Sabbatical Leave Final Report

Masters of Science in Medical Informatics

Sabbatical period January 4 to June 3, 2016

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Description of Sabbatical Leave

The purpose of my sabbatical leave was to complete my Masters of Science in Medical Informatics (MSMI) degree from Northwestern University. I began taking courses towards this goal in January 2012, to help expand my clinical pharmacy and teaching skills. I was required to complete a capstone project to earn the degree, which I could not successfully do while also working full time.

While on sabbatical leave, I completed my final two courses in the Medical Informatics Masters of Science Degree program. The first ½ of the sabbatical was focused on completing the requirements for the Health Care Operations course. This course focused on operations within a health systems setting. Health systems include the hospital and the associated ambulatory care clinics (i.e. outpatient doctors' offices). Weekly attendance included the required readings and participation in focused discussion board postings. For the discussion board postings, I was required to provide an evidence-based response to a health care operations topic posed by the course coordinator. I was also required to comment on my fellow classmates posts and respond to their questions/comments on my posts.

The major project in this course was recorded presentation that I helped develop with 3 classmates. Our presentation, titled "Enhancing Surgical Safety with RF Sponges", was aimed at the hospital's board of directors to pitch an informatics solution to a problem faced at the hospital. We chose this topic because leaving sponges inside a patient after a surgery/procedure is a significant problem that is a very costly mistake for both the patient and the health system. One medical informatics tool to help combat this issue is the radio frequency (RF) sponge system. The sponges in this system have a chip that emits radio frequency that helps surgical teams count sponges used to prevent them from leaving a sponge inside of a patient. My specific role in this project was three-fold. First, I develop the material for slides 10 (Is This an Issue for Our Organization?) through slide 14 (Cost Benefit for Our Organization). The slides for the presentation can be found in Appendix A below. Next, I reviewed the material of my groupmates to make sure the information was accurate and that we had a cohesive presentation. I also received feedback from my groupmates that I incorporated to improve my material. Finally, I presented my material during the presentation recording. In addition to creating our group's presentation, we were also required to review, comment on, and score the presentations for the other groups' presentations.

The second ½ of the sabbatical was focused on completing the Capstone Project Course. The Capstone project was designed for students to demonstrate that they were able to apply the knowledge learned in the MSMI degree program. This course required that I participate in weekly discussion board postings related to various topics within the degree program. This was similar to the discussion board postings in the previous course. The only difference is that some of the postings were focused on components that were used in our capstone projects so we had to give and receive feedback on our various capstone projects.

The capstone project was an individual project. I chose a project from a list of eight hypothetical case scenarios. The premise of this project was to serve as a medical informatics consultant for an organization within the health care system. I chose to work on the Social

Determinants of Health scenario (see Appendix B for the details of the assignment and case scenario). My client in this case was a commercial health insurance plan that participated in Michigan's Marketplace health insurance exchange program. The main problem in the case was that patients were using over utilizing the emergency room (ER). I was tasked with developing a detailed plan for how this organization could address this problem. The major component(s) of the plan needed to contain a medical informatics related solution.

The project was broken up into two parts. For Part 1, I conducted an extensive literature search related to the case scenario and developed an annotated bibliography. Part 1 was then sent to an expert in the field for review and feedback. I chose to send this to Mitzi Wasik, Pharm.D., BCPS, who is an expert in the managed care field. Additionally, she works for Aetna, a major commercial insurance company so her expert opinion was highly related to this clinical scenario. After I received her feedback, I updated my annotated bibliography and wrote the literature evaluation. Part 1 of the project can be found in Appendix C below.

Part 2 of the project was to develop the consultation packet, in a proper, real-world format. Part 2 was also sent out for real-world expert review. I again sent this out to Mitzi Wasik and used her feedback to improve the proposal. I also utilized data from her organization to help with the cost components. I also sought input from Mary Frances Ross, Pharm.D., MPH since she has a public health degree and she works in a Federally Qualified Health Clinic. She was a good expert to consult since social determinants of health is a significant public health issue and her clinic deals with many of the patients described in the case scenario. Finally, I sought feedback from Judith Heyman. She has worked with various projects that require her to put together and/or review project proposals. Her input was largely editorial in nature and providing expertise on how to put the proposal together in such a manner as to capture the attention of the client. The major recommendations required a technological and non-technological, multimodal approach. The recommendations I developed included the following components:

- Predictive analytics identifying patients who over-utilized the emergency department
- Developing a multidisciplinary care team to manage the program
- Increasing patient access to care and health foods
- Implementing changes to improve medication adherence
- Assessing health literacy and implementing measures to address inadequate health literacy
- Providing instruction on navigating the health care system
- Developing educational materials.

The proposal also contained a detailed cost analysis and monitoring plan to ensure that the program is working and what areas need to be improved after implementation. The Part 2 document can be found in Appendix D below.

Classes Taken

Class Title	Course Number	Achievement
Health Care Operations	MED INF 404	A
Capstone Project	MED INF 498	A

After successful completion of the Capstone Project course, I was awarded the degree of Master of Science in Medical Informatics (see Appendix E below for a copy of my diploma)

Future Plans/Impact on Professional Responsibilities

I have already begun incorporating the newly acquired knowledge in the medical informatics sessions I teach to the College of Pharmacy students. I revamped the Medical Informatics session in the Drug Information & Clinical Literature Evaluation (PHAR 540). I was able to get the students involved more actively in evaluating medical informatics and how it will impact them as future pharmacists. I also teach an Informatics session in the Practice Management II (PHAR 525) course. I plan to revamp this lecture to incorporate the lessons learned in the Health Care Operations course as well as my work on the capstone project since all of the projects I worked on in those courses were related to the management field.

An additional area that I have become interested in while earning this degree is the use of games (an informatics tool) to educate individuals about medically related subjects. Based on this interest, I attended the Games Learning Society conference in August 2016. That conference sparked an idea for the development of a new game that will help students learn about clinical trial design, which is a major component of the PHAR 540 course. The game will be a choose your adventure type game that will allow students to learn about how observational and experimental studies are conducted properly in the medical field. The plan is to develop the project during the Spring/Summer 2017 semester for implementation in Fall 2017 semester. The hope is that this will be designed well enough that this game can be rolled out to the health care field to help health care practitioners understand study designs and methodology so that they can better evaluate the literature. A better understanding of the literature will ultimately lead to better patient care.

This degree will also help me develop new educational opportunities for students. Dr. Billie Anderson was recently hired to develop a data analytics certificate program as well as serve as the Informatics Chair. The ultimate goal is to also develop a medical informatics degree program at the University. The plan is to work with Dr. Anderson to provide insight into the development of those programs. Additionally, I plan to work with her and figure out a way to develop an elective medical/pharmacy informatics advance pharmacy practice experience (APPE). Currently there are not a lot of opportunities for students interested in informatics to gain additional experience while in pharmacy school. The development of an informatics related APPE will give the students an opportunity to distinguish themselves within the curriculum.

Final Thoughts

The focused work on the projects in these final two course, particularly the capstone course, gave me valuable insight into the current landscape of medical informatics. The knowledge gained has given me a new vocabulary and a new understanding of the complexity of the health care system and the technology used within it. Additionally, these newly acquired knowledge and skills will allow to do pursue research in areas that I would have been unable to do prior to gaining this new degree.

Appendix A: Presentation Slides & Notes

1

ENHANCING SURGICAL SAFETY WITH RF SPONGES

Medical Informatics 404 Winter 2016

Allison Bernknopf, Jeannine Linsday, Megan Piotrowski, and Rajesh Sarvadhavabhatla

Why we're here today

2

- Have identified surgical safety and foreign objection retention as a significant issue for our organization
- Agenda:
  - Provide analysis of problem
  - Propose patient safety and cost-saving solution in alignment with our strategic safety plan

Why Address Surgical Safety

3

Joint Commission Sentinel Event
- Issue 51
- Sentinel Event Policy/Procedures

NoThing Left Behind Project
- Policy

National Scope of the Problem

4

Retained surgical items (RSIs) occur 39 times per week in the U.S

A falsely correct sponge count occurs in 1 in every 7,000 surgical cases

69% of RSIs are surgical sponges

Nearly 88% of all retained objects occur when sponge counts are thought to be correct

- Study: for every 68 RSI events, there are 34 near-misses

Causes Of Sponge Retention

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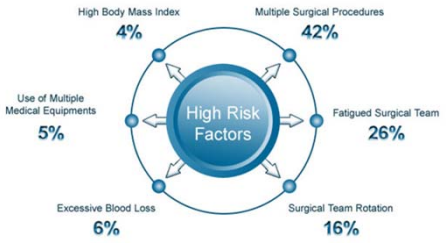
- Unmarked Sponges
- Emergencies
- Unplanned changes to surgery procedure
- Multiple surgeries performed at the same time
- Human and instrument distractions
- Error in initial count
- Lack of training, non compliance to protocols and communication failure

Risk Factors for Retained Surgical Objects

6



Consequences

7

Retained sponges result in costly re-operative expenses, legal battles and a compromised hospital reputation
CMS stopped paying for “never events” in 2008
Average unreimbursed procedural cost for a retained foreign object is $77,512
Average malpractice settlement cost: $327,726
Average malpractice legal defense cost: $43,258
Surgical infections occur in 43% of cases, with an average cost of $25,543 per patient

Patient Safety First

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- Inadvertent retention of foreign objects can cause serious patient harm.
- May require further treatment, readmission and extended hospital stay
- Increased chance of litigation and negative publicity.
- Visually searching for missing sponges lengthens procedure time, increases the risk of infection and exposes the patient to prolonged anesthesia.

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Patient Safety First

- RF sponge system allows automatic tracing of sponge body retention.
- Removes human error and burden on OR staff
- Timely tracing and more efficient than X-ray detection
- Timely tracing reduces infections due to retained objects.

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Is This an Issue for Our Organization?

8 Unintentionally Retained Sponges

$540,000

Start of my presentation material

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What Is The Solution?

Proposing to implement RF technology
- Easy of use and accurate
- Reduces anesthesia time
- High patient and medical staff satisfaction
- No radiation exposure - avoids X-Ray

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The Technology

RF Assure Detection System X

RF Assure Delivery System

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How Effective is RF Technology?

100% Specific

100% Sensitive

versus

Annual Cost Savings $404,206

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Cost Benefit for Our Organization

- Estimated cost of sponges
  - $184,800
- Estimated cost of wand covers
  - $6,552
- Total Estimated Costs
  - $191,352
- Saved Medical and Legal Costs
  - $540,000
- Saved OR Time
  - $125,000
- Saved Radiography
  - $30,000
- Total Saved Costs
  - $695,000

Annual Cost Savings = $503,648

End of my presentation material

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Implementation Planning

- In-Scope Patients
  - Surgeries: thoracic and open abdominal procedures, including C-sections
  - Vaginal deliveries
- Change Management
  - Implementation of new policy
  - Identify physician champions
- Training
  - Surgeons, nurses, and surgical technologists in use of RF technology
  - Circulator nurses for additional EHR documentation needs

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Minimal Impact to Current Workflows

- RF technology is an adjunct to current best practices used by our surgeons and nurses
- Current counting procedures, as part of safety “time outs,” will not change
- New RF scanning step occurs prior to body cavity close or after vaginal delivery
- Scan occurs even if pre and post procedure counts match
- Minimal additional documentation in the EHR
- No expected productivity losses

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Surgical EHR Enhancements

- RF technology will require minimal changes to the EHR
- Surgeon preference cards for procedures updated to include appropriate RF sponges
- Additional rows added to current circulator nurse documentation areas (shown below)

RF Wanding	11/1/2015	
	1100	1400
RF Wanding		
Was the RF Wand Utilized?	List	List
Results of RF Wand	List	List
Surgeon Notified of Outcome?	List	List
Action Taken for Detected Sponges	Free Text	Free Text

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Implementation Monitoring

- Measuring improvement and value
  - Ongoing monitoring of key performance indicators
  - Number of sponge detections
- PDSA Evaluation
  - Pilot against Control - Joint Commission
  - Implementation hospital-wide; phased by service
  - Ongoing assessment
- Provider and nurse satisfaction
  - Useful for subsequent implementations
  - Beneficial for recruiting new staff

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Our "Ask"

- Seeking the Board's approval to form a cross-functional project team empowered to contract with an RF vendor and implement this technology at our facility
- Seeking $ for initial capital outlay to acquire equipment for each of our surgical suites
- Goal: implement solution within next year

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RF Assure Video

A short video that demonstrates RF Assure's sponge technology may be viewed here:

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Appendix B: Case Scenario

MED_INF498 DL – Capstone
Case-based Project Scenario Options

Background – This document provides **8 scenarios** from which you may choose in selecting a topic on which to base your two-part Capstone project. You will find more detailed information on the Assignments pages about expectations, deliverables and formatting for Parts 1 and 2. For this assignment, you will assume the role and perspective of a consultant. As a foundation for your work, maintain a clear line of sight to national priorities to leverage health informatics to achieve the **"Triple Aim:"** better care for individuals; better population health; and lower costs without compromising access to care or patient safety.

