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Effects Of Reporting Fever Sessions And Caresense On Fever Reporting By Gastrointestinal Cancer Patients Receiving Chemotherapy

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EFFECTS OF REPORTING FEVER SESSIONS AND CARESENSE ON FEVER REPORTING BY GASTROINTESTINAL CANCER PATIENTS RECEIVING CHEMOTHERAPY

A Doctor of Nursing Practice Project

by

ODASY ELEJARDE, MSN, APRN, FNP-C

Submitted to the Office of Graduate Studies of
Prairie View A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF NURSING PRACTICE

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ABSTRACT

Effects of Reporting Fever Sessions and CareSense on Fever Reporting by Gastrointestinal Cancer Patients Receiving Chemotherapy

(May 2023)

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Patients with cancer who undergo chemotherapy are at risk of immune system compromise. Fever in a patient with cancer who receives chemotherapy can indicate presence of an infection. In patients with a compromised immune system, an infection requires immediate further evaluation and management. Thus, patients receiving chemotherapy must understand when to notify physicians of a fever for prompt evaluation and management.

Purpose. This project aimed to increase the number of fevers gastrointestinal oncology patients receiving chemotherapy reported within 24 hours of detection to MyChart messaging, CareSense, or by calling the physician's office.

Methodology. All gastrointestinal oncology patients who underwent chemotherapy received a reporting fever instructional session by the nurse practitioner. They also received CareSense prompts via text message or email. New patients receiving chemotherapy were enrolled in CareSense at the same time the chemotherapy appointment was scheduled. Patients also received a CareSense handout and an after-visit

summary. On days two and four post-chemotherapy, CareSense sent a text notification to ask the patient if they experienced a fever with a temperature ≥100.4°F. The patient's selection of yes or no elicited a follow-up response. On day six post-chemotherapy, CareSense sent a patient satisfaction survey via text to assess whether the tool improved the patient's knowledge about chemotherapy and recovery and whether the reminders were helpful. Data related to patient-reported fever and patient satisfaction were collected for three months and then analyzed.

The project was designed to assess pre- and post-reporting effects of the fever instructional session and CareSense prompt notifications of fevers within 24 hours of detection using CareSense, MyChart messaging, or calls to the physician's office. Fisher's Exact Test of Independence was used to determine if there was an increase in the number of reported fevers following the intervention. The results were significant based on an alpha=.05 and a *p*-value <.001. This result suggested that post-intervention reporting fever instructional sessions and CareSense prompts were effective, with 100% compliance of patients reporting fevers within 24 hours of detection by calling the physician's office.

Conclusion. The project provided beneficial information to practices using mobile health technology communication tools, such as CareSense, and a fever reporting session to improve optimal patient outcomes. This project also improved oncology patients receiving chemotherapy fever reporting within 24 hours to physicians to reduce life-threatening complications and fatalities associated with fever.

***Keywords*:** Gastrointestinal cancer, neutropenic fever, CareSense, fever instructional session, effects of messaging systems, chemotherapy

DEDICATION

In recognition of this amazing accomplishment, I dedicate this quality improvement project and doctoral degree to my family. Thank you for encouraging me to pursue my goals and dreams.

To my mother, Leslie Johnson, my best friend, who allows me to shine as bright as the sun. Thank you for being the best mother. I owe it all to you and God. I love you. To my dad, Roberto Elejarde, I hope you look down with a smile and know you have always been in my heart, and with me every step of the way.

To my grandmother, Emma Johnson, thank you for always being the spiritual encouragement I needed in life.

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"For I know the plans I have for you," declares the Lord, "plans to prosper you and not to harm you, plans to give you hope and a future." (Jeremiah 29:11).

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INTRODUCTION

Fever is a common occurrence in patients with cancer patients who undergo chemotherapy. Because chemotherapy is generally provided in an outpatient setting, most fevers will occur at home (Krzyzanowska et al., 2016; Perron et al., 2014). As chemotherapy affects bone marrow production of neutrophils, oncology patients are vulnerable to the negative effects of a weakened immune system and infection if a fever is not addressed quickly (Rasmy et al., 2016; Zimmer & Freifeld, 2019). These patients must receive adequate monitoring and education to mitigate this risk. Adherence to medical instructions is vital for optimal patient outcomes. Engaging patients in their care, patient-provider communication, and mobile health applications are interventions that help improve medical instruction adherence.

Patients with cancer who receive cytotoxic drugs, such as chemotherapy, are at risk for a weakened immune system that increases susceptibility to infection. In these patients, a fever is the first sign of an infection. The Infectious Diseases Society of America defines fever in patients with neutropenia as a single oral temperature ≥38.3°C (101°F) or a temperature ≥38.0°C (100.4°F) sustained over one hour. The definition of neutropenia can vary from institution to institution but is usually an absolute neutrophil count <1500 or 1000 cells/μL (Freifeld, 2011). The estimated incidence of febrile neutropenia in the USA is 60,294 each year (i.e., 7.83 cases per 1,000 patients with cancer) (Rasmy et al., 2016).

This DNP Project follows the style of the *American Psychological Association Manual (7th Ed.)*

Neutropenic fever is a medical emergency with a significant morbidity and mortality risk to patients with cancer receiving chemotherapy. To reduce adverse events, they must report the fever to the healthcare provider within 24 hours of a documented fever. Patients with cancer with untreated fevers are at risk for sepsis, septic shock, organ dysfunction, and death. Oncology patients are at a higher risk for sepsis due to their immunocompromised condition (Tavakoli & Carannante, 2021). Sepsis is caused by a dysregulated host response to infection. In patients with sepsis, malignancy is one of the most common comorbidities (Bayrak & Kitiş, 2018; Skiba et al., 2020).

Local Problem

In clinical practice in the physician's office, the oncologist first examines the patient. The nurse practitioner performs follow-up examinations. The physician and nurse practitioner provide chemotherapy education and post-chemotherapy side effect information when chemotherapy is initiated. This information is then reinforced during the chemotherapy process. However, a lack of patient understanding about the severity of the potential dangers of fever is an important deficiency of this system.

In 2020, the nurse practitioner in the gastrointestinal oncology clinic observed that several post-chemotherapy patients who experienced fevers did not notify the physician's office within 24 hours of detection. Some of these patients noted they self-treated their fever using Tylenol, over-the-counter medication, or even old antibiotics from another provider prescribed for a different indication. However, an oncology department protocol requires the infusion center nurses and physician to verbally instruct the patients to notify the physician's office within 24 hours of detecting a fever of ≥100.4°F. Each patient is

also given these instructions in writing as part of the after-visit written summary provided at the end of the chemotherapy infusion (Appendix A).

In March 2022, a data report of 147 gastrointestinal oncology patients who underwent chemotherapy found that 50 patients with a fever recorded in EPIC between January 2021–December 2021 did not notify the physician's office about the fever. A chart review of the 147 patients revealed that nine did notify the physician's office. Five of the nine patients used the MyChart messaging system; two called the office directly and spoke with an office representative. Two of the nine patients used the communication tool, CareSense (2022), to report the fever in response to:

> Generally, you want to notify your oncologist if you have the following symptoms: temperature >100.4°F, diarrhea lasting more than 24 hours or associated with cramps, mouth sores affecting eating or drinking, unusual pain or pain that is not alleviated by over-the-counter medications, shortness of breath, rash or hives, confusion or any other worrisome symptoms, or wounds that will not heal or have pus/redness. (p. 21)

One question asked the patient if they experienced symptoms like cramps, mouth sores, shortness of breath, diarrhea, or a temperature <100.4°F. However, examining the CareSense tool revealed that "Have you had a fever ≥100.4°F?" was not included.

Comparative data from December 2021–February 2022 for gastrointestinal oncology patients who underwent chemotherapy were reviewed for this project. From December 2021 to February 2022, 68 patients received chemotherapy. Of the 68 patients, 11 had a fever. Ten of the 11 patients did not notify the physician, 1 called the office to inform the physician. No patients used the MyChart messaging system or CareSense.

It was anticipated that increasing patient adherence to follow-up instructions using an instructional session and the communication tool, CareSense would provide adherence to physician follow-up. Adherence to physicians' instructions during the post-chemotherapy period is vital because close monitoring of side effects reduces adverse effects and promotes optimal health outcomes.

Problem Statement

In the gastrointestinal clinic, written and verbal instructions from infusion nurses and physicians are typically used to inform patients receiving chemotherapy they should notify the physician's office of a fever of 100.4°F within 24 hours of detection. However, patients typically did not follow-up within the recommended period. The provider would often be informed during a subsequent office visit that the patient experienced a fever several days to weeks in the past and that the fever was self-treated. An immunocompromised patient has a limited immune system because chemotherapy negatively affects the immune system. An oncology patient with a fever is at risk for hospitalization, sepsis, infection, delayed treatment, and even death. Increasing patient education using verbal and written documents, such as fever instructions printed on the after-visit summary and using the teaching back method, ensures patient engagement and understanding of fever education.

The oncology department at Houston Methodist Hospital uses the CareSense mobile health technology platform for chemotherapy patient engagement. The platform asks patients a specific question and depending on the response, a notification is then sent to a care navigator and the physician's office. To identify whether a patient receiving chemotherapy is experiencing a fever, the tool asks if the patient has a fever ≥100.4°F on

that day. When a patient selects "yes," CareSense sends the patient follow-up instructions to contact the oncologist's office. Documentation of a fever response triggers CareSense to notify the physician's office to follow-up with the patient.

Significance of the Project

In the gastrointestinal clinic, written and verbal instructions from infusion nurses and physicians are typically used to inform patients receiving chemotherapy that they should notify the physician's office of a fever of 100.4°F within 24 hours of detection. However, patients typically did not follow up within the recommended period. The provider would often be informed during a subsequent office visit that the patient experienced a fever several days to weeks in the past and that the fever was self-treated. An immunocompromised patient has a limited immune system because chemotherapy negatively affects the immune system. An oncology patient with a fever is at risk for hospitalization, sepsis, infection, delayed treatment, and even death. Increasing patient education using verbal and written documents, such as fever instructions printed on the after-visit summary and using the teaching back method, ensures patient engagement and understanding of fever education.

The oncology department at Houston Methodist Hospital uses the CareSense mobile health technology platform for chemotherapy patient engagement. The platform asks patients a specific question; a notification is sent to a care navigator and the physician's office, depending on the response. To identify whether a patient receiving chemotherapy is experiencing a fever, the tool asks if the patient has a fever ≥100.4°F on that day. When a patient selects "yes," CareSense sends the patient follow-up instructions

to contact the oncologist's office. Documentation of a fever response triggers CareSense to notify the physician's office to follow up with the patient.

Purpose of Project

The purpose of this project is to use a reporting fever instructional session and CareSense prompts to improve the reporting of fever within 24 hours by gastrointestinal oncology patients receiving chemotherapy.

Colorectal cancer is the third most common cancer in both men and women (American Cancer Society, 2023). Each year, >1 million patients with cancer receive chemotherapy or radiation in an outpatient oncology clinic in the USA (Centers for Disease Control and Prevention, 2022). As cancer prevalence increases, educating patients about their disease, its treatment, and its side effects is vital. Adverse effects of chemotherapy, such as neutropenic fever, require proper management to reduce hospitalization, treatment delays, and death. Providers and nurses are essential for the effective delivery of patient education. Therefore, education emphasizing the importance of notifying the physician within 24 hours of fever detection can reduce adverse outcomes.

The CareSense communication tool affects clinical outcomes and patient-centered care outcomes. The CareSense chemotherapy pathway is designed to provide education, monitor health and recovery, provide key reminders for needed actions, and ensure the resolution of patient action items. The CareSense chemotherapy pathway asks patients whether they have a fever ≥100.4°F and prompts them to contact their physician's office. CareSense allows the patient to have an active role in their care; it also informs the

physician's office to monitor the patient's responses and quickly follow up with the patient when necessary.

PICOT

The population, intervention, comparator, outcome, and time (PICOT) format was used to formulate the question for this quality improvement project: In patients with gastrointestinal cancer receiving chemotherapy (P), will a reporting fever instructional session and CareSense prompts (I) increase the reporting of fevers within 24 hours to MyChart, CareSense, or by calling the physician's office (O), compared with the standard of care in 2021 (i.e., verbal instructions by a physician, nurse practitioner, or infusion nurse) (C) within three months (T)? The population was patients with gastrointestinal cancer who received chemotherapy in an outpatient setting. The intervention consisted of CareSense prompts and a reporting fever instructional session on reporting temperatures/fevers ≥100.4°F to the physician within 24 hours using MyChart, CareSense, or by calling the physician's office. The number of patients who received the CareSense and reported fever instructional session intervention and those who reported fevers during three months were compared to the proportion of patients who notified the physician's office of a fever within 24 hours during the three months before the intervention. The primary outcome was to increase the number of patients reporting fevers within 24 hours to one of the three physician notification methods MyChart, CareSense, and calling the physician's office. A secondary outcome was patient satisfaction with using the CareSense communication tool.

