TECHNOLOGY CONSULTING
IN THE GLOBAL COMMUNITY

Final Consulting Report

Belau Medical Clinic

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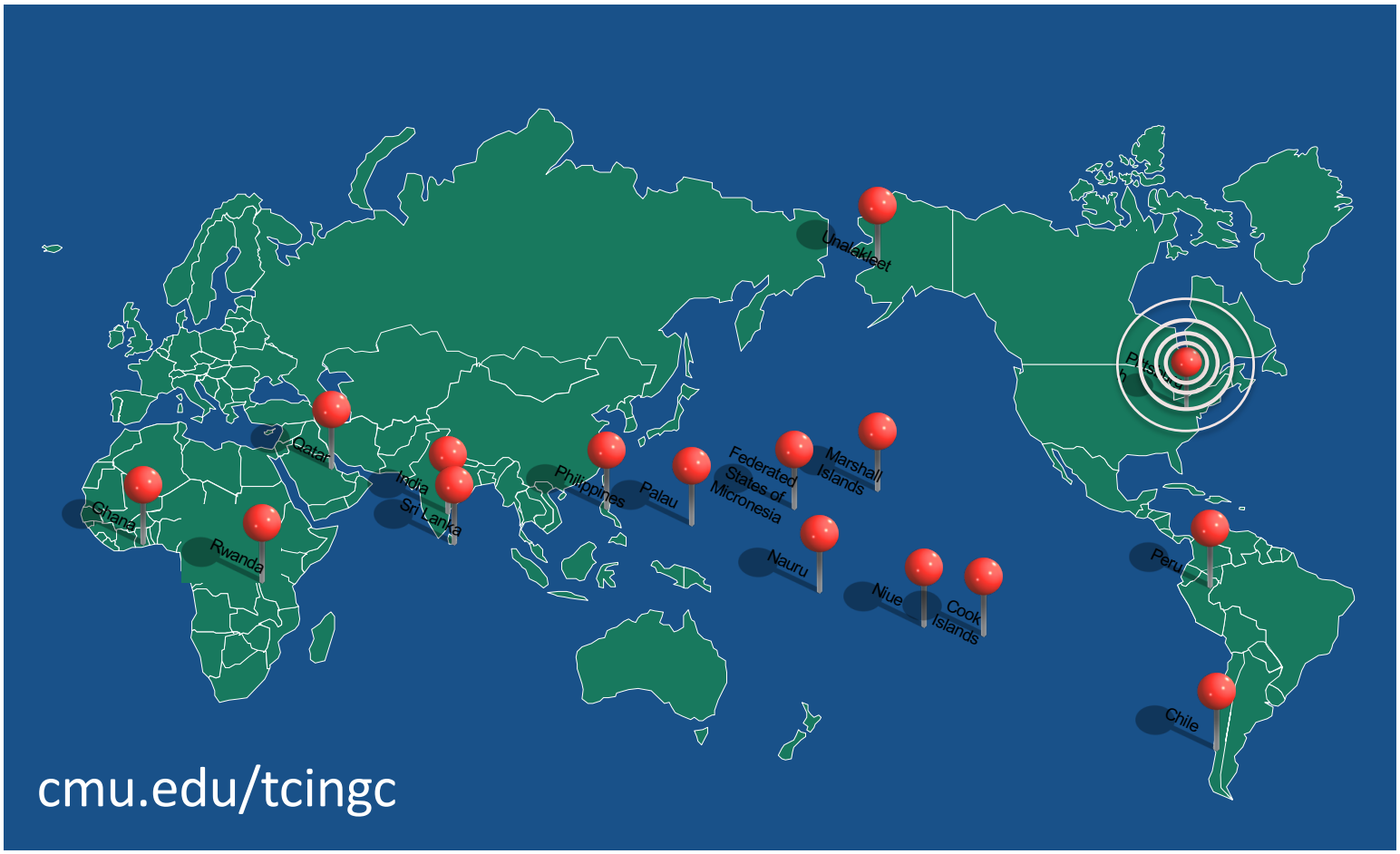
Carnegie Mellon University



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Belau Medical Clinic
Executive Summary

Student Consultant, Askari Shah
Community Partner, Dr. Victor Yano

I. About the Organization

Belau Medical Clinic (BMC) is one of the four healthcare facilities in Palau's Koror state. BMC was established in 1981 with the following mission:

> *To provide quality healthcare as an alternative to government healthcare services.*

BMC was founded by a group of five people. Dr. Victor Yano, who currently serves as director at BMC, is one of the founding members. In its early days, BMC conducted its operations from a rented apartment in Koror. BMC moved to its current location in Koror downtown in 1983.

BMC is a family owned organization and promotes a sense of community, trust and mutual respect through its people centered operations. BMC serves the community in the morning as well as evening. BMC provides services ranging from general Out Patient all the way to DNA testing. There are four physicians at BMC – two gynecologists/obstetricians and two general physicians.

BMC has a total of 38 employees, out of which 11 are foreign workers and 27 are Palauan. There are 24 female employees and 14 male employees. BMC has a good retention rate – for current employees, the average length of time working at BMC is around 5+ years.

All communication between doctors and BMC staff from other departments (nurses, receptionists, pharmacists, lab technicians, admin) takes place manually. Doctors update paper-based medical records of patients and pass them on to relevant department for further necessary action.

Critical and important information for BMC consists of patients' records, vendors' details, sales figures, and inventory data. All this information is managed manually using independent and disconnected software's. Spreadsheets, QuickBooks, an Access database and paper-based ledgers are used to track most of the information of interest.

BMC is decently equipped with technology. It has recently upgraded its computers. It also has 24/7 access to broadband internet. Networking hardware has also been purchased recently. Technology at BMC is not formally managed. BMC does not have any in-house technical expert to manage its existing technology - technology planning has generally remained non-existent at BMC. Technology planning has never been a part of any employee's job description. Technology equipment is replaced and upgraded on a need basis.

Overall, BMC is committed to improving its operations and business practices with the aim of delivering the best value to its customers, employees and the community it operates in.

II. Automation of inventory and sales tracking

Keeping a track of pharmaceutical inventory had historically remained a challenge for BMC. Absence of accurate information on medicine stocks led to problems such as delays in reordering, understocking, overstocking and expired medicines. Moreover, doctors did not have quick access to medicine availability which made their job a little tricky.

Director BMC, Dr. Victor Yano, and manager BMC, Elilai Yano, strongly felt the need of an electronic inventory management system. BMC management considered operational inefficiencies and delays in business decision making (resulting from manual and inaccurate record keeping of inventory) as the highest priority improvement area. Following outcomes were produced to address the problem at hand:

- A proof of concept and trial of Intuit Point of Sales system was conducted
- Intuit Point of Sales (POS) system was implemented and made live
- 1 master trainer and 6 system users were trained to ensure effective utilization of POS

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I. About the Organization

Organization

Belau Medical Clinic (BMC) is one of the four healthcare facilities in Palau's Koror state. BMC was established in 1981 with the following mission:

> *To provide quality healthcare as an alternative to government healthcare services.*

However, with the passage of time, government hospital in Palau has improved its quality of care. Thus, the original mission of BMC is no longer valid. Therefore, BMC's mission now is:

> *To provide quality healthcare as well as quality service delivery, as an alternative to government healthcare services.*

BMC was founded by a group of five people. Dr. Victor Yano, who currently serves as director at BMC, is one of the founding members. Dr. Yano received his medical education and training in United States and returned to Palau to serve his country. He initially worked at Palau National Hospital with the motivation of helping Palauan people. However, the government healthcare system lacked quality and reforming the system was beyond Dr. Yano's control. Therefore, he decided to set-up his own clinic where he could effectively utilize his medical training and satiate his desire of providing quality healthcare services to Palauan community. Dr. Yano's vision for BMC was inspired by Palauan culture and ended up becoming BMC's logo, shown in figure 1 below:

Figure: 1

Each element of this logo holds a cultural or medical significance which inspired Dr. Yano. The tree in the center of the logo is considered the mother of medicine in Palauan culture. Five leaves on top of the tree represent the five founders of the clinic. Seven leaves on either side of the tree signify the fact that traditional medicine in Palau is prepared using seven leaves. The two snakes symbol on the tree is a sign taken from Greek mythology which is commonly used as a symbol of medicine in United States. Thus, showing a link between modern and traditional medical practices. The two

individual leaves near the bottom of the tree are used to repel evil spirits in Palauan culture and hence depict BMC's regard for spiritual values. The yellow circular part in the middle shows the Palauan full moon which is also part of the Palauan flag and therefore a sign of patriotism. Sixteen clams in the outer rings signify the sixteen states of Palau. Finally, the two houses on either side of the outer rings show that the houses of leadership and general public in Palau are equal. These houses further elaborate that everything in Palau is driven by a strong family and community culture which is why the contents of the logo are contained within the two houses. Keeping all these factors in mind, BMC's vision can be summarized in the following words:

> *To create and run a healthcare facility which would combine modern and traditional healthcare practices, and utilize those practices in a culturally appropriate manner for serving the Palauan community.*

In its early days, BMC conducted its operations from a rented apartment in Koror where Dr. Yano was the only physician along with a foreign gynecology/ obstetrics specialist and a nurse. Almost two years after its establishment, on Thanksgiving Day in 1983, BMC moved its operations to its current building which was built on Dr. Yano's family owned land.

BMC was built through community help. Around 66% of the financial contribution came from the money raised through Palauan community. Therefore, BMC has always tried to give back to community in every way it can. Even today, BMC continues to serve patients regardless of their ability to pay. Patients who are unable to pay are given a mutually agreed soft-deadline for payment. Such patients can make payments in cash or even in the form of produce such as vegetables, fruits, fish etc. It is common for BMC to declare some of its receivables as bad debt each year.

BMC enjoys a convenient advantage with regards to its location. It is located in Koror downtown which gives it an edge over other healthcare facilities. Other two clinics in Koror and Palau National Hospital are located right next to each other, but on a distant part of the island, away from downtown area. Since most of the business activities in Koror take place in the downtown area, BMC is able to attract foreign workers as well as local working class.

