Can We Utilize the Electronic Health Record to Identify Patients at High Risk for Readmissions? Also, Define Most Common Disease States Associated with These Patients, And Create Targeted Interventions to Reduce Readmissions

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**Research Question**

Can we utilize the electronic health record to identify patients at high risk for readmissions? Also define all disease states associated with these patients and create targeted interventions to reduce readmissions. As stated in the introduction, CMS uses six primary disease states to measure performance related to readmissions: acute myocardial infraction (AMI), chronic obstructive pulmonary disease, heart failure, pneumonia, coronary artery bypass graft (CABG) surgery, and elective primary total hip arthroplasty and/or total knee arthroplasty (THA/TKA). To calculate this ratio, CMS divides the number of predicted or actual readmissions by the number of “expected” readmissions based on an average hospital with similar patients. A ratio greater than 1 would indicate increased readmissions. Since the denominator is based on data from other organizations and may not be available in real time or available at all, can the organization leverage the vast amounts of data contained in their EMR to identify patients at high risk for readmission?

**Executive Summary**

A readmission according to the Centers for Medicare and Medicaid (CMS) is an admission of a patient to any hospital within 30 days of being discharged. To measure organizations performance, CMS uses the observed to expected readmission ratio for six disease states acute myocardial infraction (AMI), chronic obstructive pulmonary disease, heart failure, pneumonia, coronary artery bypass graft (CABG) surgery, and elective primary total hip arthroplasty and/or total knee arthroplasty (THA/TKA). CMS also mandated that by 2014, organizations migrate from paper charts to electronic health records (EHR). Electronic health records store and keep all patient data in an electronic database, replacing the traditional paper medical record. CMS also gave organizations that the EHR have a “meaningful use”. The purpose of this study is to determine if the electronic health record can be utilized to predefine and identify patients at high risk for readmissions. I will design a wireframe for utilizing the EHR to flag or identify potential patients. The data will be analyzed to determine if there is a relationship between specific disease states and readmissions. I will also analyze the results and compare it to external research to develop targeted interventions aimed at reducing readmission and improving the overall health of the defined population of patients. The objective of this proposal is to outline a methodology to utilize the EHR to identify the characteristics of patients at high risk for readmission. The proposed research will be retrospective-prospective and would compare patients from the two disease states that the organization currently has excess readmissions for CABG and AMI. The desired result is to develop and descriptive clinical markers and demographics for patients at high risk for readmission. Research suggests that there are very few barriers to the success of this project and the relevant stakeholders pose no threat to the success of the proposed project.

**Social Impact Statement**

Research has proven that when patients are admitted to healthcare facilities there is a large possibility that they will be readmitted within thirty days. After conducting extensive research and data analysis, I have compiled several methodologies to help facilitate drastic reductions in readmissions. By implementing the High Readmission alert trigger in the electronic health record, an automated alert notifies clinical staff and physicians at the point of registration that a patient waiting meets the criteria for high-risk readmission. This allows the clinical staff to take a more in-depth approach when assessing possible treatment plans for this patient. Applying a proactive approach in reducing readmissions improves clinical efficiency and hospital care, resulting in improved clinical outcomes for both the facility and the patient. It also provides clinical staff with additional time to educate the patient resources that are available to them in the home. Although discharge options are given upon discharge of an inpatient stay, these options are usually for the treating diagnosis only. With the readmission alert in place gives facilities the option of treating the patient as a whole including any comorbidities or secondary diagnoses that can affect readmissions. Being proactive in the ever growing and changing field of healthcare will produce healthier patients who are better educated about their health as well as resources that are available to them and give healthcare providers and technology companies vital data to assist patients in improving their health while reducing readmissions.

**Introduction**

The electronic health record (EHR) has enabled hospitals to store vast amounts of information on their patients and could potentially offer a unique opportunity to improve the health of the patients they serve. In addition to greater pressure from the Centers for Medicare and Medicaid services (CMS) to manage costs while still providing quality healthcare, organizations also faced mandatory implementation of an electronic health record (EHR) by January 1, 2014 in order to maintain their existing CMS reimbursement levels and demonstrate meaningful use of the EHR(CMS.gov, 2019). Organizations that failed to do so faced a 1% penalty on all their CMS claims (Advisory.com, 2017). In an effort to reduce healthcare expenditures and improve overall population health, (CMS) began instituting readmission penalties on hospitals for frequent readmissions beginning in 2012. CMS defines a readmission as "an admission to an acute care hospital within 30 days of discharge from the same or another acute care hospital” (CMS.gov, 2019). The readmission however need not be for the same medical condition to qualify as a readmission. CMS uses six primary disease states to measure performance: acute myocardial infraction (AMI), chronic obstructive pulmonary disease, heart failure, pneumonia, coronary artery bypass graft (CABG) surgery, and elective primary total hip arthroplasty and/or total knee arthroplasty (THA/TKA) (CMS.gov, 2019). The penalties began in fiscal year 2013 with a maximum penalty of 1% of total CMS billings as a penalty. In FY ’14, the penalty increases to 2% and has now risen to 3%. The penalties however are not limited to the six measure diagnoses, but all diagnoses billed from a hospital to Medicare/Medicaid (Insights.com, 2017). Approximately 2,600 hospitals were penalized for readmissions for fiscal year 2018 (6/8/17 – 7/11/18). The penalties are estimated to cost these providers in excess of $900 million dollars. Hospitals are paid one fee per hospital visit that must be split between all participants in a patients’ care including the surgeon, hospital, and any other providers.