Global instructions - Regardless of which scenario you choose, your task is to:

- Research and develop a proposal to address the identified need or problem;
- Fully educate your client on relevant information and considerations;
- Prepare the client with strategies to solve the problem or fill the need; and
- Position the client for success by leveraging health informatics. I

In addition to your own research, another assignment element calls for you to reach out into the professional, consumer, or patient community to add an **"experiential"** component to the development of your research and proposal. To accomplish this, you will identify at least one trusted, knowledgeable individual with expertise related to the challenge presented in your chosen scenario. You will reach out to one or more such experts to review your draft Annotated Bibliography as you prepare Part 1 of this assignment. You also may reach out again for additional expert review and comment as you complete your Annotated Bibliography and move on to your Literature Review. Your interaction and experience with your chosen expert should be included in your Part 1 submission. Once again in your Part 2 work, you are again asked to reach out to the same expert, or another of your choosing, for another round of review, comment and constructive feedback on the client proposal you will prepare as Part 2 of the assignment. Be sure your project management and timetable for development factor in sufficient time to identify and contact at least one such expert, and to interact effectively to gain timely, valuable input.

Additional resources - The federal Agency for Healthcare Quality and Research (AHRQ) has provided a useful resource in this workflow and usability toolkit: http://healthit.ahrq.gov/portal/server.pt/community/health_it_tools_and_resources/919/workflow_assessment_for_health_it_toolkit/27865.
Here is a link to another useful AHRQ reference: http://www.innovations.ahrq.gov/

- Sufficient background on the design of the Transforming Clinical Practice Initiative to enable the client clinical practice to understand the scope and scale of anticipated practice transformation, and the level of support this Initiative will offer to achieve it;
- Clarification on how this initiative, if implemented by the client, would interact with other, comprehensive quality improvement strategies already in place, and in which the client practice already participates;
- Detail on how collaborative, peer-based learning networks are used in the Initiative to facilitate large-scale practice transformation.

Scenario 8: SOCIAL DETERMINANTS OF HEALTH

Your client is a commercial health insurance plan that participates in your state's Marketplace health insurance exchange program. A number of the health plan's nurse managers have reported a substantial uptick in frequent, multiple enrollee visits to hospital emergency rooms (ERs) in a major metropolitan area of the state. Mining available reports and data, the nurse managers have compiled a composite sketch of a typical enrollee who is making these multiple return visits to the ER. The client health plan has asked to you review and analyze these characteristics, and to make recommendations for developing a collaborative, strategic intervention plan to evaluate and respond to social determinants that impact enrollees' long-term health and wellness. Your proposal will recommend ways the health plan can coordinate with health care providers, in the target metro area and beyond, to address factors outside their walls, in the communities where enrollees' live, which have significant impacts on enrollees' health, adherence to drug treatments, and ability to control chronic conditions. Your recommendations should take into consideration, and suggest detailed responsive strategies for addressing, the following common traits and characteristics of the typical enrollee at issue, who:

- Is between the ages of 55-60, and employed;
- Has been diagnosed with diabetes, hypertension, chronic lower back pain, and anxiety;
- Is prescribed multiple prescription drugs to manage these chronic conditions, but doesn't always fill them when they run out;
- Should be visiting a primary care physician 4 times/year, but only goes when necessary to secure prescription refills;
- Is documented during ER visits (typically 4 within a 6-month period) to have blood sugar readings ranging from dangerously low, to highly elevated, indicating poor diabetes control;
- Reports skipping both meals and pills when money is tight;
- Shops in a relative "food desert" due to lack of grocery stores in the neighborhood;
- Reports going to the ER instead of the PCP's office to afford absence from work for a daytime office visit;
- Experiencing heightened stress due to life events such as death of a spouse or close family member; loss of employment or taking on financial responsibility for an unemployed family member; insecurity about having enough income to afford food, drugs and/or housing.

Appendix C: Capstone Project Part 1

Allison Bernknopf, Pharm.D., BCPS, MMI Candidate

Consulting Project Part 1

Northwestern University

May 1, 2016

Section 1: Literature Review

The Problem

ACB Insurance is a national provider of medical and pharmaceutical insurance for both the private sector and Medicare/Medicaid patients. Currently, ACB has a robust program for Medicare patients to prevent hospital readmissions and improve medication adherence. To prevent hospital readmissions, the predictive analytics team runs algorithms based on a wide variety of clinically valid factors to predict which patients are at a high risk of hospital readmission. Within 3-7 days after discharge, a pharmacist working at ACB is responsible for conducting a medication reconciliation for the patient. Additionally, a multidisciplinary team consisting of in-house nurses, medical directors, and social workers to review the patient's case and work to prevent the patient from requiring a readmission. If the patient lives within a 50-mile radius of their team, the nurse will make an in-home visit with the patient to help develop an individualized plan. If they live in a >50-mile radius, then the contact with the patient is made via the telephone. This process has been used to successfully prevent readmissions and significantly reduce costs. The pharmacy department also has a successful program for Medicare patients to help improve compliance. They use a predictive model to catch patients at risk for non-adherence before they are late refilling their medication(s). The pharmacy team has talking points and ways to help the patients with any barriers to help them improve their medication adherence.

There is an increasing number of privately insured patients as a result of the Affordable Healthcare Act. Currently, ACB has 1,908,650 privately insured patients in Michigan with ~171,779 patients having diabetes and approximately 10% of those patients are between the

ages of 45-64. In working with the nurse managers, it is clear that there is a clear increase in the number of patients in Michigan's metropolitan areas (e.g. Detroit, Lansing) overusing the emergency department (ED). Looking at the data, these patients tend to be 55-60 years old, have chronic diseases/conditions (diabetes, hypertension, chronic lower back pain, and anxiety), have polypharmacy issues, only visit the primary care provider to get refills and not for follow-up visits, and have at least 4 ED visits within a 6-month period often with markers of poorly controlled diabetes (dangerously low or highly elevated). These patients often have issues affording their medications and food and/or have little access to grocery stores. Stressors for these patients include: life events, loss of employment or being responsible for an unemployed family member, and insecurity about having enough money to eat, buy their medications, and/or afford housing. Finally, many of these patients use the ED because they can't afford to take off from work to go to the provider during daytime hours.

It was estimated that 1,374 patients were considered frequent flyers as defined above. Each ED visit can cost an average of $1316 (Truven Helath Analytics) for a total of $7,232,736 over a 6-month period for all of these patients. The total costs for office visits in a 6-month timeframe is estimated to be $398,460, based on a need for these patients to see their provider 4 times over 1 year (Truven Health Analytics). The cost differential would be -$6,834,276 for a 6-month period.

Why is this Problem Occurring?

Significant health disparities exit in the United States (Centers for Disease Control [CDC]). Low socioeconomic status (SES), which is generally based on income and education

level, race, geographic location, community setting, and health literacy have all been implicated as risk factors for health disparities (Atal, 2006; Brittin, 2015; CDC; Choi, 2015; Ford, 2016; Gebreab, 2015; Hunt, 2015; Kangovi, 2013; Nesbitt, 2016; Nguyen, 2014; Sudore, 2006; Walker, 2014). Low SES is associated with 45% less use of ambulatory care services and have the highest incidence of diabetes and obesity (Kangovi, 2013; Nesbitt, 2016). Those living below the poverty line are also 2.5 more likely to be depressed and low SES individuals are more likely to live in a food desert, defined as no grocery or equivalent type stores within a 1 mile radius for urban dwellers and 10 miles for rural dwellers (Nesbitt & Palomarez, 2016). It is important to note that geographic location and SES have been shown to be independent predictors of poor health and thus may have an additive effect when individuals are in both categories (Nesbitt & Palomarez).

Race is another significant health disparity risk factor. Between 2006 and 2010, there were no significant changes between race/ethnicity disparities, except for non-Hispanic black females (CDC). Non-Hispanic black females were able to close the gap a bit with non-Hispanic white females but a significant gap still exists (CDC). A social gradient has been described for health disparities where those from the lower SES have worse health outcomes than the middle and higher SES, the middle SES has worse outcomes than the higher SES and the higher SES has the best health outcomes. Some research has shown that whites have the most consistent gradient, blacks have the least consistent gradient, and Asians and Hispanics have a non-linear social gradient (Nguyen, Moser, Chou, 2014). This shows the complexity of race/ethnicity as it comes to health disparities.

African Americans have been shown to have the most significant health disparities compared to other races/ethnicities (Gebreab, 2015; Hunt, 2015; Nesbitt, 2016). Hispanics tend to carry less insurance, have lower household incomes, and higher rates of diabetes compared to other races/ethnicities (Nesbitt, & Palomarez, 2016). Paradoxically, they tend to also have lower mortality rates compared to other races in other underserved communities (Nesbitt). In one study life expectancy of blacks living in Chicago was 71.1 years, which was 5.8 years below the life expectancy of the overall population in Chicago and 2 years lower than the national average (Hunt, Tran, & Whitman, 2015). Hispanics had a life expectancy of 84.6 years (7.7 years higher than the overall population in Chicago and 1.2 years higher than the national average) (Hunt, Tran, & Whitman, 2015). Whites were in-between blacks and Hispanics with regards to life expectancy in Chicago with an expectancy of 78.8 years (Hunt, Tran, & Whitman, 2015). All three races were significantly different from each other ($p<0.001$ for all comparisons) (Hunt, Tran, & Whitman). Data on disparities with other races/ethnicities are limited.

In addition to outcomes, one exploration found that blacks and Hispanics living in Chicago have differing opinions as to what is important from a health care facility. For example, Hispanics are more likely than African Americans to place a higher importance on anticipated wait times, proximity to home/work, and religious affiliations (Brittin et al., 2015). Another race disparity occurs in the patient-provider status. African Americans often feel that using too much medical jargon is condescending and they tend to have more distrust in health care providers based on past history (Ford, 2016; Nesbitt, 2016). The patient-provider relationship can also have gaps in relation to age, education, employment status, income, health care access, and general health (Nesbitt, & Palmarez, 2016)

Psychological factors have also been studied as factors in health disparities. In young African American and white adults, greater hostility and time urgency lead to a higher risk of hypertension [HTN] (Ford et al., 2016). One study looked at coping flexibility, being able to appropriately use primary and secondary coping skills, and results showed that it can mitigate the effects of perceived stress on health-related quality of life (Atal, & Cheng, 2016). This is especially important for those in low SES environments since they often don't have the necessary resources to employ a primary approach to an unexpected stressor (Atal, & Cheng, 2016). Specifically in African Americans, high "anger-out", depressive symptoms, weekly-stress index, major life events, and cumulative stress were significant predictors of progression in blood pressure. This implies that additional stressors may have a cumulative effect on blood pressure (Ford et al., 2016). Medication adherence, diet, exercise, and diabetes outcomes (e.g. A1C) have all been associated with various psychological stressors [e.g. fatalism, self-efficacy, diabetes distress, and perceived stress to name a few] (Walker, Gebregziabher, Martin-Harris, & Egede, 2014). Variance in A1C has the strongest link to self-efficacy (36%), followed by social subjective status (20%), diabetes distress (17%), education level (13%), and income (11%) (Walker). Fear of losing one's SES due to inadequate safety nets and lack of social support/structure can also be seen disproportionately in those with higher income inequality within their residential community (Choi, Burgard, Elo, & Heisler, 2015). Those living with a higher income inequality are more likely to have a lower self-rated health and greater risk of psychiatric diagnosis than those living in a low income inequality community (Choi, Burgard, Elo, & Heisler, 2015).

Geographic area can also show gaps in health care. In two studies looking at CV risk score calculated using the American Heart Association's risk score (based on 7 metrics: HTN, obesity, diabetes, cholesterol, smoking status, diet, and physical activity) (Gebreab, 2015; Fang, 2012). Poor CV (0 – 2 ideal metrics) ranged from 10% to >18% in the U.S. population compared to only 1% to 4% having ideal rates (all 7 metrics were ideal). Results varied greatly by state with some being significantly lower than the national averages and some significantly better (Gabreab, 2015; Fang, 2012). Michigan was found to have 3% of the state population with an ideal CV score and 10.6% with a poor CV score (Fang, Yang, Hong, & Loustalot, 2012).