Additionally, BMC offers evening hours services to accommodate workers who are unable to visit the clinic during regular operating hours. BMC operates from 8am to 12 pm and 5 pm to 9 pm, Monday through Friday.

BMC's services are priced 20-25% lower than its competitors resulting in a convenient customer attraction and decent sales. BMC also enjoys significant goodwill from its customers due to its patient-centric operations and director, Dr Yano's, focus on helping Palauan community.

As present, BMC is doing good in terms of its business activities as well as healthcare services. However, there are numerous opportunities for improving its operational efficiencies and overall success through technological interventions. All BMC departments currently work in silos and inter-departmental communication is generally reactive. Most of the critical tasks at BMC are people dependent e.g. information regarding out-of-stock medicines is not readily available to doctors – pharmacist manually provides this information to doctors which means if the pharmacist were to be absent, the doctors will have no quick or reliable way of staying informed about medicines' availability. Similarly, procurement of pharmaceuticals and other medical supplies depends on BMC director's extensive experience and relations with the vendors. Procurement requests are usually revised multiple times based on director's feedback before purchase orders can

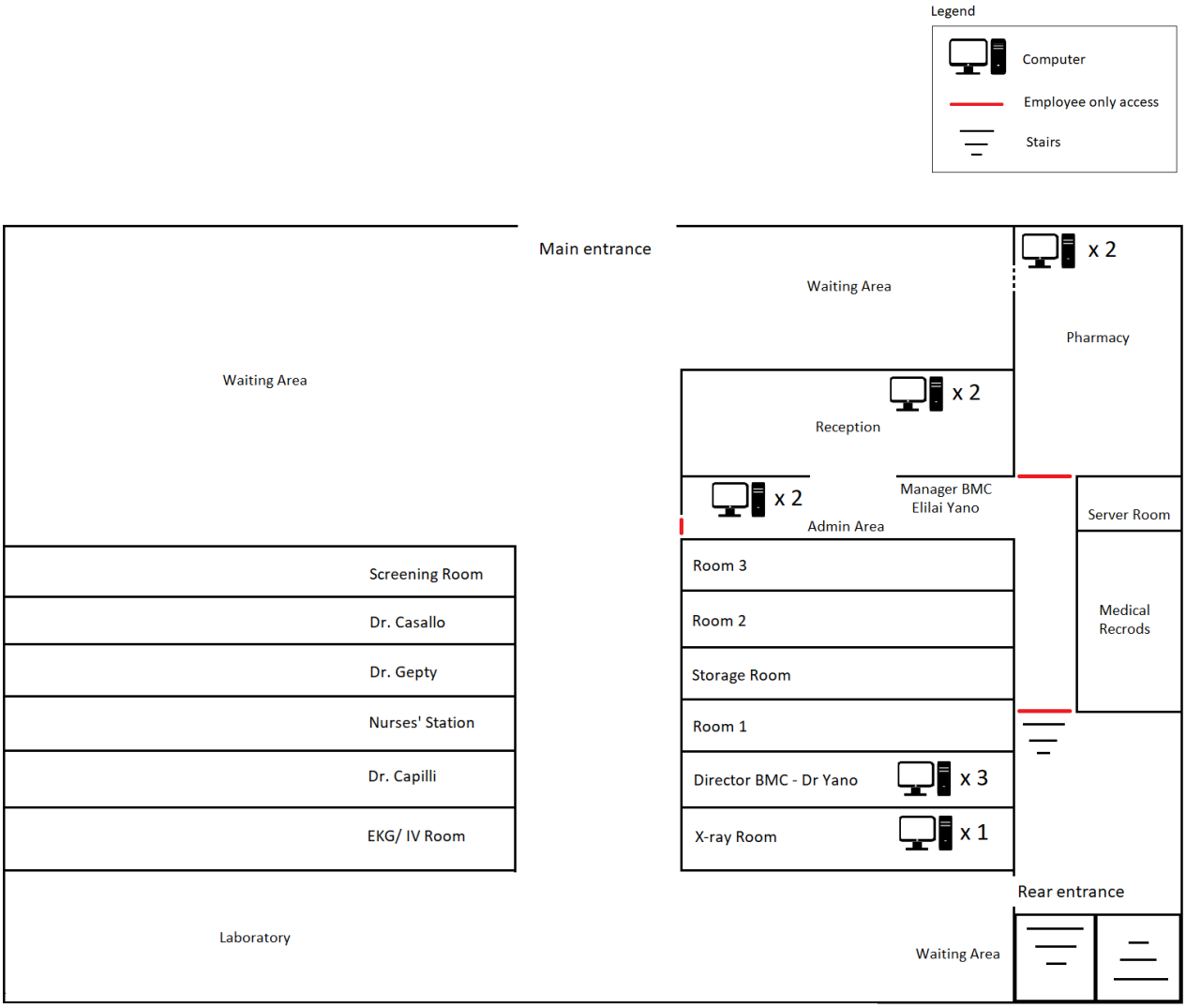
be issued. This implies that, if BMC director's supervisory role is taken out of the procurement equation, BMC's supplies will frequently suffer from problems such as overstocking, expiration and unavailability. Just like internal communications, BMC's external communications are also weak at the moment. BMC does not have any platform to digitally connect with its customers. Another challenge that BMC currently faces is storage space. BMC maintains paper-based records of patients' medical history. Storing and managing physical records is slow, in-efficient, prone to errors, and requires continuous expansion of storage space.

The common factor between all the above-mentioned challenges is limited and manual management of information at BMC.

Facilities

BMC has a total area of 7,000 sq. feet. BMC building has access from two sides with a decent size parking lot at each entrance. Only five employees have access to clinic during non-operating hours. There is no formal security system or process in place – surveillance cameras and security staff are not present. Simple lock and key measures are used to control access to the clinic. Absence of formal security measures is intentional – BMC promotes a sense of family, trust and mutual respect which is in line with the Palauan culture and values. BMC has never had any major security related problems.

Figure: 2 shows BMC's floor plan.



Adapted from Jade Martin's 2014-15 Belau Medical Clinic report

Figure: 2

Utilities at the clinic are provided by a semi-government company which is the only utilities provider on the island. Electric supply is reliable; however, BMC also has a back-up generator which has the capacity to supply power to all the critical machinery at the clinic in the event of a power breakdown.

BMC has broadband internet access provided by Palau National Communication Company (PNCC) and another company called Fairwaves. There are three1 Mbps connections which serve the whole clinic – two from PNCC and one from Fairwaves. One PNCC connection is reserved for administrative operations (BMC manager, and other staff) and the other is reserved for tele-radiography (Director BMC) - X-ray scans are shared with radiologists in India and Philippines who can then remotely provide their expert opinions to BMC. Fairwaves connection is part of the backup teleradiography system. Considering the current communication needs of the clinic, internet

bandwidth and speed are sufficient. However, internet connection can be upgraded to 10 Mbps if needed but the cost of that connection is almost 3 times the current cost – BMC pays $160/ 1 Mbps connection currently, whereas the cost of each 10 Mbps connection is $450.

BMC also has access to public hotspots of PNCC and Fairwaves, both of which require purchase of prepaid cards. These hotspots can act as a decent back up for BMCC if its broadband network runs into any internal problems. Even currently these cards are provided to reception staff to access the internet for official purposes. However, as a broadband connection is now available, the reception computers can be connected to that instead of public hotspots.

A networking system has been installed at BMC. Server hardware and computers have been connected through a wired network. The server system currently only has Microsoft Server operating system installed. However, the server is not operational as the application layer at the server has not been configured yet.

Programs

Table 3. lists the services provided by BMC

Sr. #	Service	Comments
1	General Out Patient services	In-patient and emergency services are not offered
2	Cervical Cancer Screening	Funded by a non-communicable diseases grant
3	Outreach Wellness services to communities	Funded by National Health Insurance
4	Physical examinations for expatriates	
5	Medical examinations for travelers to AUS and NZD	BMC is the only clinic authorized to conduct these exams
6	Drug tests	
7	Diagnostics	Basic radiology and pathology tests
8	Acupuncture	
9	Gynecology/ Obstetrics	
10	Immunizations	
11	DNA testing	Sample collection at BMC – Testing done in GUAM

Table: 3

Some of these programs are independently run by BMC, while others are funded by external grants. There is very limited use of computers in running these programs. The only involvement of technology is through equipment such as X-ray and laboratory machines. Computers are not used in conducting core operations of these programs.

Staff

BMC has a total of 38 employees, out of which 11 are foreign workers and 27 are Palauan. There are 24 female employees and 14 male employees. BMC has a good retention rate – for current employees, the average length of time working at BMC is around 5+ years. Employees are paid on an hourly basis. The minimum wage rate is $3.50 and the hourly wage range varies between $3.50 - $ 7.00.

Figure 4. shows the organization chart of BMC.