Definition of Terms

The key terms in this project were given the following operational definitions.

Neutropenic fever

The combination of both neutropenia, a decrease in neutrophil numbers to values below 500 cells/mm^3, and fever, with a single oral temperature ≥38.3°C (101.0°F) or a temperature of ≥38.0°C (100.4°F) that was sustained >1 hour (Rasmy et al., 2016).

Adherence

The extent to which a patient continued an agreed-on mode of treatment without close supervision (Medical Dictionary for the Health Professions and Nursing, 2012).

Follow-up care instructions

Some further action taken after a procedure was finished, such as contact by a healthcare agency days or weeks after a patient underwent treatment (Medical Dictionary for the Health Professions and Nursing, 2012).

CareSense

A mobile-first digital platform designed to guide patients through the surgical pathway using a variety of communication tools. The platform allowed patients to choose their preferred method of communication — email, phone calls, or SMS messages (Bruce et al., 2022).

CHAPTER II

LITERATURE REVIEW

Febrile neutropenia is characterized by a combination of fever and a low neutrophil count (Damon & Andreadis, 2021). It is one of the most life-threatening complications of chemotherapy treatment. US incidence is estimated at 60,294 per year (i.e., 7.83 cases per 1,000 patients with cancer) (Rasmy et al., 2016). One potential danger of febrile neutropenia is that it often presents when patients are at home, and the healthcare team is not accessible (Krzyzanowska et al., 2016; Perron et al., 2014). In chemotherapy patients, a fever requires urgent assessment and intervention and should be immediately addressed when detected (Courtney et al., 2007). Accurate temperature measurement is the most important variable that chemotherapy patients should self-monitor and report for early intervention for neutropenic fever.

Patients should be informed about how to perform temperature measurements and recognize the presence of a fever. They should also be informed about the steps required for immediate notification of the healthcare team (Clarke et al., 2015). This information should be delivered as verbal and as take-home written instructions when chemotherapy is initiated. It should be reinforced during subsequent chemotherapy cycles.

The purpose of this project was to increase the reporting of fevers via MyChart or CareSense, or by calling the physician's office within 24 hours after detection in gastrointestinal oncology patients receiving chemotherapy. An increase in the number of patient-reported fevers to the healthcare team within 24 hours of a documented fever was expected after the implementation of this project.

Search Strategy

The online databases/search engines used to compile the most current information on fevers in gastrointestinal oncology patients receiving chemotherapy included the Cumulative Index of Nursing and Allied Health, Nursing Reference Center, Medline, and PubMed. The keywords used included fever, neutropenic fever, cancer, colorectal cancer, fever education, chemotherapy-induced fever, and fever knowledge. The main topics referenced included the incidence of febrile neutropenia, diagnosis, and management of oncologic emergencies, febrile neutropenia in patients with cancer, management of neutropenic fever, cancer education, and nurse communication. Adherence to medical treatment, effects of messaging systems on patient adherence to fever reporting instructions and chemotherapy, and effects of messaging systems were also used. Health belief models, behavioral changes, and motivation were also searched.

Theoretical Frameworks

The Health Belief Model ("Model") was initially developed in the 1950s by US Public Health Service scientists ("The Health Belief Model," 2019) "to predict health behaviors" (Boskey, 2022, p. 1) by explaining that the beliefs of an individual regarding an illness and the effectiveness of its suggested behavior will predict the probability that the individual will engage in that behavior ("The Health Belief Model," 2019). The six constructs of the Model are perceived severity, perceived susceptibility, perceived benefits, perceived barriers, cues to action, and self-efficacy (Boskey, 2022).

Figure 1

Health Belief Model

Concept	Definition	Application
Perceived Susceptibility	One's opinion of chances of getting a condition	Define population(s) at risk, risk levels; personalize risk based on a person's features or behavior; heighten perceived susceptibility if too low.
Perceived Severity	One's opinion of how serious a condition is and what its consequences are	Specify consequences of the risk and the condition
Perceived Benefits	One's belief in the efficacy of the advised action to reduce risk or seriousness of impact	Define action to take; how, where, when; clarify the positive effects to be expected.
Perceived Barriers	One's opinion of the tangible and psychological costs of the advised action	Identify and reduce barriers through reassurance, incentives, assistance.
Cues to Action	Strategies to activate "readiness"	Provide how-to information, promote awareness, reminders.
Self-Efficacy	Confidence in one's ability to take action	Provide training, guidance in performing action.

Perceived susceptibility is the likelihood of individuals engaging or not engaging in specific behaviors based on their perception of risk. For example, a patient might believe the likelihood of fever due to a chemotherapy-associated decreased white blood count and a compromised immune system is low. Perceived severity refers to an individual's likelihood of avoiding or decreasing a behavior based on how severe they believe the results will be. For example, a patient might not view having a fever while receiving chemotherapy as a severe condition that can lead to sepsis or death.

Perceived benefits are that people will engage in behavior only if there is a benefit. One example of perceived benefits is the patient who adheres to instructions to seek care and notify the physician about a fever that could be severe rather than self-

manage the fever. Perceived barriers refer to how complex changing behavior will be. These barriers include "amount of effort needed, Danger, Discomfort, Expense, Inconvenience, [and] Social consequences" [original in list format] (Boskey, 2019, p. 3). Barriers include no access to mobile health technology (CareSense), low health literacy, lack of proficiency in the use of modern technology, and no availability of a thermometer to assess temperature.

Cues to action and self-efficacy consider that sometimes simply wishing to change is not enough but that external events may push for the change to occur. A patient responding to the CareSense notification on days two and four post-chemotherapy monitoring for a fever is one example of a cue to action. Self-efficacy is how strongly an individual believes in their ability to change. Those who think they can influence the change they desire are more likely to do so (Boskey, 2019). For example, a patient who measures their temperature notifies the physician of fever and believes they can adhere to follow-up instructions by responding to the CareSense post-chemotherapy fever question.

Education of gastrointestinal oncology patients receiving chemotherapy on the pathology of neutropenic fever and when to see a physician can allow these patients to assume the role of self-advocates and managers of their health. Helping patients understand that they need to notify a physician of a fever within 24 hours emphasizes the importance and severity of this condition for their patient population. If oncology patients receiving chemotherapy understand the perceived severity and susceptibility of neutropenic fevers, such as infection, sepsis, and death, they are inclined to change behaviors. As providers, informing oncology patients of the importance of adhering to follow-up fever instructions to avoid consequences that could affect their health.

Knowing the perceived benefits of physician notification of fever, oncology patients will avoid chemotherapy treatment delays that can compromise treatment outcomes.

A healthcare provider must assess a patient's health-associated barriers to help that patient attain an optimal outcome. An assessment includes the support system, finances, access to mobile health technology, level of confidence with mobile health technology, resources, and accessibility to the physician's office. A provider with insight into barriers to patient adherence to follow-up instructions can determine whether additional support or resources are needed to assist the patient with performing the recommended health action. Informing patients that life-threatening complications and fatalities are associated with fevers in oncology patients receiving chemotherapy can prompt a behavior change if not reported and evaluated promptly. Finally, engaging a patient in their care and motivation affects the effort given to behavioral change.

The Health Belief Model helped guide the project by promoting healthy behaviors, prompting behavioral changes, motivating patients to engage in their care actively, and developing a patient-provider rapport. Patient education and communication are essential for adherence to medical instructions. Cancer is a chronic illness that requires additional support and resources. Healthcare providers are a resource to assist patients in attaining optimal outcomes through participation in their healthcare and sustaining health-promoting behaviors. The mobile health technology, CareSense, was the communication tool used to help improve patient outcomes associated with engagement and adherence to instructions.

Review of the Literature

Prevalence of Gastrointestinal Cancer

Colorectal, pancreatic, and liver cancers are the most common gastrointestinal cancers. Colorectal cancer is the third most common cancer diagnosed in both men and women (American Cancer Society, 2023). Lung/bronchus and prostate cancer are more common than colorectal cancer in men; lung/bronchus and breast cancer are more common than colorectal cancer in women. In 2018, there were 18.1 million new cancer cases and 9.6 million deaths worldwide. In the USA in 2019, an estimated 145,600 new cases were diagnosed, and 51,020 people died from the disease (Wang et al., 2021). Pancreatic cancer is another common gastrointestinal cancer of concern. Although pancreatic cancer is the 12th leading cause of cancer, it is the fourth leading cause of death from cancer in the USA for both men and women (Freelove, 2020). Pancreatic cancer is usually detected at an advanced stage, which results in higher morbidity.

As the sixth most common cancer, liver cancer is the fourth leading cause of cancer deaths worldwide (Wang et al., 2021). These deaths are associated with cirrhosis in 85% of liver cancer cases. Liver cancer incidence continues to increase in many countries and is expected to continue increasing throughout the next decade (Petrick & McGlynn, 2019). Accurate liver cancer monitoring and surveillance is challenging because low- and middle-income countries have few cancer registries. In 2012, there were an estimated 782,451 new cases of liver cancer (Baecker et al., 2018). Of these cases, it was estimated that 83% were from low- to middle-income countries. Worldwide, 291,420 cases of gallbladder cancer were recorded in 2018 (Huang et al., 2021); 165,087 gallbladder cancer-related deaths occurred during the same year.

Neutropenic Fever

Neutropenic fever is the combination of both neutropenia, a decrease in neutrophil numbers to a value <500 cells/mm3 (Rasmy et al., 2016), and fever, with a single oral temperature ≥38.3°C (101.0°F) or a temperature ≥38.0°C (100.4°F) sustained >one hour. Neutropenic fever is one of the most common reasons for presentation to the emergency department (ED) for patients with cancer. Neutropenic fever is often a significant cause of morbidity and mortality. Previous estimates indicate that in the USA, >60,000 persons with cancer are hospitalized with neutropenia, and >4,000 persons die of febrile neutropenia each year (Tai et al., 2017).

Management of Fever in Patients Receiving Chemotherapy

Antibiotic therapy should be started immediately at the onset of fever. Because of the time required to obtain microbiological test results, empirical antibiotics should initially be started in patients who do not have an apparent clinical focus of infection (Heinz et al., 2017). Treatment must be started within two hours after the onset of fever, without waiting for microbiology results. The first-line antibacterial agents used should include gram-negative enterobacteria, Pseudomonas aeruginosa, Staphylococcus aureus, and streptococci (Zimmer & Freifeld, 2019). Acceptable antibiotic options include cefepime, piperacillin + tazobactam (if anaerobic coverage is required), or meropenem (if there is a history of extended-spectrum β-lactamase infection).

Neutropenic fever treatment guidelines positively affect patient outcomes. As Heinz et al. (2017) and Bhardwaj et al. (2013) noted, quick initiation of empiric antibiotic therapy is critical for the treatment of neutropenic fever. Bhardwaj and Navada's (2013) review provides information on the care of oncology patients with neutropenic fever.

Because the immune response is compromised in oncology patients undergoing chemotherapy, fever can be the only sign of infection. Infections can result from the direct effects of chemotherapy on mucosal barriers and from the direct immunosuppressive effects of the underlying malignancy. Infections are typically secondary to Gram-positive and Gram-negative organisms, such as Pseudomonas aeruginosa, Staphylococcus epidermidis, Staphylococcus aureus, viridans group streptococci, and enterococci. Bacteremia is the most documented infection, found in 10% to 25% of patients with neutropenic fever (Freifeld et al., 2011). Gram-negative bacteremia is associated with a 40% mortality rate among some groups of febrile neutropenic patients (Klastersky et al., 2007). The most common primary sites of infection are the gastrointestinal tract, lungs, and skin.

A thorough work-up must be performed when an oncology patient presents with a fever. A work-up includes a physical examination and laboratory testing. Two sets of peripheral blood cultures should be performed, each from a different site (and simultaneously, one from each lumen of a tunneled catheter, if present). If the patient remains febrile, blood cultures are typically repeated daily during the first 48 hours (Freifeld et al., 2011). Diagnostic tests and physical examination results will guide antibiotic therapy treatment decisions. Antibiotics should be administered within one to two hours of presentation (Dellinger et al., 2008). Broad-spectrum antibacterial agents against the most likely and deadly pathogens should be given as soon as possible and at maximum doses adjusted for renal and hepatic function. The initial selection of antibiotics should be guided by the patient's history, symptoms, signs, drug allergies, recent antibiotic use (including prophylaxis), previous infections (especially if antibiotic-

resistant pathogens were present), and the institution's susceptibility patterns for common pathogens. The therapy should be adjusted based on clinical response and culture results. It might be necessary to temporarily withhold chemotherapy during this time (Bayrak & Kitiş, 2018).

