Hospital Discharge Patients and Health Relationship Management Services (HRMS):

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Abstract- Unplanned readmission of hospital discharge patients is driving up healthcare costs, and the statistics are staggering. In 2010, U.S. hospital discharges numbered over 35 million and nearly 20 percent of Medicare patients were readmitted back into the hospital within the first month. The Affordable Care Act's Hospital Readmissions Reduction Program (HRRP) Centers for Medicare & Medicaid Services (CMS) began a penalty on hospitals having high readmission rates. As a result, hospitals are financially motivated to reduce hospital discharge patient readmissions. At-home patients with undetected deteriorating physical conditions can result in adverse secondary conditions (i.e., developing infections) that send them back into the Emergency Room. The most common post-discharge complications are: (i) an adverse drug event (ADE), (ii) infections acquired in the hospital, (iii) secondary acquired complications, as well as, (iv) pneumonia, and (v) depression and loneliness. Reducing adverse events post-discharge is essential for the U.S. health care system. Health Relationship Management Services (HRMS), a new healthcare paradigm, monitors the patient's health from home after discharge to help minimize hospital readmissions. At the same time, it alleviates loneliness and isolation by providing a connection to a caring health community, empowering patients to control health outcomes in collaboration with their care providers and care experts.

Keywords: *Health Relationship Management Services (HRMS), hospital discharge, hospital readmissions, remote health monitoring system*

I. INTRODUCTION

Patient hospital discharge readmissions has become a major problem for the healthcare industry. Studies show that that almost 20% of patients have adverse events within 3 weeks of being discharged, of which close to three-quarters could have been improved or prevented [1]. In 2010, U.S. hospital discharges numbered over 35 million, and nearly 20 percent of Medicare patients were readmitted within the first month [2] [3]. Research shows that, in the U.S., nearly 25 percent of discharged patients are readmitted to the hospital within 90 days. Many such readmissions originate from errors due to discontinuous, fragmented care after discharge [4]. Unplanned readmissions costs billions; thus, they have to be avoided for the financial well-being of healthcare systems and patient quality-of-life [3]. Hospitals are financially motivated to reduce readmissions, since the Affordable Care Act's Hospital Readmissions Reduction Program (HRRP) Centers for Medicare & Medicaid Services (CMS) poses a penalty on hospitals having high readmission rates that can mount to a considerable expense [5] [6] [7]. Thus, reducing adverse events post-discharge is essential for the U.S. health care system [8].

Patients may be especially vulnerable during the transition period from discharge and home care because they may be still functionally impaired during the transition from critical care to ambulatory care [9]. This stems from patients leaving the hospital "quicker and sicker" [10] [11]. Discharge patients who receive home-care are vulnerable because they generally do not receive the same around-the-clock professional monitoring they did in the hospital [12] [13]. Research shows that one in five patients had an adverse event transitioning from hospital to the home; some were preventable, while others were correctable, but could have been lowered by timely corrective actions [11]. Other studies have shown that at-home patients with undetected deteriorating physical conditions can result in adverse secondary conditions, such as developing infections that bring a person into the Emergency Room.

Due to pressure from Medicare and other payers, patients are being discharged as soon as possible, where they often return home with little or no professional assistance, and where difficult and complex care often falls under the responsibility of family members who have no training [14]. Hospitalized patients' conditions are assessed routinely, but once they go home, they are monitored only by a caregiver who is a family member or someone other than a hospital care provider [11]. For the caregiver, problems arise, such as time management, competing demands, physical and mental stress, and financial concerns [15]. Some problems also may arise due to incompetent or fraudulent caregivers.

The most common post-discharge complications are: (i) an adverse drug event (ADE), (ii) infections acquired in the hospital, (iii) procedural complications, as well as, (iv) pneumonia, (v) depression and loneliness [16]. The somewhat higher rate of ADEs after discharge may be due to patients not

being monitored as closely following discharge as they were in the hospital [11]. Another condition of a discharged patient that often develops is the feeling of isolation, depression, or lack of awareness of a supporting community of care friends. Although social isolation is more prevalent in the elderly, young adults, such as those who are disabled and confined to their homes due to a disease such as multiple sclerosis, or a young single mother who may experience loneliness and social isolation as well.

Possible Solutions

There are a number of interventions that can be used to reduce readmissions, to include prompt identification and response to symptoms signaling a worsening condition and avoidance of adverse events that result in readmission [17]. Some current suggestions for readmission prevention have included post-discharge activities, such as home visits, follow-up phone calls, and connections to the physician between inpatient and outpatient surroundings [2]. Some effective approaches include preemptive monitoring, visits to the patient's home, consultations by phone, and telemonitoring [17].