Legend
Blue: Full-time employees
Orange: Part-time employees

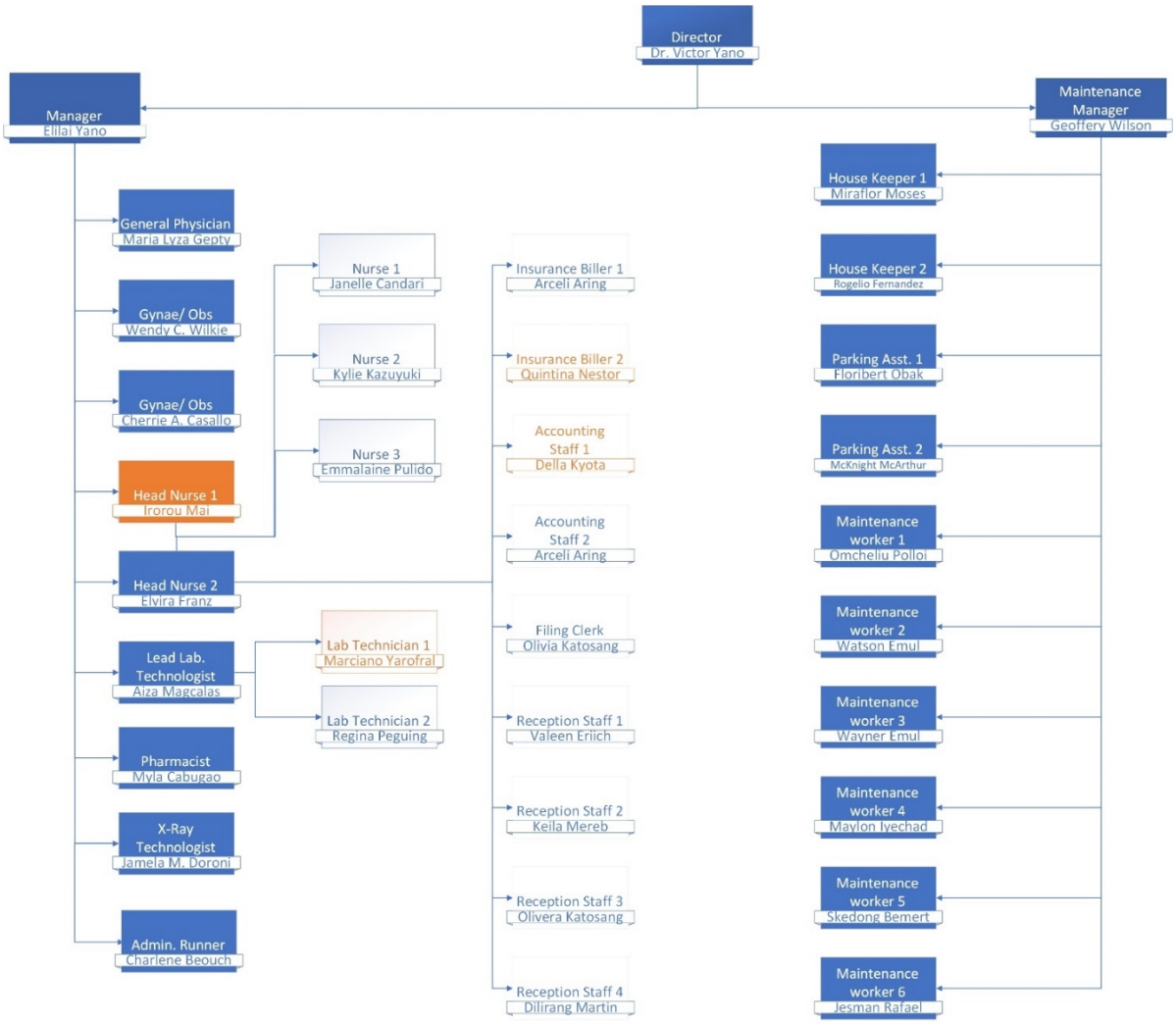


Figure 4.

Patient Care Providers

Medical Practitioners-

There are four physicians at BMC – two gynecologists/obstetricians and two general physicians. General information about all four physicians is provided in table 5.

Sr. #	Name	Specialty	Computer?	Area of responsibility
1	Victor Yano	GP	Yes	Management + Medical practice
2	Maria Lyza Gepty	GP	No	Medical practice
3	Wendy C. Wilkie	Gyne/Obs	No	Medical practice
4	Cherrie A Casallo	Gyne/Obs	No	Medical Practice

Table: 5

Dr. Yano is the only medical practitioner who has access to computers, fax machines, printers and internet in his office. Other doctors do not have dedicated computers in their offices. However, they can use the computer available in the pharmacy whenever they need to process referrals or endorse medical insurance documentation. Sometimes they also use their personal computers/laptops to do these tasks. These doctors have access to BMC's internet but the signal strength in their offices is poor. Therefore, they usually use their mobile phones and cellular data whenever they need to look up anything online or consult medical research material. BMC currently has 6 newly purchased spare computers, 3 of which can be provided to the doctors if required. However, the present use case and need of doctors may not require a dedicated computer. Nonetheless, if the clinic chooses to go ahead with an electronic health record system, then the doctors would certainly need official computers.

All communication between doctors and BMC staff from other departments (nurses, receptionists, pharmacists, lab technicians, admin) takes place manually. Doctors update paper-based medical records of patients and pass them on to relevant department for further necessary action.

Nurses-

There is a total of 5 nurses – 2 head-nurses and 3 general nurses. One head nurse works full-time while the other is available part-time. Full-time nurse manages the nursing staff as well as the reception, accounting and insurance billing staff. Part-time nurse only manages the nursing staff. At least one nurse is available during each shift (am and pm). Part-time nurse is mostly available during evening shift.

General nurses do not have specifically assigned areas of work within their work domain, they are rotated by head nurses based on work load and clinic's needs on any given day. Nurses tend to patients, manually manage nursing supplies, inventory, and work in patient screening room. Sometimes they also visit homebound patients if directed by doctors. Usually, this activity takes place over the weekends with the objective of checking in on patients and reporting their health status to doctors at the clinic.

Medical Records-

The responsibility of medical record management currently falls on reception staff. There are no dedicated resources for record management. BMC engages temporary interns or trainees from time to time to help the reception staff in maintaining medical records. Records are maintained alphabetically for Filipino patients and by date of birth for all other patients. There is no specific reason for this. In early days, records for Palauans were maintained by date of birth (DOB) and records for foreigners were maintained alphabetically. Later, an activity was conducted to convert arrangement of all records to DOB basis. However, this activity was not fully completed and all records except those of Filipinos were moved to DOB based arrangement. According to previous

student consultant, Jade Martin's report, "in some cases, multiple records are created when the date of birth is unknown by a child's non-parental guardian, when foreign names are not properly recorded, and when multiple names (Palauan/Japanese/English) are used for the same patient." This phenomenon still holds true.

Billing and insurance-

Patients can pay their dues at BMC using one or more of the following options:

1. Private insurance
2. Medical Savings Account (MSA)
3. Out-of-pocket expense

Private insurance is provided by three companies - NetCare, Calvo and StayWell. BMC has two employees who handle insurance billing. One of them works full-time while the other is available part-time. Part-time biller is available at BMC 3 days a week during evening shift. All the billing process is manual, and the billing staff does not have computers. BMC has physical copies of payment schedules for each insurance company. While receiving payments from patients, billing specialist uses patient's encounter forms and consults insurance payment schedules to determine any co-payment amount to be received from the patient. Billing specialist communicates this information to the cashier via a partially filled insurance claim form. Insurance claim form is only partially filled at the time of payment to reduce patients' waiting times at the reception. Once a patient has completed his/her visit at BMC, his/her encounter forms are handed over to the billing specialist for completion of insurance forms. Insurance billing process requires 5-6 min for filling up one form. BMC shares completed insurance forms with the insurance companies once every fortnight to receive payment.

Patients can also use MSA to make payments at BMC which are handled by reception staff. A patient can have his/her own MSA or he/she may be a beneficiary to someone else's MSA. BMC reception has a dedicated computer for processing MSA payments. This computer is used for electronically receiving MSA balance details from external BMC administrators. BMC receives updated details of patient's MSA balances daily. These details are received in the form of a pdf document via email. BMC reception staff consults that pdf document to determine patients' available MSA balances. An MSA form is filled by reception staff to process MSA payments. A manual itemized invoice is attached with that form which is then submitted to MSA authorities for payments to BMC.

Accounting-

BMC's full-time billing specialist also takes care of accounting process. She is currently being trained and supported by a part-time accountant. She uses manual sales report to populate a spreadsheet-based accounting template. BMC manager's computer is used for this purpose. The data from spreadsheet is then transferred to QuickBooks by the part-time accountant. A licensed copy of QuickBooks 2017 is currently being used by BMC for tracking its financial data.

Administration-

BMC's manager, Elilai Yano, takes care of all administrative matters. She has a dedicated computer with internet access and utilizes QuickBooks to manage financial matters of BMC. Four QuickBooks modules are used for that purpose - vendor module, customer module, employee module, and banking module. Business related challenges and details of how each of the above-mentioned modules is used by BMC are discussed under the Business Systems section.

Apart from business systems, BMC administration also faces challenges regarding the management of company owned vehicles. BMC has 8 company owned vehicles, 4 of which are used by maintenance staff, 3 are used by doctors and 1 is used by office runner. Information regarding periodic maintenance, usage, and vehicles' registration renewals is not formally stored. This creates fleet management problems for BMC. It is to be noted that maintenance staff is not directly involved in BMC's core operations – maintenance staff performs out-of-office community work.

Procurement-

BMC has the following procurement categories:

1. Pharmaceuticals
2. Medical Supplies
3. Laboratory reagents
4. Medical equipment
5. X-ray supplies
6. Office supplies

Office supplies are bought locally from supermarkets with exception of printer toners. Due to availability challenges and significantly high prices of toners in Palau, toners are ordered online from US. There is no formal procurement process in place for procurement of office supplies. Supplies are bought on a need basis.

Apart from office supplies, everything else is purchased from outside Palau. Purchase requests are submitted to director BMC by concerned departments. Director BMC reviews and approves those requests based on his experience and knowledge of the business. His decision making is currently supported by limited data as sufficient inventory information is not readily available. Director BMC negotiates with vendors and issues purchase orders via email. Procurement process is manual and relies heavily on BMC staff's experience and anecdotal knowledge of inventories.

Technology Infrastructure

BMC is decently equipped with technology. It has recently upgraded its computers. It also has 24/7 access to broadband internet. Networking hardware has also been purchased recently, and BMC is now looking to get its internal network setup. BMC's objectives for having an internal network is mainly to pave the way for implementation of EMR. The network will also sales and inventory data to be locally backed up when inventory management and point of sales get implemented.

BMC has more computers and printers than currently needed. The available hardware in operation needs to be optimized to ensure effective utilization of technology. Table 6. provides a location wise summary of technology assets available at BMC.

