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RESEARCH

Reducing Sepsis Hospitalisations through a Standardized Quality Improvement Program in Skilled Nursing Facilities

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Context: Sepsis hospitalisations with subsequent skilled nursing facility (SNF) admissions have had an annual cost of $41 billion in the United States. There has been a limited amount of literature on early interventions for sepsis in long-term care.
Objective: To assess the impact of a pilot sepsis quality improvement program (SQIP) aimed at early identification and intervention in 10 partnering SNFs in New York City.
Methods: Obtained baseline data of sepsis hospitalisations in 2017 among 10 SNFs. A SQIP was implemented utilizing the systemic inflammatory response syndrome criteria with a modified threshold temperature of 37.2°C (99.0°F). Sepsis hospitalisations were reported and validated for the intervention period in 2018 and compared to the baseline. A cost savings analysis was completed by utilizing local hospital billing records.
Findings: Overall, there was a reduction of 54 sepsis hospitalisations when comparing the intervention period (183 sepsis hospitalisations) to the baseline (237 sepsis hospitalisations), a 22.8% decrease ($p < 0.001$). The initial SQIP costs were $45,000 USD. The SQIP had an estimated cost savings between $1,039,662–$3,188,430 USD.
Limitations: Implementation at each facility was voluntary, so there may have been varying degrees of SQIP implementation. However, the hospital primary diagnosis of sepsis and cost were accurately reported.
Implications: A SQIP in a long-term care setting could reduce avoidable hospitalisations and offer cost savings. The SQIP reported is a complex intervention and needs to be methodologically understood as such. The intervention shows promise and important insights into its implementation and evaluation have been developed which would be helpful in further evaluation.

Keywords: sepsis early intervention; skilled nursing facility; reduce hospitalisations; quality improvement; sepsis cost

1. Introduction

The United States Department of Health and Human Services published that the estimated total annual fee-for-service cost for Medicare and Medicare Advantage beneficiaries with inpatient hospital admissions for sepsis with subsequent skilled nursing facility (SNF) (a care home with a high level of nursing expertise and medical services) admissions was $41 billion in 2018 (Buchman et al., 2020). A retrospective analysis of 19,460 emergency department visits from the National Ambulatory Medical Care Survey showed that 40% of nursing home residents with a diagnosis of severe sepsis were admitted to an intensive care unit (Ginde, 2013). However, there is a limited amount of literature on an intervention done in SNFs to reduce avoidable sepsis hospitalisations (Mylotte, 2020). A 2018 publication noted that an effective nursing home sepsis prevention and early detection program would require several practice changes (Sloane, 2018).

In New York State, the Delivery System Reform Incentive Payment (DSRIP) program allowed for system transformation to reduce cost and improve quality, thereby enhancing value for six million Medicaid beneficiaries in New York (New York State Department of Health, 2014). There are 70,587,631 individuals enrolled in Medicaid in the United States as of September 2020, which is approximately one in five Americans (Medicaid, 2020). The national health expenditure (NHE) data states that the total Medicaid dollars spent in 2019 were $613.5 billion or 16 percent of total NHE (CMS, 2020). One of the DSRIP initiatives was to train SNF staff on the Interventions to Reduce Acute Care Transfers (INTERACT), an evidence-based quality improvement program to identify changes in condition in SNF residents early and prevent avoidable hospitalisations

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(Pathway Health, 2020). The facility-wide INTERACT implementation set the foundation for a Sepsis Quality Improvement Program (SQIP), the specific intervention examined in this study. The objective of the SQIP was early identification of SNF residents progressing toward sepsis and to provide treatment in the facility, aiming to prevent hospitalisation or death. This paper reports the results after completion of INTERACT training, intravenous (IV) certification and phlebotomy training, and one year of SQIP implementation in a group of SNFs.

2. About the Sepsis Quality Improvement Program

2.1 Background

The SQIP was initiated, managed and funded by Staten Island Performing Provider System (SI PPS). The SI PPS is a not-for-profit limited liability company formed in 2015 to implement the DSRIP program in Staten Island with 75 partnering organizations. Among the organizations in the SI PPS network are 10 SNFs with 3,114 certified beds that provide rehabilitation services, skilled nursing care and custodial care (New York State Department of Health, 2019). This work was made possible through the Medicaid 1115 waiver amendment that was finalized through the New York State Department of Health (NYS DOH). The waiver enabled reinvestments of federal savings to improve the quality of care for New York Medicaid members and reduce avoidable hospitalisations through the DSRIP program (New York State Department of Health, 2019). The waiver created 25 different groups called performing provider systems (New York State Department of Health, 2020). The SI PPS is one of the 25 systems and is the only one covering the region of Staten Island, New York (New York State Department of Health, 2017).

2.2 Setting and study population

The SQIP was implemented in 10 SNFs with approximately 3,114 residents to reduce avoidable sepsis hospitalisations. These SNFs in Staten Island have a bed count rate of 652.5 beds per 100,000 people which is higher than the New York State bed count rate of 597.0 beds per 100,000 people (New York State Department of Health, 2019).