**Background**

As the increasing population over time, there are multidisciplinary efforts to reduce number of hospital readmission in many nations a bid to answer the increasing healthcare demand.  The United States government passed legislation in the affordable healthcare readmission and reduction program HRRP that have financial implication for excess readmission cases. Over time, readmission has been reducing across different states. Up to 21.5% of patients were readmitted for targeted conditions in 2007 within 30 days of discharge from the hospital, the number reduced to 17.8% by 2015. The statistics for the non-targeted conditions related with readmission also reduced in the same period from 15.3 to 13.1 for 2007 and 2015 respectively. This paper assesses the trend of readmission cases in the United States, and application of technology to aid analysis of the EHR to limit readmission for patients.

**Research Methodology**

As readmissions plague hospitals with financial penalties and inappropriate use of resources resulting in increased cost, the question becomes how an organization can utilize the vast amount of data stored in the EHR and transform it into useful information. Hospitals are reimbursed under bundled payments which means that hospitals are paid a single payment of all of the services performed to treat a patient during an episode of care. The bundled payment encapsulates all participants in the patients’ care. For example, if a patient has a surgery, the hospital is paid a bundled payment that must be divided between the surgeon, the anesthetist, and cover the remainder of the expenses associated with care of the patient from the nurses that care for the patient to the expense of the room, pharmaceuticals, food, and any other services the patient may need including any pre-discharge rehabilitation. These factors put a huge burden on hospitals to manage the cost of a patients care but do not take into account the number of variables that could prolong their hospital stay such as surgical complications or patient recovery times both of which are typically functions of the overall health of the patient, age, and any pre-existing comorbidities.

The objective of the study is to determine if by utilizing the EHR, patients at high risk for readmission can be identified prior to a readmission occurring. The study will also ascertain what demographic and clinical characteristics are most common amongst this population of patients. To satisfy the objectives of this research, qualitative data will be used which will eliminate any potential concerns about violations of the Health Insurance Portability and Accountability Act (HIPPA) which prohibit the unauthorized sharing of patient information.

The research approach is to begin with the two disease states for which the organization had excess readmissions for the reporting period ending in 2016 and compare it to data from 2017 and 2018. Those two disease states are coronary artery bypass graft (CABG) surgery and acute myocardial infraction (AMI). Utilizing these two specific disease states reduces the effects of confounding data and addresses the organizations’ immediate needs.

Similarities between patients in each individual cohort will be drawn and subsequently comparisons made between the two respective cohorts. Given the vast amount of data on each patient, analysis will begin with looking at some fundamental demographic data such as age and sex. Analysis will then begin to look for similarities in comorbidities and disease states other than CABG and AMI. Though CMS counts readmission to any facility, the data set will be limited to patients of this organization as readmission data to other organizations is not readily available. Utilizing this method of analysis versus some existing methods will allow the organization to understand its unique patient population in this geographic area.

**Proposed data collection Tool**

Tableau, a statistical analysis and database query tool will be used to extrapolate patient data. Two data extractions will be performed from two different time periods, June 2016 – July 2017 and June 2017 – July 2018. The purpose of using historical data is twofold. First the data for which penalties are calculated is based on historical claims data and the data extraction should mimic the extraction for which penalties are calculated. Secondly, it provides a comparative set of data when developing readmission metrics allowing comparisons between the two collective groups versus comparing members of one set of data. Using Tableau, I will query the EMR for all patients admitted with one of the above diagnoses for each of the time periods above.

In order to begin analyzing the data for the patient population, several data extractions will be made and inserted with explanations of what exactly is being presented. After each slice of data has been presented and explained, a composite analysis will be completed and explained. As defined in the executive summary of the project plan, the data will be pulled for the CMS defined periods of 2016 – 2017 as well as 2017 – 2018. The first sets of data will describe the entire patient population of these diagnoses, subsequent sets of data and analysis will look at the data at a more granular level.

Definitions:

Acute Myocardial infarction – AMI

Coronary Arterial Bypass Graft - CABG

CC- Complication or comorbidity

MCC – Major complication or comorbidity

The data above helps provide a baseline of the total percent of all admissions that are affected by the two relevant patient populations, acute myocardial infarction and coronary bypass. These two patient populations accounted for 38% of all inpatient admissions during this time frame. It is important to understand the entire patient population in terms of volume and demographics as a baseline prior to analyzing any trends.

 The majority of all inpatient admissions are from four demographically distinct groups of patients. Black females ages 48 – 83, white females ages 60 – 83, black males ages 48 – 71, and white males ages 48 – 83 aggregately comprise 67% of all inpatient admissions.

The above graph demonstrates that across all races and genders, AMI with complications/co-morbidities and AMI with multiple complications/co-morbidities is the largest percent of the population. It also of significance that amongst white males, coronary bypass with cardiac catheterization without multiple complications/co-morbidities is a large portion of volume.



