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Applying SAS® to Explore the Utilization and Impact of Sensitive Clinical Indicators on a Heart Failure Unit

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ABSTRACT

While there has been a significant reduction in HF patient's hospital length of stay, because of the disease's complexity, nearly 25% of patients hospitalized with heart failure are readmitted within 30 days, primarily due to co-morbidities. In an effort to reduce the potential of 30-day readmission and continue to reduce HF patient length of stay, our hospital implemented a care intervention that involved interdisciplinary rounding that occurs at each patient's bedside. Each clinical discipline involved in patient care is present at the bedside to discuss clinical, quality and harm indicators (i.e. pressure ulcers, central lines, foleys, medication and dosage, patient discharge, length of stay, etc.) and their potential influence on patient length of stay. The purpose of the study was to evaluate the impact of clinical culture change after the introduction of the Accountable Care Unit™ care model. The result did reveal a significant difference in the length of stay for the subset of patients discharged from the heart failure unit from an average of 13.46 days to 9.39 days ($p < 0.0001$). There was a statistically significant difference in patient length of stay by race. There was also a statistically significant in the length of stay for patients who were prescribed medications identified as high risk for this subset of patients; however, there were not any statistical differences for patient gender.

Keywords: Heart failure

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Introduction

Heart failure (HF) is a chief cause of hospitalization and contributor to health care costs in the United States (Kul, Barbieri, Milan, Montag, et al. 2012). The complexity of the disease has created a principal focus on patient length of stays in the hospital. In the ACU™ model, providers, nursing, and ancillary staff are geographically co-located and share a common set of processes, measurements, and goals for the patients on their unit (Budnitz, Shehab, Kegler, Richards, 2007; Fick, Waller, MacLean, Heuvel, Tadlock, etc., 2001). Collectively, these components alter the unit's workflow and places direct attention on patient-centered care that includes members of the clinical and allied health teams, at the bedside.

Purpose

The purpose of the study was to evaluate the impact of the Accountable Care Unit™ care model on patient length of stay and traditional organizational quality metrics (i.e. mortality, harm events, length of stay, etc.). Specific aims of the study were: (1) to measure length of stay of patients discharged from the heart failure ACU; (2) to enhance team situational awareness to achieve unit-level quality enhancements; (3) to eliminate unnecessary medical waste.

Background

Almost half of all patient readmissions are preventable and result from a lack of patient education and compliance and inadequate post-discharge follow-up (White, 2014). The effective management of heart failure is critical in patient care and patient readmission and length of stay (White, 2014). A key practice to ensuring effective disease management is a consistent standard of care that is centered on coordinated patient care and patient education. The goal of effectively standardizing patient care is not always accomplished when traditional patient care models are applied. As a counter to the traditional care model, the ACU care model was conceptualized to address the gaps in patient and family- centered care, the lack of ambiguity, concerted decision-making, culture competency and diversity— and has consistently evolved to address other concepts that are integral in patient care. ACUs function based on 4 pillars: unit-based care teams; Structured Interdisciplinary Bedside Rounds (SIBR); unit-level performance reports; and nurse-physician dyad (Castles & Shapiro, 2016). This study explored the impact of the implemented ACU standards on patient clinical and quality outcomes.

Methods

Patients were designated as a part of the study population if they were prescribed listed high-risk medications or were impacted by defined quality measurements or clinical protocol. This resulted in a subset of the unit's patients (N=1,878). Metrics identified as impacting the subset's length of stay were: frequency and dosage of high-risk medications distributed to patients, the presence of central lines and foleys, and venous thromboembolism and prophylaxis. Using SAS 9.4, a Generalized Linear Mixed Model with fixed effects allowed for likelihood based estimation that accounted for all subjects in the population. Proc Freq and Means in SAS were used to describe sample. Proc Freq and Means in SAS were used to describe the sample. Proc T-test and GLM were used in SAS to examine the inferential statistics. All data analyses were performed using SAS/STAT® version 9.4 (SAS, 2013).

Results

A total of 1, 878 patients were included in the final sample. Of the total sample population, 63.5% received high risk medications during the pre-intervention period and 26.5% received high-risk medications during the post-intervention period. Within the patient population, patients administered a foley post-intervention length of stay decreased by 2.54 days while patients with a central line length of stay decreased by over five days. Resulting analysis showed that patient's overall length of stay decreased from 13.46 days to 9.39 days ($p<.001$) days within the observed period. There were statistically significant differences for length of stay by race ($p<0.001$). There was also a statistically significant length of stay for patients on which high risk medications were utilized; however, there were no statistically significant differences for patient gender.

Table 1. Frequency tables of selected patient demographics

Gender				
Label	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Male	1116	59.42	1116	59.42
Female	762	40.58	1878	100.00

Race				
Label	Frequency	Percent	Cumulative Frequency	Cumulative Percent
White	758	40.36	758	40.36
Black	1087	57.88	1845	98.24
Hispanic	29	1.54	1875	99.84
Other	4	0.21	1878	100.00

Table 2. N, Mean Length of Stay, Mean Age, Standard Deviations, Minimum, and Maximum for High Risk Medications

	Pre-period					Post-period				
Label	N	Mean LOS ¹	Std Dev	Min	Max	N	Mean LOS ¹	Std Dev	Min	Max
Opioids	438	14.05	7.76	2.04	28.26	153	9.17	7.14	2.01	28.87
Antibiotic	78	16.13	8.16	3.61	27.96	67	6.43	4.20	2.07	20.91
Oral Hypoglycemic	47	11.32	5.87	2.66	21.77	20	12.86	7.65	2.24	22.14
Telemetry	309	13.33	7.46	2.02	28.87	118	9.54	7.22	2.02	28.87
VTE Treatment	169	12.49	7.46	2.10	28.87	79	10.09	7.56	2.12	28.87
VTE Prophylaxis	151	12.28	7.33	2.02	25.31	60	7.74	5.53	2.01	26.01