Sr.#	Location	Item	Quantity	Comments
1	Pharmacy	Computers	2	1 new, 1 legacy
2		Printers	2	1 dot matrix, 1 regular
3	Admin.	Computers	2	1 new, 1 legacy
4		Printers	2	1 printer, 1 copier/ scanner
5		Internet router	1	General purpose
6	Server room	Servers	4	2 current networking needs, 2 future backups
7		Networking switch	1	16 ports, for existing networking needs
8	Room 3	Printer	1	Ultrasound printing
9	Storage room	Networking switch	1	16 ports, for future expansion
9	Dr. Yano's office	Computers	3	2 personal, 1 tele-radiography
10		Printers	2	
11		Internet routers	2	1 Tele-radiography, 1 other uses
12	X-ray room	Computer	1	Processing and storing x-ray images
13		Scanner	1	X-ray image scanning
14	Laboratory	Computer	1	General purpose
15		Printers	4	Printing diagnostic tests' results
16	Inventory	Computers	6	Available for use
	Total	*Computers*	*16*	
		Printers	*11*	
		Routers	*3*	
		Servers	*4*	
		Switches	*2*	

Table 6.

Table 7. provides the specifications and usage details of computers available at BMC

Sr. #	Item	Model	OS	Memory	Allocation
1	Computers x 10		Windows 7	8 GB RAM – 500 GB HDD	1 – Pharmacy 1 – Reception 1 – lab 1 – Xray 6 - available
2	Computer x 1	Lenovo Ideacenter 300-20ISH	Windows 10 Home	8 GB RAM – 1 TB HDD	Manager BMC
3	Computer x 1	eMachines EZ1601	Windows XP Home edition	1 GB RAM – 149 GB HDD	Not in use – Old computer manager BMC
4	Computer x 1	Acer Aspire SA85/AP S285	Windows 7 professional - 32 bit	512 MB RAM– 128 GB HDD	Pharmacy legacy PC – Printing labels
5	Director CT/XRay old PC x1	Acer Aspire X1420G	Windows 7 Home Premium – 64 bit	4 GB RAM – GB HD – 1 TB HDD	Used as teleradiography backup – Connected to a different ISP
6	Director CT/ Xray new x1	HP Compaq 8200 Elite SFF PC	Windows 7 Professional 64 bit	16 GB RAM – 1 TB HDD	Main PC for telelradiograohy
7	Director Old PC x1	eMachines EL1331G	Windows 7 Home Premium – 64 bit	2 GB RAM – 320 GB HDD	Old data and softwares

Table 7.

Table 8. provides location wise details of printers and scanners at BMC

Sr. #	Location	Model	Comments
1	Reception	Brother DCP – L5650DN	Multifunction copier. Black and white prints only
2	Reception	HP Deskjet 3637	Printing health certificates. Colored printing option is available
3	Manager Printer/ Fax	HP Officejet 4635	Colored and black and white prinitng
4	Manager Copier/Scanner	Canon Imageclass D420	Old machine available for general use
5	Pharmacy printer	HP Envy 5534	Rarely used. No operational need
6	Pharmacy dot matrix	KXP1131E	Printing medicine labels for prescriptions
7	Director	HP Officejet 5745	For word processing. Colored option printing is available
8	Director	HP Laserjet pro MFP M127 FW	Laser printer brought in as an upgrade. Colored printing option is available.
9	Ultrasound	HP Laserjet pro 200 color M251 MW	Colored printing is available. Used for printing ultrasound images
10	X ray room scanner	EPSON Expression 1640 XL	Special purpose large size scanner for scanning Xrays
11	X ray room printer	HP Deskjet 990CXI Pro series	Printing bone density images. Colored printing option is available
12	Lab x 2	EPSON LX 300-II	Dot matrix, black and white printing
13	Lab	OKIDATA B4600	Dot matrix, black and white printing
14	Lab	Joliemark LQ - 360K	Dot matrix, black and white printing

Table 8.

Table 9. provides location wise details of networking hardware installed at BMC.

Sr. #	Location	Equipment	Comments
1	Server room x2	CUK HPE ProLiant ML10 Gen9 Tower Server	
2	Server room x2	HP ProLiant ML10 v2 Tower Server System	
3	Server room x2	16 port switch TL-SG1016	
4	Nursing station x2	16 port switch TL-SG1016	

Table 9.

Technology Management

Technology at BMC is not formally managed. BMC does not have any in-house technical expert to manage its existing technology. Whenever a problem is faced, it is reported to BMC manager, Elilai Yano. BMC manager gathers as much information about the problem as she can, and then tries to solve the problem through online research. In case a solution cannot be found, she engages a local IT service providing company, Jezzrae, for professional help. Jezzrae is paid on a case by case basis. Jezzrae's services are limited to basic hardware and software management.

Data regarding past technology issues does not exist as technology problems are not logged. Moreover, there are no maintenance routines in place - problems are only tackled when they arise.

Technology Planning

Technology planning has generally remained non-existent at BMC. Technology planning has never been a part of any employee's job description. Technology equipment is replaced and upgraded on a need basis. In 2015, BMC realized the need for upgrading its computers and setting up a network. From that point on, it took BMC three years to complete the purchase of required hardware due to logistical and sourcing issues.

BMC is now looking to upgrade its software systems. In the short term, BMC wants to have an inventory management and point of sales system installed. BMC's objectives for having such a system are following:

1. Have better control over profit/loss through better tracking of pharmaceutical inventory and sales
2. Be able to have a rational CAPEX budget based on historic data and BMC's financial performance
3. Optimize inventory levels through better demand projections
4. Drive inventory and purchase costs down

BMC also has an informal plan to further upgrade its technology during the next 5 years. BMC intends to have an Electronic Health Record system in place. Through that system, BMC hopes to:

1. Digitize medical record keeping and retire physical record management process
2. Be able to utilize medical data to track healthcare trends over time
3. Use health data to measure treatment's effectiveness
4. Use health data to evaluate its healthcare service delivery performance

A coordinated effort for technology planning is required. BMC's operations are not as complex as those of a similar facility in a first-world country, however, it does need technology to overcome challenges such as inventory management, record keeping, performance measurement, budgeting, and business planning.

One of BMC's competitors, Pacific Family Medical Supply (PFMS), is using a point of sales system. BMC had reached out to PFMS in the past to seek help and learn about their best practices, however, PFMS was reluctant in sharing any information with BMC. It is known that PFMS is using the Microsoft Point of Sales system which was also recommended to BMC by Jade Martin. However, Microsoft has retired this system and therefore, it is no longer an option for BMC.

Communication

There is no standard mode of communication at BMC. Departments are connected through landline phones. BMC staff uses personal mobile phones for communication. During operating hours, critical information is shared with the departments in printed form via notices or memos. During non-operating hours, any critical information is shared via text messages. Doctors, manager and director at BMC also use emails to communicate with each other. Overall, BMC employees are well informed about social media and actively use platforms like Facebook. They also have personal email accounts.

BMC does not have a formal way of sharing data. Digital files and data are manually shared using either flash drives or external hard drives. There is no central repository or shared folder to store and access digital files. However, when BMC's internal network gets set up, it will simplify the file sharing process.

There are no data security measures in place. Currently, the only data which digitally goes out of BMC is X-ray and computed tomography (CT) scans. BMC does not offer CT scanning services; however, patients can get their CT scans from National Hospital which can then be used by BMC doctors. X-ray scans are shared electronically with doctors in Philippines and India for expert opinions. BMC utilizes the services of a Guam based company, M&D Web Creations to manage transfer of X-rays and CT scans. M&D provides secure access to an online repository where BMC can upload the images. These images can then be remotely accessed by doctors in a read only manner. M&D deletes the uploaded images every month to ensure security and privacy of patients' data.

BMC has significant room for improving its communications. It does not have a website. There have been informal conversations in the past about setting up a website. However, the idea had been put on hold for being low on priority. As an alternative to website, the idea of utilizing a Facebook page as a communication platform has been discussed with BMC manager. Such a page can be sufficient to serve BMC's public communication needs. Moreover, setting up a Facebook page not require any technical expertise or financial investment from BMC. Therefore, a Facebook page has already been setup and going forward the process of utilizing the it effectively will also be

formalized. We will create an SOP for managing BMC's Facebook page and will train reception employees in that regard.

BMC maintains a physical record of patients' contact (phone #) and identity information. This information is available through medical records and can be used to reach out to the patients if needed.

At department level, communications are not proactive. Communications are only need-based, and required information gets passed in informal ways. Due to its informal nature, critical information sometimes gets ignored and can have unpleasant consequences. For example, a patient's BMC journey ends at the payment counter. Before arriving at the pharmacy, patients' last encounter is with the pharmacy. Since, there is no formal communication between pharmacy and the payment counter, it is possible that patients may leave the clinic directly from pharmacy, without making their due payments.

In general, information dissemination at BMC is people dependent. Record of official internal or external communications does not exist. Sometimes information does not get communicated to intended recipients on time. Some external information gets delivered to Director BMC exclusively. However, he can be out of island at times and thus unable to forward that information to BMC staff. To prevent such information delays, director BMC has been engaging BMC manager in all such communications hoping to avoid information delays in the future.

Information Management

Critical and important information for BMC consists of patients' records, vendors' details, sales figures, and inventory data. All this information is managed manually using independent and disconnected software's. Spreadsheets, QuickBooks, an Access database and paper-based ledgers are used to track most of the information of interest. However, not all the information gets captured and even the one that is captured has limited usability. Most of the time, only macro level information is captured. For example, the pharmacy does not record itemized sales and is only able to tell dollar amount of medicine sold on a particular day.

All inventories are manually tracked, and information is repeatedly entered into spreadsheets. Similarly, accounting information is repeatedly entered into QuickBooks software - the information is manually extracted from paper-based documents (sales reports, invoices, cheques) and transferred in to a spreadsheet template which is then used to feed information into QuickBooks. BMC Pharmacy has an access database which was built by a local resource a long time ago. However, the database is only being used to print labels for prescriptions when dispensing medicines to patients. It does not track quantities or prices.

The only electronic flow of information among staff is through text messaging between supervisors and admin, and emails between director, manager and doctors.