Remote monitoring technology that combines all of these elements may significantly impact a decrease in hospital readmissions by using sensors to detect key wellness indicators, such as quality of sleep, adherence to medications, and physiological information [17]. Sensors used in a patient's own home can continuously monitor daily living activities and detect subtle clues to potential health problems, notifying caregivers to potential developing health conditions [17]. Research shows that, due to monitoring, for example, patients having heart failure reduced emergency department visits and exhibited a tendency toward reducing readmissions and overall costs [18].

Patients who receive social support from family or friends have healthy beneficial impacts on the "cardiovascular, endocrine, and immune systems" which serve as protective barriers against disease [19]. At-home caregivers can help prevent readmissions by understanding prescribed dosage and adherence to medication schedules [20]. Caregivers should be aware of and be able to recognize risk factors, such as COPD or heart failure. Also, potentially adverse events can be avoided by tracking small changes in the patient's day-to-day behavior, such as sleep patterns, eating, clinical vital signs and mental state [20]. Real-time monitoring with alerts can lead to intervention and prevent unnecessary trips to the hospital [20].

Real Solutions: Health Relationship Management Services HRMS

A comprehensive solution to these problems is a new paradigm in patient healthcare called Health Relationship Management Services (HRMS), which is a daily system of patient remote health monitoring, patient health data analytics, follow-up and response. HRMS helps decrease hospital readmissions, healthcare costs, increase access, and provide "anywhere, anytime monitoring diagnosis and treatment" [21]. HRMS reads patient health data and immediately sends this raw data to the cloud for restructuring into information that can be accessed and interpreted by a caregiver over time. If there is a change in the patient's health data that requires immediate action, the patient is contacted to see what might be causing the change. When repeated, the continuous use of the monitor adds more personalized patient health data into the system.

Constant remote health monitoring of a patient can also detect patient disconnect or inactivity, indicating conditions such as a fever, pneumonia, or medication misuse that may need to be followed-up on. HRMS may also be an effective strategy for disease management in high-risk heart failure discharge patients because it monitors physiological conditions [18] [23]. HRMS may detect symptoms of "hypertension or hypotension, malaise, or requests for comfort or simple communication needs that can be relayed in real time" [24].

Since patients are provided access to real-time personal health information in an understandable format, they now have the ability to contribute, correct or amend information in their own Electronic Health Records (EHR), which can accept patient generated data. By actively capturing and centralizing personal health data, hospital discharge patients are encouraged to become involved in their health with user-friendly access via friendly portals [25]. Patients will also be provided with outbound motivational messages, reminders, and opportunities to further engage in their own health care.

For the isolated patient, the interactive app will provide an outlet to the outside world which may limit a sense of loneliness and isolation by discussing health issues with others through Patient Health Narratives (PHN) [26]. Care management platforms incorporate community resources to support patients giving patients access to organization supported social media, games, etc., that encourage engagement and positive behavior change [25].). By connecting to a caring, supportive, health care community through an online patient portal app, the patient can share stories to better understand health conditions, prescription medications, and alleviate psychological health problems.

HRMS has other benefits, such as providing quality end-of-life care by honoring patient wishes regarding life-sustaining treatment. HRMS can incorporate patients' advanced directives wishes and links to Medical Orders for Life-Sustaining Treatment (MOLST) information and forms accessible by health care practitioners and facilities [27]. Also, since the needs of foreign-born patients may be considerably different from American-born patients, HRMS assessment and care planning now includes culturally sensitive care that meets the patients' needs, irrespective of their background [28].

Hypothetical Case Study

This hypothetical case study is about Carolyn, a baby-boomer aged mother, who is discharged from the hospital after abdominal surgery. She has been hospitalized for several days, and is still in constant pain, requiring regular doses of pain medication. Carolyn is facing at least two weeks of recovery and recuperation at home, after which time, she will be able to return to her job. At the time of discharge from a hospital, a discharge nurse prints out several pages of instructions for Carolyn delineating what type of procedure was done, what to expect at home, and how and when to take prescribed medication. This procedure is often lengthy and confusing to many patients when instructions are given to them, and research indicates that, not only do many discharge patients misunderstand discharge instructions, some even appear to be unaware that they don't understand them [29]. Now it is okay for Carolyn not to

remember everything the nurse tells her at this point of discharge because HRMS has shown that she can access this information through an HRMS remote patient portal later in the comfort of her own home.

