UTILIZATION OF A VISIT-BASED SEPSIS ASSESSMENT

to Prevent Hospital Readmissions

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Sepsis results in 270,000 deaths annually in the United States. Despite the current healthcare focus on sepsis, there exist few postacute best-practice standards to rapidly identify health changes in home healthcare patients to prevent and reduce hospital readmissions due to sepsis. We systematically examined whether an evidence-based process and intervention triggering home healthcare clinicians to activate a *Positive Sepsis Assessment* would re-

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duce the likelihood that the patient would be readmitted to the acute care hospital. Over 24 months, we tracked the rate of sepsis readmissions to acute care hospitals through the initial phase of early recognition education; assessment, review, and revision of best-practice algorithms; standardized documentation; and proactive care management, in conjunction with the patient's primary care provider. During our review of the last 12 months of data on home care patients triggering the *Positive Sepsis Assessment,* 130 patients were identified to have potential signs of sepsis. Ninety-seven of these patients received early medical intervention in place and were not readmitted to the hospital. Our findings suggest that a multidisciplinary home healthcare team utilizing standard sepsis education and sepsis algorithm on every patient during every visit can reduce and prevent readmissions.

Over 1.7 million adults in the United States are diagnosed with sepsis each year, resulting in nearly 270,000 deaths (Centers for Disease Control and Prevention, 2016). In 2011, U.S. healthcare systems spent $20.3 billion dollars on hospital care for patients with a diagnosis of sepsis, and in turn sepsis is one of the most costly and impactful diagnoses in healthcare (O'Brien, 2015). Because the majority of patients hospitalized with sepsis reside at home within the community, prompt sepsis recognition and timely interventions are key factors in reducing sepsis-related hospitalizations (Page et al., 2015). Patients who are diagnosed with sepsis and treated earlier in the disease process do not advance to severe sepsis or septic shock (Ferrer et al., 2014; Filbin et al., 2014; Whiles et al., 2017). Likewise, patients with lower severity of sepsis are less likely to require intensive care unit stay, have lower mortality, and lower overall costs (Paoli et al., 2018).

Although there has been a decline in inhospital sepsis mortality from 35% in 2000 to 18% in 2012 (Iwashyna et al., 2012; Kaukonen et al., 2014), readmission after a sepsis hospitalization happens at a 30-day readmission rate of 17.5% (Gadre et al., 2019). A significant proportion of patients served by home healthcare (HHC) teams are those that are at a higher risk of sepsis. This includes patients who are sepsis survivors and those who were hospitalized for nonsepsis conditions and later cared for by HHC. Screening all HHC patients for sepsis is critical for early recognition and treatment. In 2016, guidelines were published by the Surviving Sepsis Campaign to outline and define care for sepsis patients while in acute care (De Baker et al., 2017). The combination of high incidence of sepsis, high sepsis mortality, and high cost of care for these patients has led many multilevel healthcare systems to reinnovate the care of these patients. A component of this innovative change to impact the occurrence and reoccurrence of sepsis is found in HHC and its potential effect on preventing hospital readmissions.

The first step was to develop a sepsis care plan for each individual patient visit to identify medical status changes and escalate the appropriate level of care.

WellSpan Health, an integrated healthcare system serving over 700,000 unique patients in South-Central Pennsylvania, began an initiative in 2017 to develop an interdisciplinary, innovative, continuum of care model to address the patient risks impacting poor outcomes. WellSpan Health is comprised of six acute care hospitals, a behavioral health hospital, a surgery and rehabilitation hospital, over 200 outpatient locations, and WellSpan Visiting Nursing Association (VNA). The role tasked to the WellSpan VNA was to identify the greatest area of impact that HHC had on the reduction of sepsis-related readmissions to acute care hospitals. WellSpan VNA employs 244 clinical staff comprised of registered nurses (RNs), licensed practical nurses (LPNs), home healthcare aides (HHAs), physical therapists (PTs), occupational therapists (OTs), and speech language pathologists (SLPs). WellSpan VNA provided on average 350 home care visits per day in fiscal year 2018.