 The above graph captures the admitting diagnosis of the identified population of patients with one of the two diagnoses identified by sex. Both males and females of both races have the same four primary admitting diagnoses.

 The graph above illustrates the number of patients in the qualifying diagnoses that were either admitted through the emergency room or that have an emergency room visit in the 60 days prior to their admission for a qualifying diagnosis. Each population has a significant number of EC visits and admissions.



 The distribution of patients in the identified population by insurer. The majority of all patients across all genders are races is Medicare, Medicaid, and Medicare Advantage patients.



 The above graph shows the geographic distribution of the identified patient population. The majority of African American patients come from five distinct zip codes: 31030, 31206, 31204, 31201, and 31061. Each of which are either rural or lower socio-economic areas. The majority of white patients come from four distinct zip codes: 31008, 31093, 31216, and 31210. Though there are pockets of low income in these zip codes, they are more affluent that those of their African American peers in the cohort.

**Data Conclusions**

 The EMR contains a plethora of data that can be used to identify patients that may be at high risk for readmission. By statistically analyzing the data on relevant demographic information, the six criteria below were found to be the most common across the population. Meeting these six criteria will trigger an alert in the EMR that this patient is at high risk for readmission. Meeting any five of these criteria will create a flag that the patient could potentially be at high risk for readmission. Meeting four of these criteria will create flag that the patient is at moderate risk for high admission. Once the trigger has determined the level of risk, clinical staff will be notified that the patient is at risk for readmission. The nurse manager for that particular unit and case manager will also be notified in order to ensure that post-discharge patient contact is established.

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| **Criteria** | **Flag Trigger** |
| Age | 48 -83 |
| Race | Black or White |
| Gender | Male or Female |
| EC Admission or prior EC Admission | Yes |
| Admitting Diagnosis | Shortness of Breath, Chest pain, chest pain (other), non-stemi elevation |
| Zip Code | 31201, 31204, 31210, 31008, 31093, 31216, 31061, 31030, 31206 |

**Other factors influencing the rate of readmissions**

Readmission of patients depends of various factors, of which some are unavoidable; for instant it depends of individual patient factors with a natural history of an underlying disease, or separate problem that is not related to the patient’s health history.  Amongst the patient factors is the inability of patients to follow a medical plan.  For instance, there is a case growing trend of old aged patents who missing their prescription and treatment plants because of lack in the follow up process.  Upon discharge, up to 7.45% of elders get it difficult to keep with the prescription because of forgetfulness, lack of caution or under dose of overdose of the prescription (Hines, et.al, 2006).  In this case, the health care department needs to consider alternative care plans that include a nursing home until cure.  Such case of readmission is preventable, with a nursing help, of an enlightened family care for these elders, their readmission for treatment could not surface.

Alternatively, there are other readmission cases that are related to quality of healthcare of previous hospitals.  During healthcare delivery, doctors could make mistake in the mode of delivery.  A doctor could give the wrong prescription, to a patient with unnecessary drugs that works only for short term (Amarasingham, et.al, 2010).  When discharging such patients, neither the doctor nor the patient expects readmission, but after short period, the initial symptoms could once again resurface to ignite the illness hence calling for readmission.

Poor healthcare choices like discharging before time as an administrative intervention to reduce the number of patients lying in bed also result to readmission. It is not ethical to make such decision, however, up to 5.6 cases of readmission in less developed courtiers where the healthcare centers are concerned with delivery of healthcare within a limited budget. Early discharge without completing the due medical plan is a contributing factor to readmission case, Patients and or their families could ask for an early discharge to reduce the amount of money they have to pay for hospital inpatient bills.  Countries with high poverty rates that do not have insurance plan for their nationalities are the most affected with such cases of readmission (Mahmoud, et.al, 2018). All over Africa, there are cases of inpatient imprisonment; this arises when the hospital bills surpass the financial ability of a patient.  They are kept in the hospital until their respective families could raise money to clear their bills.  To prevent such scenarios, patients seek early discharge to reduce bills, a factor that could lead to readmission if the medication plan was not complete.

Therapeutically errors also contribute to gross ineffective medication and are highly associated with readmission. Issues of medical use are frequent to the therapeutic errors associated with readmission.  Adverse medical event occurs in 23% of patients after discharge from hospitals (Hines, et.al, 2006).  Of these adverse events, two thirds are determined by preventable events.  For instance, a patient can be sent home without the due medial prescription necessary for their treatment plan.  In this case, the patient does not revive from their condition; their condition of diseases could spurt to emerge severe impact for readmission that could also lade to death.  This condition is often associated with lack of finance to buy full medical bills or poor prescribed by doctors.  Elsewhere, there are cases where patients receive medication from two similar medications of different labels. The case is common for generic and proprietary medications as used in healthcare systems.  Finally, inadequate monitoring of patient use of drugs can result to ineffective care hence increasing the probability for readmission.