Business Systems

BMC uses four QuickBooks modules (Employee, Vendor, Customer, Banking) to manage its business.

Employee module contains employees' profiles which consist of their personal and professional information. Payroll information is stored in this module to maintain salaries' expenses in QuickBooks. Payroll is processed using excel spreadsheets. Individual computations are performed in excel for each employee every two weeks. This process can be optimized by creating slightly advance formula-based templates in excel.

Vendor module contains contact details of vendors. Information regarding vendors' areas of service are not recorded currently. However, a comment section for each vendor exists in this module which can be used to store further information of interest about the vendors.

Customer module is used to record details of customers whose employers have a contract with BMC to pay BMC directly for services availed by such customers at BMC. BMC uses this module to track information of those customers and to prepare payment claims for their respective employers. Similarly, any individual customer who is unable to make full payment, his/her details are also recorded in the customer module to keep a track of account receivables. However, there is no formal system to know a customer's promised payment deadline. A physical form is used to record details of promised payment details and deadline, whereas QuickBooks only contains details of amount due.

Banking module is used to record details of invoices, payments and department-wise sales. Itemized details of sales for each department are not available.

Apart from its core business activities, BMC also has other sources of cash inflows. BMC receives contracts and grants to perform community work, conduct medical research and provide free healthcare services. For convenience purposes, funds from all such projects are transferred directly into BMC's bank account. Funneling all the cash flows into a single account leads to confusion for BMC administration. Tracking all the financial information for each of the projects becomes a challenge. It presents significant problems in terms of accounting and auditing of the funds as the existing financial management process relies on paper-based records.

For one project, a dedicated bank account is available and is used to track financial information. BMC administration finds it a reliable and convenient method of tracking the project's finances and desires a similar solution for other projects. After discussions with BMC manager, a viable solution for tracking finances of each project has been proposed. It has been agreed to create a new entity for each project in QuickBooks and to treat it separately from BMC's core business. This solution has been implemented and seems to be working fine so far.

II. Automation of inventory and sales tracking

Motivation

Keeping a track of pharmaceutical inventory had historically remained a challenge for BMC. Absence of accurate information on medicine stocks led to problems such as delays in reordering, understocking, overstocking and expired medicines. Moreover, doctors did not have quick access to medicine availability which made their job a little tricky.

Director BMC, Dr. Victor Yano, and manager BMC, Elilai Yano, strongly felt the need of an electronic inventory management system. BMC management considered operational inefficiencies and delays in business decision making (resulting from manual and inaccurate record keeping of inventory) as the highest priority improvement area.

During 2016 and 2017, BMC had contacted a Philippine based company, Tranzend, to help the clinic with its inventory management needs. Tranzend gave BMC quotations ranging from 40,000 USD to 140,000 USD, excluding airfare and accommodation cost for its staff, to solve BMC's inventory management problem. Careful analysis of Tranzend's proposals revealed that the scope of work it offered was only partially addressing BMC's problems. BMC's time investment in this effort and eventual lack of progress also indicated that the clinic needed to get some tangible results in resolving its problems.

Outcomes

A detailed analysis of BMC's operations was conducted during the first 5 weeks. Work flows were modelled in Microsoft Visio and each model was critically analyzed with the help of BMC manager (see appendix A). This activity helped in simplification of and standardization of process flows.

Successful implementation of a solution highly depended on BMC's organizational capacity and skillset of its staff. Given the cultural norms and a relaxed Palauan work ethic, it was not possible to conduct a formal analysis of BMC staff's skills during the 10-week period. Therefore, anecdotal analysis was conducted through conversations with selected staff members. BMC manager also provided helpful insights in that regard. All the gathered information sufficiently served in planning learning and development needs of BMC staff with regards to implementation of electronic inventory management system.

Similarly, BMC's existing computer hardware and other technology infrastructure was assessed. Existing infrastructure had already been connected through a physical network, however the networking benefits were not realized. Using the physical network BMC's hardware was optimized – staff at reception and pharmacy were given access to a common printer which allowed reduced the number of printers installed by 3. Similarly, necessary updates/upgrades to software's such as Windows Operating System and Microsoft Office were made. Up-to-date infrastructure provided useful information for implementation of an inventory management solution. It allowed identification of any platform-based software limitations and other compatibility issues. Moreover, this activity also ensured that any security or usage risks were minimized through updates.

Rigorous desktop research was undertaken to identify software solutions for BMC. Cost benefit analysis of three software solutions was conducted. Two of these solutions were commercially available and one was considered as an in-house development project. After completion of analysis, all the findings were presented to Director BMC (see appendix B). It was unanimously agreed that Intuit POS system was the most suitable choice for BMC – it was low cost, addressed all BMC's inventory management challenges and was integrable with BMC's existing financial software, Intuit QuickBooks. A week-long trial of Intuit POS was conducted, using 30-day online trial version, before purchase of the actual software. The trial provided satisfactory results.

After conclusion of trial, preparations for the implementation of Intuit POS were started. BMC's staff was trained on using the POS software through two weeks of hands on training on the actual software before making the software live. These trainings were conducted daily and were based on a mock 'on the job learning' model.

A stocktaking activity was also conducted with the help of BMC's pharmacist. Inventory items' details (serial numbers, barcode numbers, description, expiry data etc.) and quantities were recorded in Microsoft Excel spreadsheets by the pharmacy staff. To ensure accuracy of inventory numbers, POS software's roll out was planned to go live on a Monday which allowed the inventory stocktaking to be completed over the weekend without disrupting BMC's normal operations.

Data migration and system set up was conducted by TCinGC consultant and BMC manager was fully engaged and involved throughout this process. Multiple system user accounts for staff were also created in POS. Each account was linked to a particular user group – user groups were configured to control access rights and maintain transparency of the system. Some users could only read data while others could read and right. Similarly, each user could access only the information which was essential in performing his/her duties. BMC manager configured these accounts with the help of the consultant. BMC manager's active role in this process ensured that she had a complete understanding of setting up the system and could conveniently manage the system even beyond the duration of consulting engagement.

Implementation of POS software (see appendix C) produced positive results for BMC. It provided live and accurate information about inventory levels. Previously, the staff had to spend time in physically counting the items and the process could take anywhere between a few hours to a few days depending upon the number of items involved. POS software also enabled automatic transfer of sales data into the financial software which gave BMC management accurate financial information at any given time. Previously, sales were recorded on paper and required manual processing. Sales data was extracted from sales receipts and input into Microsoft Excel spreadsheets which were then fed to the financial software. An external finance specialist used to conduct this process with the help of BMC's billing specialist every week and frequently ran into problems due to errors from manual handling of sales data. POS's implementation eliminated the need for external help, made transfer and processing of information accurate, and removed delays in consolidation of financial information.

Recommendations

Data backup

BMC has been successful in transforming its sales and inventory management processes. As digital nature of the new systems has made BMC's operations efficient, at the same time it poses new challenges. Going forward, BMC needs to be careful about data storage and security. BMC should look to implement data backup systems and for that it can utilize its already purchased server hardware. Server hardware can be connected to the Intuit POS and QuickBooks systems and periodic backup routines can be put in place. This would ensure that BMC minimizes the risk of losing its sales, customers, and inventory data.

Analytics

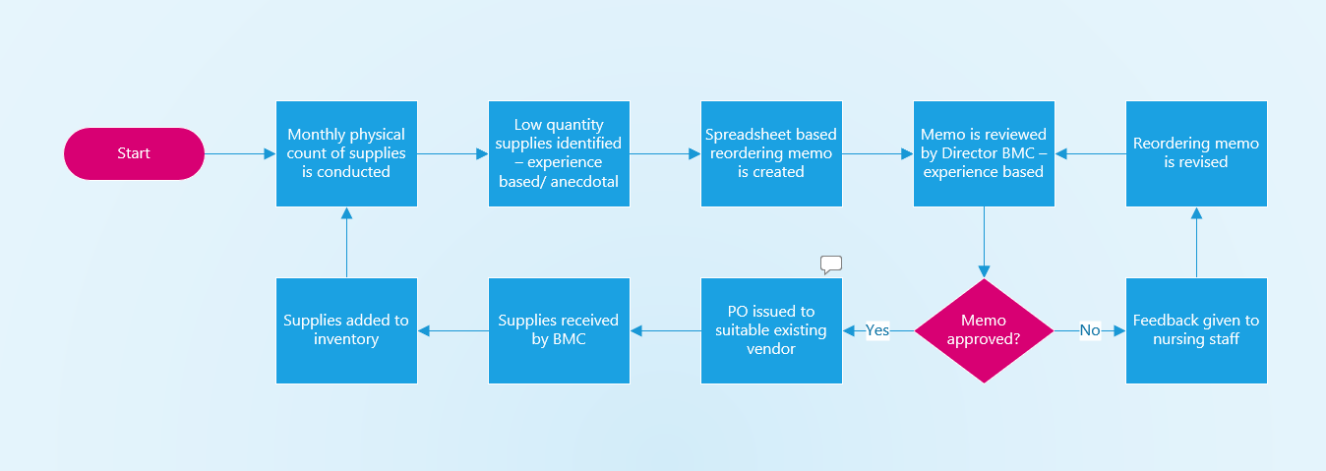
BMC now has a complete information system in place for its sales and inventory data. BMC can look to improve its sales and reduce costs by analyzing the data. It is recommended that after 6 to 9 months BMC should engage an analytics consultant to analyze the recorded data. This activity would allow BMC to optimize its business strategy and decision making. At the same time it would allow BMC to assess the performance and efficacy of the implemented system by comparing the quality of information and insights with historic data.