Skiba et al.'s (2020) study of febrile neutropenia treatment used a retrospective audit of patients with solid organ malignancy and a subsequent diagnosis of febrile neutropenia. The patient administration system provided data based on ICD-10 codes, and this information was entered into a standardized data collection tool. Ninety-eight admissions (88 patients) for febrile neutropenia were recorded during the one year study period. In 89% of the cases (88 admissions), antibiotics that conformed to Australian guidelines were provided. The study found that of 72 admissions presenting to the ED with a fever and admitted directly to the hospital, the average time of antibiotic administration from fever detection to admission was 279 minutes. Considering the entire cohort of patients, only 11% received antibiotics within the 60 minutes recommended by the guidelines. Of all patients treated for febrile neutropenia, 8.2% (eight patients) died. Of these patients, two died directly from sepsis, four died from sepsis-related complications, and two died from the cancer for which they received treatment.

Changes were made at the center due to poor performance when responding to febrile neutropenia. First, patient education materials were redesigned to emphasize the importance of promptly reporting any case of high fever >38°C. Second, the febrile neutropenia alert card was simplified to make it easier to understand. Third, a new admissions pathway that streamlined admissions for patients with febrile neutropenia was introduced, and an acute admissions unit was instituted. Finally, a "febrile neutropenia

box" contained flow sheets describing the treatment process and the antibiotics required to streamline patient treatment.

Like Skiba et al. (2020), Wright et al. (2013) examined guideline recommendations for compliance for febrile neutropenia. They also examined factors that affected adherence to febrile neutropenia guidelines and analyzed how guideline use affected patient outcomes. The study evaluated guideline-based antibiotics, vancomycin, and granulocyte colony-stimulating factors (GCSFs). During this 10-year prospective study, 25,231 patients with solid tumors were admitted to the hospital with febrile neutropenia. Of the patients admitted with neutropenic fever, 76.9% had colorectal cancer, and 78.8% had other gastrointestinal cancer. Guideline-based antibiotics were given alone or combined within 48 hours of hospital admission. The antibiotics were cefepime, ceftazidime, imipenem, meropenem, piperacillin/tazobactam, and an aminoglycoside in combination with ciprofloxacin or ticarcillin/clavulanate. The results indicated that guideline-based antibiotics were administered to 19,897 patients (79%). Vancomycin was given to 37% of the patients, with at least one dose during the first 48 hours of hospitalization. GCSFs were administered to 63% of the patients, with at least one dose during hospitalization. The use of vancomycin increased from 17% in 2000 to 55% in 2010; GCSF use decreased from 73% to 55%. In conclusion, prompt initiation of guideline-based antibiotics decreased the mortality rate. Establishing guideline adherence to improve patient outcomes is vital for patient care. It is as important as antibiotic selection as a quality-of-care metric for treating febrile neutropenia.

Providing appropriate intravenous antibiotics within 60 minutes of admission of a patient who presents with suspected febrile neutropenia is critical for optimal outcomes.

This is a consistent finding in the literature (Koenig et al., 2020; Saeed & Al-Atiyyat, 2015; Skiba et al., 2020). Delays in antibiotic treatment administration can result in death from sepsis or meningitis (Koenig et al., 2020; Skiba et al., 2020). Rosa and Goldani (2014) examined the administration time of antibiotics and quality-of-care measures in patients with febrile neutropenia. This two-year prospective cohort study in Southern Brazil followed 169 patients who received chemotherapy and were admitted for febrile neutropenia. Antibiotic administration time was evaluated as a predictive factor for 28-day mortality. The time to antibiotic administration was independently associated with 28-day mortality; each increase of one hour in the time to antibiotic administration increased the risk of 28-day mortality by 18%. Administering antibiotics at <30 minutes after detection of neutropenic fever was associated with lower 28-day mortality rates than antibiotic administration times between 31 and 60 minutes. There were 29 deaths in the study population, and the study found that early administration of antibiotics was associated with higher survival rates in patients with febrile neutropenia.

Patients' Response to Chemotherapy Side Effects

Olver et al. (2018) surveyed 436 patients receiving chemotherapy to understand how the patients intended to report chemotherapy side effects, such as a high fever (>38°C), fatigue, nausea or vomiting, nail changes, and skin rash. They found that 67% of the respondents said they would obtain treatment for a fever >38°C. However, fewer (41%) would do so for bruising or bleeding.

Livingston et al.'s (2011) 443 randomly selected and evaluated patients with cancer who went to the ED and had recently received chemotherapy. Of all the patients, 5.3% had gallbladder, liver, or pancreatic cancer. Febrile neutropenia was the most

common ED discharge diagnosis (15%) and most likely to result in hospital admission (82.8%). The study outcome was the development of strategies to reduce preventable presentations to the ED. Achievement of this outcome would aid patients and reduce additional healthcare costs related to chemotherapy treatment. Like Olver et al. (2018), Livingston found that patients who received chemotherapy often experienced side effects of treatment, and fever was a commonly reported side effect.

Bayrak and Kitiş (2018) conducted a descriptive study to examine the main reasons for ED visits in patients with cancer admitted to the ED at a university hospital. This four-month study included 243 participants; 47 patients and 196 relatives of patients completed the questionnaire. The questionnaire consisted of 21 questions (six questions on demographic characteristics, nine about treatment and disease, five about the reasons and frequencies of ED visits, and one about homecare). Gastrointestinal tract cancer was the most common cancer (34.2%). The study found that 84.0% of the patients received chemotherapy, and 69.1% received chemotherapy before their last ED visit. The study also found that 59.3% of patients were not informed about possible emergencies after chemotherapy; 58% did not consult a physician or health department before presenting to the ED. Like Livingston et al., the primary reason for ED visits in this current study of patients with cancer was due to nausea, vomiting, pain, and high fever. The researchers recommended that nurses and providers educate the patients and family members about side effects and how to manage them during chemotherapy. Timely triage and emergency care guidelines should be established to give better care to patients with cancer who present to the ED.

Intervention/Education

Importance and Effectiveness of Chemotherapy Patient Education

Providers are essential for the facilitation of patient communication to improve patient outcomes. The effect of limited health literacy in cancer care is vast. It can affect a patient's ability to make treatment decisions, follow directions on a prescription label, or adhere to neutropenic precautions (Dickens et al., 2013). Research results suggest that all patients, regardless of health literacy skills, education level, age, or socioeconomic status, benefit from easy-to-read resources (Centers for Disease Control and Prevention, 2010). A general goal for written patient education materials is that they should be written at or below a sixth-grade reading level. Providers and nurses are essential for the effective delivery of patient education. Helping patients comprehend complex health information reduces the risk of adverse outcomes and is an optimal approach to patient-centered care (Foster et al., 2016). Nurses should use language free from medical terminology and jargon during patient teaching. They should present the most critical information first. The use of the teach-back technique should be considered as a quick way to assess the teaching and the effectiveness of the resource (DeWalt et al., 2010).

Studies in the Literature Review

Providing high-quality chemotherapy patient education is a key aspect of febrile neutropenia treatment. Clarke et al. (2015) examined patients' and caregivers' perspectives on neutropenic fever and patient education. They conducted a study to examine the pre-hospital experiences of patients who presented with need-to-treat neutropenic sepsis. The study was designed to examine the early conditions that indicated a problem and to determine why patients delayed going to the ED. This qualitative

research study included interviews with 22 patients and 10 caretakers. Of these patients, 37% waited >12 hours before going to the ED after experiencing symptoms. The mean delay was 11 hours. The interview results revealed themes that helped explain the reasons for the delays. They included receiving confusing or mixed messages about the importance of a rapid response. Some patients were in denial because they did not want to go to the hospital. In some cases, the patients did try to get treatment, but the non-specialists they visited thought the signs were mild, did not recognize the possible neutropenia, and released the patients without treatment.

The results of the Clarke et al. (2015) study suggested there needs to be more effective education or adherence to protocols for prompt reporting of neutropenic fevers in chemotherapy patients. To examine that issue more directly, researchers in Nova Scotia conducted a descriptive survey of adult hematological, gynecological, and medical oncology patients who had received chemotherapy over four months in 2018 (Kaupp et al., 2019). Of the 142 individuals surveyed, 41% indicated they were satisfied, and 47% indicated they were very satisfied with the education they received about their oncology treatment. The survey also found that 30–43% of the respondents would have appreciated receiving more education through follow-up instructions from a pharmacist. Respondents with post-secondary education were much more likely to want an appointment with a pharmacist.

The Kaupp et al. (2019) study revealed important aspects of the results of effective patient education. Pétré et al. (2017) examined the opinions and attitudes of health practitioners responsible for providing patient education and their educative attitudes toward therapeutic patient education (TPE). The results suggested that to

provide effective TPE, health practitioners must have an educative attitude. Several themes emerged from the interviews with 33 participants, primarily nurses (17) and females (29). Most importantly, the study found that having an educative attitude was not explicitly taught using formal training but was expected to be learned or internalized implicitly. Furthermore, health providers have a responsibility to help their patients not only cope with their disease but change their attitudes and beliefs about it. One aspect missing from the educative attitude is the need to provide psychological support for those struggling with the disease, which can be confusing and frightening. Changing training programs to include these elements will strengthen TPE to help patients more effectively. Cumulatively, these studies found that when effective patient education is lacking, prompt reporting tends to be lower than it should be; chemotherapy patients are at a greater risk of sepsis from febrile neutropenia. Other studies have found that patients and healthcare providers generally have positive attitudes toward patient education.

Similar to Clarke et al. (2015), a study in France evaluated TPE given by pharmacists and nurses (Marmorat et al., 2020). The study focused on improving the patient's response to adverse events and increasing adherence to treatment recommendations. The primary goal of these education programs was to increase the patient's ability to make good decisions, think critically and creatively, solve problems, communicate, build healthy relationships, and manage their lives productively and as healthily as possible. This study uniquely combined psychosocial skills with medical self-care skills and most of the literature on TPE focuses on self-care rather than psychosocial skills. However, the researchers noted that this educational approach needs to consider the complexities of motivating patients using TPE.

Adherence to Medical Instructions

A critical aspect of patient care for cancer patients using chemotherapy is how well clinicians adhere to practice and clinical guidelines when using treatment approaches. Two studies were conducted to examine the effectiveness of instructions to use pegfilgrastim as a prophylactic approach to prevent chemotherapy-induced neutropenia (Crawford et al., 2021; Tralongo et al., 2020). Crawford et al. (2021) examined the adherence of medical staff to clinical guidelines for treating chemotherapy patients. Their review found that when an organization implemented an electronic medical record (EMR) system, adherence to the recommendation of pegfilgrastim as a prophylactic measure increased to 76.2% after the institution of the EMR, compared with the before-EMR adherence of 67.5%. The authors noted that these findings suggested that if recommendations for pegfilgrastim were not already coded into EMR systems, adding them could improve patient outcomes by increasing adherence to the clinical guidelines and reducing the risks of febrile neutropenia and hospitalization. Tralongo et al.'s (2020) results were consistent with Crawford et al.'s (2021) findings, including the recommendations for pegfilgrastim as primary prophylaxis when managing patients with chemotherapy-induced neutropenia.

Danova et al. (2020) discussed how providing prophylactic treatment using GCSFs reduces febrile neutropenia and subsequent hospitalization. Pegfilgrastim is a GCSF. The authors noted that international guidelines for the treatment of chemotherapy patients consistently recommend the use of GCSF for patients at high risk (>20%) of febrile neutropenia or when patients have other recognized risk factors (e.g., advanced disease, advanced age, have experienced febrile neutropenia in the past). This study

found that low adherence might result from clinicians' need for more awareness of the value of GCSF for these patients. Both studies found lower adherence in clinical practice. However, they proposed different solutions. Crawford et al. (2021) suggested using decision support systems in the EMR to resolve the problem. In contrast, Danova et al. (2020) suggested that better education is sufficient. These approaches could complement one another.

Pétré et al.'s (2017) results suggested that clinicians must have an educative attitude to reach their patients effectively and encourage them to adhere to medical advice. Clinicians had an educative attitude if they were (1) willing to spend the time needed with patients to ensure they understand the need for compliance; (2) had a good attitude toward TPE; and (3) felt that patient education was an important part of their clinical role. The theme of practitioner attitude toward training appears elsewhere in the literature (Lelorain et al., 2017; Marmorat et al., 2020). The use of messaging systems is one way that has been proposed to improve medication adherence.

Effects of Messaging Systems on Patient Adherence to Fever Reporting and Chemotherapy

As technology has become more available and ubiquitous, medical research on the use of technology to improve patient adherence to treatment has increased (Bruce et al., 2020, 2022; Davoodi et al., 2016; Fenerty et al., 2012; Mougalian et al., 2018; Rico et al., 2020). Discussions of the uses of technology have included the broad umbrella of mHealth technologies (Bruce et al., 2020, 2022; Mougalian et al., 2018), a more focused concentration on the benefits of mobile phones for increasing adherence (Davoodi et al.,

2016), and a specific focus on the effect of use of messaging systems (e.g., text messaging) on adherence (Fenerty et al., 2012; Rico et al., 2020).