Another type of medical care errors that could lead to readmission is failed handoffs.  It is common to have patients transferred to nursing homes, from hospitals for special primary care.   Information Bridge between the parent hospital and the nursing homes is a medical error common across different healthcare settings in the world. For instance, pending tests at discharge could not be communicated to nursing care providers to affect the quality of care provision.  Approximately 41% of discharged patients have pending teats at the time of discharge, out of these, almost a tenth of the patients require interventions but the care providers in the nursing homes doesn’t get such information (Hines, et.al, 2006).   Such cases result to readmissions, disabilities and even death in the extreme cases.  a case study of 2007 in Manhattan identifies that almost a third of tests recommended in hospital-based team as a mitigation of monitoring patient health after discharge to nursing homes are not obtained by necessary care providers (Mortazavi,et.al, 2016).  Alternatively, it is common that discharge documentation often contains inaccuracies in medications, it is important for nursing homes to keep communications with the parent hospitals as a measure of reducing the possibility of patient readmission.

During healthcare delivery, follow-up is necessary to helps supplement different aspects of wellness, the medical team gets the opportunity to assess their patient’s condition during a follow up to the patient it is important for psychological wellness they get assurance from the doctors that their medication plan is working.  Absent or delayed follow up has effects on the wellness and could result to possible readmission.  Absence or delayed follow up affects the effectiveness of healthcare, amongst heart attack patients, follow-up is necessary to test individual indicators of associated risk factors such as the rate or heartbeat.  Without follow up activity for a heart attack patient, there is a probability of 37% that such patient could be readmitted with heart attack within 30 of discharge (Mortazavi,et.al, 2016).  Follow up activities as heat care mitigations is necessary for chronic diseases, chronic diseases often required a long medical treatment plan. It is impossible for patients to mitigate such medical plans without follow up to capture the necessary medical data and relay due information on the state of the disease.  The case is common for hypertension, and diabetes amongst other illnesses. In one retrospective study of 5000 discharge cases, timely follow up activity for medical interventions reduced the possibility of readmission with the same disease within 30 day three times hence effective to boosting healthcare delivery.

Readmission often targets patients of higher risk such as those with adverse post discharge, these risk factors are influenced by clinical and demographic parameters.  A cohort study identifies that risk factors vary, depending on the interval of discharge and time for readmission (Hines, et.al, 2006).  Risk factors for early readmission for a period of one week after discharge are different to risk factors for later readmission case after a week to a month or 30 days (Mortazavi,et.al, 2016).  Some of the clinical risk factors include, the use of high risky medication, these includes antibiotics, narcotics, antipsychotics, antidepressants, and hypoglycemic agents amongst many others.  Similarly, patients with more than six chronic conditions have such clinical risk factors, and finally, specific conditions such as advanced obstructive pulmonary disease, cancer, heart failure, diabetes, weight loss and depression are special condition that attracts readmission of patents.

The characteristics of the population also determines the readmission rate in a population, it is referred to as demographic and logistical factors.  A case of prior hospitalization including unplanned hospitalization in the last one year creates a possibility for readmission.  Lower health literacy or lack of basic understanding on health issues affecting a patient also influences the rate of readmission.  For instance, inability to understand basic medical programs in place for a healthy recovery often leads to errors when one does due individual procedures.  There is a high probability that he or she will not meet the effectiveness necessary to curb ill health therefore increasing the chances of getting readmitted.  Besides, the socioeconomic status of the population, affects the rate of discharge, lower socioeconomic status limit aces of basic resources for healthcare hence resulting to possible readmission (Mahmoud, et.al, 2018).  Discharge against medical advice is logical factor that also results to possible readmission since in this case, patients get to leave without complete medical interventions hence predisposing them to advancement of their ill health.

**Impacts of readmission of public and individual health**

Readmission back into a hospital implies that the patent is relocated another hospital bed and put in care of medical professionals. It results to an increase in the number of persons in the hospital setting attending medical care.  Readmission is identified as a major cause of hospital congestion thus reducing the bed capacity in these hospitals.  Statistics of hospital readmission cases indicate that averagely, 34.5% of the total hospital population in developing countries is cases of readmission (Kirby, et.al, 2010).  it contributes to the large hospital congestion by increasing the length of stay in these facilities.

For individual patient, readmission implies that the patient gets to spend more time in the hospital.  Increase in the length of stay in hospital has negative implication psychologically, socially and economically to a patient healing process.  The patient gets to develop a negative mindset and deprive him or herself from other necessary activities or reduce the healing process.  For a working adult, it implies that he or she must strop daily economic activities to attend to health care when readmitted.  In this case, it shall reduce the amount of income and could result to economic depletion if the situation of constant readmission persists.

Generally, readmitting a patient implies that he or she must spend more on hospital healthcare, one gets to pay unnecessary impatient costs upon readmission. This cost translates to national healthcare costs for nations with health insurance (Amarasingham, et.al, 2010).  Readmission is associated with extreme health circumstances, readmitted patients elevates cost of healthcare by contributing to healthcare center congestions and reducing the efficiency of care by reducing the speed due to the congestion (Kirby, et.al, 2010).  Statistics of America national healthcare budget indicates that less than 5% of American population spends more than 25% of the healthcare budget (Kirby, et.al, 2010); amongst them are patents in critical care and those with frequent readmission cases.