The 10 participating SNFs are independent organizations with no administrative, clinical or financial connections, and are not affiliated with a hospital. Among the SNFs, seven are for-profit, two are not-for-profit and one facility is owned by New York City (Medicare, 2020). Each SNF accepts private insurance and government health plans. Many beneficiaries are dually eligible for Medicare and Medicaid coverage (New York State Department of Health, 2007).

2.3 Definition of sepsis

The medical directors at each SNF agreed to the definition of sepsis as a suspected or proven infection with two criteria: (1) a new onset of an elevated temperature 37.2°C (99.0°F) or higher; and (2) a white blood cell (WBC) count greater than 12,000 per cubic millimeter or less than 4,000 per cubic millimeter. If, in any case, the mean arterial pressure (MAP) is less than 65 mm Hg, the resident would be immediately transferred to the hospital unless the resident had a Do-Not-Hospitalize (DNH) order. The MAP is calculated by the formula:

$$MAP = [\text{systolic blood pressure} + 2\ (\text{diastolic blood pressure})]/3$$

A hospital transfer would also be necessary if a third criterion was met with either a heart rate greater than 110 beats per minute or a respiratory rate greater than 25 breaths per minute.

2.4 Utilization of INTERACT to identify sepsis

The SQIP was implemented after INTERACT training was completed. SI PPS organized a two-day INTERACT train-the-trainer program in May 2016. The training course was titled INTERACT Certified Champion training and was taught by a registered nurse (RN) with previous INTERACT implementation and quality improvement experience. This training was designed to help clinical leaders implement and sustain the INTERACT quality improvement program at their respective SNFs. There were two to four RNs per SNF that completed the training with a total of 22 champions across the 10 SNFs. In the period between May 2016 and March 2017, there were 7,533 participants trained on INTERACT across all disciplines for full-time, part-time and per diem staff, including administrators, RNs, licensed practical nurses (LPN), certified nursing assistants, rehabilitation therapists, dietary staff, social workers, recreation staff and housekeeping staff. The INTERACT Champion was instrumental in providing the initial training for all SNF employees and ongoing education annually. Champions also worked with their SNF staff development team to incorporate INTERACT into the orientation training for new employees.

In alignment with INTERACT principles, a current state assessment of the SNF's clinical capabilities was completed. This assessment confirmed that all 10 facilities were capable of the following: (1) Intravenous (IV) antibiotics; (2) IV fluids; (3) peripherally inserted central catheter (PICC) management; (4) pain management; (5) stat labs; (6) stat X-rays; and (7) filling new medications within eight hours. The leadership teams specified that prior to SQIP implementation, SNFs would utilize a vendor for IV and PICC management. In a previous publication, it was noted that timely insertion of an IV catheter in a nursing home could vary (Mylotte, 2020). Successful SQIP implementation would require SNFs to have their own nursing staff initiate IV therapy. Starting in January 2018, SI PPS organized IV certification and phlebotomy training offered to nurses who would be administering treatment for the SQIP. The courses were taught by an RN for a four-hour classroom lecture that concluded with a skills test. The education met all standards of practice associated with IV therapy and phlebotomy. There were two separate classes offered:

1. Basic IV therapy and central line overview training taught RNs and LPNs how to start IVs with proper aseptic technique and attention to infection control.
2. Phlebotomy training was provided for RNs and LPNs to validate skills associated with blood sampling via

direct venipuncture, short peripheral IV therapy and central vascular access device for defined diagnostic indications.

The training expense in total was $20,000 for 200 nurses (at a rate of $100 per nurse) and was offered throughout 2018 upon request by the SNFs. The leadership team at each SNF would request more training as SQIP implementation progressed. Additionally, due to staff turnover, there were several newly hired nurses throughout the SNFs that were selected by their leadership team to complete training.

2.5. The SQIP process

The SQIP process evolved from an initial idea through piloting (see below). The process is initiated by a staff member in the facility identifying a change in a resident's condition utilizing INTERACT. The nurses at each SNF provided their staff with education specifically on the early signs and symptoms of sepsis, which could include one or more of the following: (1) confusion or disorientation; (2) shortness of breath; (3) tachycardia; (4) tachypnea; (5) fever or shivering; (6) cold clammy skin; (7) extreme pain or discomfort (CDC, 2017).

After a staff member identifies a change in the resident's condition, an RN is contacted. The RN then completes a head-to-toe assessment, collects vital signs and calculates the MAP (Shankar-Hari et al., 2016). The RN reports the essential assessment findings to the treating physician. A staff member would also contact the resident's family to notify them of the change in condition, educate them on the plan of care and give them the option to transfer the resident to the hospital. If the resident or health care proxy chooses for the resident to be transferred to the hospital, then their decision is honored. It is important to note that initial education for family members is provided in advance by the SNF medical director describing the INTERACT program and SQIP in a letter that is mailed out to each family's home.