Finally, health literacy level (HLL) has been proven to be an independent risk factor for health disparities (Sudore, 2006; Stewart, 2015). In one study, patients with lower HLL tend to be male, black, have less than a high school education, earn <$10,000 in annual income, and were more likely to live in Memphis not Pittsburgh (Sudore et al., 2006). These patients were also more likely to have fair to poor self-rated health, hypertension, diabetes, obesity, and high levels of depressive symptoms (Sudore et al., 2006). When the results were adjusted for education level, the results remained statistically significant (Sudore et al., 2006). These patients were also less likely to practice health preventive behaviors (e.g. have a primary care provider, received the influenza vaccine in the last year, or have insurance coverage for medications) (Sudore et al., 2006). Another study conducted with African American patients found that nearly 19% had low HLL (Stewart et al., 2015). They were more likely to be male, younger, and have a lower education level (Stewart et al., 2015). With regards to outcomes, they had an increased odds of being current smokers, have a poorer self-rating of both general

and physical health, and higher perceived stress (Stewart et al., 2015). They were not, however, associated with mental health or depressive symptoms (Stewart et al., 2015).

All of the research into health disparities make it clear that there are major determinants of health disparities, particularly race, SES, psychological factors, geographic/community factors, and health literacy. Delving further into the research clearly demonstrates that these are interactions between these different factors and it is not easy to determine how much of an interaction there is between all of these factors. Therefore, all of these factors need to be considered when assess risk. This is not always an easy task as not all of these factors are known or evaluated. For example, only certain races have been studied and the implications of mixed races is unknown, since these individuals are often excluded from analyses. Additionally, there is little research in sexual orientation disparities and assessments of gender are often limited to male and female, not accounting for those who identify as other gender types. Finally, health literacy is often not assessed in patients and education level or ability to read is often used as a marker, which is inappropriate.

Suggestions for Improvement

A variety of strategies have been tried to improve the rates of non-urgent frequent fliers in EDs (Enard, 2013; Flores-Mateo, 2012; Murphy, 2014; Nesbitt, 2016; Pearl, 2014; Reinuis, 2013). Technology-based interventions include utilizing the electronic health record (EHR), Health information exchange, telemedicine, and a comprehensive approach by Kaiser that includes the development of internet, mobile, and video technology. Enard and colleagues used a web-based program to identify frequent fliers (Enard, & Ganelin, 2013). A

multidisciplinary team of social workers, case managers, residents, and physicians met to determine an individualized patient plan. These plans could be viewed from the main tracking board by clicking on a specific icon. They were able to reduce ED visits by 10% (98 per month to 88 per month). Kaiser was also very successful in the implementation of their program to improve patient outcomes (Pearl, 2014). They did have some initial issues with resistance from HCPs, reimbursement problems with virtual visits, and financial costs of implementation. The telephone-based, case-management approach saw mixed results (Reinius et al., 2013). They failed to decrease the # of hospitalizations but they were able to decrease ED visits by 20%.

Since ACB Insurance has a successful program identifying medication adherence issues and predictive risk assessment of patients at high risk of readmission, the solution that I am recommending is to expand the current program to address the increase in ED frequent fliers. The analytics department will be charged with developing an algorithm that can identify patients that are at a high risk for being a frequently flier. Starting with the factors that were found in the initial data mining (as noted above), gender, race, SES, income, education level, health literacy, if known, and other factors noted above should also been included to determine if they make the predictive model strong. Finally, looking at the factors that are used currently in the algorithm for high risk of readmission should be evaluated to see how well they predict identification of high risk frequent fliers since many of these will overlap.

Claims data will also be used to find patients who are currently frequent fliers. One change will be to have the social worker go with the nurse or sit in on the phone conversation since these patients have self-identified that they are having support issues. Additionally,

community support workers may be used for consultation to help with community specific barriers/concerns, as these have been noted to be an issue in this patient population.

Another aspect of this will be to help increase access to resources. These patients identified as living an a relative "food desert." Helping gain access to health foods is needed but it cannot stop there. Studies have shown that just providing access will not necessarily improve buy patterns (Cummins, 2014; Elbel, 2015). Therefore, education will need to be a key component to helping improve buying patterns, including helping them shop for healthier foods at fast food restaurants and convenience stores, and learn how to read food labels. Additionally, the HLL of these patients should be assessed and plans adjusted accordingly based on the patient's HLL.

Finally, patients stated that they are using the ED since they have limited access to their healthcare providers. This is consistent with other research that found patients preferred to use hospitals because they were cheaper, especially when you factor in transportation costs, had extended hours, lack of quality care from their primary care provider, and clinics switching to only same-day appointments (Kamgovi et al., 2013). Some ways to help the patients here will be to help the patients find different providers who are closer to public transportation, have extended hours, and provide higher quality of care. Another suggestion is to set up a pilot program with some providers to provide telemedicine appoints. This could be started by allowing providers to have set times for follow-up appointments that are all telephonic or via video conferencing. One suggestion would be to have the provider clear one more every month from 9 – 12 for these telemedicine appointments. These would be scheduled with the patient just as if they had a face-to-face visit. These would be ideal for patients who just need

follow-up evaluation and not a full physical. As long as the appointment is done via audio or video connection and it is synchronous, the provider can bill for it in Michigan as if it were a face-to-face visit (State of Michigan).

Conclusion

The patients identified as a subset of frequent fliers in our privately insured population have some clear health disparities. A multimodal approach utilizing predictive analysis for identification of high-risk patients, patient education, psychosocial support, and providing better access to care are all needed to help improve these outcomes.

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Truven Health Analytics (2013). *Avoidable Emergency Department Usage Analysis*. Retrieved from: http://img.en25.com/Web/TruvenHealthAnalytics/EMP_12260_0113_AvoidableERAdmissionsRB_WEB_2868.pdf?utm_medium=email&utm_source=Eloqua

Section 2: Annotate Bibliography Shared with Expert

1. Kangovi, S., Barg, F. K., Carter, T., Long, J. A. Shannon, R., & Grande, D. (2013). Understanding Why Patients of Low Socioeconomic Status Prefer Hospitals Over Ambulatory Care. *Health Affairs,* 32(7), 1196-1203.

Kangovi and colleagues conducted a qualitative study to determine why patients preferred the hospital over ambulatory care services. Reasons for this preference include cheaper care at the

hospital, better access to care, issues with clinics only doing same-day appointments, issues with timely advice from primary care provider (PCP), and poor quality of care from the PCP. One reason stated was that hospital care was cheaper than ambulatory care services, even for patients with some insurance since they have to factor in higher transportation costs to go to their primary care provider. This information is vitally important because you can't help patients change behaviors if you don't understand why they behave that way.

2. Enard, K. R., & Ganelin, D. M. (2013). Reducing Preventable Emergency Department Utilization and Costs by Using Community Health Workers as Patient Navigators. *Journal of Healthcare Management,* 58(6), 412-428.

Enard & Ganelin conducted a retrospective cohort analysis of a Web-based, multidisciplinary intervention for patients considered frequent fliers of the emergency department (ED). A multidisciplinary team met to develop an individualized care plan for patients that could be viewed by clicking on a yellow icon on the main tracking board. The top 50 frequent fliers were identified and 18-20 completed care plans were in place during the intervention period, which decreased from the number of ED visits from 98 per month to 88 per month. This is a possible solution that could be implemented at hospitals within the network. Frequent fliers could be tagged in the EHR and also referred to this program by ED personnel.

3. Flores-Mateo, G., Violan-Fors, C., Carrillo-Santisteve, P., Peiro, S., & Argimon, J. M. (2012). Effectiveness of Organizational Interventions to Reduce Emergency Department Utilization: A Systematic Review. *PLoS One,* 7(5), e35903. Retrieved from: http://www.crd.york.ac.uk/PROSPERO.

Flores-Mateo and colleagues conducted a systematic review to analyze the effectiveness of interventions to reduce ED utilization from 1985 through 2012. Interventions had to focus on chronic diseases (e.g. diabetes, asthma, COPD) and adults, and looked at included improving access to non-ED primary care, including both increasing numbers of primary care centers/physicians and increasing hours of access. The most effective interventions for reducing ED utilization were primary care accessibility and ED cost-sharing. The ED cost-sharing could be misleading since it may not account for those with low socioeconomic status.

4. Murphy, S. M., & Neven, D. (2014). Cost-Effective: Emergency Department Care Coordination with a Regional Hospital Information System. *The Journal of Emergency Medicine,* 47(2), 223-231.

Individualized plans were developed for frequent fliers (at least 3 visits per year) at the ED and were made available to all participating EDs to access the plan via an electronic patient information exchange system. Patient were referred by the ED physicians and a multidisciplinary team developed the care plan, including identifying the primary care providers (PCP). Frequent users had between 3 and 11 visits per year and extreme users had >11 visits per year. Extreme users had a median of 19 visits during the pre-period, which was reduced by

15 visits during the 2-year intervention period compared to frequent users who had a median of 7 visits during the pre-visit, which decreased by 5 during the intervention period, thus reducing users' hospital costs were by $6091 and $1285, respectively. Thesedata are useful because it shows cost savings for various levels of frequent fliers.

5. Rahman, S., Chang, A. M., Alqatari, M., & Pines, J. M. (2013) Non-emergency Department Interventions to Reduce ED Utilization: A Systematic Review. *Academic Emergency Medicine,* 20, 969-985.

This systematic review focused on non-ED interventions to reduce unnecessary ED utilization. Interventions included, patient education, accessibility to ambulatory care services, pre-hospital diversion, managed care, and patient financial incentives. Each of the interventions showed mixed results. While many of the interventions are non-technology based, they could be enhanced by the use of technology. For example, the patient education could be enhanced by leveraging available mobile apps and the use of telemedicine to make the PCPs more accessible, even during normal business hours.

6. Suffolk Care Collaborative (n.d.). *Evidence-based Strategies for Disease Management in High Risk/Affected Populations: Diabetes.* Retrieved from: https://suffolkcare.org/sites/default/files/Evidence-Based%20Strategies%20for%20Disease%20Management-%20Diabetes.pdf

The Suffolk Care Collaborative is seeking to improve patient care by identifying individuals with diabetes and empowering them to improve their self-care. Providers will enter data through the health information exchange which will populate Cerner's HealtheIntent so the data can be used to determine where resources and efforts should be allocated. Patients deemed to be high-risk will be assigned to a care manager and patients will have access to the Stanford Diabetes Self-Management Training. This could be another good example of an effective model for improving diabetes care.

7. Reinius, P., Johansson, M., Fjellner, A., Werr, J., Ohlen, G., & Edgren, G. A Telephone-based Case-management Intervention Reduces Healthcare Utilization for Frequent Emergency Department Visitors. *European Journal of Emergency Medicine,* 20, 327-334.

A randomized controlled trial was conducted to determine if a telephone-based case-management intervention run by nurses could improve hospital utilization for patients who frequently overuse the ED (3 or more visits in a 6-month period). Patients would come in and meet with the nurse manager to develop an individualize care plan, then nurses contacted patients, on an average of every 11 days, to facilitate interactions between the patient and their health care providers as well as social services. Patients had chronic conditions, although diabetes was not one of the conditions. While there were no differences in the number of hospitalizations, there was a 20% decrease in ED visits (RR 0.77, 95% CI 0.69-0.86) and

improved quality of life of the patients. This type of intervention can be accomplished by utilizing nurses/pharmacists at the insurance company.

8. Pearl, R. Kaiser Permanente Northern California: Current Experiences with Internet, Mobile, and Video Technologies. *Health Affairs,* 33(2), 251-257.

While the U.S. has been slow to incorporate technology to engage patients, Kaiser Permanente has been successful utilizing technology to improve patient care and reduce costs. Since 2008, Kaiser has been utilizing electronic health records, and developed online, mobile, and videos for patients. Some obstacles faced include resistance from HCPs and issues with reimbursement for virtual visits, and the financial costs of implementation. The issue with the virtual visits could be overcome as states now have laws in place for telemedicine and billing can be done for telemedicine services depending on how they are conducted. The Kaiser model could serve as a model for how to successfully implement a program to help patients who are over utilizing the ED.

9. Caburnay, C. A., Graff, K., Harris, J. K., McQueen, A., Smith, M., Fairchild, M., & Kreuter, M. W. (2015). Evaluating Diabetes Mobile Applications for Health Literate Designs and Functionality, 2014. *Preventing Chronic Disease Public Health Research, Practice, and Policy,* 12, E61. Retrieved from: http://www.cdc.gov/pcd/issues/2014/14_0433.htm.

Mobile apps for diabetes were evaluated to determine how health literate they are, including comparing free and paid apps. Paid apps ($0.99 to $29.99) were more likely to use common language, avoid medical jargon, use active voice, label links clearly, and have a back button. It is not clear based on the research if the more expensive apps were the ones that were more health literate or if the cheaper apps were also more health literate than the free ones and cost of apps could be a problem for patients with low socioeconomic status. This could be important for the current problem since health apps could be one of the ways to help patients become more controlled and develop healthier lifestyles.