¹Length of stay

Table 3. N, Mean Length of Stay, Mean Age, Standard Deviations, Minimum, and Maximum for Race

	Pre-period					Post-period				
Label	N	Mean LOS ¹	Std Dev	Min	Max	N	Mean LOS ¹	Std Dev	Min	Max
White	544	14.55	7.61	2.10	28.26	214	8.63	5.07	2.07	22.79
African American	736	12.85	7.42	2.02	28.87	351	9.72	7.50	2.01	28.87
Hispanic	29	10.03	4.15	2.20	17.47	0	-	-	-	-
Other	0	-	-	-	-	4	16.92	0.00	16.92	16.92

Table 4. N, Mean Length of Stay, Mean Age, Standard Deviations, Minimum, and Maximum for Gender

	Pre-period					Post-period				
Label	N	Mean LOS ¹	Std Dev	Min	Max	N	Mean LOS ¹	Std Dev	Min	Max
Male	745	13.71	7.81	2.01	22.14	371	9.30	5.83	2.01	22.14
Female	564	13.21	7.08	2.02	28.88	198	9.47	8.12	2.02	28.87

Table 5. N, Mean Length of Stay, Mean Age, Standard Deviations, Minimum, and Maximum for Central Lines and Foleys

	Pre-period					Post-period				
Label	N	Mean LOS ¹	Std Dev	Min	Max	N	Mean LOS ¹	Std Dev	Min	Max
Foleys	677	11.98	7.26	2.02	28.87	297	9.44	7.18	2.01	28.87
Central line	632	15.12	7.43	2.10	27.96	272	9.27	6.16	2.12	26.01

Conclusions

The Accountable Care Unit (ACU™ care model) presents an opportunity to overcome the disadvantages created by the lack of team situation awareness and accountability. While, on average, patients spent less time in the hospital the current length of stay of within this subset of patients stay does present an opportunity for the continuation of this intervention. This research is currently being expanded to examine the relationships that impact patient outcomes beyond the length of stay.

References

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Attachment A

SAS Syntax

```
proc format;
```

```
value simcf
```

```
1=" Opioids"
2=" Antibiotic"
3=" Oral Hypoglycemic"
4=" Telemetry"
5=" VTE Treatment (Criteria provided below)"
6=" VTE Prophylaxis (Criteria provided below)";
```

```
value statgf
```

```
1=" 6W / Before"
2=" 6W/ After"
3=" 7W"
4=" 8W/ Before"
5=" 8W/ After"
6=" 10E"
```

```
7 = " 10W"
```

```
8 = "MOU/ before"
```

```
9 = " MOU /After";
```

```
value RACEF 1="WHITE"
              2="AFRICAN AMERICAN"
              3="HISPANIC"
              4 =" OTHER"
              5="American-Indian"
              6="Oriental/Asian"
```

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```

7 = " Decline to response";
value RACEgF 1="WHITE"
              2="AFRICAN AMERICAN"
              3="HISPANIC"
              4 =" OTHER"
              5="American-Indian/Oriental/Asian" ;
value sexf 1=" MALE"
           2=" FEMALE"          ;

data all;
set ph.phall16;
IF UID =" " THEN DELETE;
if 2<=los<31;
*if 30<los<999999 then delete;
if race>7 then race=.;
if station="0" or station ="STA" then DELETE;
If station="9E" then delete;
if race=1 then raceg=1;
  else if race =2 then raceg=2;
  else if race=3 then raceg=3;
  else if race=4 then raceg=4;
  else if race=5 or race=6 then raceg=5;
if readmit =0 the readg=0;
  else if readmit = 1 then readg=1;
month = month (servdt);
if station = "6W" and '30Sep2013'd < servdt < '01Apr2104'd then stationg=1;
if station = "6W" and '31Mar2014'd < servdt < '01Oct2105'd then stationg=2;
if station = "7W" then stationg=3;
if station = "8W" and '30Sep2013'd < servdt < '31Aug2105'd then stationg=4;
if station = "8W" and '31Jul2015'd < servdt < '01Oct2105'd then stationg=5;
if station = "10E" then stationg=6;
if station = "10W" then stationg=7;
if station = "MOU" and '30Sep2013'd < servdt < '01Apr2105'd then stationg=8;
if station = "MOU" and '30Apr2015'd < servdt < '01Nov2105'd then stationg=9;
label
  month = "Month of service"
  Stationg =" New station group"
  readg = " readmission"
;
format stationg statgf. year yearf. race racef. sex sexf. raceg racegf. readg readgf.;
run;

ods rtf; ods listing close;

%macro avg (q,t);
proc means data=two maxdec=2;
class &q; var age los ;
  TITLE1 'Mean / by ' &t; run; %mend avg;
%avg (sex, gender);
%avg (raceg, race);
%avg (stationg, stationg);
%avg (simdescc, simdescc);
run; ods rtf close; ods listing; quit; run;

```

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```
ods rtf;ods listing close;

%macro ttest (q,t);
proc ttest data=two;
  class &q;
  VAR los;;
  title ' ttest /by' &t ;run;

%mend ttest;
%ttest (sex, gender);
run;
ods rtf close;ods listing;quit;run;

ods rtf;ods listing close;
%macro glm (q,v);
proc glm data=two;
  class  &q;
  model  &v = &q / ss3;
  lsmeans &q / pdiff cl adjust=tukey ;   title ' GLM  ';

%mend glm;
%glm (race,los);
%glm (raceg,los);
%glm (simdescc,los );
%glm (stationg,los );run;
ods rtf close;ods listing;quit;run;
```