An intervention would begin if there were a new onset of an elevated temperature 37.2°C (99.0°F) or higher, and a white blood cell (WBC) count greater than 12,000 per cubic millimeter or less than 4,000 per cubic millimeter. If an infection is suspected and only one criterion is met, then vital signs are checked every four hours and the following is obtained: (1) urine culture; (2) chest X-ray; (3) comprehensive metabolic panel (CMP) in the morning; and (4) repeat complete blood count (CBC) in the morning. The SNF residents receiving palliative care would have their care plan and advance directives reviewed before treatment.

The intervention steps if the two criteria are met are as follows:

1. The nurse obtains both anaerobic and aerobic blood cultures from two separate sites. The blood cultures are obtained before starting IV antibiotic therapy.
2. A review of prior antibiotic use in the past six months is completed. In the absence of prior antibiotic use, the recommended antibiotics are vancomycin and meropenem (Rhodes et al., 2017). The nurse places the IV to administer antibiotics and IV fluids as ordered by the physician.
3. The results of the blood cultures would become available after 48 hours and are reviewed by the infectious disease consultant.
4. The following are obtained: urine culture, chest X-ray, complete blood count (CBC) and comprehensive metabolic panel (CMP).
5. The nurse checks vital signs every four hours and the resident's status is placed on the 24-hour report and monitored closely.
6. The nurse has ongoing contact with the physician to apprise of the resident's response to treatment.
7. The resident's family is also informed of the treatment and progress.

3. Evaluation of the Sepsis Quality Improvement Program

We sought to evaluate implementation of the SQIP intervention and understand its impact. The Human Experimentation Review Board (HERB) of Wagner College approved this study (#F20-5) and determined it to be exempt from further review. We undertook a baseline assessment of the hospitalisations from the SNFs using existing service data. We describe this in more detail next, before discussing the evaluation of the SQIP.

3.1. Baseline and ongoing analysis of sepsis hospitalisations

The DSRIP program allowed SI PPS to build a secure data warehouse to receive Medicaid claims data from the NYS DOH. The data warehouse also securely received information on Medicaid recipients, including the primary admitting diagnosis from two local hospitals on Staten Island. The 10 SNFs also sent their Medicaid census report to SI PPS on a monthly basis in order to accurately identify the hospitalisations that occurred among their residents. This information was processed through the data warehouse which validated the number of hospitalisations with a primary admitting diagnosis of sepsis within the SNF population.

An analysis of the hospitalisations with the most frequent primary admitting diagnoses among SNF residents was completed by SI PPS in 2017. That was the first time an aggregated analysis of SNF residents with Medicaid had been completed. The analysis revealed that sepsis was the most frequent hospital primary admitting diagnosis and was seven times more common than any other primary admitting diagnosis prior to the SQIP intervention.

Throughout 2017 and 2018, further focused analyses of this situation were completed utilizing the International Classification of Diseases 10th Revision (ICD-10) codes for sepsis. **Table 1** lists the primary admitting diagnoses and their ICD-10 codes which were specific to SNF residents that had been hospitalized for sepsis during the period between January 1, 2017, through December 31, 2018. There are other ICD-10 codes for sepsis that were excluded since those were not a primary admitting diagnosis for the SNF residents during that period.

Table 1: Sepsis ICD-10 diagnosis code and primary admitting diagnosis for hospitalisations in 2017 and 2018 among SNF residents.

ICD-10 Diagnosis Code	Primary Admitting Diagnosis
A40.1	Sepsis due to Streptococcus, Group B
A40.3	Sepsis due to streptococcus pneumoniae
A40.8	Other streptococcal sepsis
A41.01	Sepsis due to methicillin-susceptible Staphylococcus aureus
A41.02	Sepsis due to methicillin-resistant Staphylococcus aureus
A41.1	Sepsis due to other specified Staphylococcus
A41.3	Sepsis due to haemophilus influenzae
A41.4	Sepsis due to anaerobes
A41.50	Gram-negative sepsis, unspecified
A41.51	Sepsis due to Escherichia coli
A41.52	Sepsis due to pseudomonas
A41.59	Other gram-negative sepsis
A41.81	Sepsis due to enterococcus
A41.89	Other specified sepsis
A41.9	Sepsis unspecified organism
B37.7	Candidal sepsis
R65.20	Severe sepsis without septic shock
R65.21	Severe sepsis with septic shock

The data fields utilized to ascertain that a sepsis hospitalisation was the result of a direct transfer from a SNF were: (1) first name; (2) last name; (3) date of birth; (4) Medicaid Client Identification Number (CIN); (5) SNF admission date; (6) SNF discharge date; (7) hospital admission date; (8) hospital discharge date; (9) hospital primary admitting diagnosis with associated ICD-10 code; and (10) hospital visit identification number. There were instances in which a SNF resident was hospitalized for sepsis more than once, therefore the hospital visit identification number was essential for data analysis in order to count each unique sepsis hospitalisation. The pre-intervention baseline data between January 1, 2017 and December 31, 2017 was compared to the intervention period data between January 1, 2018 and December 31, 2018 to assess the impact of the SQIP.

