**IT Staff**
Staff members follow good security practice, such as securing information for which they are responsible not divulging sensitive information to others (resistance to social engineering) having adequate ability to use information technology hardware and software using good password practices understanding and following security policies and regulations recognizing and reporting incidents	Unclear	Unclear	No	Yes
All staff at all levels of responsibility implement their assigned roles and responsibility for information security.	Unclear	No	Unclear	Yes
There are documented procedures for authorizing and overseeing all staff (including personnel from third-party organizations) who work with sensitive information or who work in locations where the information resides.	Yes	Unclear	No	Yes

Operational Practices- General Staff Practices (OP3.2): Contextual Information		
Organizational Level	**Protection Strategy Practices**	**Organizational Vulnerabilities**
Senior Management		Fairly certain people share passwords and accounts
Operational Area Management		I've heard they have so much trouble logging in and out and moving from machine to machine that they just don't bother.
Staff	We get "don't share passwords" type of training.	Physical layouts, insufficient equipment, and cramped space – all leads to sharing passwords, accounts, and machines, whatever. We all trust each other.
IT Staff	All staff are trained on passwords.	