As defined by Bruce et al. (2020), the broad umbrella of mHealth includes a spectrum of services available in mobile technology, such as mHealth applications, web-based portals for patient communication, and receiving messages directly to the phone via SMS systems. One benefit of involving patients in mHealth technologies is that they become more engaged and committed to their care. They will then be more active in assuming responsibility for improving their outcomes. Active patient involvement is a common thread in the research on improving patient adherence to medical instructions (Bruce et al., 2020; Mougalian et al., 2018; Tuominen et al., 2021). Bruce et al. (2020) found that compared with a control group, the groups actively using mHealth technology had lower readmission rates over 30-, 60-, and 90 days; the length of stay for those in the experimental group was also shorter than for the control group. These findings provide strong evidence supporting using mHealth technologies to improve patient engagement and adherence outcomes.

The Davoodi et al. (2016) study of using mobile phone technology to improve patient adherence examined the literature for evidence of effective mobile phone technology use for managing chemotherapy side effects in patients after release from the hospital. They found that mobile technologies, such as mobile phones, are increasingly used to manage patient side effects and adherence to treatment guidelines effectively. Using these technologies results in behavioral changes, more rapid detection of side effects, and an increased likelihood of appropriate patient actions within the correct period. The authors identified the recurring theme that rapid response improves patient

outcomes. Text messaging is a major technology that has received considerable attention for several years in studies of patient compliance.

Fenerty et al. (2012) examined patient reminder systems to improve treatment adherence. This meta-analysis of the literature examined various attempts to improve medication adherence but focused on the benefits of text messaging systems used to improve patient outcomes. They found poor treatment adherence in 30–50% of the population, "regardless of disease process, prognosis or background" (Fenerty et al., 2012, p. 128). Multiple studies examined by Fenerty et al. found that when text messaging reminder systems are used, marked adherence improvement occurs, compared with control groups. This finding is consistent with the findings of other studies (e.g., Bruce et al. (2022) and Rico et al. (2020)). During the development of these systems, it is important to identify what is important for managing neutropenic fever and what kinds of reminders should be included in communications.

Conclusion/Summary

In chemotherapy patients, neutropenic fever is a medical emergency with a severe risk of morbidity and mortality. Febrile neutropenia can seriously affect patient outcomes when there is a delay in fever assessment and evaluation. Healthcare providers are essential for providing health information and educating patients about neutropenic fevers. A CareSense and fever reporting instructional session and using the mobile health technology CareSense for patient and physician communication can lead to increased patient reporting of fever and adherence to follow-up instructions.

CHAPTER III

METHODOLOGY

This project aimed to increase the reported fevers to MyChart, CareSense, or calling the physician's office within 24 hours of detection by gastrointestinal oncology patients receiving chemotherapy. The primary outcome was to increase the number of patient-reported fevers to the healthcare team within 24 hours of a documented fever.

Study Design

The pre-and post-project design analyzed the effects of a reporting fever instructional session and CareSense prompts in patients with gastrointestinal tract cancer receiving chemotherapy. The patients were instructed to notify the healthcare team of a fever within 24 hours using the CareSense communication tool, MyChart messaging, or by calling the physician's office. An EPIC system retrospective chart review of patient records was performed pre-implementation from December 2021 to February 2022 to identify the number of patients who had a reported fever but did not notify the physician's office within 24 hours. The EPIC system chart review also identified the number of patients who notified the physician's office to report a fever via MyChart or by calling the physician's office. A CareSense chart review was conducted for the same period, December 2021 to February 2022, pre-implementation, to identify the number of patients using the communication tool CareSense to notify the physician's office of a fever. Post-implementation, a three-month EPIC and CareSense chart review was performed to determine whether there was an increase in the number of patient-reported fevers to the

healthcare team within 24 hours of a documented fever via one of the three physician notification methods.

Population and Sample

The target population for this project was all gastrointestinal oncology patients receiving chemotherapy in an outpatient oncology clinic. All patients received the reporting fever instructional session. Only new patients were enrolled in CareSense at the Houston Methodist Medical Center location. Patients could opt out of CareSense prompts by replying "STOP" anytime if they no longer want to receive messages. The sample descriptive data included each patient's age, ethnicity, primary language, and whether they were new or established. An estimated effect size of 0.32, a power of 0.8, and a significance level of 0.05 were used to determine that a minimum sample size of 76 was necessary to detect a significant difference in the number of patients who reported fevers within 24 hours, pre-and post-intervention. The project's effect size was based on a Kearney et al. (2009) study of 112 breast, lung, or colorectal cancer patients receiving outpatient chemotherapy. The study evaluated the effect of a mobile-based, remote monitoring, advanced symptom management system on six chemotherapy-related symptoms, incidence, severity, and distress. A statistically significant change in reporting was found for two of the six symptoms. The study found a 32.3% change in reports of fatigue and a 31.6% change in reports of hand-foot syndrome.

Instruments/Measures

The project included three instruments (CareSense, EPIC/MyChart, and patient satisfaction survey) used to collect data related to reporting fevers within 24 hours and to patient satisfaction. The data collected included gastrointestinal oncology patients

receiving outpatient chemotherapy who called the physician's office and used MyChart and CareSense.

The EPIC electronic health record system allows patient engagement, remote care, access to records, enhanced provider coordination, and a patient portal. The patient portal, MyChart, allows patients to access their health records and laboratory results and direct communication with their physicians via messaging.

The CareSense mobile health (mHealth) technology integrates communication between patients and clinicians. CareSense was developed initially for patients who underwent preoperative and postoperative total joint surgery at Houston Methodist Hospital (Bruce et al., 2022). For these surgery patients, the CareSense technology consisted of patient-centered text messaging and email to educate and monitor patients over 50 days, from before orthopedic surgery to post-hospital discharge. Bruce et al. (2022) found that the use of mobile health for patient care is likely to be effective and used by patients undergoing orthopedic surgery if they are connected to clinical staff who can respond to problems that arise. This study also examined patient satisfaction. The patients thought CareSense was efficient, welcoming, and encouraging. CareSense was subsequently expanded for use by other services at Houston Methodist Hospital.

CareSense was designed to ask specific questions regarding side effects experienced after chemotherapy. The communication tool asked the patient if they were experiencing side effects, such as nausea, diarrhea, and fever. It also asked the patient if they had a temperature ≥100.4°F on days two and four post-chemotherapy. If the patient selected "Yes," follow-up instructions were provided (e.g., "OK. Please contact your Oncologist's Office so that we can evaluate whether you might have an infection. If it is

after hours, you can still call your oncologist's office at <plug in individual locations phone number>"). CareSense then alerted the triage nurse: "The patient has indicated that he or she has symptoms suggesting possible infection" (Appendix B). If the patient answered yes, they were instructed to call the doctor, and CareSense then notified the nurse. If the patient answered no, the system encouraged the patient to continue to monitor symptoms. If the patient did not respond, CareSense sent a prompt 24 hours later.

On day six after chemotherapy, CareSense electronically sent a patient satisfaction survey via the patient's preferred method of communication (Appendix B). The patient satisfaction survey asked, "How much do you agree or disagree with the following statements? It was helpful to me to receive alerts, reminders, and emails from this program about my chemotherapy. This program improved my overall knowledge about my chemotherapy and recovery compared to what I knew before." Responding to these questions, the patient selected an answer from the following choices: strongly agree, agree, undecided, disagree, and strongly disagree.

Procedure of Implementation

On the day of a scheduled office visit, all gastrointestinal oncology patients receiving chemotherapy received the standard information session plus a reporting fever instructional session given by the nurse practitioner (Appendix C). During the gastrointestinal oncology patient's office visit, this informational session occurred in the physician's clinic. The 20-minute informational session included information about the patient's chemotherapy regimen, potential chemotherapy side effects, how to manage potential side effects, and the use of the communication tool, CareSense (Appendix D).

During the visit, the patient was informed that CareSense was a third-party patient communication and education provider. The patient regularly received text messages, emails, or phone calls that included reminders about their care, educational materials for treatment at home, and monitoring questions designed to check their symptoms and concerns. The CareSense tool allowed the physician and their team to help patients with their recovery progress. In addition to the session, the patients received a CareSense handout and an after-visit summary. The after-visit summary also provided instructions about notifying the physician if the patient had a temperature ≥100.4°F.

After a patient's insurance approved chemotherapy, new patients were enrolled in CareSense when scheduled for the initial chemotherapy appointment at the Houston Methodist Medical Center. Once enrolled in CareSense, each patient began receiving Welcome Messages via text or phone call. Email alerts were also available. During the welcome message, the patient was also asked to confirm that their contact information was accurate. CareSense notifications began five days before the patient's chemotherapy infusion date. They consisted of information about the infusion center location, parking, telephone numbers, and safety tips for chemotherapy.

On days two and four post-chemotherapy, CareSense prompts sent a notification via text to ask the patient, "Have you experienced a fever with a temperature ≥100.4°F?" The patient could select yes or no; both elicited a follow-up response. On day six after chemotherapy, CareSense sent a patient satisfaction survey via text to assess whether the tool had improved the patient's knowledge about their chemotherapy and recovery and whether the reminders were helpful.

Data Analysis

The goal of the study was to increase the number of patients who reported fevers within 24 hours to MyChart, CareSense, or by calling the physician's office after implementing the intervention.

An EPIC team member provided de-identified aggregate data on the number of patients reporting fever via MyChart, by calling the physician's office or using CareSense. Data analysis included the number of patients who notified the physician's office of a fever within 24 hours during the three-month project period. This proportion was compared to the proportion of patients who complied with notifying the physician's office of a fever within 24 hours during the three months before the intervention. The patient satisfaction survey results provided on day six post-chemotherapy were also analyzed to determine whether the patients thought the CareSense alerts and notifications about their chemotherapy and recovery were helpful. The data analyses were performed using Intellectus Statistics (2022).

Ethical Consideration

The project protocol was submitted to the Prairie View A&M University and Houston Methodist Hospital Institutional Review Boards. Permission to complete the project was received from both institutions (Appendix E and F). To maintain patient privacy and confidentiality, de-identified aggregate data from EPIC/MyChart and CareSense were retrieved by an EPIC and a CareSense team member. The data were stored in a locked cabinet in the gastrointestinal oncology clinic. Although all patients received the reporting fever instructional session, they could opt out of CareSense prompts by replying "STOP" if they no longer wished to receive messages.

CHAPTER IV

RESULTS

This project aimed to increase the number of fevers reported within 24 hours of detection by gastrointestinal oncology patients receiving chemotherapy. The patients used MyChart, CareSense, or called the physician's office to report the fever. The results are presented in two sections: (1) descriptive statistics: demographic data, including age, race, ethnicity, preferred language, and whether patients were new or established, and (2) inferential statistics.

Descriptive Statistics

A total of 98 gastrointestinal oncology patients participated in the project. The ages of the patients ranged from 29–89 years. Caucasian was the most frequent race (*n* = 70, 71.43%); other races included Asian, Black, and Hawaiian/Pacific Islander. Ethnicities of the patients included Hispanic or Latino; Not Hispanic or Latino was the most frequent (*n* = 71, 72.45%). English was the preferred patient language (*n* = 74, 75.51%). Other patient-preferred languages included Arabic, Spanish, Vietnamese, and Chinese-Mandarin. There were 84 established patients (*n* = 84, 85.71%) and 14 new patients. Results for frequencies and percentages of visit type, race, and language are presented in Figures 2 and 3.

Pre-Intervention, 68 gastrointestinal oncology patients received chemotherapy from December 2021–February 2022. The ages of the patients ranged from 24–90 years. Caucasian was the most frequent race (*n* = 50, 73.53%); other races were Asian, Black, and Hawaiian/Pacific Islander. Ethnicities of the patients included Hispanic or Latino, but

Not Hispanic or Latino was the most frequent response (*n* = 51, 75.00%). English was the preferred patient language (*n* = 51, 75.00%). Other patient-preferred languages included Spanish, Chinese-Mandarin, and Arabic. The results for frequencies and percentages of visit type, race, and language are presented in Figures 4 and 5.

The histogram is one of the most important graphical representations in statistical practice. It provides a consistent estimate of any density function, with very few assumptions (Scott, 2010). A histogram was used to present mean age and standard deviation results. Pre-intervention, the mean age was 61.89 and the standard deviation was 13.28. Post-intervention, the mean age was 64.50 and the standard deviation was 10.60. Figure 6 presents a histogram of age, pre-intervention. Figure 7 presents a histogram of age, post-intervention.