WellSpan VNA leadership, with guidance from the WellSpan Medical Director of Continuing Care Services, identified that its greatest contribution to WellSpan successfully achieving its goal of national top performer status in sepsis care was to implement a standardized patient evaluation tool to screen HHC patients for sepsis, which would help to identify patients with early signs of sepsis and subsequently begin timely intervention in their homes. A previous study (Drahnak, 2015) showed that nursing staff education increased recognition, reporting, and treatment of sepsis patients. Additionally, sepsis education can enhance the understanding of sepsis, including the manifestations and management of sepsis (Braun-

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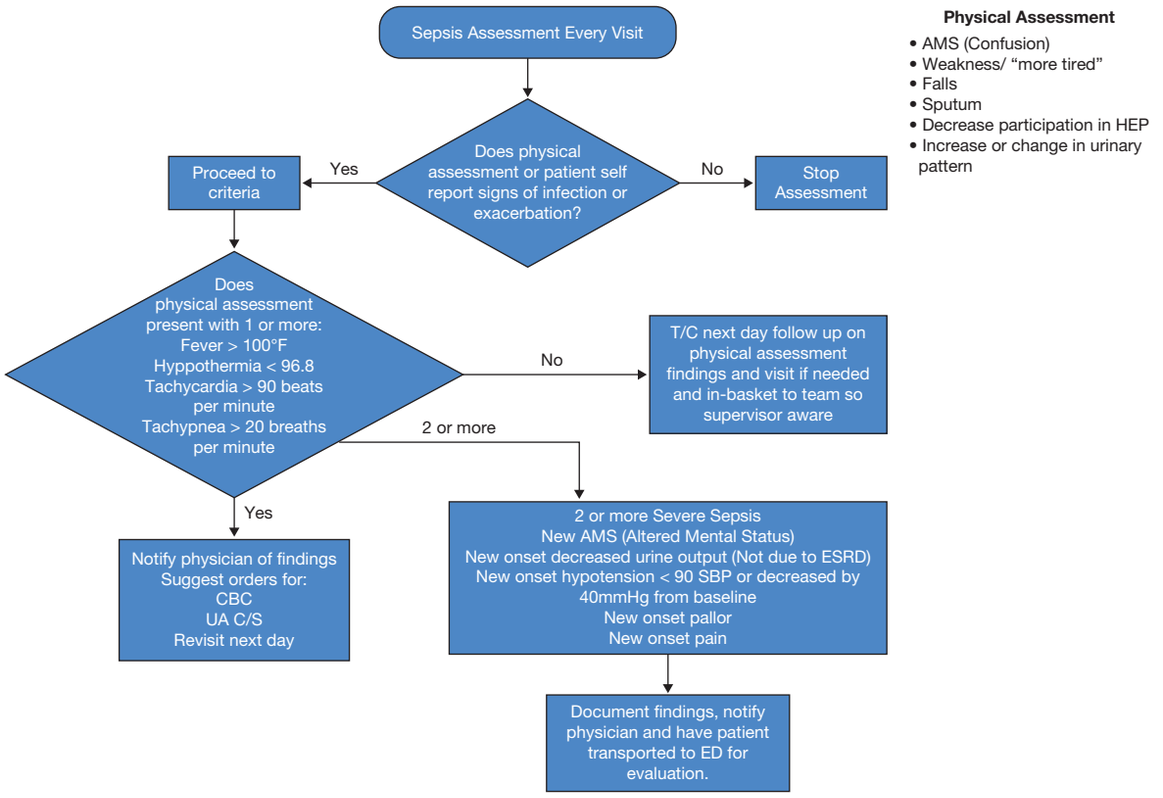
Figure 1. Initial sepsis algorithm.



Alfano et al., 2017). The purpose of this quality improvement project was to determine if visit-based sepsis assessments prevented sepsis readmissions in HHC patients and improved the likelihood of patient survival.

Methods/Interventions

With the potential for high impact on over 90,000 patient care visits per year, WellSpan VNA developed practice standards to incorporate early recognition of health status changes in homebound patients, and implement evidence-based processes and interventions establishing coordination of care between the primary care provider (PCP) and the HHC providers. Initial focus for best-practice standards targeted the guidelines of the Systemic Inflammatory Response Syndrome (SIRS) Criteria and the Sepsis/Severe Sepsis Criteria to create a sepsis assessment algorithm for all HHC clinical staff. A sepsis algorithm (Figure 1) was developed using HHC best-practice guidance available from Sepsis Alliance (2019) and Home Care Association of New York (Bowermann et al., 2016).

The next step was to develop a sepsis care plan for each individual patient visit to identify health status changes and provide the appropriate level of care. The first version of the algorithm (Figure 1) combined the sepsis screening using SIRS criteria (Comstedt et al., 2009) to either closer monitor the patient through frequent visits, or to collaborate the care more intensely with the patient's PCP, depending on screening results. Other components of the sepsis care plan included standardized patient assessment and treatment documentation.

Criteria for SIRS is met if at least two findings are present in the areas of: temperature higher than 100.4 °F (38 °C) or lower than 96.8 °F (36 °C); heart rate higher than 90 beats/min; respiratory rate higher than 20 breaths/min; and white blood cell count higher than 12,000/mm or less than 4,000 mm (Kalil & Pinsky, 2019).