Readmission is an indicating of critical healthcare situation that does not satisfy the need of their patients.  Higher the readmission rate implies that one’s health situation is constantly deteriorating; hence, it is a risk to a patient’s life.   An independent study on readmission risk indicates that it is most likely for an individual to lose life after five successive readmission cases, this study indicates that such high readmission rates indicates insufficiency of healthcare systems to mitigate healthcare demand of the patient.

**Common disease states with high risk of readmission**

Most readmission cases are associated with mainly chronic diseases that develop as a result of complications of the internal body systems.  Diseases prone to readmission vary in types, most are as a result of the slow healing process of the internal organs such as brain and kidney, some are drug related, while some are as a result of chronic disease that develops in body as a result of one’s lifestyle.  Most of these diseases are more associated with the elderly, in old age, the body functions and processes slowly deteriorate.  In this it makes it very difficult to heal from some common illness.

In America, intestinal obstruction is associated with frequent readmission cases for patents within seven days and thirty days at an index of 43.5 (Desai, & Stevenson, 2012).  The chronic heart failure as a result of heart valve disorder ranks second in the list, with an index of 43.0.  Chest pain and shortness of breath, pancreatic disorders and alcohol related disorders follow with an index of 42.6, 42.3 and 41.2 respectively (Desai, & Stevenson, 2012).  Hypertension with complication, diabetes mellitus with complication, chronic pulmonary disease and congestive heart failure completes the list of diseases with highest readmission rates.

Heart failure has the higher number of casualties in statistics in the United States of America, even though its readmission rate has been dropping since 2009, from 214, 198 which was 25% to 183,534 in 2013 that represents 23.5% (Mahmoud, et.al, 2018).  These readmission cases are high amongst elderly above the age of 65, followed by senior adults between the age of 45 – 65.  Over time, the trend of readmission has often affected more female than male in 2009, 51% of the readmitted population were female, the percentage of female increased later to 53.3% in 2012 then reduced to 52.7% in the year 2015.  Finally, there is a large disparity on the distribution of heart failure readmission cases when considering the race of the individuals.   Caucasians are the most affected persons, in 2009, they constituted 64% of the readmitted population, the number dropped to 62.7% in 2012 and then raised to 63.4% in 2015.   African Americans follow at 14% in 2009, 14.7% in 2012 and 14.8% in 2015 (Mahmoud, et.al, 2018).

Acute myocardial infarction is a life-threatening condition causing heart attack, it occurs when the myocardium tissues of the heart is deprived of oxygen supply due to blockage of the coronary arteries in the heart.  Without oxygen supply, the muscles of the heart begin to die, infract, therefore stopping the heart activity of pumping blood to the other section of the body. The entire body experience low blood pleasure as a result of such attack unlike the heart where the congestion of blood reduces efficiency of heat pumping rejuvenation.  In this condition, delayed medical mitigation threatens the life of the patient making it a high-risk medical condition for readmission. Availability of sensors that can track the rhythm of the heart and track the blood pressure in real time could aid timely notification for quick medical intervention that can increase the chance of survival during readmission.

Heart failure condition is a chronic disease that can be controlled with medication, regular exercise and correct diet choices after discharge.   Elsewhere in nation like Canada, the coping rate of heart failure patients after discharger has been focused on reducing the predisposing factors with medical support over time.  Obesity amongst the patient is a high-risk factor, by using controlled diet and regular exercise, it is possible to limit the threat of obesity on hear failure. However, there is need for healthcare support and coordination of patents healing processes as applied in the province of Alberta where it managed to reduce the readmission rated of heart failure patients from 29% in 2008 to 12.5% in 2017. Therefore, it implies that it is possible for patients to cope the situation and reduce readmission rates.

The New York cardiac surgery reporting system indicates that the readmission rate of patient of coronary bypass rate was 13% as of 2016.  The median time for readmission is identified to be 6 days, the major cause of readmission is linked to pulmonary complications, including pleural effusions.   Pleural effusions refer to the deposition of transudate or exudate fluid within the pleural space between the tissues of the lungs and the chest walls. It increases pressure to the lungs upon deposition and reduce the volume of the chest hence preventing the normal lung inflammation during inhaling process, therefore, its life threatening by preventing one from breathing.   Another high risk associated with the disease is the short readmission time which is less than one week.  The treatment plan in readmission is most probably another surgery post-surgery in the lung regions is risky.  Health care systems are determined to reduce the risk associated with then readmission, initially, doctors could propose longer stay in hospital to reduce their risk of readmitting the patent.  However, current real time hear pulse rate screening and blood pressure monitoring technology could help to monitor patient recovery after discharge to reduce both readmission and longer hospitalization.

**Healthcare technologies utilizing EHR to reduce patient’s readmissions**

Current technological advancement in health care applies different technologies to reduce loopholes in healthcare systems that attract readmission case.  Such technology is getting infused in the health care systems to supplement doctors and nurse’s capability in ensuring a health revival after discharge.  Other technologies such as cheater and user-friendly screening technology, and electronic health records, supplemented with use of internet access could unifies the delivery of healthcare with limitation of distance alone to march full hospital like heath care delivery.  Current technology allows for readmission risk assessment periodically within the healthcare centers as used in Aurora Healthcare in Milwaukee, Wisconsin (Bayati, et.al, 2014).  It integrates communication with a specific reference hospital or physician, medical reconciliation, multidisciplinary rounds, education on the medical procedures to patients, discharge notes, verified up to date patient discharge paper work, post discharge care coordination and compliance in medication all to improve the rate of recovery to reduce readmission.