3.2. Pilot project of the intervention

In July 2017, the administrator, medical director, and director of nursing at one SNF pilot-tested a Plan-Do-Study-Act (PDSA) cycle by implementing a sepsis intervention on one unit using the Systemic Inflammatory Response Syndrome (SIRS) criteria (Reyes et al., 2018). The SNF leadership team decided that the SIRS criteria were appropriate for their residents, although there are publications with differing results on sepsis screening tools (Marik and Taeb, 2017). Any staff member could identify changes in a resident's condition by utilizing the INTERACT tool called STOP AND WATCH (Pathway Health, 2018). The administrator and medical director at the SNF also conducted a retrospective review of the residents who had been hospitalized for sepsis previously to confirm that those residents had met the SIRS criteria. This retrospective review allowed the team to understand who would have been a candidate for screening.

The PDSA cycle was initiated in August 2017 at one SNF with three iterations that proceeded for two and a half months, with a total of 28 residents selected; 10 residents met the criteria and a total of four residents were hospitalized. It was noted that two of the four hospitalisations could have been safely managed in the SNF but were transferred to the hospital by request from the residents' family members. During the first month, there were 18 residents selected: nine short-term residents and nine long-term residents; three residents met the SIRS criteria and all three were managed safely in the SNF. During the second month, seven additional residents were selected: six short-term residents and one long-term resident; four of these residents met the criteria and all four residents were transferred to the hospital. Then, during the last month, from October 1, 2017 through October 13, 2017, three residents were selected: one short-term resident and two long-term residents; all three residents met the criteria and were safely managed in the SNF.

One of the most important components during the PDSA was putting together a sepsis kit in order to have all the items consolidated and available during an intervention (Jump et al., 2019). **Table 2** lists the quantity and items that were included in each sepsis kit. The SNF leadership teams chose to have the antibiotics separate from

Table 2: Sepsis kit items.

Quantity	Item
4	Specimen Bag
2	IV Start Kit
2	IV Extension Set
2	0.9% Sodium Chloride Flush 10 ml
2	24 Gauge Angiocath
2	22 Gauge Angiocath
2	Tourniquet
2	Povidone/Iodine Swab
2	Anaerobic Orange Top Blood Culture Tube
2	Aerobic Gray Top Blood Culture Tube
2	Butterfly Needle
2	Lavender Blood Tube
2	Gold Blood Tube
2	Gray Blood Tube
2	Green Blood Tube
2	Vacutainer
1	Box of 2 × 2 Gauze
1	Box of Alcohol Swabs
1	Box of Bandages
1	Roll Tape
1	Blue IV Clave
1	Inventory Sheet

the kit since the antibiotics are chosen based on the infection type and the resident's medical history. The SNF's medical team also reviewed the hospital antibiogram which could facilitate the choice of antibiotic therapy. The funds for the kit were provided by SI PPS in the amount of $2,500 for each SNF to purchase the items. Each SNF was equipped for SQIP implementation by January 2018.

The SI PPS team members actively involved with SQIP implementation were: (1) Director of Continuing Care and Quality Management; (2) Chief Medical Officer; and (3) Executive Director. In September 2017, SI PPS convened the Clinical Quality Committee to have the pilot site share their initial PDSA process and results. The committee members suggested a rollout of the initiative in each SNF.

3.3. Roll-out of the SQIP intervention

In October 2017, SI PPS convened a meeting with the medical directors, administrators and nursing leadership from all 10 SNFs. At the meeting, the aggregated baseline data was presented along with a detailed overview of the PDSA, and the resources required. The medical directors from all 10 SNFs approved the SQIP process and voluntarily agreed to implement the SQIP at their respective facilities. Following this meeting, SI PPS held bimonthly meetings—allowing for consistent collaboration among all 10 SNFs—which helped facilitate SQIP implementation and served as a forum for clinical leadership teams to share feedback on barriers and facilitators. The SNF leadership disseminated information with their staff, which allowed for improved identification and removal of obstacles to fulfill the program.

3.4. Outcome analysis

To understand the impact of the SQIP, the data on hospitalisations from the intervention period were compared to the pre-intervention period. All hospitalisations were tracked monthly and validated by the hospital's primary admitting diagnosis. Once the data for 2018 were validated, a two-sample proportion test was conducted. In this analysis, the number of primary admitting diagnoses of sepsis and the average monthly SNF Medicaid census were compared for 2017 and 2018. The hospitalisation rate was calculated for each SNF by identifying residents with a hospital primary admitting diagnosis of sepsis. The rate was dependent on the SNF's average monthly Medicaid census, which included both short-term and long-term residents. The SQIP implementation plan and documentation were managed at each facility by the medical director and team. The SNFs voluntarily shared their screening and intervention data on a monthly basis. **Figure 1** shows the timeline of events from January 1, 2017 through December 31, 2018.

4. Results

4.1 Sepsis hospitalisation statistics

Overall, there was a reduction of 54 sepsis hospitalisations during the intervention period in 2018 a decline of 22.8% compared to the pre-intervention period in 2017 ($p < 0.001$). Sepsis hospitalisations were counted if there was a primary admitting diagnosis of sepsis. **Table 3** summarizes the characteristics of the SNF residents with sepsis hospitalisations.