In a combined effort of process observation and outcomes measurement, the root cause analysis of the current practices in HHC identified the need to create a clinical education program to standardize

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One example is the creation of a weekly readmission meeting that incorporates a root cause analysis to guide the interdisciplinary clinical supervisors in discussion and investigation of hospital readmissions.

patient assessment, treatment documentation, and the triggering response to collaborate the care more intensely with the patient's PCP when health status changes were identified. At WellSpan VNA, over 240 clinical staff received specific training to standardize the process of patient visits and to develop engagement of the clinical staff. In-person trainings at monthly nursing and rehabilitation staff meetings occurred over a 3-month period in 2017. These educational experiences walked the clinicians through the algorithm; established the use of pulse oximeter by every clinician, oral thermometer distribution to every patient who did not possess a thermometer in their home, and use of manual blood pressure cuff/stethoscope; standardized the documentation within the electronic medical record (EMR); and established the collaborative care team communication when the algorithm led to a positive assessment of the patient. Customized care plans were imbedded into the EMR and clinical staff received education on how to initiate the care plan at the start of care for all home care patients, how to document the physical assessments within an identified sepsis intervention, and where to document the collaboration of care with the patient's PCP and other team members when a positive sepsis assessment was triggered.

In 2019, following 2 years of monthly chart auditing, significant outcome changes were noted in the areas of clinical engagement and utilization of the new sepsis standard practice (Figure 2). The three data points that were established as measurable criteria were: 1) Sepsis care plan established on admission, 2) Sepsis assessment completed and documented every visit, and 3) Vital signs assessed and documented every visit. Utilizing a standardized tool, 60 random and distinct home care patients from the four-county wide system who started services in that month were selected for the chart audit. Initial data from July 2017 found 80% of audited charts had the sepsis care plan established on admission; 32% of audited charts had completed and documented sepsis assessments; and 67% of audited charts had vital signs assessed and documented. One year into the new standard, 96% of audited charts had the sepsis care plan established on admission; 66% of audited charts had completed and documented sepsis assessments; and 66% of audited charts had vital signs assessed and documented. These baseline metrics identified a need to change the home health clinical standard to focus the efforts around early detection and early intervention for sepsis prevention.

Once the baseline data of the program interventions were analyzed, we identified that changes to the sepsis algorithm needed to focus beyond the guidelines for vital sign standards to include greater detail of clinical observation in the physical assessments of patients. The STOP and WATCH tool was developed in 2002 by the Centers for Medicare and Medicaid Services to help reduce hospital transfers from postacute care and skilled nursing facilities (Ouslander et al., 2014). The STOP and WATCH tool, when used consistently, has been shown to decrease transfers from skilled nursing facilities to hospitals (Lee et al., 2016). The STOP and WATCH tool was incorporated into a new practice standard algorithm throughout the VNA with distribution and education (Figure 3).

Figure 2. Sepsis standard practice.