Incorporation of technology limits both avoidable and unavoidable readmission cases, by supplying necessary information of a patent’s heath condition.  To facility readmission it is important that technology bridges the loopholes that occur after discharge of a patents.  There are programs that helps assess readmission risk assessments and apply necessary resourced to appropriate patents.  Currently, there are such programs, Meditech Corp. and INOVA health care have implemented processed for real time assessment of readmission risk stratification.  Institutions like Augusta Heath in VA; Fishersville applies the use of Meditech EHR to accesses relevant information on the risk assessment and displays the day using a LACE model.  Though such application, care managers can identify patents with critical need of medical attention and could invite the medical team for mitigation.  The LACE scores also help in determination of necessary interventions basing of the established risks.  As a result, instead of readmission, the healthcare department can organize and immediate a follow up appointment.  Patients on higher risk could have heath coaching or home nursing.  This methodology has proven effective to transition healthcare services from hospital base to home base, while reducing readmission rates to 6.5% from the average 15.6%.

In a bid to reduce readmission cases, effective use of electronic communication increases reliable connection between different healthcare parties.  Traditional telephone communication proves unreliable, a alongside discharge statement, these interventions did not accurately communicate patients’ situations.  Use of telephone communication and discharge statesmen alone is isolated and have tendency of information los or miss interpretation.  This paper had earlier identified that amongst the causes of readmission is miss information.  Current technology in hospital communication integrates sensors, and the EHR in a single database to constitute a whole round data, healthcare mitigations are also capturing with information on the type of operations and medication used on a patent (Bayati, et.al, 2014).  In the long run, the communication is supported with past health history to effect accurate medical mitigations of doctors.  Messaging venders such as ZixCorp makes it possible to create to and for email messaging that could refer a physician on data within the system without the need of duplication, in this case, the doctor will be referring not only to the real time data but also to medical history of the patient making it possible to capture the correct health condition of a patient and to track healthcare delivery, and to eliminate possible misinformation (Kirby, et.al, 2010). Such medical interventions as used in Lahey health system in Burlington has helped increases healthcare efficiently and reduced 30-day readmission cases to less than 15%.

Medical error is identifying as one of the causes of readmission, as aforementioned, there is need for medical reconciliation between the pharmacy technicians and the doctors to limit possible errors in prescription.   Initially, pharmacy technicians did depend on information not only from primary physicians but also from family members, individual patients to issue the due medications.  Accuracy of information delivery more so if it was delivered from a no medical professional constituted the medication errors that contribute to readmission.  However, EHR technology, and current medical communication platforms are bridging the gap of information to limit misinformation of pharmacy technicians when delivering medication.  EHR information access supplemented with integrated communications stems makes it possible to share accurate patient medical information directly across in paten and outpatient care areas at Aurora Healthcare in Milwaukee Wisconsin (Mahmoud, et.al, 2018). Such technological mitigation has enabled the healthcare to produce accurate medication information hence contributing to a recued readmission case to less than 14%.

Elsewhere in northwestern Lake Forest in Lake Forest Illinois have integrated the use of EHR to avail timely multidisciplinary information access as a measure of enhancing positive information.   During treatment, a successful multidisciplinary round at a bedside involves the entire medical team, the physicians, nurses, case managers, and pharmacist and family members.  With software, the hospital facilitates information access by login for different health care’s professional to facilitate real-time information aces from the patents EHR.   The use of EHR at Northwest Lake Forest hospital allows for timely delivery of such information to all the medical professionals and the family members with templates that pull in critical information for medical reconciliation.  Such information access makes it possible for the medical team to intervene with necessary medical treatment plans to the goal of care plan hence improving the healthcare delivery approach and limiting possible case of readmission.

Technology to minimize readmission must factor in the element of distance from medical clinics to enhance affectivity.  Healthcare goes beyond individual communication between the medical practitioners to accessibility of the healthcare clinics and resources to the entire society.    Nations with improved family care addresses the situation by delocalizing nurses and primary health providers to the local regions to be close to population.  Other nations such as the Norway use community health providers to bridge this gap.  However, not all people reside in regions with proximity to healthcare centers, beyond in rural settings, distance from hospitals is still and impediment to access of follow up activities after discharge. In third world state an alternative approach is necessary to bridge the gap.  The governments cannot afford to allocate nurses to the remotest regions because of economic issues; In this case, nurses also need to apply the use of technology in monitoring the affairs of their patient remotely, to supplement the follow up activity.  Already, across different countries in Africa such as Kenya there are healthcare applications for android phones that targets to bridge the gap between the nurses and the general population. An application called AMBUSAVE is used as an emergency medical app that could allow the patient to call for the help of a physical closest to the region of stay.  With such application, the interrelation of patients will be better; it shall not limit one to the location for treatments.  Besides being in treatment, long distance travel is not eliminated; therefore, it helps normalize the recovery processes while keeping connection to the healthcare centers for emergency

EHR is used to aid patient education to reduce health illiteracy as a measure of reducing possible readmission.   This approach has proven successful with pneumonia and chronic disease patients such as hypertension.  The success of patent education is considered necessary in self mitigation in timely medication access.  At Aurora Healthcare in Milwaukee, Wisconsin, upon discharge, a heart attack and diabetes patient is educated on their condition, the medical team informs the patents on limitations they are predisposed to by their condition, and possible mitigations when they experience attack. A diabetic patient is also supplied with a sugar level sensor that informs him or her on her sugar lever, heart attack patient is informed on the indicators of possible attack.  To allow for self-mitigation, they are also thought on defend approaches they could use during these emergencies to effect wellness.