10. Ornstein, B. W. (2013). *The Best Smartphone Apps for Diabetes Management.* Retrieved from: http://www.everydayhealth.com/diabetes/the-best-smartphone-apps-for-diabetes-management.aspx

Patients ruoutinely have their phones with them wherever they go. Diabetes apps can help patients track their glucose readings, carbs, and exercise among other things. Benefits include the ease of recording, reminders and recommendations for low/high blood sugars. Disadvantages can be the cost of some and they can become “tiresome” after a while. Some apps that were recommended include Diabetes Buddy, Diabetes Pilot, Glucose Buddy, and iDiabetes. These can be very useful tools that would be part of an education intervention.

11. Scheibe, M, Reichelt, J., Bellmann, M., & Kirch, W. (2015). Acceptance Factors of Mobile Apps for Diabetes by Patients Aged 50 or Older: A Qualitative Study. *Meidicne 2.0,* 4(1). Retrieved from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4376102/

There are a large number of patients over the age of 50 with diabetes but many of these patients do not utilize available apps to help them manage their disease. A qualitative evaluation of 32 patients was conducted to determine what factors influence their acceptance of diabetes apps. About 1/3 of the patients considered themselves "highly interested" in new technology and 13% were not interested at all. Only 25% of the patients actually owned a smartphone and only 2 patients had already used an app for their diabetes. Some of the reasons for not using the apps included: lack of additional benefit, training needed to use the apps (particularly for those who don't currently use a smartphone/tablet), high financial cost-benefit ratio, data privacy, and lack of interoperability between devices. When some apps were tested, most patients felt that the apps were not functional, usable nor easy to grasp. Some of the patients did feel that the apps had a positive impact on their monitoring. Looking at why patients over the age of 50 and what they prefer in a diabetes app can have a significant impact on whether or not the patient will use an app. These preferences can also be taken into effect to help develop an app that will appeal to patients over the age of 50.

12. Shah, V. N., & Garg, S. K. (2015). Managing Diabetes in the Digital Age. *Clinical Diabetes and Endocrinology,* 1. Retrieved from: https://clindiabetesendo.biomedcentral.com/articles/10.1186/s40842-015-0016-2

Many technologies have been developed to help patients with diabetes to help patients get information on diabetes as well as self-manage their disease. There are several mobile apps and online sites/programs available for diabetes, healthy eating, and physical activity. Many of these technologies have yet to be proven effective for improving diabetes outcomes, with most of the studies being observational or underpowered. Barriers to the use of digital tools include: cost, lack of evidence, socioeconomic factors, data protection, data security and regulatory barriers. Various technologies discussed here may be viable options for this patient population.

13. Smith, A. (2015). *Pew Research Center: U.S. Smartphone Use in 2015.* Retrieved from: http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/

Data in 2015 show that 64% of U.S. adults own a smartphone and some patients are dependent on their smartphone to access online services and information. Around ½ of these dependent uses have had to cancel service due to financial difficulties and 1/3 of these dependent users also reach their data maximum. Older adults tend to use smartphones for more basic functions, keeping up with breaking news, and sharing and finding info about community events, while African American and Latino users also use the smartphone to look up public transportation more than white users. How older adults that own smartphones utilize them can have a significant impact on whether or not they will be able to use their device effectively

to help them manage their diabetes, including finding information about the disease. Additionally, users may need to find public WiFi hotspots to be able to utilize the phone but this can increase data security concerns.

14. Cummins, S., Flint, E., & Matthews, S. A. (2014). New Neighborhood Grocery Store Increased Awareness of Food Access but Did not Alter Dietary Habits or Obesity. *Health Affairs,* 33(2), 283-291.

It is speculated that providing access to grocery stores and supermarkets can lead to improved health outcomes. In Pennsylvania, a supermarket was opened in "food desert" to help patients improve their buying habits. While this helped improve awareness to access, it did not change buying habits of the residents. This likely means that simply providing access to healthier foods will not be enough to help patients make behavioral changes.

15. Elbel, B., Moran, A., Dixon, L. B., Kiszko, K., & Canto, J. (2015). Assessment of a Government-subsidized Supermarket in a High-need area on Household Food Availability and Children's Dietary Intakes. *Public Health Nutrition,* 18(15), 2881-2890.

It is suggested that improving access to healthy food would improve healthy eating through better purchasing of food. The Healthy Food Financing Initiative, provided by the U.S. federal government has supplied over $500 million to set up better food access across the U.S. Providing access to more food options failed to provide a difference in buying habits for parents. One major limitation of this study is that many participants were already shopping in supermarkets so it is not clear exactly what these healthier food markets provided over the supermarkets. While this study was focused on children, it does add to the body of evidence that just providing access to food is likely not enough and education and behavior modification strategies are likely needed to help improve grocery buying.

Section 3: Feedback from Experts

I currently work for Ferris State University as a pharmacist/professor for the College of Pharmacy, and I don't have a traditional clinical practice. In selecting a scenario, I chose one that would challenge me the most since I tend to learn the most with that approach, which is how I wound up with Scenario 8. I decided to utilize the expertise of two different experts. Both are clinical pharmacists working in two different areas of the healthcare sector. The main expert is Mitzi Wasik. Mitzi is a clinical pharmacist who has specialized in managed care pharmacy. Currently serves as the Director of Pharmacy Programs at Aetna. The other

pharmacist is Mary Frances Ross who is a clinical pharmacist/professor with the Ferris College of Pharmacy. I utilized her expertise as an ambulatory care pharmacist. Mary Frances works in a federally qualified health center (FQHC) and also obtained her Maters in Public Health a few years ago. While both of these individuals were on the clinical side, they did offer different perspectives.

Feedback from Mitzi: One major note was about the lack of background information that looked at low socioeconomic status (SES) and health disparities or cultural competence. One thing she commented on was that the data might all be in Medicaid or Medicare patients since, in her experience, these patients tend to be covered with one of those plans rather than true commercial coverage. She also suggested looking at quality of care by state. The other big suggestion she had was looking at predictive analysis. This is what the insurance companies are relying heavily on, at least for the Medicare/Medicaid populations. After additional research (see below for Additional Research), I gathered more information from Mitzi about how they were doing their predictive analysis and what they were doing with their results. The focus of her work with Medicaid patients, and her team of 20 pharmacists, include doing a medication reconciliation within 3-7 days of discharge from the hospital. They also have a large team of nurses, medical directors and social workers making up their multidisciplinary team looking to help keep patients from being readmitted to the hospital. The analytics team runs algorithms based on multiple factors that identify high-risk members versus non-risk members for readmission. If the patient lives within a 50-mile radius, the nurse goes to the patient's house for follow up but if >50 miles the nurse will contact the patient via telephone. In her organization, commercial patients have case management but it is not as intense and is disease state focused, which also differs from market to market. For Medicare patients they have a mandatory benefit for all members, called an in-home assessment and that is typically outsourced.

This led me to some very interesting and rich data that I had not found in my initial bibliography. While reviewing some of those resources an idea occurred to me about being able to use our claims data to determine if patients are not refilling their medications on time. Since I didn't know the inner workings of these programs, I asked Mitzi if she was able to identify patients who were non-compliant. She responded by saying that they have a whole model built to do predictive analysis to catch patients before they are late in their refill so they can help with any barriers. The data are real time and usually only 24-48 hours old. Their model runs bimonthly but plan is to run them weekly. Based on this information, and some information from the literature, I developed additional details for an organization that I will be consulting for.

My consultation with Mary Frances happened after I had done a bunch of additional research. She did not have much more to add than Mitiz. She did find one resource that she sent me on health literacy (HL) and technology. She also discussed some of the barriers to implementing some of the components I was suggesting. For example, one technology that I am suggesting piloting is telemedicine. Mary Frances mentioned that it has to be done appropriately. Our discussion also reminded me that I needed to verify if my chosen state (MI) really allow for

reimbursement of telemedicine consultation services. She also pointed out that I need to make sure that by implementing these strategies, that this was cost effective.

Section 4: Additions to the Annotated Bibliography

16. Nesbitt, S., & Palomarez, R. E. (2016). Increasing Awareness and Education on Health Disparities for Health Care Providers. *Ethnicity & Diease,* 26(2), 181-190.

A wide variety of socioeconomic, racial, and community factors can lead to health disparities and many individuals are still unaware that these disparities exist or the specific factors that can contribute to health disparities. Solutions proposed for improving health disparities included, using community health workers, focusing goals for the local community, and educating people about health disparities. A wide variety of approaches are needed to narrow the health disparities between various groups and this article provides a good foundation for these approaches.

17. Choi, H., Burgard, S., Elo, I. T., Heisler, M. (2015). Are Older Adults Living in More Equal Counties Healthier Than Older Adults Living in More Unequal Counties? A Propensity Score Matching Approach. *Social Science & Medicine,* 141, 82-90.

Choi and colleagues sought to determine if those with a higher income inequality were in poorer health compared to those with lower income inequality when patients had similar demographic and socioeconomic factors. The research was done with both non-matched and matched samples. Counties with low income inequality had significant differences in demographic and socioeconomic factors when compared to high income inequality counties, and those in high income inequality counties reported lower scores on the self-rated health score. When patients were matched, however, there were no significant differences in the low income inequality group and the high income inequality group. These data have implications to say that community in which a patient lives can also play a significant role in health outcomes.

18. Nguyen, A. B., Moser, R., & Chou, W.-Y. (2014). Race and Health Profiles in the United States: an Examination of the Social Gradient through the 2009 CHIS Adult Survey. *Public Health,* 128, 1076-1086.

The social gradient theory states that as you increase your SES, your health outcomes improve (e.g. middle SES has better outcomes than lower SES but worse than high SES). Patients who are White had the most linear gradients, with the exception of hypertension that did not differ amongst White SESs. Hispanics and Asians tended to have non-linear gradients. Disparities were most noticeable in the lowest SES. These data are important because it shows that disparities may be more than just SES so need to look beyond the SES when assessing risk.

19. Hunt, B. R., Tran, G., & Whitman, S. (2015). Life Expectancy Varies in Local Communities in Chicago: Racial and Spatial Disparities and Correlates. *Journal of Racial and Ethnic Health Disparities,* 2, 425-433.

Chicago is divided into 77 distinct community sections. Life expectancy was 76.9 years (1.7 less than the national average) in the overall population, 84.6 years for Hispanic patients (1.2 years above the national average), 78.8 years in White patients (0.2 years above the national average), and 71.7 years in Black patients (2 years below the national average). The lower 4th quartile communities were predominately found in the West and South Sides and the majority of people in these communities were black. It is hard to know if the differences seen here were due to race/ethnicity or if there were regional differences in these patters.

20. Walker, R. J., Gebregziabher, M., Martin-Harris, B., & Egede, L. E., (2014). Independent Effects of Socioeconomic and Psychological Social Determinants of Health on Self-Care and Outcomes in Type 2 Daibetes. *General Hospital Psychiatry,* 36(6), 662-668.

Looking at social factors can be important to determine why patients are not compliant with lifestyle changes and outcomes. There was a significant associate between diabetes outcomes and a variety of factors, including higher SES and lower perceived stress. Patients with a better diabetes knowledge and quality of life were both associated with lower perceived stress and other factors. It is important to note how these factors can impact diabetes knowledge and quality of life since those are closely related to how well patients can self-manage their diabetes.

21. Atal, S., & Cheng, C., (2016). Socioeconomic Health Disparities Revisited: Coping Flexibility Enhances Health-Related Quality of Life for Individuals low in Socioeconomic Status. *Health and Quality of Life Outcomes,* 14, 7. Retrieved from: http://www.ncbi.nlm.nih.gov.turing.library.northwestern.edu/pmc/articles/PMC4709869/

Patients with a flexible coping strategy are able to appropriately use both primary and secondary approaches to unanticipated stressors. Patients with a higher subjective SES but a low coping flexibility score had higher health-related quality of life scores compared to those with a low coping flexibility score but a lower subjective SES. Other data within the study also suggest that a patients coping flexibility helps to mitigate the effects of being in a lower SES category. These data are important because it helps demonstrate that one of the skills these patients will need includes appropriate coping skills, especially since many of the patients suffer from anxiety related to personal/social issues that are out of their control.

22. Vable, A. M., Canning, D., Glymour, M. M., Kawachi, I., Jimenez, M. P., & Subramanian, S.V., (2016). Can Social Policy Influence Socioeconomic Disparities? Korean War GI Bill eligibility and Markers of Depression. *Annals of Epidemiology,* 26, 129-135.

One of the ways to help improve disparities is social reform. Looking at those eligible for the Korean War GI Bill benefits, veterans with lower and higher SES had a smaller disparity compared to non-veterans when looking at depressive symptoms. It is important to note that they only looked at veteran men who were eligible and not who actually utilized the benefits.

This is a demonstration that social policies may have an impact on social disparities, though there were still disparities with this social policy.

23. Sudore, R. L., Mehta, K. M., Simonsick, E. M., Harris, T. B., Newman, A. B., Satterfield, S., . . . Yaffe, K., (2006). Limited Literacy in Older People and Disparities in Health and Healthcare Access. *Journal of the American Geriatric Society,* 54, 770-776.