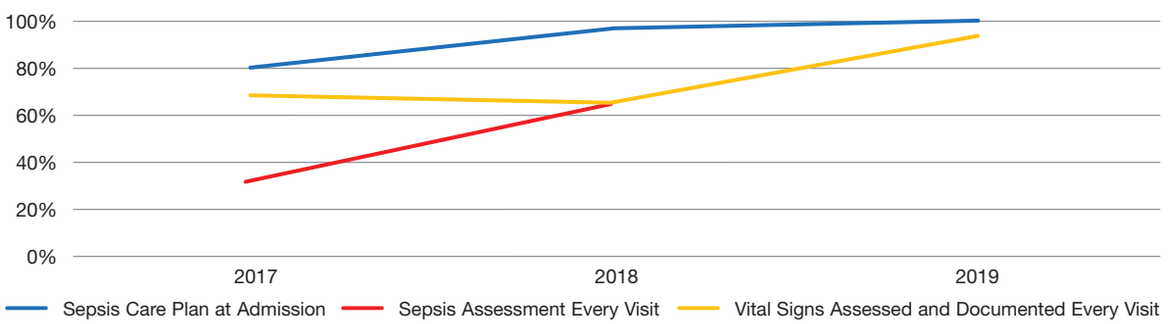

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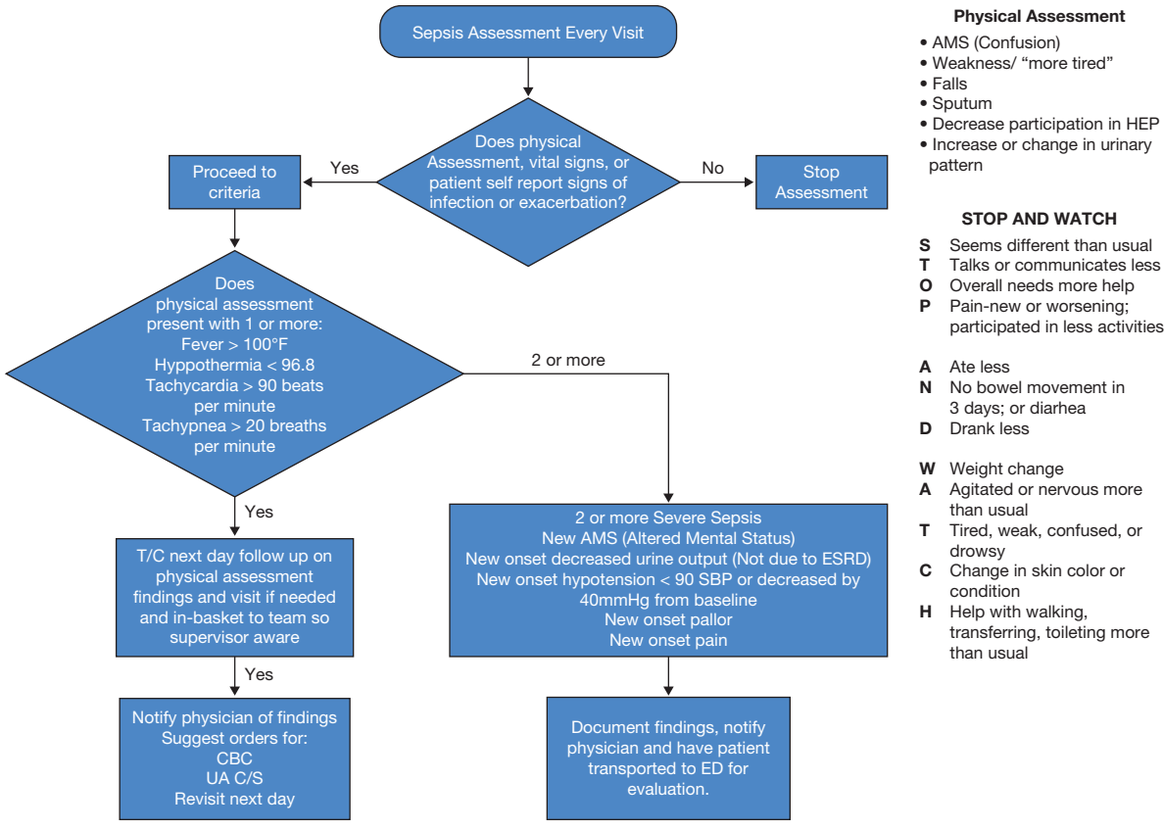
Figure 3. Updated sepsis algorithm.



The updated algorithm emphasized the follow-up responsibilities of the HHC clinician to the patient's PCP, the clinical supervisor, and the need for a follow-up visit to the patient and/or a telephone call. Through data analysis of the pareto chart of documentation inconsistencies, a standardized "Smart Text" within the EMR was created to capture the identifying abnormal biometrics and physical assessments. In addition, the temperature threshold was lowed to 100 °F. Lastly, all positive sepsis assessments were tracked to identify if the early medical intervention changed the patients' outcome and whether the patients were admitted to acute care.

Results

The results found improvement in patient outcomes and a lower admission and readmission rate of patients for sepsis. Tracking of patient outcomes identified if positive sepsis screening led to an early medical intervention that changed patient outcomes by either avoiding admission or readmission to an acute care hospital, or if the patients who needed hospital transfer had less severe sepsis, hence improving their likelihood of survival. Between July 2018 and June 2019, of all patients who were screened for sepsis, 130 patients were identified as triggering a positive sepsis assessment. During this time, 97 out of 130 patients (Figure 4) avoided hospitalization by either receiving treatments in their homes, at their PCP office, or at an urgent care center. The remaining 33 patients required transfer to an acute care hospital. Out of 33 admissions, 21 had a diagnosis of infection or sepsis (Table 1), and 32 out of 33 patients were subsequently discharged back home. There was one mortality. No patients required transfer to a postacute facility following hospitalization. Further analysis regarding length of stay and sepsis severity on admission is currently in progress.