Figure 2

Visit Type by Race, Post-Intervention

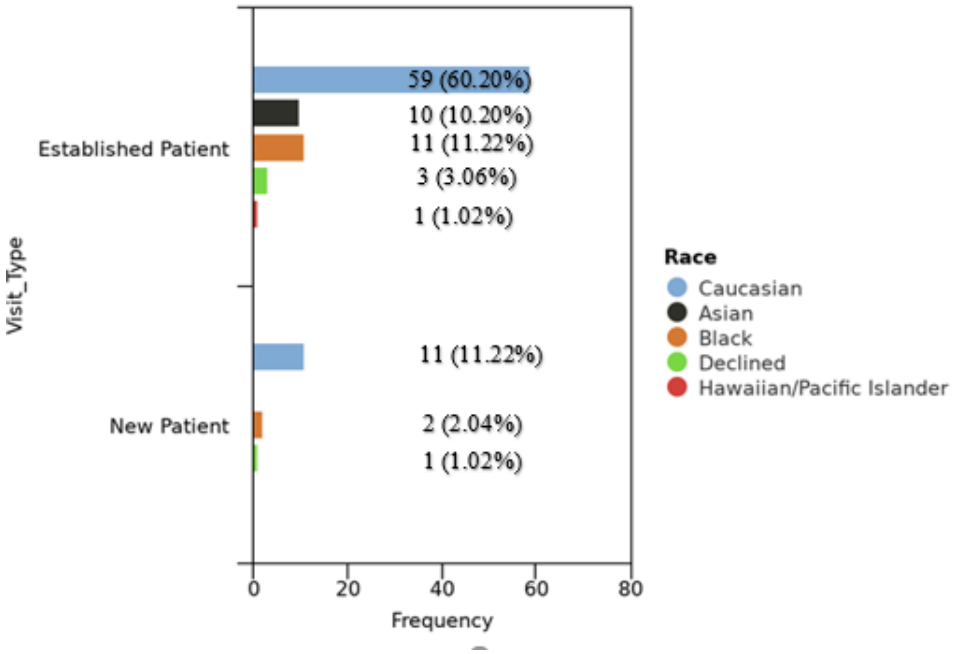


Figure 3

Visit Type by Preferred Language, Post-Intervention

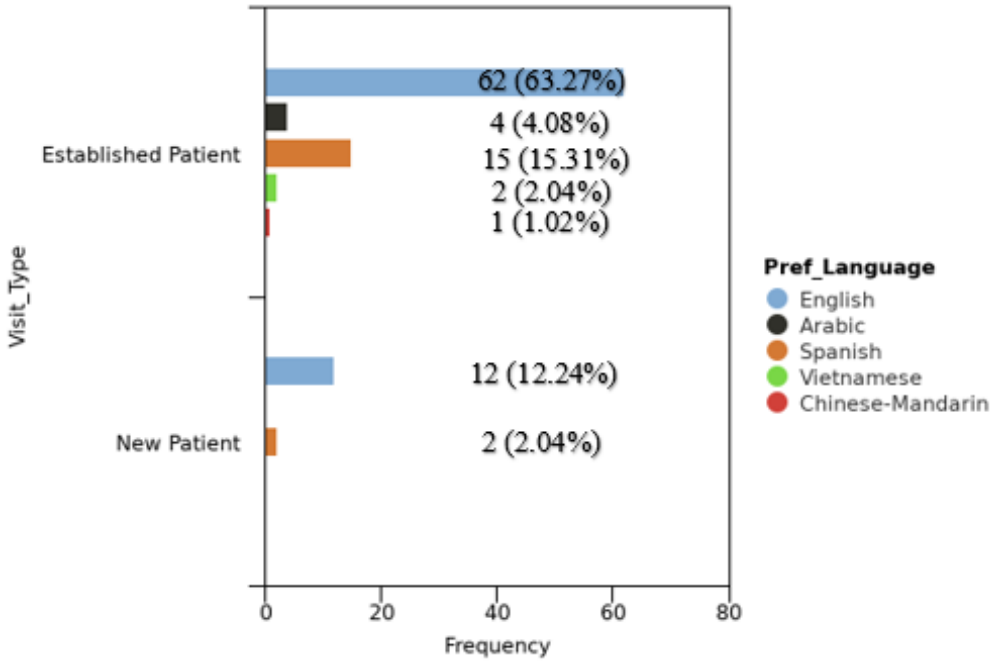


Figure 4

Visit Type by Race, Pre-Intervention

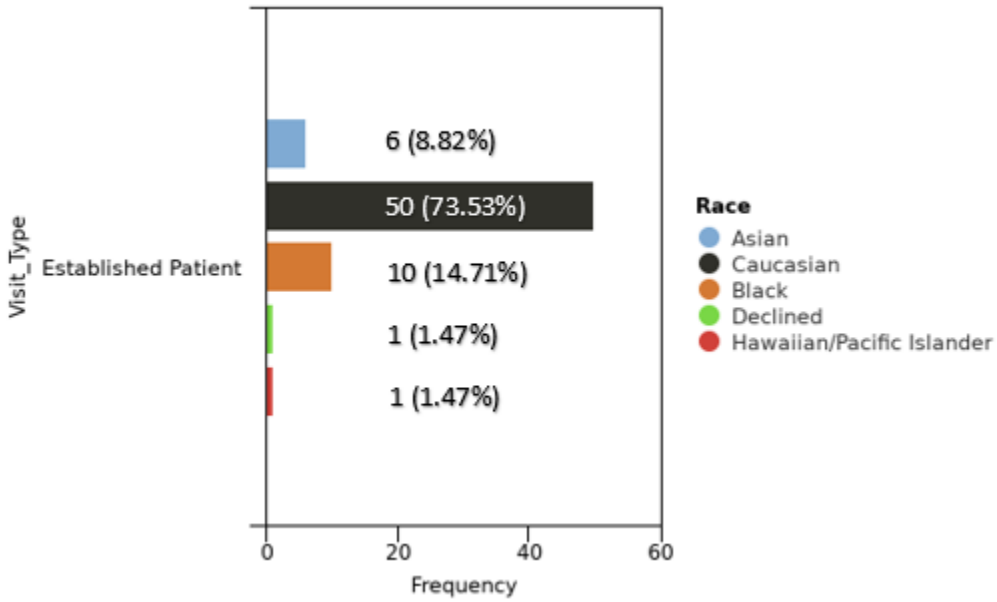


Figure 5

Visit Type by Preferred Language, Pre-Intervention

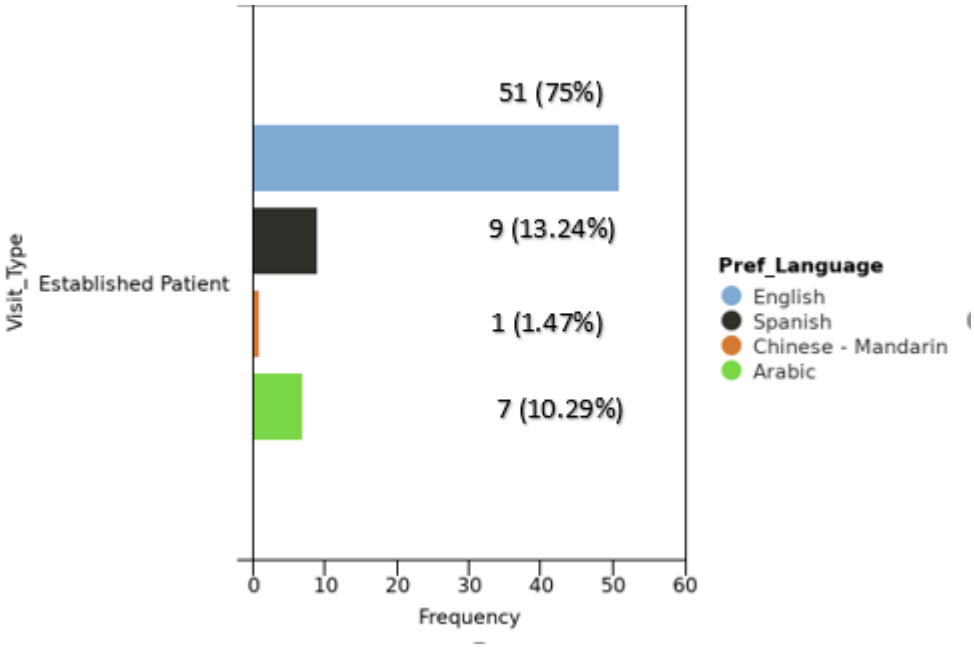


Figure 6

Pre-Intervention Histogram of Age

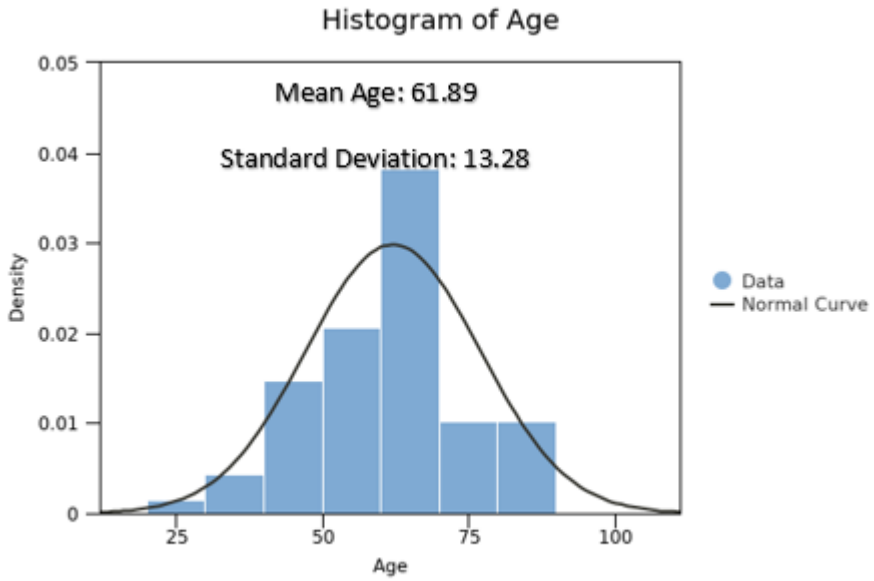
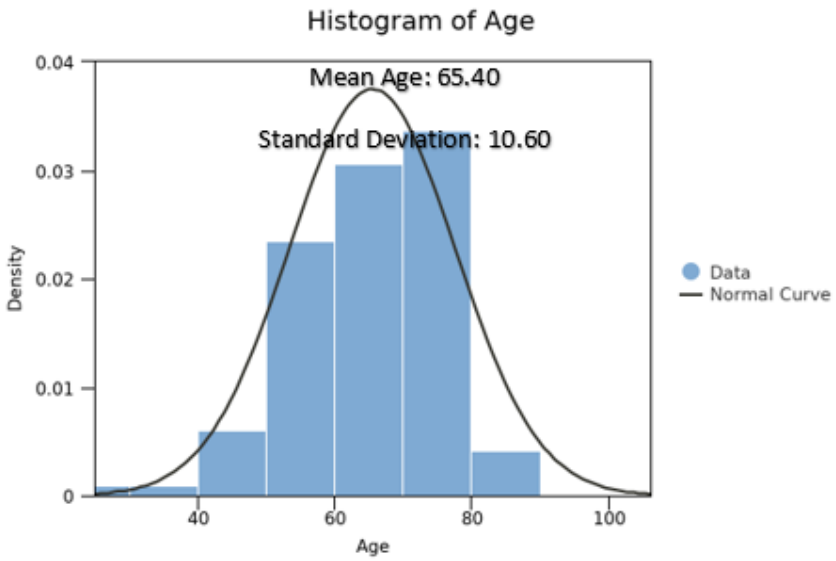


Figure 7

Post-Intervention Histogram of Age



Inferential Statistics

Inferential statistics were used to examine the following PICOT question: Among patients with gastrointestinal cancer receiving chemotherapy (P), will a reporting fever instructional session and CareSense prompts (I) increase the reporting of fevers within 24 hours of fever detection to MyChart, CareSense, or by calling the physician's office (O) during a three-month period (T) compared with the standard of care in 2021 (i.e., verbal instructions by a physician, nurse practitioner, infusion nurse) (C)?

Data on gastrointestinal oncology patients receiving chemotherapy who received a reporting fever instructional session and CareSense prompts were collected from December 2022–February 24, 2023. The data analysis included each patient's responses to chemotherapy side effects, particularly fever, on days two and four after chemotherapy.

On day six post-chemotherapy, the CareSense patient satisfaction survey asked about each patient's satisfaction with the use of CareSense to report post-chemotherapy side effects. The patient satisfaction survey asked, “How much do you agree or disagree with the following statements? It was helpful to me to receive alerts, reminders, and emails from this program about my chemotherapy. This program improved my overall knowledge about my chemotherapy and recovery, compared to what I knew before."

Additionally, collection of data on patient reporting of fever by calling the physician's office or using MyChart messages was performed using an EPIC chart review. The EPIC chart review also collected data on documented fevers that were not reported to the physician's office.

Pre-intervention (i.e., from December 2021–February 2022), 68 gastrointestinal oncology patients received chemotherapy; of the 68 patients, 11 had a fever. Ten of the 11 patients did not notify the physician. One patient called the office to inform the physician of a fever; no patients used the MyChart messaging system or CareSense. These results indicated that the rate of fevers reported within 24 hours of detection was only one percent.