**Use of EHR data in preventing heart failure readmission in Alberta Canada**

Alberta health services, in corporation with the cardiovascular health and stroke strategic clinical network developed and successfully applied a community centered program called heart failure optimization.  It gives heart failure patients the necessary information to best manage their condition and provide social support to help them recover after discharge.  The EMR is integrated with a network of professional in the health care systems, policy makers, community leaders and patients to assisted people in the transition from in patient to out-patients.  In this program, the patent is assessed every three weeks, there is a titrating process that where a patient gets medications then they are eliminated one by one, as the physician studied the best medication which works best for the patient’s system.  The program has incorporated stakeholders like family and the society to help the patient in the enabling environment through the process by incorporating social education online and in health care centers.

To individual patients, one gets to learn about their condition of heart failure.  The heath care teams teach on the symptoms of the heart failure, and possible mitigations of heart failure. For instant, patient of heart attack is advised to specific diet to such as limiting the amount of Sodium in their food, regular exercise, amongst other preventive measures.   This way, patients understand their condition to eliminate the possibility of medical literacy that could affect their medication trends.  The patients also get specialized teaching on identification of their mediation.  In order to avoid confusion, these healthcare teams provide visual prescription charts for medication guide to prevent the possibility of taking wrong medicine (Bayati, et.al, 2014). Besides, they are given contacts to the medical centers where they could communicate directly with the medical team in case of emergencies. The success of the program lies on the Incorporating close social support is the most important approach in the entire program.  Through local centers, the healthcare professionals reach out to educate the public on the heath initiatives for different chronic illnesses including heart disease (Desai, & Stevenson, 2012).  Besides, new victims are also recruited into the program at this point by recommendations from the hospital or from the public.

Any successful healthcare policy to reduce heart failure readmission cases, must take a public centered approach to incorporate the entire society in the healthcare system as in the Alberta heart failure optimization program.   However, there are many other improvements on technology that makes it possible to apply even better health management techniques to facilitate better healing processes and to reduce the readmission of heart failure patients.  Amongst them is the application of machine leaning in healthcare, and the improvement in the sensor technology, with more cheaply and effective sensors that can generate EHR information that informs the coping process of the patent in real time.

**New technologies that help in reducing Heart failure readmission cases**

**Wearable and implant sensors**

These mitigations are made possible by different technologies; amidst them are communication technology, real time healthcare databases, cheap sensors for different health indicators, health prediction logarithms and application, and the internet.  There are many communication technology and platform in sue within different hospitals.  Most take different forms from applications to websites where users, as medical providers are logged in to keep connected, hence facilitating communication.  Currently, almost all the hospitals within the United States of America has internet enabled communication technology, where one could refer services of a doctor when needed to.  Besides, medical professionals are also educated on use of internet communication to supplement their day to day work in different facilities.  The success of healthcare communication technology is attributed to the success of communication technology, these platforms are unlimited they facilitate twenty four hour communication hence effective in aiding heath care monitoring and support when needed.   Most of these screening devices are designed to keep track of basic healthcare indicators. For instance, there are wearable’s, and in pants that assesses the rate of heart beat and the level of sugar in one’s body which is used for diabetes patents amongst other health indicators in real time.

It is important to note that such wearable’s or implants work on real time, unlike traditional healthcare systems where one needed to get to the hospital, queue in long lines waiting for such measurements with high cost, such wearable’s and implants does the same work, therefore, it saves not only money but also time.  In addition, healthcare sensors are today more commercialized; companies are competing to produce the most effective sensor technology cheap enough to capture a big market.  This industry has attracted players from vast fields including Nike, a sports company, Samsung, Sonny, Apple, and other mobile technology companies. The wearable and implant sensors products are produces to capture the growing of individuals interested in keeping track of their medical condition in real-time data such as athletes and chronic diseases patents.  Sporting companies such as Nike have interest to asses such variables not only of heath target population but also sports personality. Internal body function information is also critical to the sporting fields, as it is used to assess and athlete functionality.

These sensors monitor indicators such as the pulse rate, and the body activity.  The sensors are then linked wither by Bluetooth or internet to a phone, with a user profile.  Here, the patent data is collected over time and stored in the Electronic Heath Database and can be shared to the physician’s other critical information such as the rate of body activity, distance covered are also captures and are vital for medical decision making.  With such technology, it is possible to capture, and relay patient data in real time to the medical officer hence the best approach for remote medical assessment.