The mean of the average daily Medicaid census for the 10 SNFs was 192 residents in 2017 and 211 residents in 2018. **Table 4** shows each SNF indicated by a letter with their corresponding results.

4.2 Screening and intervention data

Three facilities voluntarily shared their screening and intervention data from the rollout phase of the project. They indicate that respiratory infections were the most common suspected infection source.

The pilot SNF that initiated the PDSA cycle was the earliest adopter among the 10 SNFs. The lessons learned from the PDSA permitted this team to identify a larger cohort of residents for the intervention period. The data from a focused review between January 1, 2018 and December 31, 2018 had 110 screenings, in which all 110 cases resulted in interventions and 20 required hospitalisations. It was reported that the onset of sepsis was often due to pneumonia, which accounted for 38 cases.

Another SNF that was an early adopter of the SQIP intervention during rollout provided data from a focused review between November 1, 2017 and December 31, 2018. They had 44 screenings in which 30 resulted in interventions and five required hospitalisations. It was

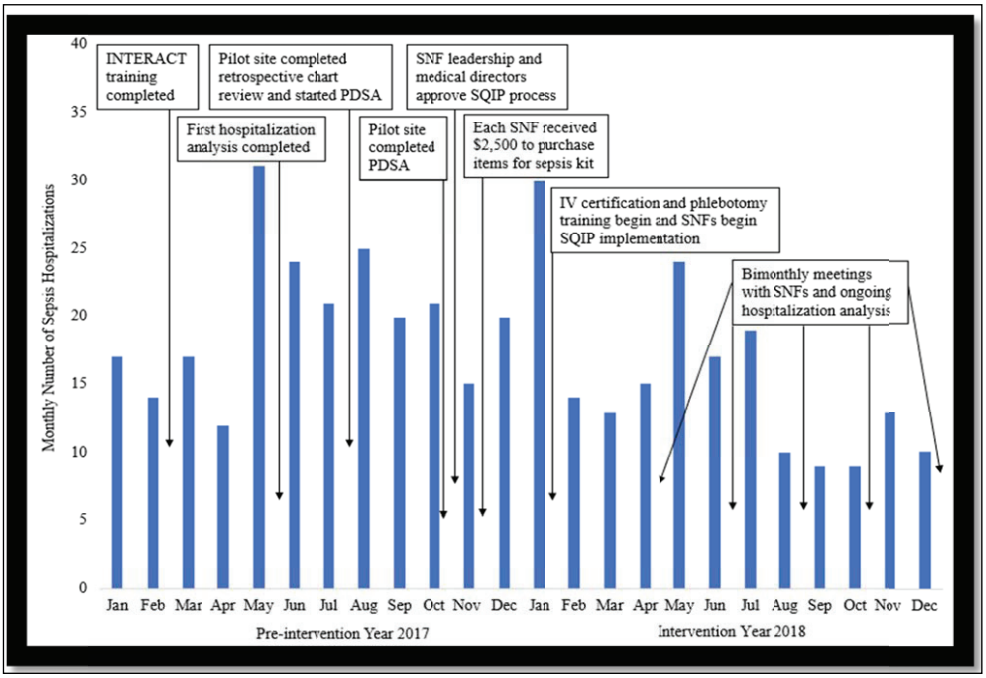

Figure 1: Timeline of events in 2017 and 2018 in relation to the monthly number of sepsis hospitalisations within the SNF Medicaid population.

Table 3: Characteristics of SNF residents with sepsis hospitalisations.

Characteristic	Pre-intervention Year 2017	Intervention Year 2018
Mean age (standard deviation)	71 (16)	73 (14)
Number of female residents hospitalised for sepsis	97	88
Number of male residents hospitalised for sepsis	98	68
Number of SNF residents with ≥ 1 sepsis hospitalisation	195	156
Number of SNF residents with ≥ 2 sepsis hospitalisations	27	20
Number of primary ICD-10 diagnosis codes for sepsis	237	183
A40.1	3	0
A40.3	2	0
A40.8	2	1
A41.01	2	1
A41.02	6	6
A41.1	1	0
A41.3	2	1
A41.4	0	1
A41.50	4	5
A41.51	10	4
A41.52	1	1
A41.59	5	3
A41.81	2	1
A41.89	6	2
A41.9	189	155
B37.7	2	0
R65.20	0	1
R65.21	0	1

Table 4: Sepsis hospitalisation rates among SNF residents with Medicaid in 2017 and 2018.

Skilled Nursing Facility	2017 Total Number of Sepsis Hospitalisations	2017 Sepsis Hospitalisation Rate Per 1,000 Resident Days	2018 Total Number of Sepsis Hospitalisations	2018 Sepsis Hospitalisation Rate Per 1,000 Resident Days	p-value
A	11	8.73	1	0.67	<0.001
B	22	2.52	8	0.75	<0.001
C	28	5.60	14	2.04	<0.001
D	37	7.25	22	5.51	0.16
E	18	4.03	14	2.77	0.175
F	10	1.75	7	1.06	0.213
G	57	5.53	53	5.12	0.365
H	15	2.84	15	2.70	0.5
I	34	4.16	38	4.16	0.5
J	5	1.47	11	3.25	0.906
Total (Mean)	237 (24)	(4.39)	183 (18)	(2.80)	<0.001

reported that the onset of sepsis was often due to respiratory infections, which accounted for 17 cases, and urinary tract infections, which accounted for 14 cases.