The data collected post-intervention (December 2022–February 24, 2023) included 98 patients. Of the 98 gastrointestinal patients who received chemotherapy, five had a fever; all five patients notified the physician’s office by calling within 24 hours of fever detection, which was a response rate of 100%. A chi-square test for independence was performed to determine the difference in the proportion of patients reporting fevers within 24 hours, pre- vs. post-intervention. The results of a Fisher’s Exact Test are reported due to expected cell values <5. The Fisher’s Exact Test result of p=.001 was

significant, based on an alpha value of .05. This result suggested that a post-intervention reporting fever instructional session and CareSense prompts were effective, with 100% compliance of patients with fevers reporting those fevers within 24 hours of detection by calling the physician's office. Table 1 presents the Fisher's Exact Test results.

Table 1

Pre- and Post-Intervention Patient Fever Reporting (N=16)

	Documented Fevers		
Reported	Pre	Post	*p*
Fever not reported	10[6.88]	0[3.12]	.001
Yes reported	1[4.12]	5[1.88]	

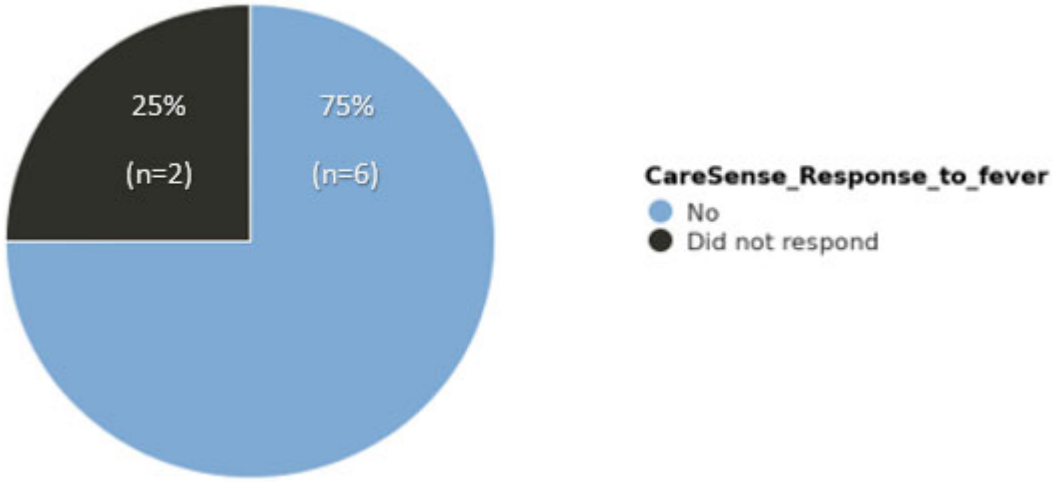
Note. Values formatted as Observed [Expected].

CareSense Patient Notification and Satisfaction Survey

New gastrointestinal oncology patients receiving chemotherapy were enrolled in CareSense, with an opt-out option. On days two and four post-chemotherapy, CareSense sent a notification to the patients via text message, "Have you experienced a fever with a temperature ≥100.4°F?" The patient could select yes or no; either response elicited a follow-up response. Eight of the 14 new patients were enrolled in CareSense and received chemotherapy at Houston Methodist Medical Center. The six new patients not enrolled in CareSense received chemotherapy at Methodist infusion locations and had not implemented CareSense use. Of the eight enrolled patients, the most frequent response to the question about experiencing a fever with a temperature ≥100.4°F was "No" (75%; 6 patients). Two patients (25%) did not respond to the CareSense fever question. Figure 8 (pie chart) presents the results for the patients' responses to CareSense queries about fever.

Figure 8

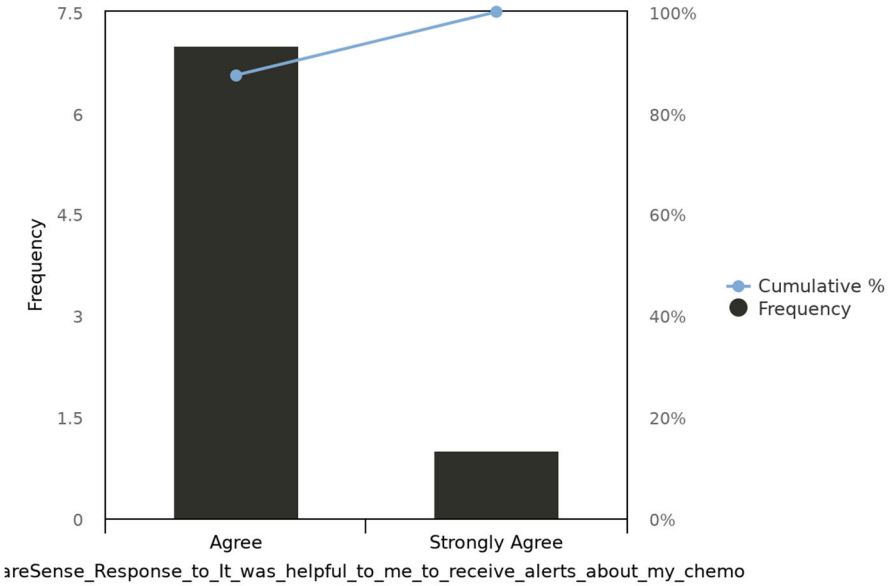
Responses to CareSense Queries About Experiencing a Fever



On day six post-chemotherapy, patients enrolled in CareSense received a satisfaction survey that asked about the use of CareSense for reporting post-chemotherapy side effects. The patient satisfaction survey asked, “How much do you agree or disagree with the following statement? It was helpful to me to receive alerts, reminders, and emails from this program about my chemotherapy." The response options were strongly agree, agree, undecided, disagree, and strongly disagree. Of the eight new patients enrolled in CareSense, seven patients selected the response agree (n = 7, 87.50%). One patient selected the response strongly agree. The results of the analysis suggested that new patients receiving chemotherapy found the CareSense alerts about their chemotherapy helpful. Figure 9 presents Pareto chart results for the new patients’ responses to the CareSense alerts survey.

Figure 9

New Patients' Responses to CareSense Alerts



The survey also asked, "How much do you agree or disagree with the following statement. This program improved my overall knowledge about my chemotherapy and recovery compared to what I knew before." The response options were strongly agree, agree, undecided, disagree, and strongly disagree. All eight enrolled patients selected agree (n = 8, 100%). The results of the analysis suggested that new patients receiving chemotherapy believed CareSense improved their overall knowledge about their chemotherapy and recovery, compared to their previous knowledge.

CHAPTER V

DISCUSSION AND CONCLUSION

This quality improvement project found that the number of reported fevers within 24 hours of detection improved among gastrointestinal oncology patients receiving chemotherapy. The reporting fever instructional session and CareSense prompt on reporting fevers within 24 hours by gastrointestinal cancer patients receiving chemotherapy increased patients' fever reporting to their physicians within 24 hours (Table 1, Pre- and Post-intervention).

This project stimulated discussions of CareSense and its use for follow-up with oncology patients post-chemotherapy to assess symptoms and side effects of chemotherapy. Many oncologists must be aware of CareSense and its ability to follow-up with patients. Oncologists were informed about CareSense as a platform for patient engagement for chemotherapy patients. The chemotherapy pathway used in CareSense asks patients a specific question; depending on the response, a notification is sent to a care navigator and the physician's office. Oncologists were informed that the chemotherapy pathway asks patients on days two and four post-chemotherapy if they have experienced chemotherapy-associated symptoms, such as nausea, vomiting, fever, mouth sores, rash, and other side effects. The oncologists were receptive to how the communication tool, CareSense, could be used for patient engagement. They ensured they would inform their patients about CareSense, in addition to using MyChart or calling the office to notify the physicians of a fever.

Relationship to Literature Review

The project improved the patient's reporting of fevers within 24 hours of detection by calling the physician's office. The project also increased the use of CareSense among patients. Pre-intervention in 2021, two patients used CareSense; post-intervention, eight patients used CareSense. The increase in provider notification using one of the three methods was consistent with other study findings. Several studies found that provider notification and patient outcomes improve when patient education and mobile phone technology use are implemented.

Like Marmorat et al., (2020) and Davoodi et al., (2016), the project focused on improving patients receiving chemotherapy notifying the physician of an adverse event, such as fever, within the recommended 24-hour period. The study found that no patients receiving chemotherapy used MyChart to notify the physician of a fever within 24 hours of detection. However, five patients called the physician's office. The results revealed there were no patients with documented fevers who did not notify the physician's office. These results suggested that the fever reporting instructions session improved patient adherence to physician notification of a fever within 24 hours of detection.

Like Mougalian et al., (2018), and Bruce et al., (2020), this study found that use of the mobile health technology CareSense improved patient engagement and appropriately managed chemotherapy side effects and adherence to treatment recommendations. The results indicated that eight newly enrolled patients used CareSense, compared with no patients from December 2021–February 2022. The CareSense satisfaction survey results indicated seven enrolled patients agreed with "It was helpful to me to receive alerts, reminders, and emails from this program about my chemotherapy." One patient strongly agreed. Eight patients agreed with "This program

improved my overall knowledge about my chemotherapy and recovery compared to what I knew before." The project findings suggested that the communication tool, CareSense, benefited patient engagement and physician notification of chemotherapy side effects.

Recommendations for Practice

A sustainable plan that promotes fever education and reporting of fevers to physicians within 24 hours using one of three communication methods, CareSense, MyChart, or calling the physician's office, has been developed. The plan includes a reporting fever instructional session during the first physician and nurse practitioner visits and ensuring that new chemotherapy patients are enrolled in CareSense. Patients can opt-out of CareSense prompts. Other recommendations include checking the patients' responses in CareSense and ensuring patients have consistent follow-up office visits with the physician and nurse practitioner to assess and evaluate symptoms and side effects of chemotherapy. Finally, the patient's satisfaction with communicating with the physician via CareSense, MyChart, or by calling the physician's office can be evaluated during office visits.

Limitations

The results of this quality improvement project apply to the project setting. Though the findings are not generalizable, they are transferable. The findings of this quality improvement project can be implemented in similar healthcare settings by disseminating the results.

Conclusions

The results of this project indicated that a fever reporting session and use of CareSense improved the number of patients notifying the physician of a fever within 24

hours of detection. There was 100% compliance of patients who experienced a fever in reporting it to the physician within 24 hours. Patients enrolled in CareSense used the communication tool to report, “No” when asked if they experienced a fever with a temperature ≥100.4°F on days two and four post-chemotherapy. In addition, the CareSense patient satisfaction survey responses indicated that the patients agreed that the alerts about their chemotherapy were beneficial. The satisfaction survey responses also revealed that the patients agreed that it improved their knowledge about chemotherapy and recovery, compared with their pre-intervention knowledge.

This project improved adherence of gastrointestinal patients receiving chemotherapy to fever follow-up instructions, thus promoting optimal health outcomes.

Future Work

The results indicated that a fever reporting session and CareSense prompts helped to improve fever notification by patients to physicians within 24 hours of fever detection, thus reducing adverse post-chemotherapy side effects. In the future, a fever reporting session and CareSense prompts will be implemented in other specialties within oncology. Using this method in other oncology specialties requires education of physicians and nurses about the use of the communications tool, CareSense. Dissemination of the project outcomes will allow other clinics to use a similar method to improve patient-physician notification.

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APPENDIX A:

AFTER-VISIT SUMMARY

Appendix A: After Visit Summary

AFTER VISIT SUMMARY

[redacted]

HOUSTON Methodist LEADING MEDICINE

9/6/2022 10:15 AM HMH Cancer Center INF 713-441-7987

Instructions

Notify your provider of any signs of infection: Fever > 100.4F, chills, runny nose, sore throat, wounds that won't heal, have pus or redness, ear ache, painful urination or urine that is cloudy, dark, or bloody. Any signs of bleeding: excessive bruising, nose bleeds, blood in sputum, blood in urine or stool. Nausea, vomiting, pain, diarrhea or constipation that is not relieved with prescribed medications. Any chest pain, shortness of breath, abdominal swelling, less than 2 bowel movements/day, confusion, or any other worrisome symptoms.

In case of a medical emergency, please dial 9-1-1 or go to the nearest emergency department.

Today's Visit

You were seen on Tuesday September 6, 2022. The following issues were addressed: Chemotherapy-induced neutropenia and Cancer of pancreas.