Caregivers are called upon to perform certain routine caregiving tasks once a patient goes home. Carolyn's daughter, Megan, will help her bathe, prepare meals, administer medication, and change wound dressings. However, since Megan has received very little advice or training from the nurse to care for her mother, these are activities that Megan is not trained to do. Although she is loving and supportive, she also works full-time, so her free time is limited. Hospital staff often does not provide education for these tasks until the day of discharge, which may or may not be the best time for the caregiver to learn their responsibilities. As a result, Megan feels overwhelmed and stressed over this responsibility of caring for her mother, and because of her job commitment, she cannot be readily available, even in an emergency [30].

After Carolyn's formal discharge at the hospital, Megan escorts her to the hospital pharmacy where she is given her prescribed medications, is educated about their use, and has her questions satisfactorily answered. Carolyn is also set-up with a unique account with HRMS, a prescribed at-home health monitoring system. Carolyn is provided with the HRMS remote monitoring unit that comes with case that automatically will connect her to the internet and the patient portal through a customized android system with access to all instructions for medications and other healthcare instructions. It is crucial for Carolyn's recovery and health safety that she clearly understand her medication instructions, as well as how to use the remote health monitoring system that will provide her and Megan with health related information at a later date. HRMS will allow Megan to access current information about her mother's health, medication, and at-home instructions even while she is at work. Automatic reminders are sent for important instructions that must be done at certain times, such as drinking water to avoid dehydration and taking medication at the proper time. Since the HRMS system can also capture all of Carolyn's vital health metrics to assess physiological changes, Carolyn's physician can get feedback about her state of mind and physiological and psychological conditions.

Upon arriving at home, Megan places the monitoring system alongside Carolyn's medication on her nightstand, so she can use it every morning when she rises and every night before she goes to bed. She can view video instruction on her screen how to use the system, which, when used according to directions, captures Carolyn's personal health data that is immediately sent to the cloud for analytics. Typically, twice a day at the time Carolyn brushes her teeth, she can see a screen on her cradle that will show her health metrics with every use, so she knows her health progress every day.

While Carolyn is recovering, she is left alone quite frequently. Research shows that loneliness is a widespread social problem with severe physiological and health implications, and appears to be a risk factor for raised Systolic Blood Pressure (SBP) and escalations in SBP over time [32]. So, in-between Megan's visits, Carolyn engages with the patient app that is part of the monitoring platform to pass the time by reading an interactive online magazine with patient health stories and health

newsfeeds, and playing games that reward her with points that can be cashed in for prizes. This will help her understand how to recover faster, which at the time of discharge may not have been understood. Now, Carolyn has an HRMS remote caregiver that is part of the community who supports her and will avoid a sense of loneliness when Megan is not around. HRMS, as a contact to the outside world, will help alleviate that sense of isolation that is important for recovery [32].

HRMS tries to capture as much information about Carolyn as possible, so if she has not understood her discharge instructions, she may receive reminders followed by calls from the Communication Center later on. If Carolyn does not respond to the patient portal, calls or messages, this may be an indication that something is wrong. HRMS can track when Carolyn takes her medications and can tell if there is a change in her pattern. Lack of attentiveness may indicate that she is not taking her medication properly or may not be exercising per her physician's orders, and the HRMS system will want to know why. Physiological parameters can be tracked for normalcy, and if they appear abnormal (for example, if Carolyn seems to be developing a fever which indicates a post-surgery sign of inflammation), action can be taken. Although incidences of post-op surgery infections are low, individuals who have undergone surgery are the most vulnerable to infections caused by bacteria that resists some antibiotics [33]. Also, if Carolyn should experience swelling of her legs, feet, ankles, calves or thighs, it may be the result of fluid buildup (fluid retention) or from inflammation in tissues or joints [34]. Swelling of the legs may be a sign of a serious disorder, such as a blood clot or heart disease [34].

If any of these conditions are present indicating a deteriorating condition, a patient advocate in the Communication Center, who has been alerted by the analytic engine of HRMS, will place a call to Carolyn to find out if there is an underlying cause that needs action and determine whether further escalation is necessary. This information is recorded in her secured personal data file for later review by her physician. The next level of escalation is to contact her personal care friend, whom, in this case, is her daughter, Megan. There is a constant update in Carolyn's status, and last level of the escalation path would be an emergency call to her physician or to the ER.

Because of HRMS, Carolyn has become an integral part of a new health care delivery model of point-of-care analysis and self-testing system. Carolyn is encouraged to be more engaged in her own healthcare by having access to her own health information and caregivers. Through connected monitoring systems, Carolyn's daughter now can track her post discharge condition to reduce chances of readmission. Carolyn can stay in touch with others within a caring, interactive, health community through her HRMS patient portal app, a platform that allows her to become personally involved by viewing and contributing to her own health record, providing her with a sense of ownership over her own health outcome. By having a "doctor in a box," any health alerts will be immediately followed-up on, so Carolyn can avoid readmission to the hospital.

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