Health literacy (HL) is an often neglected but important factor in a patient's healthcare. The study found that almost one in 4 older persons had limited HL and it was more common in patients with chronic diseases and patients with a lower self-rated health. When they accounted for education of the patient, there were no significant changes in the outcomes. While these data are in older patients, the data are important because it shows that HL needs to be assessed and addressed and that educational level is not a good marker for determining HL level.

24. Ford, C. D., Sims, M., Higginbotham, J. C., Crowther, M. R., Wyatt, S. B., Musani, S. K, . . . Parton, J. M. (2016). Psychological Factors are Associated with Blood Pressure Progression among African Americans in the Jackson Heart Study. *American Journal of Hypertension,* March 10. Retrieved from: http://ajh.oxfordjournals.org/content/early/2016/03/04/ajh.hpw013.long

The Jackson Heart study observed African Americans (AA) to determine etiologies of cardiovascular disease (CVD). High "anger-out", depressive symptoms, weekly stress inventory (WSI)-events, major life events (MLE), and cumulative stress were all associated with risk of blood pressure progression, which was similar across both sexes, but did not change the incidence of hypertension. These observations provide some insight into some of the risk factors specific to AA patients.

25. Gebreab, S. Y., Davis, S. K., Symanzik, J., Mensah, G. A., Gibbons, G. H., & Diex-Roux, A. V. (2015). Geographic Variations in Cardiovascular Health in the United States: Contributions of State- and Individuals-Level Factors. *Journal of the American Heart Association,* 4, e001673. Retrieved from: http://www.ncbi.nlm.nih.gov.turing.library.northwestern.edu/pmc/articles/PMC4599527/

The American Heart Association has a 7-metric measure (hypertension, obesity, diabetes, cholesterol, smoking, diet, and physical activity) that is rated as an ideal cardiovascular health (CVH) metric if a patient meets all the criteria. Having an ideal CVH can reduction in all cause mortality risk of 78% compared to those with poor CVH (meets 0 to 1 of the criteria). A variety of sociodemographic factors (e.g. non-Hispanic Black or Hispanic, low SES, and median household income) were associated with increased odds of having a poor CVH metric but access to grocery stores and recreational fitness facilities were not. These data help further the evidence suggesting that demographic and social factors are associated with higher risk.

26. Fang, J., Yang, Q., Hong, Y., Loustalot, F., (2012). Status of Cardiovascular Health Among Adult Americans in the 50 States and the District of Columbia, 2009. *Journal of the American Heart Association,* 1, e005371. Retrieved from: http://www.ncbi.nlm.nih.gov.turing.library.northwestern.edu/pmc/articles/PMC3540670/

This study was focused on the American Heart Association's CV 7-piece metric and classifying how this metric varies across the 50 states. Michigan in particular was below the national median with only 3% of residents having an ideal CV score, a mean CV score of 4.4, and 10.6% residents having a poor CV score. These data show that Michigan is one of the states that needs a significant improvement in risk factors associated with cardiovascular disease.

27. Brittin, J., Elijah-Barnwell, S., Nam, Y., Araz, O., Friedow, B., Jameton, A., . . . Huang, T. T.-K. (2015). Community-Engaged Public Health Research to Inform Hospital Campus Planning in a Low Socioeconomic Status Urban Neighborhood. *Health Environment Research & Design Journal,* 8(4), 12-24.

In order to appropriately plan their medical center upgrades, one Chicago organization went to the community to determine what was important to both the Latino and African American residents. There were significant differences between the Latino and African American populations, including beliefs about transportation, proximity of the facility to home/work, and provision of good services. While the focus of this was to help improve how the medical center would improve their facilities, it is important to note that there were significant differences in two different races, which supports that understanding community dynamics is important when developing plans for helping individuals with their disease management.

28. Chen, X., Cheskin, L. J., Shi, L., & Wang, Y., (2011). Americans with Diet-Related Chronic Diseases Report Higher Diet Quality Than Those Without These Diseases. *Journal of Nutrition,* 141, 1543-1551.

One of the major behaviors that contribute to the success or progression of chronic diseases such as diabetes. Patients with a high quality diet tended to be older, women, non-Hispanic white or Hispanic, higher education, and use food labels. Patients with a good nutrition knowledge also had a significantly better quality diet than those without good nutrition knowledge. It is important to note that patients with better knowledge of nutrition and using food labels do better with their diet so that this is part of the individual plans for patients to help them increase their knowledge and use of food labels.

29. Stewart, D. W., Vidrine, J. I., Shete, S., Spears, C. A., Cano, M. A., Correa-Fernandez, V., . . . McNeill, L. H., (2015). Health Literacy, Smoking Status, and Health Indicators in African American Adults. *Journal of Health Communication,* 20, 24-33.

Health literacy can be a strong predictor of health outcomes, with some evidence to show it is a better marker than other factors such as education level, income, and race or ethnicity. In

African American patients, low HL level was found to be an independent risk factor for poor health.

30. Zarkogianni, K., Litsa, E., Mitsis, K., Wu, P.-Y., Kaddi, C. D., Cheng, C.-W., . . . Nikita, K. A Review of Emerging Technologies for the Management of Diabetes Mellitus. *IEE Transactions on Biomedical Engineering,* 62(12), 2735-2749.

A variety of technologies are discussed as ways to improve diabetes care, including sensors and risk engines. Many of the technologies mentioned are still experimental and/or high cost. There are multiple available risk engines for helping to determine long-term complications for patients with diabetes. These models are good to look at to help determine which factors are good to include in the predictive analytic algorithms.

31. Bates, D. W., Saria, S., Ohno-Machado, L., Shah, A., & Escobar, G., (2014). Big Data in Health Care: Using Analytics to Identify and Manage High-Risk and High-Cost Patients. *Health Affairs,* 33(7), 1123-1131.

Discussions about how data analytics can be used in healthcare include identifying high risk patients. Ideally data from multiple sources can help provide more data and more factors to include in the predictive analytics. It is important to make sure that algorithms are utilized are developed with data from similar patients. This article discusses the benefits and risks of using predictive analytics and how this technique is becoming more popular as we gather more and more data.

32. Alper, J., (2015). *Health Literacy and Consumer-Facing Technology: Workshop Summary*. Retrieved from: http://www.nap.edu/21781.

There were some unique examples of how to use technology in creative ways to help older individuals utilize smartphones in disease management (e.g. using the phone to take pictures of foods as a visual diary rather than having the patient try and type in all the information). It was recommended that technology be built to the types of patients not the stereotypes suggesting that a better understanding of the end users is needed.

33. Centers for Disease Control, (2013). CDC Health Disparities and Inequalities Report. *Morbidity and Mortality Weekly Report,* 62(3). Retrieved from: http://www.cdc.gov/mmwr/pdf/other/su6203.pdf

One major gap in health care is health disparities. When looking at diabetes, there are still significant health disparities in race and ethnicity between non-Hispanic Whites and non-Hispanic Blacks or Hispanics, including most subgroups. One area where some improvement was seen between 2006 and 2010 was for non-Hispanic black women but a bigger gap was noted for Hispanics, especially Hispanic women. Lower education and income also remained as significant health disparities. This is important to show that previous methods to correct these disparities have not really worked.

34. Washington, R. E., Andrews, R. M., & Mutter, R., (2013). *Emergency Department Visits for Adults with Diabetes, 2010*. Retrieved from: https://www.hcup-us.ahrq.gov/reports/statbriefs/sb167.jsp

In 2010, there were 12.1 million DM-related ED visits for adults, which is approximately 515 visits per 10,000 people. Of these, almost 60% were treated and sent home without a hospital stay. It was more common to send patients home from the ED in those aged 45-64 and higher in low income patients. About ¼ of these patients were privately insured. These data are useful to see what the national data are regarding ED use by adults.

35. Truven Health Analytics (2013). *Avoidable Emergency Department Usage Analysis*. Retrieved from: http://img.en25.com/Web/TruvenHealthAnalytics/EMP_12260_0113_AvoidableERAdmissionsRB_WEB_2868.pdf?utm_medium=email&utm_source=Eloqua

Cost of treating patients in the ED can be significant. The average cost of an ED visit in 2010 was $1316 compared to $145 for an office visit. These data are useful in helping to determine if getting patients to visit their primary care provider instead of using the ED.

36. Agency for Healthcare Research and Quality (2014). *2014 National Healthcare quality & Disparities Report: Michigan.* Retrieved from: http://nhqrnet.ahrq.gov/inhqrdr/Michigan/benchmark/summary/All_Measures/All_Topics

The AHRQ looks at a variety of quality measures to determine how well states are meeting these metrics for quality care. Michigan was reported to have 39 measures that were far from the benchmark (<50% achieved), close to the benchmark (between 50% and 90% achieved), and 83 measures where they achieved the benchmark or better. Diabetes was one area that was slightly improved but still in the weak area. These data help to determine how well the Michigan healthcare system is compared to all other states.

37. State of Michigan (2012). Enrolled House Bill No 5408. Retrieved from: http://www.legislature.mi.gov/documents/2011-2012/publicact/pdf/2012-PA-0214.pdf

Telemedicine was defined as “use of electronic media to link patients with health care professionals in different locations.” This means that providers must be able to use audio or video technology to interact with the patient in a synchronous manner. This is important because this allows for billing of telemedicine services in Michigan.

Recommendations for Reducing Emergency Department Overuse and Improving Patient Outcomes

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Executive Summary

Objective

It is estimated that 1,374 ACB Insurance of Michigan (ACBMI) patients frequently overuse the emergency department, defined as 4 or more avoidable or inappropriate emergency department (ED) visits within a 6-month period by the same individual (ED overusers [EDOs]). This leads to ACBMI spending $14.4 million annually to cover the EDO costs. The recommendations provided in this document are designed to reduce the frequency of ED visits, decrease costs, and improve patient outcomes.

Targeted Patient Population

An analysis of ACBMI's claims database was conducted to determine which factors contribute to ED overuse. Results showed that patients were 55 to 60 years old, had multiple chronic conditions (diabetes, hypertension, chronic lower back pain, and anxiety), had polypharmacy and compliance issues, lived in urban areas with limited access to affordable healthy foods, had financial difficulties, and lacked access to providers after working hours. In addition to these factors, inadequate health literacy levels have been shown to play significant role in a patient's ability to properly use the healthcare system.

Recommendation

A multimodal, EDO case-management program is recommended. While the recommendation is largely based on utilizing technology, there are some non-technological

recommendations included since a well-rounded program is needed to produce the best outcomes. The program consists of the following components: predictive analytics identifying EDOs to enroll in the program, development of a multidisciplinary care team to manage the program, increasing patient access to care and healthy foods, implementing changes to improve medication adherence, assessing health literacy and implementing measures to address inadequate health literacy, providing instruction on navigating the health care system, and developing educational materials.

Cost

It is estimated that 420 patients will be enrolled in the program during the initial 6-months. An estimated 3,402 ED visits are anticipated, if no intervention is implemented, costing approximately $4,477,032. Total costs for implementing the full program is $426,840. Based on these data a 10% reduction in the number of ED visits is required to cover the costs of implementing the program. An 11% reduction in ED visits would need to be sustained over 5-years to cover the costs of implementing the program over that time.

Program Monitoring

Various metrics are recommended as monitoring parameters to determine the effectiveness of the program. A dashboard will be created to monitor the progress of the program's main outcomes, including: change in ED use, costs, disease outcomes, compliance, and patient satisfaction.

Proposal

Objective

It is estimated that 1,374 ACB Insurance of Michigan (ACBMI) patients frequently overuse the emergency department, defined as 4 or more avoidable or inappropriate emergency department (ED) visits within a 6-month period by the same individual (ED overusers [EDOs]). This leads to ACBMI spending $14.4 million annually to cover the EDO costs (Truven Health Analytics [THA]). The recommendations provided in this document are designed to reduce the frequency of ED visits, decrease costs, and improve patient outcomes.

Background

A variety of interventions have been studied to determine the impact on the ED overuse and cost. The results of these studies provide insight into areas that should be included in a comprehensive EDO case management program. Studies evaluating community interventions found mixed results (Flores-Mateo, Violan-Fors, Carrillo-Santisteve, Peiro, & Argimon, 2012). Emergency department use was decreased when patients had increased access to primary care through expanded hours, were taught how to navigate the healthcare system, and/or attended monthly educational sessions (Flores-Mateo, Violan-Fors, Carrillo-Santisteve, Peiro, & Argimon, 2012). On the other hand, telephone triage, telephone consultation, and use of a care facilitator (helped patients identify community health care services and educated patients in self-care) all failed to impact that ED overuse rates (Flores-Mateo, Violan-Fors, Carrillo-Santisteve, Peiro, & Argimon, 2012). Studies that failed to affect ED overuse, were mainly

conducted in countries where all patients have national healthcare and many only evaluated a single intervention. Therefore, these interventions may still serve a useful purpose when used as part of a comprehensive case management program.