Another SNF that was a later adopter in the rollout had utilized the first two months to prepare for full implementation, which started in the third month of the intervention period. The data from a focused review between March 1, 2018 and December 31, 2018 had 52 screenings, in which 48 resulted in interventions and six required hospitalisations. It was reported that the onset of sepsis was often due to pneumonia, which accounted for 17 cases.

4.3 Cost savings analysis

The SQIP cost savings analysis was completed by utilizing the local hospital billing records for hospital admissions with a primary admitting diagnosis of sepsis. The costs, according to the hospital billing records, were in the range of $19,253–$59,045 USD per sepsis hospital admission with a primary admitting diagnosis of sepsis. **Table 5** shows the cost of SQIP implementation and the estimated savings. During the baseline period, there were 237 hospital admissions for sepsis with an estimated cost range of $4,562,961–$13,993,665 USD among the 10 SNFs. In comparison, during the intervention period, there were 183 hospital admissions for sepsis with an estimated cost range of $3,523,299–$10,805,235 USD among the 10 SNFs. The SQIP cost of supplies and training was $45,000 USD for 10 SNFs. The estimated cost savings range during the intervention period was between $1,039,662–$3,188,430 USD excluding the SQIP cost.

4.4. More informative communication to family members

Another result of the SQIP was timely and informative communication to the resident's family members. Several facilities had sent out mass mailings throughout 2018 to inform families about the SQIP, INTERACT and palliative care. These educational materials also became part of the SNF admission packets for new residents. The feedback from staff regarding the SQIP was positive and the director of nursing at one SNF commented:

> 'We like to know that our residents are being cared for as best as we can. The sepsis program allows us to go a little bit beyond so that our residents and families are comforted with our ability to provide IV therapy and treatment to give the care that residents need here'.

5. Discussion

The 10 SNFs, which are competitors in the long-term care marketplace, had set aside commercial interests to improve the quality of care for their residents. Participation in the SQIP was voluntary and therefore the fidelity of the application of INTERACT and the clinical protocols were left to each SNF's administration and clinical leadership team. The performance between SNFs could not be differentiated because of the complexities of their residents over time. Thus, SI PPS chose to compare each SNF's performance to itself in the pre-intervention and intervention periods. SI PPS also compared the performance of the whole SNF cohort to the original baseline.

There were no controls applied for Case Mix Index (CMI) when analyzing the results. There was also an absence of mortality data in the data warehouse, so this was not part of the analysis. SI PPS also developed a simple tracking tool for facilities to record screening counts and the number of interventions completed that SNFs could utilize internally. Three SNFs consistently shared this data with SI PPS, which was included in the results. Offsetting the limitations was the ability to obtain and validate the hospital's primary admitting diagnosis of sepsis among the SNF Medicaid population.

During the initial implementation period, several facilities reported that there were residents still being transferred to the hospital for sepsis that did not meet the SIRS temperature criterion of 38.0°C (100.4°F). It was shared at the bimonthly meetings that facilities changed the

Table 5: Cost and estimated savings of the SQIP.

Item	Amount (USD)
Cost of Sepsis Supplies	$25,000
Training Expense for IV Certification and Phlebotomy	$20,000
Cost Range of Sepsis Hospitalisations in 2017	$4,562,961–$13,993,665
Cost Range of Sepsis Hospitalisations in 2018	$3,523,299–$10,805,235
Estimated Range of Cost Savings in 2018	$1,039,662–$3,188,430

temperature criterion from 38.0°C (100.4°F) to 37.2°C (99.0°F) as approved by their respective medical directors. Another suggestion was to utilize the INTERACT care path for fever (Pathway Health, 2020) and review the temperature criterion with the medical team. All INTERACT tools were made available in each SNF and were also accessible for free online at the Pathway Health website (Pathway Health, 2018). Throughout the intervention period there was enhanced usage of INTERACT, including early detection tools, use of care paths, communication tools and quality improvement tools.

Supporting the initiative was the simultaneous implementation of an antibiotic stewardship program during the SQIP. The antibiotic stewardship program provided the foundation to form facility-specific antibiotic therapy guidelines for pneumonia, urinary tract infection, and skin and soft tissue infections (AHRQ, 2017), which could prevent the progression of the infection to sepsis.