Blood Pressure 155/69	BMI 24.99	Weight 179 lb 3.2 oz	Height 5' 11"
Temperature (Oral) 96.4 °F	Pulse 76	Respiration 18	Oxygen Saturation 97%

Done Today

Comprehensive metabolic panel for Chemotherapy-induced neutropenia, Cancer of pancreas
CBC with platelet and differential for Chemotherapy-induced neutropenia, Cancer of pancreas
Magnesium level for Chemotherapy-induced neutropenia, Cancer of pancreas
Estimated GFR
Treatment conditions for Chemotherapy-induced neutropenia, Cancer of pancreas

Medications Given

gemcitabine (GEMZAR) chemo injection 200 mg/5.26 mL Stopped at 2:38 PM for Chemotherapy-induced neutropenia, Cancer of pancreas
NAB-PACLitaxel (ABRAXANE) Stopped at 1:47 PM for Chemotherapy-induced neutropenia, Cancer of pancreas
ondansetron in 0.9 % sodium chloride Stopped at 12:40 PM for Chemotherapy-induced neutropenia, Cancer of pancreas
sodium chloride Stopped at 12:40 PM for Chemotherapy-induced neutropenia, Cancer of pancreas
sodium chloride Last given at 12:08 PM for Chemotherapy-induced neutropenia, Cancer of pancreas

What's Next

SEP 20 2022 — Chemo Infusion, Tuesday September 20 10:15 AM — HMH Cancer Center INF, 6445 Main St OPC-21st Floor, Houston TX 77030

APPENDIX B:

CARESENSE CHEMOTHERAPY PATHWAY AND PATIENT SATISFACTION SURVEY

Appendix B: CareSense Pathway including survey

HOUSTON Methodist LEADING MEDICINE

Houston Methodist New Patient Chemotherapy Pathway

Pathway 299

Spanish:

Houston Methodist New Patient Chemotherapy Pathway (Spanish…

Note:

(1) Patient can opt out by replying "STOP" at any time if they no longer wish to receive messages - page 8 of this document.

(2) Review Day 2 and Day 4 instructions related to fevers - pages 18 and 20 of this document.

(3) Patient Chemo Satisfaction Survey - page 21 of this document.

CARESENSE

Content

Anchor: Chemo Appointment Date
Day: Day of Sign Up
Attachments: New patient chemotherapy parking map (per hospital location)
Action Item: Separate Welcome email per hospital location

Welcome Message

Subject: Welcome to Houston Methodist Cancer Center

We are honored that you have chosen Houston Methodist Cancer Center. We are here to be your partner through this difficult time. Our team is committed to collaborating with you to tackle this medical challenge head-on; by treating the disease and truly caring for you, our patient.

We are contacting you through this method because your preferences indicate that you are comfortable receiving communication from Houston Methodist. Please be mindful that texts and emails are not secure and pose some risks for disclosure, and if you are using this method of communication, you are accepting these risks. For secure communication, please enroll in the patient portal (sign up link in footer of emails).

Providing resources is a simple way that Houston Methodist Cancer Center's nationally recognized team is dedicated to providing you with the best possible care. From your diagnosis throughout treatment, our specialists will create customized treatment plans to fight your cancer and our highly skilled support staff will help you recover both physically and emotionally.

These materials are designed to help you navigate this journey. From details about scheduling appointments and accessing your information to a detailed list of resources and essential data related to your treatment, we encourage you to use these resources to hopefully make this journey less difficult.

Additional Resources: On the bottom of every email you receive from this system, there will be a link to log into your Patient Portal. This portal will allow patients to review previous resources sent to them and see upcoming content as well. Please see the bottom of this email to view the Patient Portal and create your secure login.

Houston Methodist Main

- **Clinical Dietitian Specialist:** Nutritional information and concerns
  - Renee Stubbins: 713-441-9221
- **Outpatient Social Worker:** Offers counseling and other supportive services
  - April Pichon 713-441-8507
- **Oncology Nurse Navigators:** Offer guidance, education, and local resource referrals based on personal needs
  - 346-238-5657
- **Radiology Scheduling:** PET/CT scans and MRI
  - 713-441-6550
- **Infusion Scheduling:** Chemotherapy, fluids, and injections
  - 713-441-7987
- **Billing and Customer Service:** Financial assistance and insurance
  - 832-667-6291
  - 877-493-3228
- **Oncology Financial Liaisons:** Financial counseling and guidance related to outside financial assistance programs, such as grants and foundations
  - 713-363-7352
- **Drug Assistance Program:** Drug financial assistance with copays/deductibles
  - drugassist@houstonmethodist.org
  - 713-441-7134

We are honored that you have chosen Houston Methodist Cancer Center. We are here to be a partner through this difficult time. Our team is committed to collaborating with you to tackle this medical challenge head-on; treating the disease and truly caring for you, our patient. Please remember that no one will monitor this system during the night or on holidays. For urgent needs that require a response in less than 48 hours, please call your Oncologist.

Please save us in your phone as "Houston Methodist Cancer Center." You can reply "STOP" at any time if you no longer wish to receive these messages.

Anchor: Sign up
Day: 0
Time: 11:00 AM
Survey: Houston Methodist Email Confirmation
Type: Text link survey
Group:
Attachments:

We just would like to take a minute to confirm some of your contact information.

- No Email
  - It looks like we don't have your email address on file. We provide a lot of education and important FAQs through email. Would you like to provide it?
    - Yes
      1. What is your email address?
    - No
- Has Email
  - The following is the current email address we have on file for you: <patient's email.> We provide a lot of education and important FAQs through email. Would you like to update this information?
    - Yes
      - What is your email address?
    - No
- Thank you for your responses.

Anchor: Chemo Appointment Date
Day: -4
Time:
Group:
Attachments:

We just emailed you some important information about chemotherapy, which includes where to go for your first chemotherapy appointment. We encourage you to review this email well in advance of your first chemotherapy appointment.

Anchor: Chemo Appointment Date
Day: -4
Attachments: New Patient Chemotherapy Parking Map (per each hospital location)
Action Items: Each Hospital has their own email

Anchor: Chemo Appointment Date
Day: +2
Time: 3:00 PM
Name: Houston Oncology New Patient Chemo Monitoring 2
Type: Sms/phone call survey

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1. Have you had any diarrhea?
a. Press 1 for Yes
i. If the patient responds Yes, then reply with: "We're sorry to hear that! Were you able to take your medication as prescribed for your diarrhea?"
a. Press 1 for Yes
i. Follow-up with: "Did your medication alleviate your diarrhea?"
a. Press 1 for Yes
i. Respond with "Good! We're glad to hear the medication brought you some relief."
b. Press 2 for No
i. Reply with "OK. Please contact your Oncologist Office at ~~[Hospital Location Phone Number]~~."
CareSense: Send an alert to triage nurse and say: "Patient _____ indicated that the anti-diarrhea medication did not bring relief".
b. Press 2 for No.
i. If the patient responds no to the question "Were you able to take your medication as prescribed for your diarrhea?" then ask: "Please select the option that best describes why you were unable to take the medication."
a. You tried to take the medication but were unable to hold it down due to the nausea and/or diarrhea.
i. If the patient selects this option, then respond: "OK. Please contact your Oncologist Office at ~~[Hospital Location Phone Number]~~ to see if we can provide you some relief." CareSense: Send an alert to triage nurse that says: "Patient was unable to hold down the anti-diarrhea medications."
b. You've lost your medication or misplaced it.
i. If the patient selects this option, then respond with: "Please contact your Oncologist Office at ~~[Hospital Location Phone Number]~~ to see if we can get that prescription replaced" CareSense: Send an alert to triage nurse that says: "Patient lost or misplaced his or her anti-diarrhea medications."
c. You just haven't gotten around to taking the medication yet.
i. If the patient selects this option, then respond with: "OK. Please take it as soon as you can in order for you to hold your food and drink, which is important for your recovery."

b. Press 2 for No.
i. If the patient responds No to "Have you had any diarrhea?" then reply with: "That's great! Continue to drink at least 2 liters of fluid daily, and eat small, frequent meals."

Per location numbers:

HM Main= No number. Use a generic sentence without a phone number.
HM Baytown=281-420-7211
HM Clear Lake=832-783-1190
HM Sugar Land=281-276-5200
HM Woodlands=936-270-3480
HM West=832-522-8521
HM Willowbrook=281-737-0435

Anchor: Chemo Appointment Date
Day: +2
Time: 5:00 PM
Name: Houston Oncology New Patient Chemo Monitoring 3
Type: Sms/phone call survey

Generally, you want to notify your oncologist if you have the following symptoms: temperature greater than 100.4 F, diarrhea lasting more than 24 hours or associated with cramps, mouth sores affecting eating or drinking, unusual pain or pain that is not alleviated by over-the-counter medications, shortness of breath, rash or hives, confusion or any other worrisome symptoms, or wounds that will not heal or have pus/redness.
Have you experienced a fever with a temperature of 100.4 degrees F or greater?
A. Press 1 for Yes
i. If the patient responds with yes. "OK. Please contact your Oncologist Office so that we can evaluate whether you might have an infection. If it is after hours, you can still call your oncologist's office at <plug in individual locations phone number>" CareSense—Send an alert to the triage nurse that says: "The patient has indicated that he or she has symptoms suggesting possible infection."
B. Press 2 for No
i. If the patient responds with no, then reply: "That's wonderful to hear! Please continue to monitor for symptoms of infection." CareSense, if the patient does not respond, then resend 24 hours later and add in "We don't believe you've answered our questions. We really want to hear from you so we can make sure you're doing well. Please take just a couple minutes to answer our questions." Move from email to text, if not done so already.

Per location numbers:

HM Main= No number. Use a generic sentence without a phone number.
HM Baytown=281-420-7211
HM Clear Lake=832-783-1190
HM Sugar Land=281-276-5200
HM Woodlands=936-270-3480
HM West=832-522-8521
HM Willowbrook=281-737-0435

Anchor: Chemo Appointment Date
Day: +3
Time:
Condition: HMH Sugar Land Hospital only

Support Programs Alert

Houston Methodist here. Because we understand that cancer care extends beyond our patients' physical needs, we offer a number of programs designed to support cancer patients, families, and caregivers. Please take a moment to learn about our Survivorship Programs, Resource Guide, and Support Groups at http://bit.ly/cancerpatientsupport.

Anchor: Chemo Appointment Date
Day: +4
Time: 1:00 PM
Name: Houston Oncology New Patient Chemo Monitoring 1
Type: Sms/phone call survey

1. Have you had any nausea today?
a. Press 1 for Yes
i. If the patient responds Yes, then say "OK. We're sorry to hear that, although it is expected." Then ask:
2. Were you able to take your prescribed medications?
a. Press 1 for Yes
i. If the patient responds Yes, follow up with:

3A. "Did your medication alleviate your nausea enough to eat and drink?"
a. Press 1 for Yes
i. If patient responds Yes, then say: "Good! We're glad to hear the medication brought you some relief."
b. Press 2 for No
i. If patient replies with No, reply with "OK. Please contact your Oncologist Office at ~~[Hospital Location Phone Number]~~." CareSense: Send an alert to triage nurse and say: "Patient indicated that the nausea medication did not bring enough relief for him or her to eat and drink".
b. Press 2 for No
i. If the patient responds 'No' to the question "Were you able to take your prescribed medications?" then ask:
3B. Please select the option that best describes why you were unable to take the medication.
a. You tried to take the medication but were unable to hold it down due to the nausea.
i. If the patient selects this option, then respond: "OK. Please contact your Oncologist Office at ~~[Hospital Location Phone Number]~~ to see if we can provide you some relief." CareSense: Send an alert to triage nurse that says: "Patient was unable to hold down the nausea medication today."
b. You've lost your medication or misplaced it.
i. If the patient selects this option, then respond with: "Please contact your Oncologist Office at ~~[Hospital Location Phone Number]~~ to see if we can get that prescription replaced" CareSense: Send an alert to triage nurse that says: "Patient lost or misplaced his or her nausea medications."
c. You just haven't gotten around to taking the medication yet.
i. If the patient selects this option, then respond with: "OK. Please take it as soon as you can in order for you to eat and drink, which is important for your recovery."

b. Press 2 for No: If the patient responds No to the question: "Have you had any nausea today?" then say: "Awesome! We're glad to hear that! Continue to drink at least 2 liters of fluid every day and eat.