Discussion

These data indicate that a visit-based sepsis assessment utilized in HHC was effective in reducing read-

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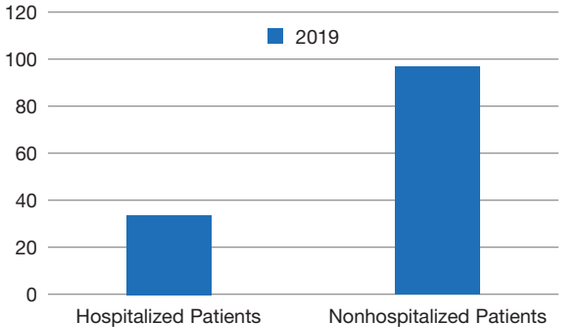
Figure 4. Patient triggered positive sepsis assessments.



missions, yet there continues to be opportunities to improve the outcomes of patients who required readmission. The results do suggest that patients who screened positive for sepsis and needed transfer to an acute care hospital had less severe sepsis, hence improving their likelihood of survival. It is possible that without a formal sepsis screening algorithm and early interventions, more patients would have been readmitted back to acute care with high likelihood of presenting with a severe sepsis, which could have detrimental outcomes.

We employed techniques such as plan-do-study-act, regular audits for continued monitoring of process measures, and a lean daily management system to drive up adoption of sepsis screening as a standard part of clinical care for every patient at every visit. Clinical coaching strategies and clinical education were foundational to our success in implementing the program across 12 care teams in multiple counties.

Through continued monitoring of sepsis metrics, this HHC program added new measurements and services. One example is the creation of a weekly readmission meeting that incorporates a root cause analysis to guide the interdisciplinary clinical supervisors in discussion and investigation of hospital readmissions. Clinical coaching strategies, clinical education, and newly added programs for high-risk diagnoses have been the positive outcomes from this program. The newest program created as a result of the Sepsis Program is the Cardio-Pulmonary Program implemented June 2019. This program identifies patients with high-risk diagnoses (heart failure, chronic obstructive pulmonary disease, pneumonia) at time of intake to HHC and incorporates a standard practice for visits and patient education.

Clinical education and coaching, clear sepsis algorithm, monitored program auditing, and best-practice service delivery were successful in preventing and reducing patient rehospitalizations for sepsis. The efforts and commitment of the interdisciplinary team comprised of nurses, therapists, and HHAs contributed to the success of this program model. Without the engagement of HHC clinicians, more patients would have been readmitted to acute care. Sepsis readmissions can be prevented

Table 1. HHC Patient Readmission Diagnoses and Readmission Outcomes (*N* = 33)

Readmission Diagnosis	HHC Patients Readmitted to Acute Care	Outcome of Readmission
COPD	1	Discharge Home (1)
Falls	4	Discharge Home (3), Death (1)
Weakness	2	Discharge Home (2)
UTI	6	Discharge Home (6)
Dehydration	1	Discharge Home (1)
Sepsis	9	Discharge Home (9)
Elevated heart rate	2	Discharge Home (2)
Cellulitis	1	Discharge Home (1)
Wound status change	4	Discharge Home (4)
GI bleed	1	Discharge Home (1)
Osteomyelitis	1	Discharge Home (1)
Heart failure	1	Discharge Home (1)

Note. COPD = chronic obstructive pulmonary disease; GI = gastrointestinal; HHC = home healthcare; UTI = urinary tract infection.

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by HHC clinicians who are focused on the best-practice standards to improve patient outcomes.

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The authors declare no conflicts of interest.

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Artificial Pancreas Improves Type 1 Diabetes Management

NIH: To test the efficacy and safety of an artificial pancreas, a team at the Jaeb Center for Health Research carried out a six-month study of the Control-IQ technology system from Tandem Diabetes Care. They enrolled 168 people with type 1 diabetes. Participants were randomly assigned to use either the Control-IQ artificial pancreas or sensor-augmented pump (SAP) therapy. SAP uses a continuous glucose monitor and insulin pump, but still requires frequent input and decisions from the user about when and how much insulin to administer. The Control-IQ system uses advanced computer algorithms to automatically adjust insulin doses based on glucose levels.

People who used the artificial pancreas system showed a significant increase in the amount of time their blood glucose levels stayed in the target range of 70 to 180 mg/dL—from 61% at start of the study to 71%. This translated to an additional 2.6 hours per day in range. In contrast, the control group remained unchanged at 59%. Artificial pancreas users also showed improvements in time spent with high and low blood glucose and other measurements related to diabetes control. No severe low blood sugar (hypoglycemia) events occurred in either group. Diabetic ketoacidosis—a life-threatening complication—occurred in one participant in the artificial pancreas group due to an issue with the insulin pump setup called pump infusion set failure.

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