**The Rothmans index**

Besides the preventable readmission factors, that is prevented by up to date interdisciplinary communication in the healthcare departments, there are other technologies that does more to calculate risk score that could qualify a patent for readmission, for instance, Rothmans index.  The Rothmans index was developed by Michael and Steven Rothmans, two computer scientist brothers.  They came with the idea after sudden loss of their mother just four days after getting discharged from a surgery.  The idea was inspired by the fact that the hospitals Electronic Health record could not initiate self-operations such as summary of the patient’s health measures that could send notification to physicians for other hidden medical complication.

Before a patient experiencing heart failure, their body reactions send indicators.   The heart shall not be in the position to pump blood properly I the body; in this case, the pulse rate of the heart activity reduces.  Besides, the amount of oxygen in the body also reduces, as a result, normal activities such as vision becomes blurred.  The body also becomes weak and the patent is likely to lose support.  Of these indicators, the pulse rate becomes the first to send sights of potential heart failure.  With the previous mentioned sensors, it is possible to capture the pulse activity in real time and update the information in the EHR.  The Rothmans index operates by comparing the input data of pulse activity against the normal thresholds and sends notification immediately when an abnormality occurs.  This way, it notifies the patient on basic indicator to help them initiate due survival techniques.

Besides, EHR are big data, its manipulation is time consuming to the healthcare providers.  For instance, some basic data captured in the system includes an entry of different dates and different units of measuring diverse medical conditions from the hear pulse rate, to chemical composition of the body, without visualization these data become too much co comprehend.  Before actual processing of information, a doctor could waste alt of time to read repeatedly.  Such approach did was make the use and application of the Electronic Heath records tiresome.  The Rothman index is an innovation that also organizes the data in a user-friendly outlay.  Therefore, besides automating the EMR data processing, Rothman Index encouraged incorporation of the electronic data into healthcare provision by simplifying their use.

The Rothmans Index was designed to take routine collected patient data such as vital signs assessments from nurses, the patients skin condition, heart rhythm and laboratory test results all with a score scale from one to 100.  In its interpretation, lower score indicates high risk for readmission of the patent.  When studies against the EHR charts of patients that are readmitted after discharge, the score strongly correlates with relapse instances, hence the score is critical to predicting possibility of readmission in patents, even before discharge.  The Rothmans index has helped in interpretation of patient’s health records and displaying their health progression over time.  On the bed side, the data is critical to facilitate healthcare delivery; it shall notify the physicals the situation of the patient to prevent cases of relapse in the inpatients as well.

Apart from Rothmans index, there are other technology using the same approach but with different products that also worlds to analyze the EHR to helps in the identification of possible readmission case.  Originally, healthcare delivery systems depended on 2 cohorts as index of risk prediction for a possible 30-day readmission patient.  other technology that could help in the interpretation of the EHR to alert on possible heart failure condition, include, hospital all accuse thirty-day readmission index (HATRIX). This idea targets interventions necessary to improve transition of care that can further reduce hospital readmission cases when implemented.

**Conclusion**

As much as it is necessary, readmission increases the cost of healthcare; it also results to increase in patent population hence congestions in healthcare centers. Congestion in healthcare centers compromises the quality of healthcare that one receives from these institutions; healthcare centers are determined to reduce the rate of readmission.  The use of technology has proven effective to reducing readmission cases, this paper identifies incorporating technology cover the errors that could lead to readmission of patient work in healthcare centers across America.  A study of healthcare approach in Alberta Canada revels holistic approach where technology is incorporates in public health care to limiting readmission of heart failure, it works better to give patients more control over their situation as they heal.  This paper also identifies available but unused game changer technologies that could incorporate real time screening of patents to track their progress and manipulate the data to inform them and the physicals on their threatening conditions.  Incorporation of the proposed screening and EHR data processing technologies in healthcare could help reduce readmission by giving patents ability track their progress, but also identifying indicators of their situation in real time for quick medical mitigation.  Besides, it aids the storage and communication of the EHR data to respective care centers to help inform the physicians on the progress of the patients.  Considering that the world will experience an increase a tremendous population increase in the next decade, hospitals in urban centers will be getting more patients.  It is to the interest of public health that healthcare centers still get to service these patients without necessarily reaching hospitals. By allowing screening remotely, and analysis of the screening data also remote healthcare could transition to remote servicing enabled by the internet.  Physicians could send recommendations remotely to be captured in the patients’ health records and with integration of other parties such as the pharmacists with healthcare application, technology could help to bring healthcare services closer to the public uniquely to curb readmission. Utilization of technology as well as continuous monitoring and analyzation of patient data in the EMR can assist in reducing readmissions. Perhaps most importantly, doing so paves the way for social and governmental interventions in public health. By taking all proactive measures using technology and EMR data, healthcare organizations can set the stage to expose the other socioeconomic issues that contribute to poor health in communities and increased readmissions. There is a lack of primary care providers in many communities and many patients do not have a primary care provider. The elderly population with the highest readmission rate also lacks community and social support to assist them in their health whether that’s transportation to doctor visits, finances to purchase medications, or simply remembering appointments. Though technology can assist with some of these issues, this population is the least technologically savvy and changing human behavior is a time-consuming daunting task.

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