In addition to the community studies noted above, four studies were conducted that evaluated interventions implemented within the ED (Enard, 2013; Murphy, 2014; Pillow, 2013; Reinuis, 2013). Two of the studies used a multidisciplinary team of various healthcare providers, social workers, and community individuals (e.g. chaplains) to develop individualized care plans for EDOs. (Pillow, 2013; Murphy, 2014). Pillow and colleagues flagged patients in the system as EDOs and made their care plans available from the main electronic tracking board used in the ED (Pillow, Doctor, Brown, Carter, & Mulliken, 2013). Over a 17-month period ED visits decreased from 98 per month to 88 per month (Pillow, Doctor, Brown, Carter, & Mulliken, 2013). Murphy and colleagues also flagged the patient's electronic record allowing the providers to view the patient's care plan electronically. The plan was also automatically faxed over to the ED when the patient was registered in the ED (Murphy, & Neven, 2014). They were able to decrease the number of annual ED visits by 15 (from 19 to 4) for extreme users (those with 11 or more ED visits a year) and by 5 (from 7 to 2) for frequent users (those with 3 to 11 ED visits a year) (Murphy, & Neven, 2014). Hospital costs for the ED visits at one year were decreased by $710,474 for all patients compared to a cost of $265,680 to run the program (Murphy, & Neven, 2014).

Another study used patient navigators (Enard & Ganelin, 2013). Patient navigators were bilingual individuals who were state-certified community health workers. They met with the patient during the ED visit to address barriers, coach the patient on how to navigate the

healthcare system, educate the patient and their family, make referrals and help schedule appointments for the patient. The patient navigators also contacted the patients 3 to 10 days after ED discharge to review their plan and to help resolve any issues. The cost of the program was estimated at $45,880 (cost of one full-time patient navigator) so an annual reduction of 115 ED visits was required to cover the costs of the program. Patients were divided into various subsets ranging from patients with 1+ ED visits to 5+ ED visits in the pre-intervention period. There is some overlap in the groups in that those in the 5+ group are also in the 1+ group. Total reductions in ED visits at 12 months were 302 for the 1+ group and 178 for the 5+ group ($p<0.05$). Costs were decreased by $120,800 for the 1+ group and $71,200 for the 5+ group.

The fourth study evaluated having nurse managers contact EDOs, defined as 3 or more ED visits within a 6-month period (Reinius et al., 2013). They contacted patients via telephone approximately every 11 days to facilitate contact with healthcare providers and support interactions with social workers; they did not provide any medical advice to these patients. Patients who received these had a decrease in ED visits of 23% (Relative Risk 0.77; 95% Confidence Interval 0.69-0.86) 1 year after implementation of the intervention.

While Kaiser Permanente of Northern California (KPNC) hasn't specifically looked at reducing ED visits, they have implemented a number of technologies that has helped them receive and maintain a 5-star Medicare Advantage rating (Pearl, 2014). These programs have also helped KPNC consistently rank in the top 10% nationally with their quality outcomes. A key component of their program includes secure e-mail contact with their providers. They also have a wide range of videos, electronic newsletters, and interactive online tools (available at http://kp.org) to help patients learn about self-care and obtain answers to common medical

questions. Finally, they are in the process of implementing video conferencing visits between patients and providers. Member surveys have found that patients are more likely to be satisfied with their care if they use the e-mail messaging, and these technologies allow better access to medical care without needing to miss work or school. Some challenges faced by KPNC include ensuring data are encrypted to comply with the Health Insurance Portability and Accountability Act (HIPAA) of 1996, resistance from providers, and requiring an office visit for patient authentication. Kaiser has noted ethnic differences in the use of these technologies, with 50.2% of white patients using them, compared to 34.1% of African American members and 36.4% of Hispanic members.

Emergency Department Overusers (EDOs)

Factors that contribute to a patient's overall health and use of the health care system are called determinants of health (World Health Organization [WHO], 2016). The determinants of health that contribute to inappropriate or avoidable ED visits need to be considered in order to provide an effective recommendation for decreasing ED overuse. An analysis of ACBMI's claims database found 1,374 members were EDOs. These the following determinants of health for EDOs were identified (Figure 1, page 24 for a visual profile these EDOs):

- Age between 55 and 60 years
- Have multiple chronic conditions – diabetes, hypertension, chronic lower back pain, and anxiety
- Have polypharmacy issues (i.e. take multiple medications for each medical condition)
- Have compliance issues – skip meals and medication, especially when money is tight

- Live in urban areas and "relative food desserts" – food desserts are defined as areas that have limited access to affordable healthy foods, such as fresh fruits and vegetables (CDC, 2012)
- Suffer from high levels of stress due to:
  - Loss of employment or supporting an unemployed family member
  - Lack of financial resources to pay for their housing, food, and medical costs (including medications)
- Lack access to providers after working hours and are unable to miss work to visit their health care provider during working hours

These patient factors are consistent with the literature evaluating the impact of determinants of health on patient outcomes (Brittin, 2015; CDC, 2013; Fang, 2012; Ford, 2016; Gebreab, 2015; Kangovi, 2013; Nesbitt, 2016; Walker, 2014). Other important factors that may be contributing to ED over use include:

- Income – Patients with lower income levels were found to have poorer health outcomes, including higher rates of diabetes (CDC, 2013). One study found that patients living below the poverty line are 2.5 times more likely to be depressed than those living above the poverty line (Nesbitt & Palomarez, 2016). While not specifically mentioned in the ACBMI analysis, risk factors for depression include major life changes, stress and chronic diseases (National Institute of Mental Health [NIHM], 2016).
- Race and ethnicity – In addition to differences in health outcomes, race and ethnicity can play a role in a patient's view about the health care system, including what they value as

important to their health and their relationship with healthcare providers (Brittin, 2015; Ford, 2016; Nesbitt, 2016).

- Health Literacy Level (HLL) – Health literacy is defined as the "degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (U.S. Department of Health and Human Services [HHS], n.d.). Patients with an inadequate HLL are more likely to rate their health as poor to fair, have preventable chronic diseases (e.g. diabetes, obesity, and hypertension), and higher levels of depression compared to those with higher HLL (Sudore et al, 2006). Patients with inadequate HLL are also less likely to have insurance coverage for their medications and less likely to practice preventative behaviors, such as visit their primary care provider (PCP) or receive the influenza vaccine (Sudore et al, 2006).

Recommendation

A multimodal, EDO case-management program is recommended. While the recommendation is largely based on utilizing technology, there are some non-technological recommendations included since a well-rounded program is needed to produce the best outcomes. The program consists of the following components: predictive analytics identifying EDOs to enroll in the program, development of a multidisciplinary care team to manage the program, increasing access to care, implementing changes to improve medication adherence, assessing health literacy and implementing measures to address inadequate health literacy, providing instruction on navigating the health care system, and developing educational and other necessary components to address these patients' determinants of health issues. Each

component of the program is detailed below (a visual representation can be found in Figure 2 (page 25).

Predictive Analytics to Identify EDOs

Predictive analytics will be used to project the number of ED visits per patient in the next 6-months. Thirty percent of patients with the highest predicted number of ED visits will be enrolled in the program. These patients will be grouped into extreme risk (more than 6 ED visits in a 6-month period) and high risk (4 to 6 ED visits in a 6-month period). Patients will be identified using a combination of factors identified by the ACBMI analysis and the literature. These factors include:

- Diagnosis of at least one of the following chronic diseases – diabetes, hypertension, chronic lower back pain, and anxiety
- Number of diagnosed chronic diseases
- Polypharmacy – categorized as $\leq$ 5 chronic prescriptions; 6 to 10 chronic medications; and >10 medications
- Elapsed time compliance - evaluated by looking at the elapsed time between when a medication should have been filled and when the medication is actually filled (Fairman, & Motheral, 2000). Calculated as: Average days elapsed since chronic medications are filled = (number of days elapsed$_1$ + number of days elapsed$_2$ + . . . number of days elapsed$_n$)/(total number of chronic medications)
- Percentage of medications filled on time – calculated as: Percentage = (number of chronic medications filled on time/total number of chronic medications) x 100

- Having a primary care provider (PCP)
- Income level, if known
- Number of ED visits in the previous 6-months
- Number of stress factors present (if known) – factors include: loss of employment, supporting an unemployed family member, difficulty affording housing/food/medical costs/medications
- Length of time as a plan member – newer plan members (0 to 2 years of enrollment in the plan) tend to use the ED more frequently than long-term plan members (M. Wasik, personal communication, May 25, 2016).

Development of a Multidisciplinary Team

A multidisciplinary team will be assembled to manage the program. The team should consist of the medical director, nurses, mental health specialist, and pharmacists. They will develop an individualized plan based on the patient's risk; patients in the extreme risk group will require the most intensive plans, and those at high risk can have lower intensity plans.

After the plans are developed, nurses will conduct an in-home consultation with enrolled patients who live within a 50-mile radius of ACBMI. The consultation for those who live outside the 50-mile radius will be conducted via phone or video conferencing. For the extreme risk patients, a local social worker or community health worker will accompany the nurse to address community specific issues and to facilitate interactions between the patient and the nurse.

Increase Access to Care

In order to improve patient compliance with PCP visits, expanded office hours and alternative telemedicine options will be offered. These types of appointments will help patients access providers around their work schedule and decrease their transportation costs. Any one or combination of the options below can be implemented. Regardless of which option(s) is(are) chosen, these programs must be compliant with HL7 and HIPAA standards and ensure proper, secure exchange of patient information. Additionally, the age and socioeconomic status of the targeted EDOs can be an issue. Patients with these factors generally do not have a smartphone nor computer access (Smith, 2015). Therefore, at least one of the chosen options must allow patients to access the providers via the telephone, without the need for mobile or computer applications. Patients who are using smartphones or computer-based applications should be educated to recognize if they are using a secure connection and the importance of password protecting their devices.

Telemedicine Option 1: In-House, Physician-Run Telemedicine Appointments

The physicians will be available via telephone or video conferencing. Patients can contact the on-call physician to discuss their chronic conditions, determine if they should visit the ED or an urgent care facility, etc. After the consultation, the on-call physician will enter a note describing the consultation into the patient's profile, and contact the patient's PCP to discuss the appointment. These appointments can also serve as follow-up consultations for patients' chronic diseases.

Option 2: Third Party-Run Telemedicine Appointments

In considering this option, the telemedicine company must provide services to patients via telephone, not just video conferencing. Of the top 10 rated telemedicine companies, Teledoc, iCliniq, and StatDoctors all provide 24/7/365 coverage via computer, mobile device, and phone options (Roland, 2015; iCliniq, n.d.; StatDoctors, 2016; Teledoc, 2016). The selected company must provide statistics on follow-up with the primary care provider to ensure continuity of care is maintained.

Option 3: PCP-Run Telemedicine Appointments

This option provides direct accessibility to patients' PCPs for follow-up care via telephone or video conferences. Providers can reserve a minimum of one morning per month, one afternoon per month, and one evening per month to schedule telemedicine appointments. This will allow patients to conduct follow-up appointments with their providers without needing to take an entire day off from work and may allow some patients to schedule their telemedicine appointment while on break at work. These appointments would be scheduled and billed as regular follow-up office visits. Michigan allows billing for telemedicine appointments as long as they are conducted synchronously via audio or video connection (State of Michigan, 2012).

Implement Changes to Improve Medication Adherence

For all patients in the program, the pharmacist will review the patient's medication profile on a bi-annual basis to determine the most cost-effective and safeest options for the patient. This review will also look at ways to decrease the complexity of the patient's

medication regimen. The pharmacist will then contact the provider to discuss suggested changes to the patient's medication profile. If changes are agreed upon, the pharmacist will contact the patient to discuss these new options.

All patients in the extreme risk group and those with less than 80% compliance (number of chronic medications filled on time/number of total chronic medications x 100) in the high risk group will be assessed for upcoming refills for chronic medications on a weekly basis. The patient's profile will be flagged, and the pharmacist will be notified of upcoming refills. The pharmacist will then contact the patients to remind them of the upcoming refill, review instructions for complicated medication regimens, address questions patients have about their medications, and address any barriers.

Assess Health Literacy Level (HLL) and Implement Measures to Address Inadequate HLL

All patients enrolled in the program will have their HLL assessed by the nurse during the initial visit, using the Agency for Healthcare Research and Quality's Health Literacy Measurement Tool (Agency for Healthcare Research and Quality [AHRQ], 2016). This tool is available in both English and Spanish. A plan will be developed for all patients with an inadequate HLL that includes providing the patient with necessary materials tailored to their health literacy needs and help them better understand their medical conditions and medications. They will also be provided with instruction sheets developed for patients with inadequate HLL on self-care and medications.