There have been changes to the definition of sepsis throughout the past several years, and research publications have focused largely on screening for sepsis in a hospital setting. In a 2020 publication, it was noted that the SIRS criteria were eliminated from the latest definition of sepsis. Other screening tools such as the 100-100-100 Early Detection Tool and the quick Sequential Organ Failure Assessment (qSOFA) score for sepsis have been utilized (Mylotte, 2020). There was also a study published in 2018 comparing the qSOFA, SIRS criteria and National Early Warning Score (NEWS) for predicting in-hospital mortality and ICU admission in emergency admissions treated as sepsis. The study questioned whether the qSOFA should be utilized over the NEWS (Goulden, 2018). In a study published on comparing screening tools in nursing homes, Sloane et al. (2018) suggested that a screening tool should be highly sensitive. The study from a retrospective chart audit found that the 100-100-100 Early Detection Tool was fairly sensitive at 79% and was more sensitive than the SIRS criteria. However, based on previous studies and the evolving concept of sepsis, there is not a gold standard for sepsis screening in SNFs.

A quality improvement program could help SNFs determine which sepsis screening criteria and process is appropriate for their residents. Reducing avoidable sepsis hospitalisations would also provide financial savings and could be explored for value-based purchasing arrangements (Favini et al., 2017). An article published in 2018 in Critical Care Medicine showed that one hospital admission with a primary diagnosis code of sepsis had a cost range of $16,324–$51,022 USD (Paoli et al., 2018). The cost range that SI PPS analyzed was slightly higher and could have been due to the length of stay or severity of the condition and comorbidity.

Despite the methodological limitations to this study discussed above, we would argue that the SQIP has evolved from an initial idea, through a pilot and a larger-scale implementation, to be a promising intervention to improve long-term care practice in an important and neglected area. SQIP is a complex intervention, and this study needs to be understood in that context. The framework for evaluating complex interventions (Craig et al., 2008) recommends that considerable attention is given to early phases of evaluation of these interventions, in order to better understand key aspects of the intervention (e.g., details of how it operates and is thought to work) as well as of methodological issues (such as outcomes and data collection) before more robust evaluations can be undertaken. We see this study as contributing to developing this detailed understanding of complex interventions to improve sepsis care in long-term care. Further work on quality improvement cycles could focus on understanding the implementation aspects by monitoring fidelity and tracking key performance indicators.

6. Conclusion

A properly-implemented SQIP could help decrease the incidence of sepsis in SNFs and maintain continuity of care. Additional benefits included: (1) cooperation among competing facilities to identify best practices and resources that can be shared; (2) upskilling staff whose abilities may then be applied to other medical conditions; 3) the potential for financial savings in SNFs and hospitals; and (4) the mutual benefits for SNFs and neighboring hospitals to work together to focus on reducing avoidable hospitalisations.

The SNFs had SQIP workflows in place beyond the intervention period and continued to utilize INTERACT, which has been instrumental in the early identification of changes in condition and safely managing residents in the facility. Although the SQIP was designed and analyzed for Medicaid recipients, the interventions were applied for all SNF residents regardless of health care coverage.

Future research could analyze SNF residents with all forms of health insurance, track mortality rates, and measure the timeliness of interventions. A longitudinal study following SNF residents could be the basis for future discussions on palliative care and hospice care. Working within a community partnership model with SNFs and hospitals helped promote collaboration of best practices,

which generated collective interest, action and dissemination of findings. It also built community spirit and social capital, and helped promote a culture of better health care practices within the populations served.

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Competing Interests

The authors have no competing interests to declare.

References

AHRQ, Agency for Healthcare Research and Quality. 2018. *Minimum Criteria for Antibiotics Tool*. Available at: https://www.ahrq.gov/nhguide/toolkits/determine-whether-to-treat/antibiotic-tool.html. (Accessed: 31 July 2018).

Buchman, TG, et al. 2020. 'Sepsis among Medicare beneficiaries: 1. The burdens of sepsis, 2012–2018'. *Critical Care Medicine*, 48(3): 276–288. DOI: https://doi.org/10.1097/CCM.0000000000004224

CDC, Centers for Disease Control and Prevention. 2017. *CDC urges early recognition, prompt treatment of sepsis*. Available at: https://www.cdc.gov/media/releases/2017/p0831-sepsis-recognition-treatment.html (Accessed: 19 October 2020).

CMS, Centers for Medicare & Medicaid Services. 2020. *NHE Fact Sheet*. Available at: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NHE-Fact-Sheet (Accessed: 18 March 2021).

Craig, P, et al. 2008. 'Developing and evaluating complex interventions: the new Medical Research Council guidance'. *BMJ*, 337: a1655. DOI: https://doi.org/10.1136/bmj.a1655

Favini, N, et al. 2017. 'Comparative trends in payment adjustments between safety-net and other hospitals since the introduction of the hospital readmission reduction program and value-based purchasing'. *The Journal of the American Medical Association*, 317(15): 1578–1580. DOI: https://doi.org/10.1001/jama.2017.1469

Ginde, A, et al. 2013. 'Impact of older age and nursing home residence on clinical outcomes of U.S. emergency department visits for severe sepsis'. *Journal of Critical Care*, 28(5): 606–611. DOI: https://doi.org/10.1016/j.jcrc.2013.03.018