About the Consultant

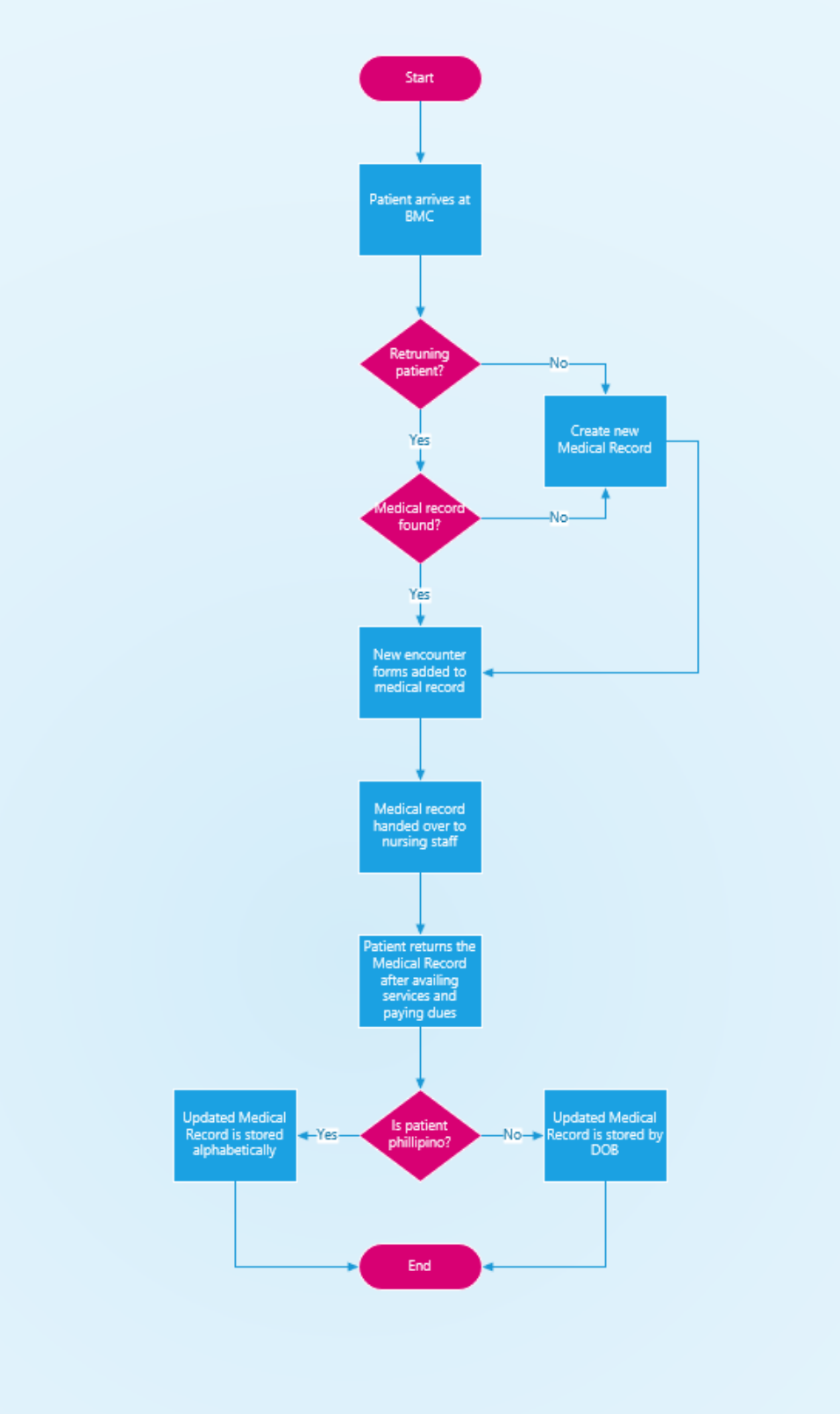
Askari Shah is a graduate student of Information Systems Management at Carnegie Mellon University (CMU). He has over four years of global experience working across private and public sectors. Prior to pursuing graduate degree at CMU, he worked with the likes of Coca Cola and Chief Minister's delivery unit in Pakistan. He will be returning to CMU after taking part in the Technology Consulting in the Global Community internship over the summer to continue his graduate study at CMU in fall.

Appendix A.

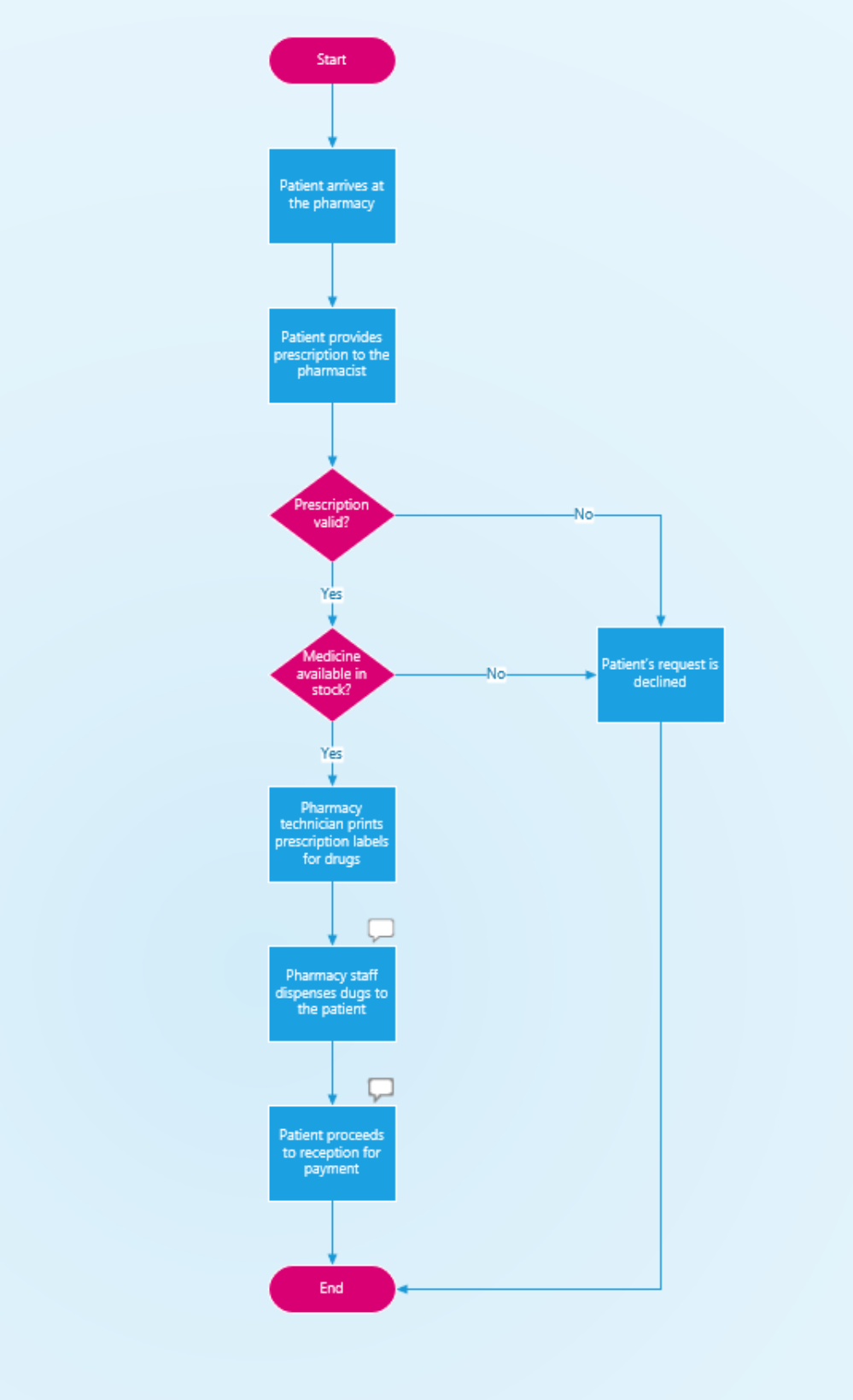
Nursing inventory process flow



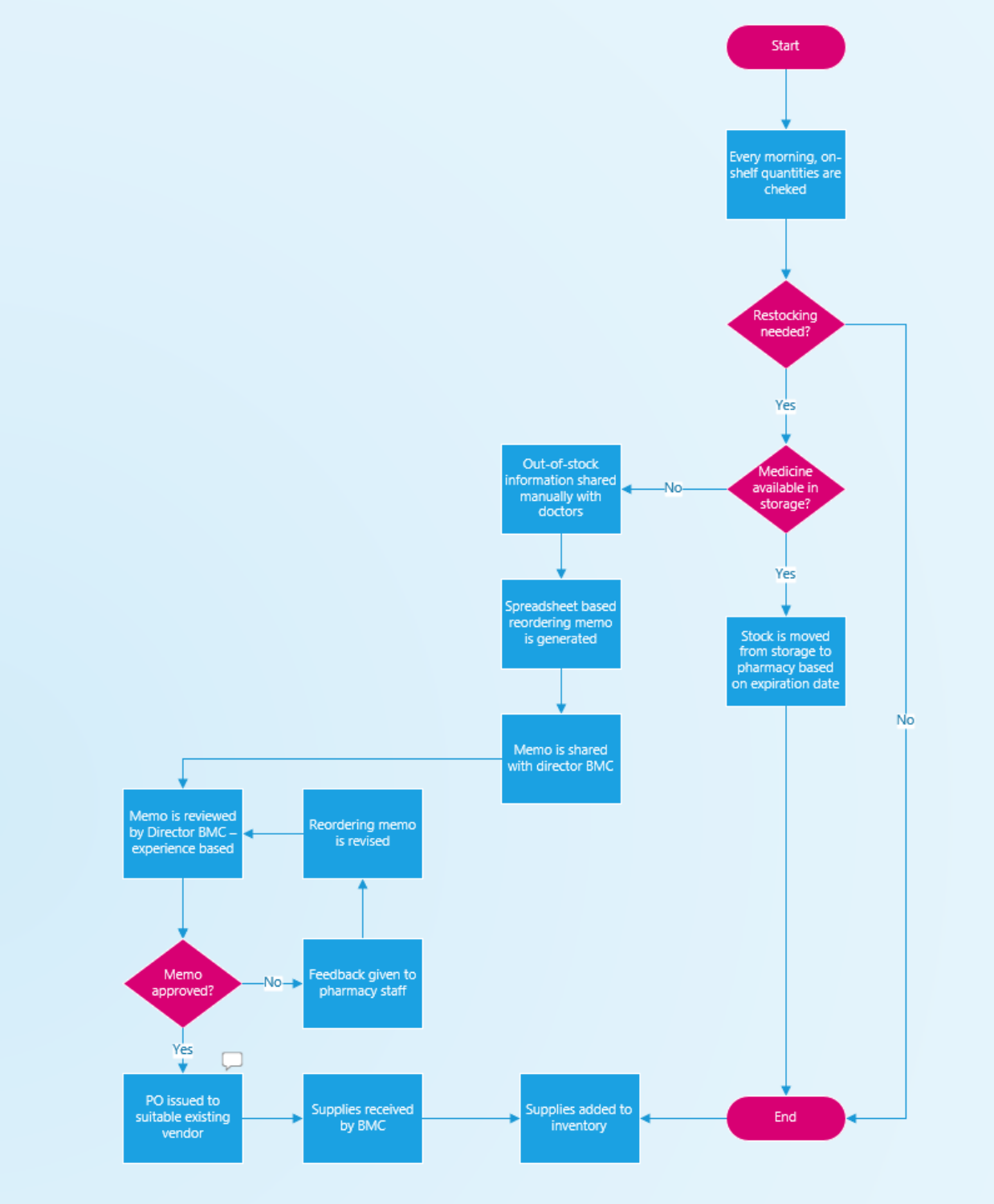
Medical records process flow:



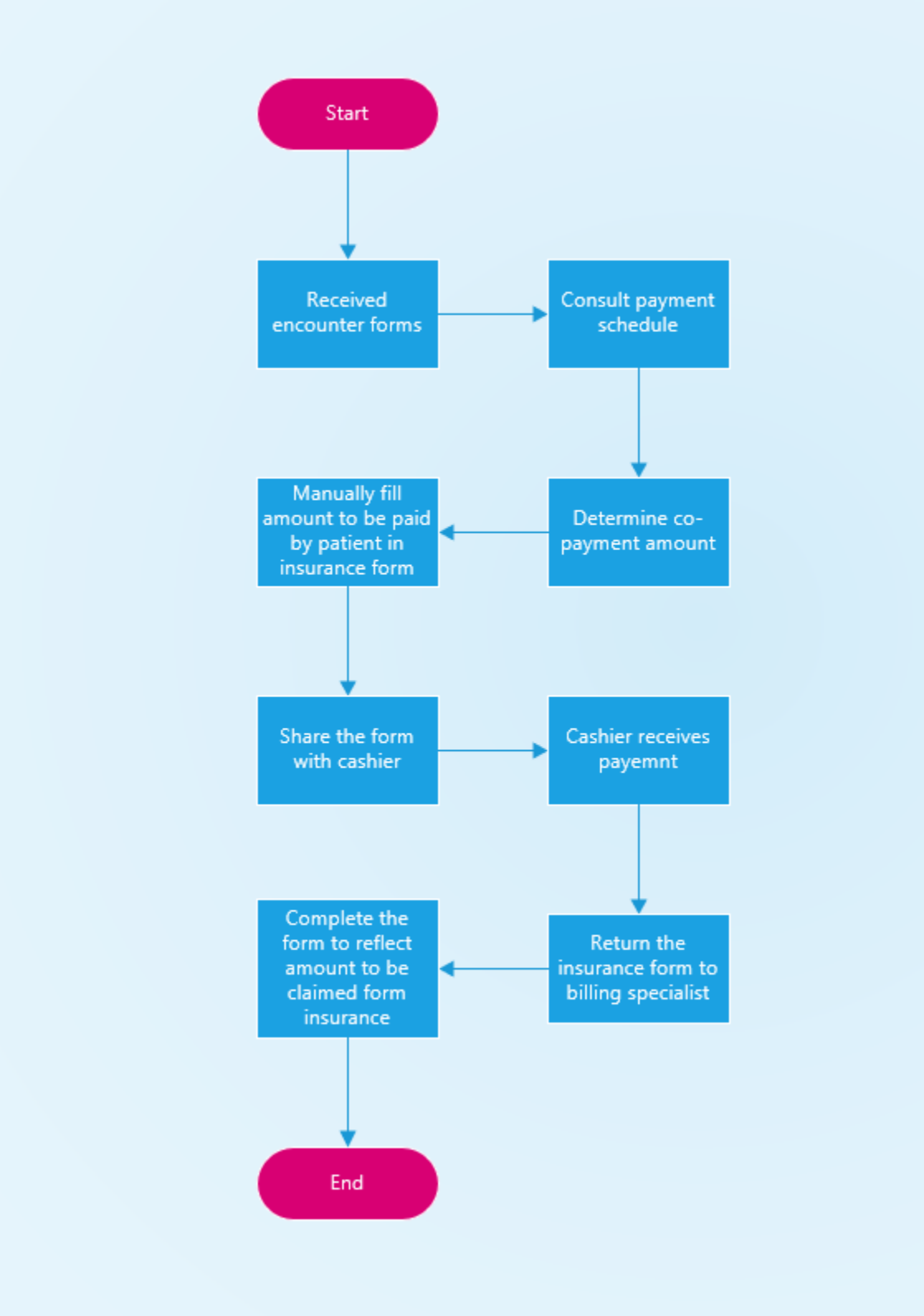
Pharmacy service delivery process flow:



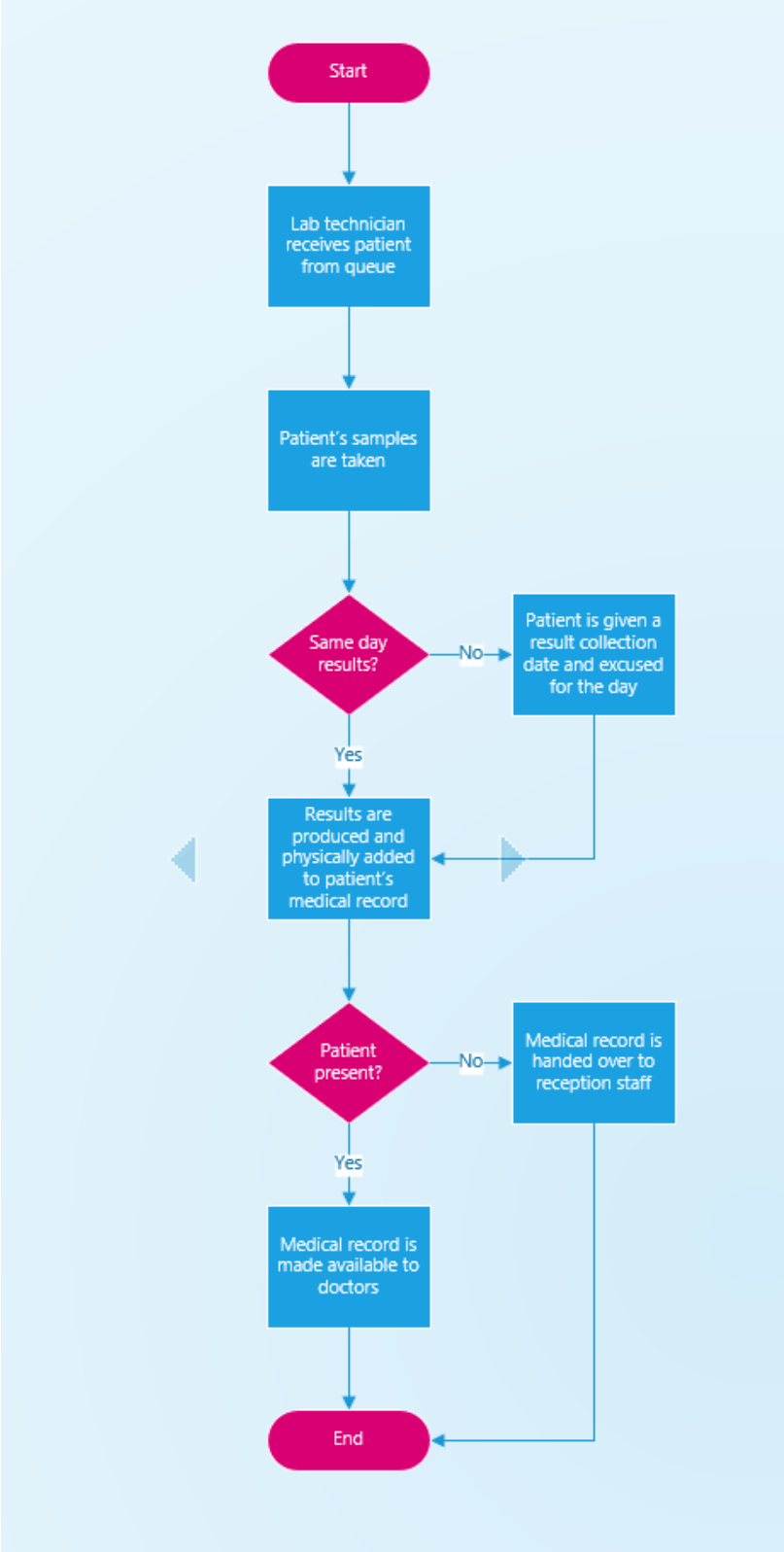
Pharmacy internal operations process flow:



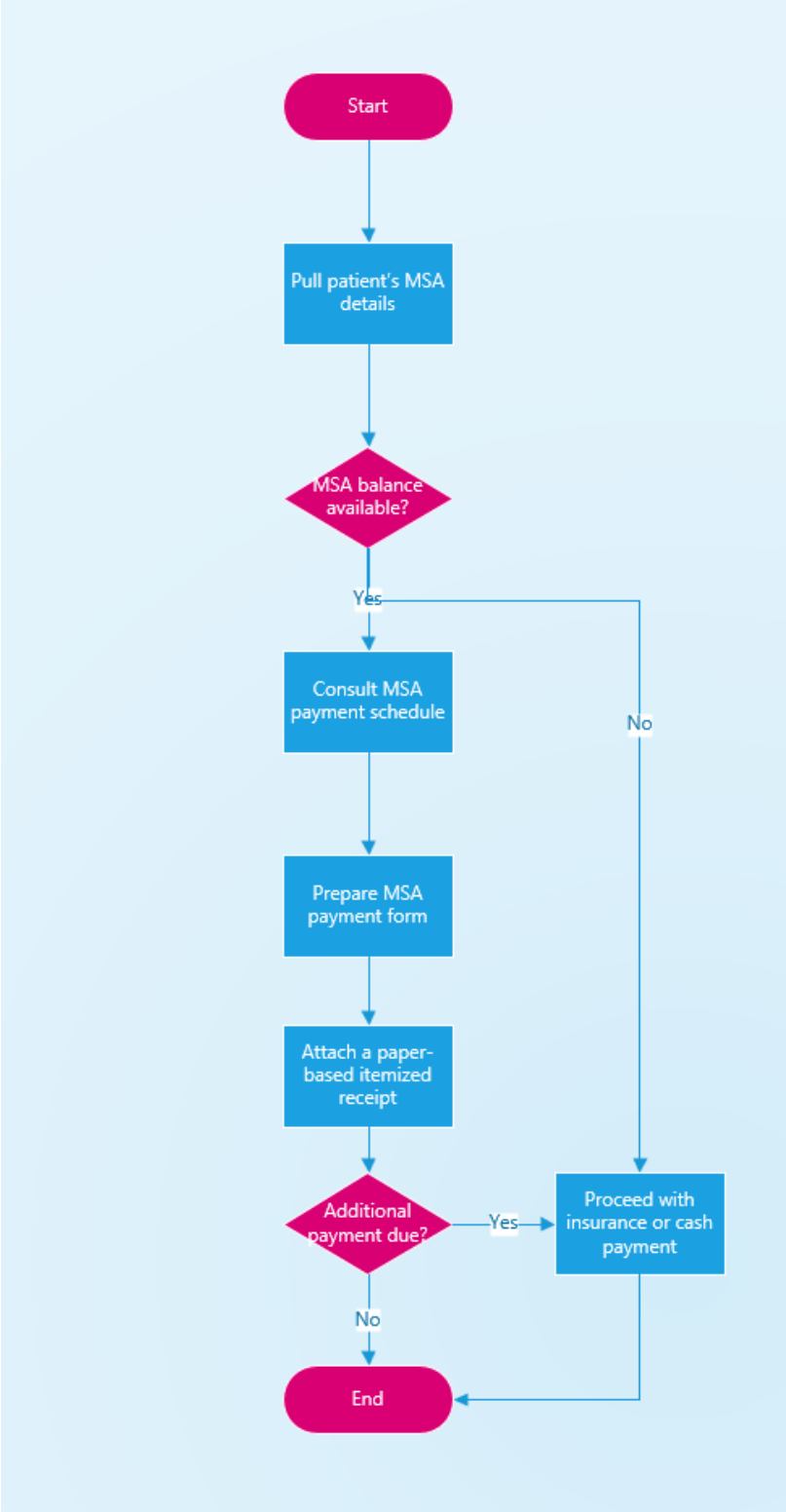
Insurance billing process flow:



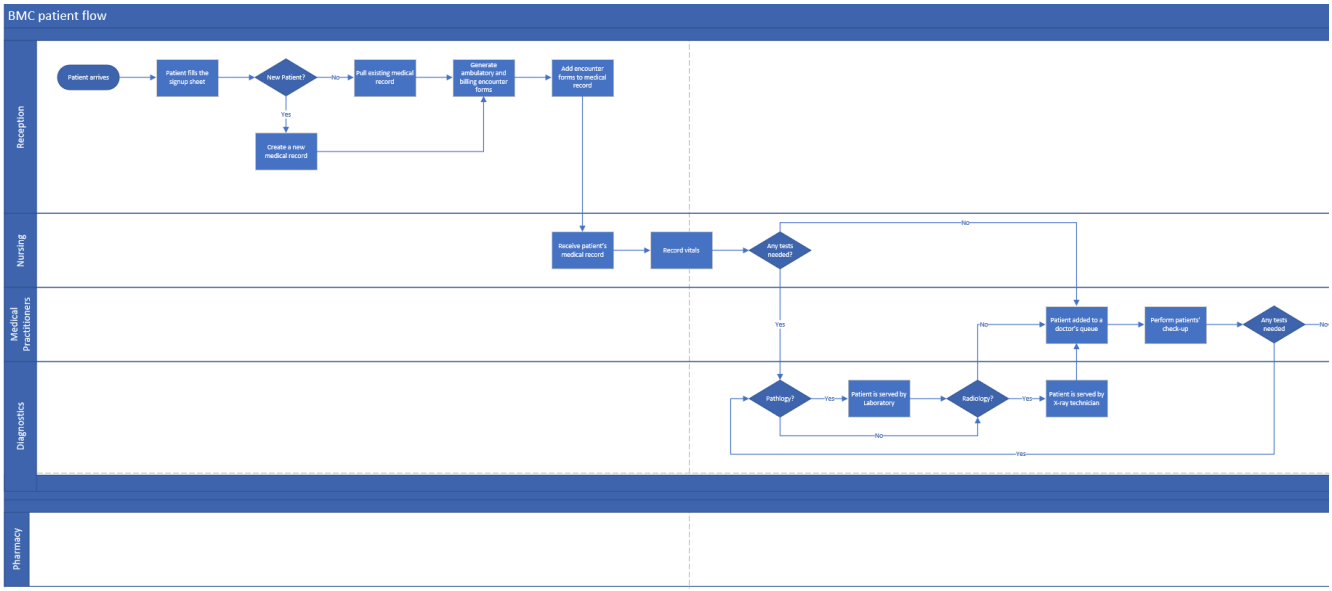
Lab process flow:

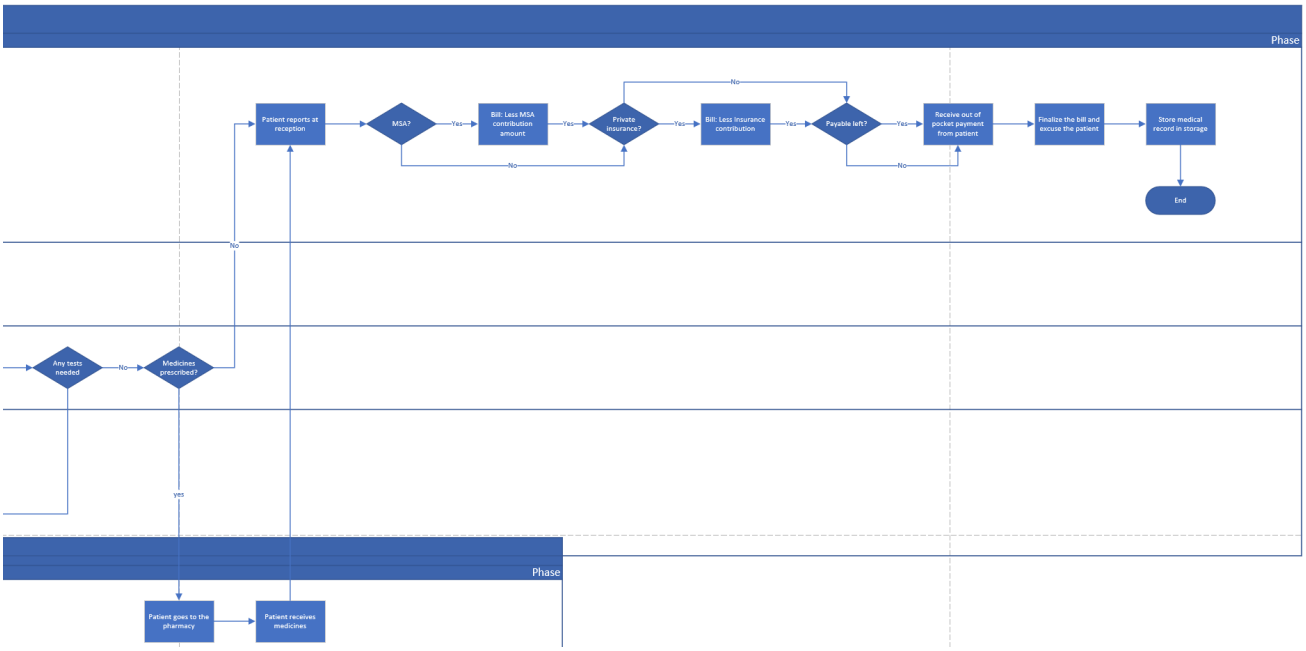


Medical Savings Account (MSA) billing process flow:



Patient flow (see the Visio file provided with the report for exact flowchart):





Appendix B.

Decision matrix for selection of solution for BMC's inventory and sales management problems.

	Description	Custom DataBase	Intuit POS	GenSolve
1	*Cost/ user*	Free	$1,360	$66.5 / month
2	*Total cost (after discount) - 2 users*	Free	$2,560	$121 / month
3	*Time for implementation*	4-6 weeks	2-3 weeks	Unknown
4	*Compatibility with QuickBooks financial software*	No	Yes	Unknown
5	*Continuous training and operating support*	No	Yes	Yes
6	*Future updates*	No	Yes	Yes
7	*Troubleshooting support*	No	Yes	Yes
8	*Reporting*	Limited	Detailed and cusomizable	Detailed and cusomizable
9	*Main purpose of software*	Pharmaceutical inventory tracking	POS and Inventory management	Complete practice management
10	*Comments*		Trial version has been explored, and it meets BMC's requirements.	Cloud based practice management solution. If this solution is considered a worthy option, a demo can be requested from GenSolve. The information presented here has been taken from Gensolve's UK website. Gensolve is also available in Australia and NewZealand. However, it is unknown whether Gensolve will be able to provide its services in Palau - there can be certain health data restrictions which may prevent Gensolve from moving data stored in its UK or Australia serves out of those countires. For 4-7 Full Time Equaivalent (FTE) medical practioners, the cost will be $160 per FTE practitioner.

Appendix C.

Intuit Point of Sales software implemented at BMC.