Provide Instruction on Navigating the Healthcare System

All high risk patients that are new to the plan (within 2 years of the enrollment date) and all extreme risk patients will have a consultation with the nurse detailing what resources are available to them, including available mental health services. Social and community health workers will accompany the nurse to educate the patient about available community resources. Instructions on navigating the ACBMI website via mobile device and/or computer will be provided for patients who have access to the website.

While helping the patient navigate the website, it is a good time to remind them that care should be taken to protect their personal information. Patients will be educated on how to identify secure websites and password protect their mobile devices and computers.

Develop Educational Materials and Other Necessary Components to Address Determinants of Health

Educational videos and pamphlets will be developed to help patients better understand their chronic diseases. These will include diabetes, hypertension, chronic lower back pain, anxiety and other common chronic medical conditions. Educational materials will also be created for common preventative care issues, such as annual eye exams, vaccinations, and proper foot care.

Studies have shown that just providing access to healthier foods does not improve food buying patterns (Cummins, 2014; Elbel, 2015). Therefore, materials will include nutritional counseling such as understanding the impact of food on their medical conditions, understanding food labels, healthy eating within their culture, and healthy food choices when

they have limited food options (e.g. shopping in a convenience store, eating at a fast-food restaurant, etc.). The materials should be available on the websites for patients to access and should be in a format that can be given/sent to a patient.

Additionally, educational sessions or seminars will be scheduled in communities with a high concentration of program enrollees. Involving local members of the community or religious centers will help improve the credibility of the information presented at these sessions.

Finally, assistance will be offered to patients with limited access to grocery stores and affordable local markets by working with local organizations or social and community health workers. One example is the Ride to Groceries program in Flint, MI (Mass Transportation Authority [MTA], 2014). Individuals can ride the special buses for $0.85 per ride to go to Walmart or a supermarket (MTA, 2014). They also offer a Call-in service where individuals can pay $2.225 per ride to go to these stores (MTA, 2014).

Cost Analysis

It is estimated that 420 patients will be enrolled in the program in the initial 6-months, with approximately 336 (80%) in the extreme risk group and 84 (20%) in the high risk group. An estimated 3,402 ED visits are anticipated if no intervention is implemented costing approximately $4,477,032. Total costs for implementing the full program are $426,840. Based on these data a 10% reduction in the number of ED visits is required to cover the costs of implementing the program. An 11% reduction in ED visits would need to be sustained over 5-years to cover the costs of implementing the program over that time. The cost analysis is based on full participation in the program and full compliance with all medical appointments. Figure

3, Figure 4, Tables 1 and Table 2 (pages 26-29) have detailed information about the cost analysis.

Program Monitoring

Various metrics are recommended as monitoring parameters to determine the effectiveness of the case management program. A dashboard will be created to monitor the progress. These metrics include:

- Number of avoidable ED visits
- Percent change in avoidable ED visits = ((number of pre-program initiation of avoidable ED visits – number of post-program initiation avoidable ED visits)/number of pre-program initiation ED visits) x 100 (a decrease of 11% is required to cover the costs of implementing the program)
- Costs
  - ED overuse
    - ED Costs = Pre-program initiation ED visit costs – post-program initiation ED visit costs (A cost decrease of at least $426,840 is required to cover the cost of implementing the program)
    - Percent change in ED costs from the start of the program = ((pre-program initiation ED visit costs – post program initiation ED visit costs)/pre-program initiation ED visit costs) x 100
  - Overall health care utilization costs: Percent change = (all medical and pharmacy claims costs prior to program initiation – all medical and pharmacy claims costs after

the program is initiated)/all medical and pharmacy claims costs during the pre-intervention period) x 100

- Disease Control
  - All of the calculations for the disease outcomes metrics have the same base formula: Percent change = (number of patients at goal pre-program initiation – number of patients at goal post-program initiation)/number of patients at goal pre-program initiation) x 100
  - The goals for the individual diseases are defined as
    - Diabetes goal is an A1C of <7% (or the target A1C determined by the PCP) (American Diabetes Association [ADA], 2016)
    - Hypertension goal is a blood pressure (BP) of <140/90 (or the target BP determined by the PCP) (ADA, 2016)
    - Chronic lower back pain
      - Percent change in patients with controlled pain pain – pain goal is the subjective measure set by the patients and their PCPs. Goal will be considered the pain level, on a scale from 1 to 10, that the patient feels is comfortable with
      - % of patients on chronic opioids who are receiving a bowel regimen – all patients receiving chronic opioids need to be on a regimen that includes a stool softener and a laxative.
  - Development of other chronic diseases – these include other chronic conditions not mentioned above.

- Medication Adherence
  - All chronic medications
    - Compliance rate = (number of chronic medications medications filled on time/total number of chronic medications that should be filled) x 100
    - % of patients who at least 80% compliant with all medications
  - Diabetes medications
    - Compliance rate = (number of diabetes-related medications filled on time/total number of diabetes-related medications that should be filled) x 100
    - % of patients who are at least 80% compliant with diabetes medications
  - Hypertension medications
    - Compliance rate = (number of hypertension-related medications filled on time/total number of hypertension-related medications that should be filled) x 100
    - % of patients who are at least 80% compliant with hypertension-related medications
- Patient satisfaction and quality of life
  - Patients should be asked to rate their satisfaction with the case management program (on a scale of 1 to 10, with 1 being least satisfied and 10 being most satisfied
  - Satisfaction with the telemedicine program (on a scale of 1 to 10, with 1 being not and all and 10 being extremely
  - Change in Quality of Life (QoL)
    - This will be assessed using the Ferrans and Powers Quality of Life Index Diabetes Version III (Ferrans and Powers, 1984)
    - Change = QoL score pre-program initiation – QoL score post-program initiation

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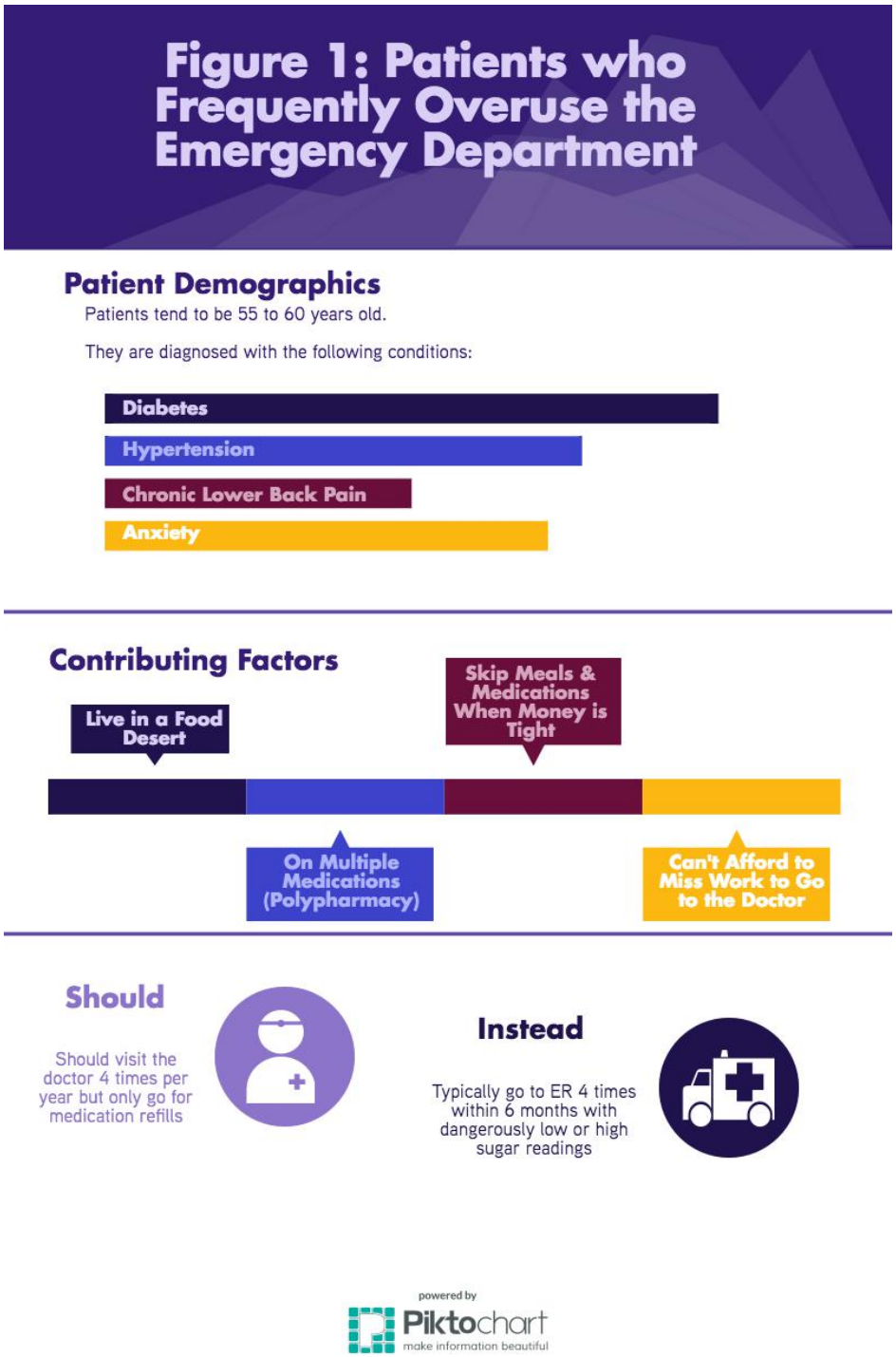
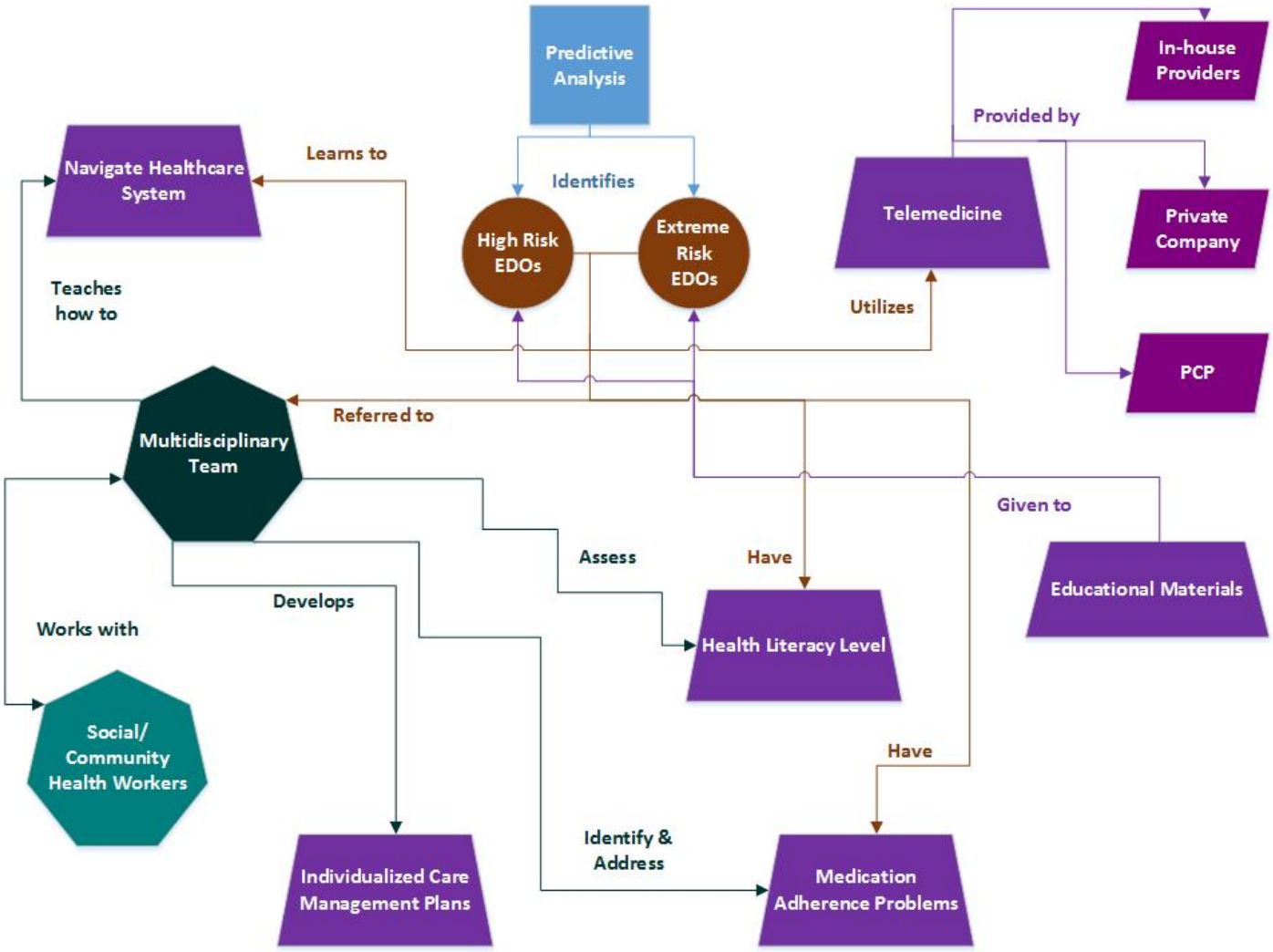
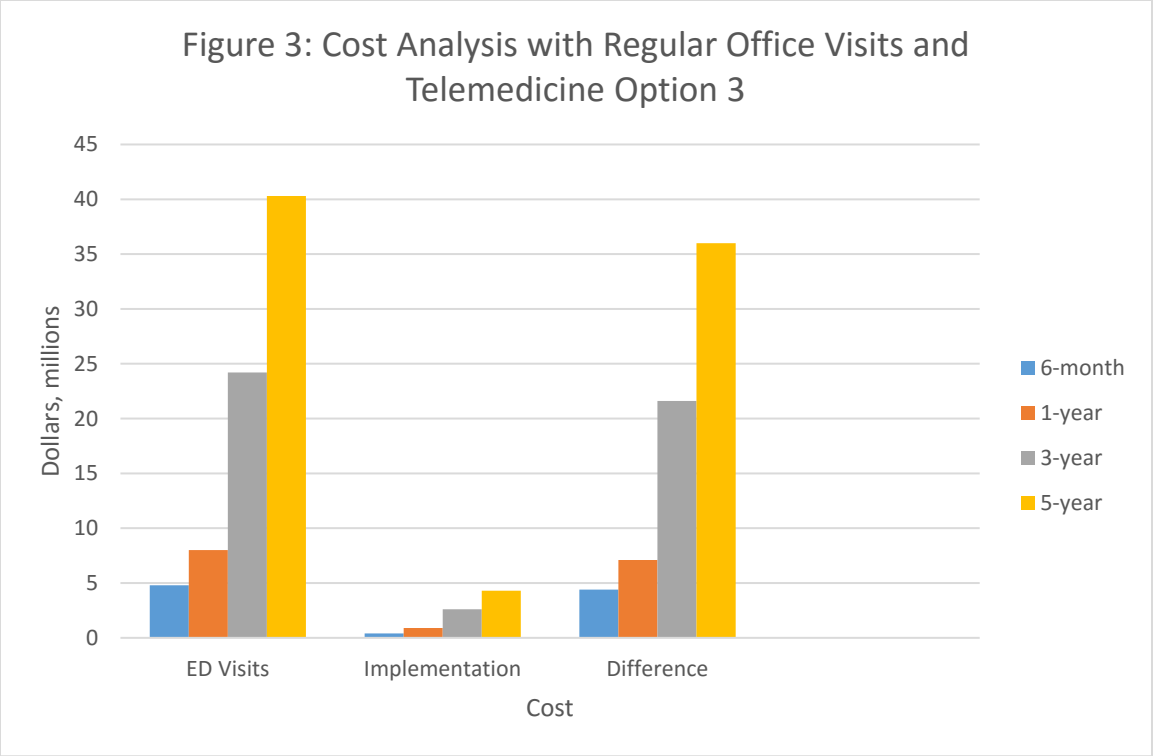