Per location numbers:

HM Main= No number. Use a generic sentence without a phone number.
HM Baytown=281-420-7211
HM Clear Lake=832-783-1190
HM Sugar Land=281-276-5200
HM Woodlands=936-270-3480
HM West=832-522-8521
HM Willowbrook=281-737-0435

Anchor: Chemo Appointment Date
Day: +4
Time: 3:00 PM
Name: Houston Oncology New Patient Chemo Monitoring 2
Type: Sms/phone call survey

---

1. Have you had any diarrhea?
a. Press 1 for Yes
i. If the patient responds Yes, then reply with: "We're sorry to hear that! Were you able to take your medication as prescribed for your diarrhea?"
a. Press 1 for Yes
i. Follow-up with: "Did your medication alleviate your diarrhea?"
a. Press 1 for Yes
i. Respond with "Good! We're glad to hear the medication brought you some relief."
b. Press 2 for No

i. Reply with "OK. Please contact your Oncologist Office at ~~[Hospital Location Phone Number]~~." CareSense: Send an alert to triage nurse and say: "Patient _____ indicated that the anti-diarrhea medication did not bring relief".

b. Press 2 for No.

i. If the patient responds no to the question "Were you able to take your medication as prescribed for your diarrhea?" then ask: "Please select the option that best describes why you were unable to take the medication."

a. You tried to take the medication but were unable to hold it down due to the nausea and/or diarrhea.

i. If the patient selects this option, then respond: "OK. Please contact your Oncologist Office at ~~[Hospital Location Phone Number]~~ to see if we can provide you some relief." CareSense: Send an alert to triage nurse that says: "Patient was unable to hold down the anti-diarrhea medications."

b. You've lost your medication or misplaced it.

i. If the patient selects this option, then respond with: "Please contact your Oncologist Office at ~~[Hospital Location Phone Number]~~ to see if we can get that prescription replaced" CareSense: Send an alert to triage nurse that says: "Patient lost or misplaced his or her anti-diarrhea medications."

c. You just haven't gotten around to taking the medication yet.

i. If the patient selects this option, then respond with: "OK. Please take it as soon as you can in order for you to hold your food and drink, which is important for your recovery."

b. Press 2 for No.

i. If the patient responds No to "Have you had any diarrhea?" then reply with: "That's great! Continue to drink at least 2 liters of fluid daily, and eat small, frequent meals."

Per location numbers:

HM Main= No number. Use a generic sentence without a phone number.
HM Baytown=281-420-7211
HM Clear Lake=832-783-1190
HM Sugar Land=281-276-5200
HM Woodlands=936-270-3480
HM West=832-522-8521
HM Willowbrook=281-737-0435

Anchor: Chemo Appointment Date
Day: +4
Time: 5:00 PM
Name: Houston Oncology New Patient Chemo Monitoring 3
Type: Sms/phone call survey

Generally, you want to notify your oncologist if you have the following symptoms: temperature greater than 100.4 F, diarrhea lasting more than 24 hours or associated with cramps, mouth sores affecting eating or drinking, unusual pain or pain that is not alleviated by over-the-counter medications, shortness of breath, rash or hives, confusion or any other worrisome symptoms, or wounds that will not heal or have pus/redness.
Have you experienced a fever with a temperature of 100.4F or greater?
A. Press 1 for Yes

i. If the patient responds with yes. "OK. Please contact your Oncologist Office so that we can evaluate whether you might have an infection. If it is after hours, you can still call your oncologist's office at <plug in individual locations phone number>" CareSense—Send an alert to the triage nurse that says: "The patient has indicated that he or she has symptoms suggesting possible infection."

B. Press 2 for No

i. If the patient responds with no, then reply: "That's wonderful to hear! Please continue to monitor for symptoms of infection." CareSense, if the patient does not respond, then resend 24 hours later and add in "We don't believe you've answered our questions. We really want to hear from you so we can make sure you're doing well. Please take just a couple minutes to answer our questions." Move from email to text, if not done so already.

Per location numbers:

HM Main= No number. Use a generic sentence without a phone number.
HM Baytown=281-420-7211
HM Clear Lake=832-783-1190
HM Sugar Land=281-276-5200
HM Woodlands=936-270-3480
HM West=832-522-8521
HM Willowbrook=281-737-0435

Anchor: Chemo Appointment Date
Day: +6
Name: Houston Oncology New Patient Chemo Satisfaction
Type: Pathway Email Survey

At this point, you have just about completed this timeline of education about your chemotherapy. Thus, we will be stopping our alerts soon. We're hoping you can answer a few last questions.

How much do you agree or disagree with the following statement? "It was helpful to me to receive alerts, reminders, and emails from this program about my chemotherapy."

1. Strongly agree
2. Agree
3. Undecided
4. Disagree
5. Strongly disagree.

Please explain why you chose this option. What did you like or not like about the system?

- Free Text Space

How much do you agree or disagree with the following statement? "This program improved my overall knowledge about my chemotherapy and recovery compared to what I knew before."

1. Strongly agree
2. Agree
3. Undecided
4. Disagree
5. Strongly disagree

Please explain why you chose this option. How did this system improve or not improve your knowledge?

- Free Text Space

Anchor: Chemo Appointment Date
Day: +7

We just emailed you some information on how to manage neutropenia (which happens when the number of white blood cells, the body's main defense against infection, decreases and your body then becomes unable to defend itself against infection), anemia (when the red blood cells cannot carry oxygen as well, often leading to bruising), and hair loss. Take a look at your email at your earliest convenience.

Anchor: Chemo Appointment Date
Day: +7
Action Items: Patient Portal to be added

Subject: How to Manage Neutropenia, Anemia, and Bruising

APPENDIX C:

REPORTING FEVER INSTRUCTIONAL SESSION SCRIPT BY NURSE PRACTITIONER

Appendix C: Fever Reporting Session Script

CareSense and Reporting Fever Instructional Session

Nurse Practitioner: Hello, your chemo plan is as noted. Potential common side effects of chemotherapy are nausea, vomiting, diarrhea, and a loss of appetite. Fever is common due to the chemotherapy's impact on the neutrophils. Neutrophils are a component of your white blood cells that help with fighting infections. Patients must monitor for a fever after receiving chemotherapy, as most fevers occur at home. Please ensure to have a thermometer at home to take your temperature orally.

Patients receiving chemotherapy are at risk for a weakened immune system, which can also make them susceptible to infections. A fever is considered an oral temperature of 100.4 F or greater. If a fever is experienced, you will need to notify the physician's office by either MyChart, calling the office, or using CareSense.

MyChart

MyChart includes an electronic messaging portal that you can message the physician's office. Direct communication with the office is between the hours of 8am-5pm Monday through Friday. If a message is received after hours the office staff will contact, you on the next business day.

Calling the office

When calling the office you will go through several prompts to speak to a live person when contacting the office. The representative in the call center will take your message regarding the fever 24 hours a day. The representative will send a message to the office, where the physician's nurse and Nurse Practitioner will be notified of your fever. The physician's nurse will contact you to assess further and evaluate your symptoms.

CareSense

CareSense is a communication tool you will be automatically enrolled in once your chemotherapy appointment has been made. (I will assess whether the patient or caregiver's number or email will be used for CareSense enrollment).

CareSense will ask questions about the side effects of chemotherapy on days +2 and +4 post-chemotherapy. CareSense will ask if you have had a fever of 100.4F or greater, and when you select "yes," CareSense informs the patient of follow-up instructions to contact the oncologist's office. A notification is sent to a care navigator and the physician's office. Our office will follow up and contact you to assess further and evaluate your symptoms. If after hours the on-call physician will return your call to further evaluate your fever.

Are there any questions or concerns?

APPENDIX D:

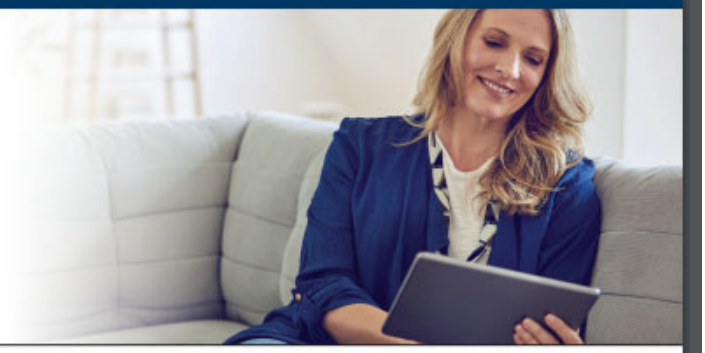
CARESENSE FLYER

YOUR PARTNERS IN HEALTH

Appendix D: Care Sense Flyer

You don't think about your health only when you're at a hospital or doctor's office — and neither do we.

At Houston Methodist, we're interested in your complete recovery and well-being.



You're invited to participate in an innovative program that helps you learn how to manage your condition and allows your doctor's team to monitor your health.

Through our partnership with CareSense, a third-party patient communication and education provider, you'll receive text messages, emails or phone calls on a regular basis, including:

- Reminders about your care.
- Educational materials for treatment at home.
- After-hospitalization care instructions.
- Monitoring questions designed to check on your symptoms or concerns.

This program allows us to help you with your recovery journey. To stop receiving texts and emails from Houston Methodist, type the word STOP to any incoming CareSense message.

Please contact your doctor's office if you have any questions.

HOUSTON Methodist LEADING MEDICINE

APPENDIX E:

PRAIRIE VIEW A&M UNIVERSITY IRB EXEMPTION LETTER

PRAIRIE VIEW A&M UNIVERSITY
A Member of the Texas A&M University System

To: **Chloe Gaines, Ph.D., RN, PNP-BC, Principal Investigator**
Odasy Nicole Elejarde, Co-Investigator

From: Tony Maloy, MPA
Associate Director, Export Controls
Office of Research Compliance

Date: November 16, 2022

Re: IRB Protocol #2022-124

After review of your form/application, it has been determined the proposed activities described do not meet the definition of research with human subjects according to federal regulations and IRB approval is not needed.

Thank you for the time and effort put into preparing and submitting your application. If you have any further questions, please call the Office of Research Compliance at (936) 261-1553.

Tony Maloy, MPA
Associate Director, Export Controls
Office of Research Compliance
Email: tlmaloy@pvamu.edu

APPENDIX F:

HOUSTON METHODIST HOSPITAL IRB EXEMPTION LETTER

Shannan K. Hamlin, PhD, RN, AGACNP-BC, CCRN, NE-BC, FCCM
7550 Greenbrier, RB3, Mailbox 1
Houston, TX 77030-2707
(346) 356-1327
SHamlin@HoustonMethodist.org

December 15, 2022

TO: Odasy Elejarde

SUBJECT: *The Effects of a Reporting Fever Instructional Session and Caresense Prompts on the Reporting of Fevers within 24 Hours by Gi Cancer Patients Receiving Chemotherapy*

Based on the information and protocol provided, the HMRI IRB has determined that the project referenced above does not meet the definition of Human Subject Research per 45 CFR 46 and does not require prior IRB review and approval at Houston Methodist.

Please understand that should your protocol change in any way your new protocol will need to be resubmitted for review and a new IRB determination made before any data collection can begin.

If you have any questions, do not hesitate to contact me. Best of luck on a successful quality improvement project!

Sincerely,

Shannan Hamlin, PhD, RN, AGACNP-BC, CCRN, NE-BC, FCCM
HMAI IRB Designated Member

Odasy Elejarde, MSN, APRN, FNP-C

11803 Sorsby Way
Houston, Texas 77047
832-654-3833
Od_2004@yahoo.com

PROFESSIONAL SUMMARY

Patient-focused Family Nurse Nurse Practitioner with Oncology Specialty experience. Well known for being independent, compassionate, and a collaborative team member with admirable interpersonal skills. I am devoted to developing as a team leader within an innovative, high-quality, patient-centered practice.

EDUCATIONAL BACKGROUND

Prairie View A&M University: College of Nursing
Houston, Texas
Doctor of Nursing Practice
2023

Prairie View A&M University: College of Nursing
Houston, Texas
Master of Science: Family Nurse Practitioner
2018

Prairie View A&M University: College of Nursing
Houston, Texas
Bachelor of Science: Nursing
2011

LICENSURE AND CERTIFICATION

- Advanced Practice Registered Nurse (APRN), Texas Board of Nursing, Active
- Family Nurse Practitioner, American Academy of Nurse Practitioners Certification, Active
- Registered Nurse, Texas Board of Nursing, Active
- DEA Certificate
- American Heart Association Health Care Provider, CPR, Current
- Advanced Cardiovascular Life Support Provider, Current

PROFESSIONAL EXPERIENCE

Nurse Practitioner
Houston Methodist Hospital
April 2019 - Present
Partner with GI Medical Oncologist Mean Abdelrahim, M.D., Ph.D., PharmB. Independently conducts health assessments, monitor, and evaluate patients' response to Oncology treatments. Develops care plan under physician supervision, initiates appropriate interventions, and evaluates care outcomes. Provide personalized care and follow-up for patients in an inpatient and outpatient setting. Collaborates with interprofessional healthcare team members to manage/coordinate patient care.

Registered Nurse
Houston Methodist Hospital
February 2014 - March 2019
Perform comprehensive assessments in an outpatient setting along with implementing care plans. Administer chemotherapy infusions and blood products. Assess, monitor, evaluate, and document patients' response to Oncology treatments.

Registered Nurse
MD Anderson Hospital
March 2012- March 2019
Collaborate with multidisciplinary teams to coordinate and develop individualized treatment plans. Administer chemotherapy infusions, blood products, and stem cell transplants. Assess, monitor, and evaluate patient's response to Oncology treatment. • Educate patient and family of physiological expectations for cancer treatments.

Registered Nurse
Riverside General Hospital
June 2011- January 2012
Assess clients' ability to engage in psychological counseling. Provide nursing education and disease prevention to clients.

MEMBERSHIPS

American Association of Nurse Practitioners
Houston Area of Nurse Practitioners
Oncology Nursing Society