Goulden, R, et al. 2018. 'qSOFA, SIRS and NEWS for predicting inhospital mortality and ICU admission in emergency admissions treated as sepsis'. *Emergency Medicine Journal*, 35(6): 345–349. DOI: https://doi.org/10.1136/emermed-2017-207120

Jump, RLP, Levy, SM and **Saltsman, WS.** 2019. 'Post-acute and long-term care settings as first responders for the Surviving Sepsis Campaign'. *The Journal of the American Medical Directors Association*, 20(3): 275–278. DOI: https://doi.org/10.1016/j.jamda.2018.11.010

Marik, PE and **Taeb, AM.** 2017. 'SIRS, qSOFA and new sepsis definition'. *Journal of Thoracic Disease*, 9(4): 943–945. DOI: https://doi.org/10.21037/jtd.2017.03.125

Medicaid. 2020. *September 2020 Medicaid & CHIP Enrollment Data Highlights*. Available at: https://www.medicaid.gov/medicaid/program-information/medicaid-and-chip-enrollment-data/report-highlights/index.html (Accessed: 18 March 2021).

Medicare. 2020. *Medicare Nursing Home Compare*. Available at: https://www.medicare.gov/nursinghomecompare/search.html (Accessed: 19 October 2020).

Mylotte, JM. 2020. 'What is the role of nursing homes in the surviving sepsis campaign?'. *The Journal of the American Medical Directors Association*, 21(1): 41–45. DOI: https://doi.org/10.1016/j.jamda.2019.07.022

New York State Department of Health. 2007. *Definitions for Medicare/Medicaid dual eligibles and Medicare Part D information*. Available at: https://www.health.ny.gov/health_care/medicaid/program/medicaid_transition/definitions.htm (Accessed: 19 October 2020).

New York State Department of Health. 2014. *DSRIP Overview*. Available at: https://www.health.ny.gov/health_care/medicaid/redesign/dsrip/overview.htm (Accessed: 16 April 2020).

New York State Department of Health. 2017. *DSRIP Performing Provider Systems (PPS)*. Available at: https://www.health.ny.gov/health_care/medicaid/redesign/dsrip/pps_map/index.htm (Accessed: 17 July 2020).

New York State Department of Health. 2019. *Redesigning New York's Medicaid Program*. Available at: https://www.health.ny.gov/health_care/medicaid/redesign/ (Accessed: 16 October 2020).

New York State Department of Health. 2019. *Staten Island Performing Provider System, LLC*. Available at: https://www.health.ny.gov/health_care/medicaid/redesign/dsrip/pps_map/county/co_richmond.htm (Accessed: 17 July 2020).

New York State Department of Health. 2019. *Staten Island Performing Provider System, LLC Project Plan Application*. Available at: https://www.health.ny.gov/health_care/medicaid/redesign/dsrip/pps_applications/docs/richmond_med_ctr_staten_island_hospital/3.8_richmond_cna.pdf (Accessed: 18 March 2021).

New York State Department of Health. 2020. *Delivery System Reform Incentive Payment (DSRIP) Program*. Available at: https://www.health.ny.gov/health_care/medicaid/redesign/dsrip/ (Accessed: 16 April 2020).

Paoli, CJ, et al. 2018. 'Epidemiology and costs of sepsis in the United States-An analysis based on timing of diagnosis and severity level'. *Critical Care Medicine*, 46(12): 1889–1897. DOI: https://doi.org/10.1097/CCM.0000000000003342

Pathway Health. 2018. *Stop and Watch Early Warning Tool*. Available at: https://pathway-interact.com/wp-content/uploads/2018/09/INTERACT-Stop-and-Watch-v4_0-June2018_June-2018.pdf (Accessed: 6 April 2020).

Pathway Health. 2020. *Care Path Fever*. Available at: https://pathway-interact.com/download/fever/ (Accessed: 6 April 2020).

Pathway Health. 2020. *INTERACT Version 4.0 Tools for Skilled Nursing*. Available at https://pathway-interact.com/tools/ (Accessed: 6 April 2020).

Reyes, BJ, et al. 2018. 'Early Identification and Management of Sepsis in Nursing Facilities: Challenges and Opportunities'. *The Journal of the American Medical Directors Association*, 19(6): 465–471. DOI: https://doi.org/10.1016/j.jamda.2018.04.004

Rhodes, A, et al. 2017. 'Surviving Sepsis Campaign: International guidelines for management of sepsis and septic shock: 2016'. *Critical Care Medicine*, 45(3): 486–552. DOI: https://doi.org/10.1097/CCM.0000000000002255

Shankar-Hari, M, et al. 2016. 'Developing a new definition and assessing new clinical criteria for septic shock: For the third international consensus definitions for sepsis and septic shock (sepsis-3)'. *The Journal of the American Medical Association*, 315(8): 775–787. DOI: https://doi.org/10.1001/jama.2016.0289

Sloane, PD, et al. 2018. 'Can sepsis be detected in the nursing home prior to the need for hospital transfer?'. *The Journal of the American Medical Directors Association*, 19(6): 492–496. DOI: https://doi.org/10.1016/j.jamda.2018.02.001

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