Note: *Food Desert is defined as limited access to healthy foods such as fruits and vegetables (Centers for Disease Control and Prevention, 2012)

Figure 2: Overview of the EDO Case-Management Recommendation

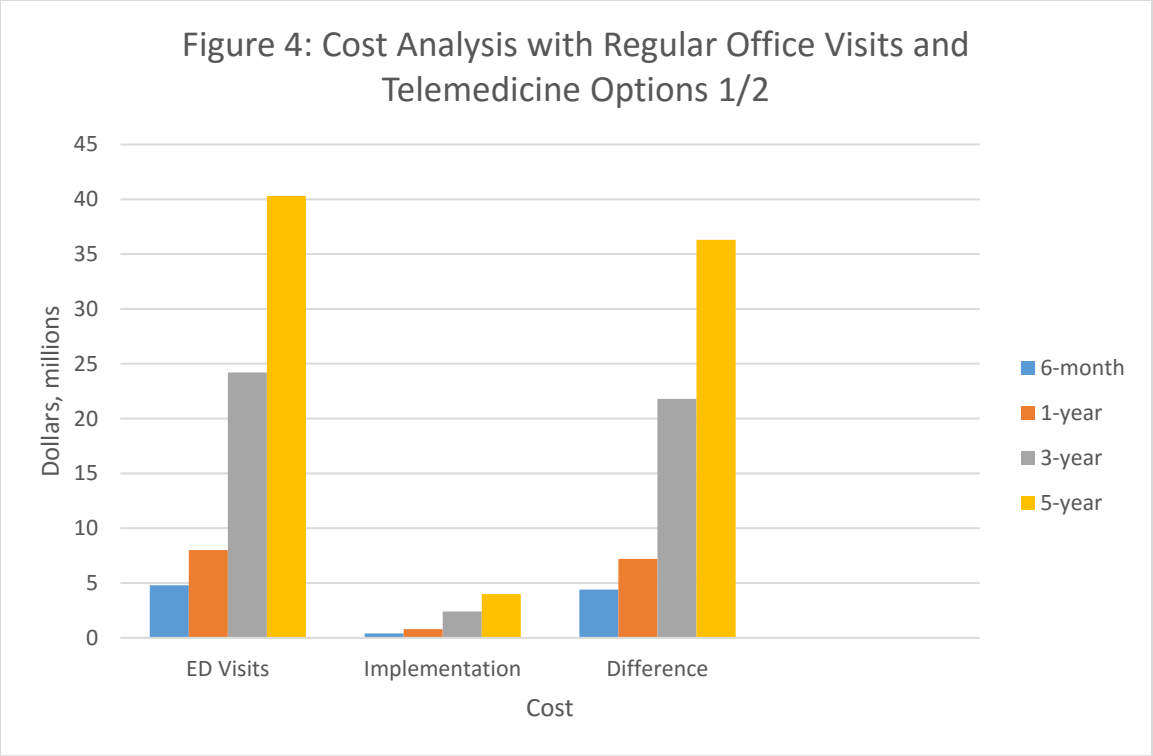


Note: EDO = emergency department overusers, defined as patients who have for or more avoidable/inappropriate emergency department visits within a 6-month period; PCP = primary care provider



Notes:

- ED visits costs were based on an average ED visit cost of $1316 (THA, 2013). Costs for 1-, 3-, and 5-year analysis were adjusted based on expected expansion of the care management program.
- Implementation costs included: analytics administrative costs based on current costs, implementing the program costs based on a per patient per month (PMPM) cost of $2, and costs for regular office visits (M. Wasik, personal communication, May 25, 2016).
- Regular office visits need to be considered as part of the cost of the implementation cost since it is expected that patients will be visiting their primary care provider more frequently. Costs were based on an average of 4 visits per year and $145 per visit (THA, 2013)



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- 6-month costs were based on 70% of enrolls having 2 telemedicine visits and 30% of patients having 1 regular office visit and 1 telemedicine visit during the 6-month period. 1-, 3-, and 5-year costs were based on 3 telemedicine visits and 1 regular office visit per year

Table 1: Detailed Cost Analysis with Regular Office Visits and Telemedicine Option 3

	Cost ($)			
	6-month	**1-year**	**3-year**	**5-year**
Total ED Visits[a]	4,477,032	8,058,658	24,175,974	40,293,290
Total Implementation	426,840	853,680	2,567,088	4,288,560
Analytics Admin[b]	300,000	600,000	1,800,000	3,000,000
Program Implementation[c]	5,040	10,080	36,288	70,560
Regular Office Plus Telemedicine Visits[d]	121,800	243,600	730,800	1,218,000
Cost Differential	4,050,192	7,204,978	21,608,886	36,004,730

Notes:
a: Total ED visits costs were based on an average ED visit cost of $1316 (THA, 2013). Costs for 1-, 3-, and 5-year analysis were adjusted based on expected expansion of the care management program.
b: Analytics administrative costs were based on current administrative costs (M. Wasik, personal communication, May 25, 2016).
c: Program implementation costs were based on a per patient per month (PMPM) cost of $2 (M. Wasik, personal communication, May 25, 2016).
d: Regular office visits need to be considered as part of the cost of implementing the program since it is expected that patients will be visiting their primary care provider more frequently. Costs were based on an average of 4 visits per year and $145 per visit (THA, 2013)

Table 2: Detailed Cost Analysis with Regular Office Visits and Telemedicine Options 1/2

	Cost ($)			
	6-month	**1-year**	**3-year**	**5-year**
Total ED Visits[a]	4,477,032	8,058,658	24,175,974	40,293,290
Total Implementation	426,840	853,680	2,567,088	4,288,560
Analytics Admin[b]	300,000	600,000	1,800,000	3,000,000
Program Implementation[c]	5,040	10,080	36,288	70,560
Regular Office Visits[d]	82,530[e]	174,300[f]	522,900[f]	871,500[f]
Cost Differential	4,050,192	7,204,978	21,608,886	36,004,730

Notes:
a: Total ED visits costs were based on an average ED visit cost of $1316 (THA, 2013). Costs for 1-, 3-, and 5-year analysis were adjusted based on expected expansion of the care management program.
b: Analytics administrative costs were based on current administrative costs (M. Wasik, personal communication, May 25, 2016).
c: Program implementation costs were based on a per patient per month (PMPM) cost of $2 (M. Wasik, personal communication, May 25, 2016).
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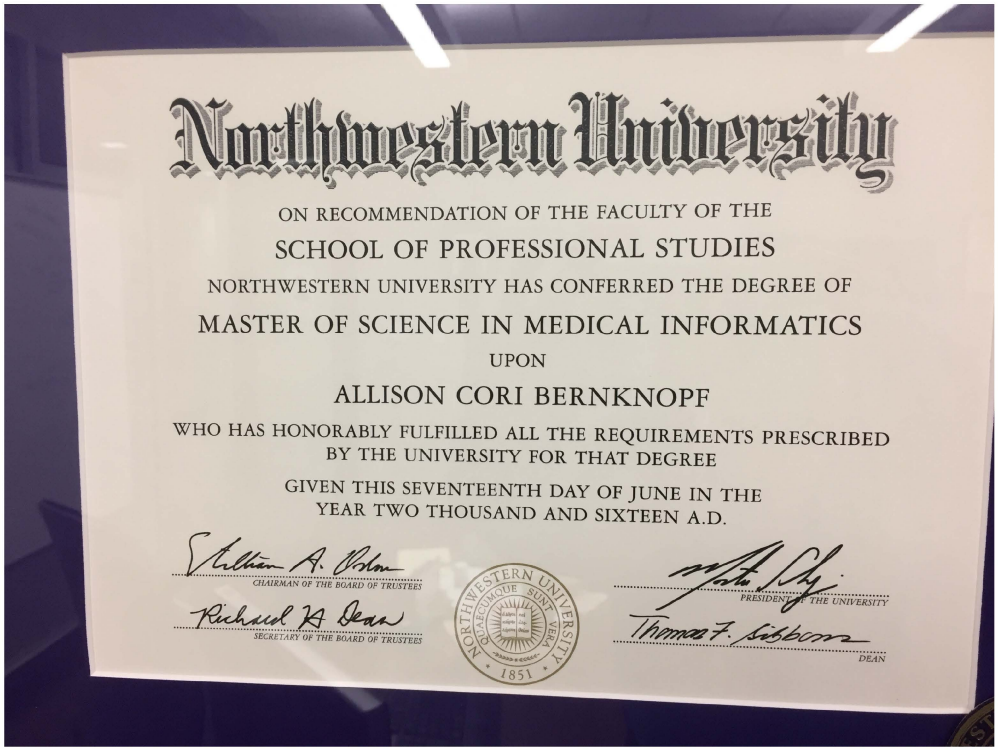
e: 6-month costs were based on 70% of enrolls having 2 telemedicine visits and 30% of patients having 1 regular office visit and 1 telemedicine visit during the 6-month period
f: 1-, 3-, and 5-year costs were based on 3 telemedicine visits and 1 regular office visit per year

Appendix E: Diploma



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MASTER OF SCIENCE IN MEDICAL INFORMATICS

UPON

ALLISON CORI BERNKNOPF

WHO HAS HONORABLY FULFILLED ALL THE REQUIREMENTS PRESCRIBED BY THE UNIVERSITY FOR THAT DEGREE

GIVEN THIS SEVENTEENTH DAY OF JUNE IN THE YEAR TWO THOUSAND AND SIXTEEN A.D.

CHAIRMAN OF THE BOARD OF TRUSTEES

SECRETARY OF THE BOARD OF TRUSTEES

PRESIDENT OF THE UNIVERSITY

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