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Using SAS® to examine peripheral intravenous access using ultrasound guided

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Abstract

Patients with difficult access usually undergo a central line or peripheral inserted central catheter (PICC) placement. Central venous access is more invasive, time consuming and prone to serious complications. Preventing complications related to central lines is an ongoing goal for healthcare providers, insurers, regulators and patient advocates. Establishing peripheral intravenous (PIV) access is a pivotal step in providing care for patients in hospital settings. This study analyzed data from a convenient sample of 70 of adult patient treated in one hospital in South Carolina. One of the nurses identified these patients as having difficult venous access. After two failed attempts by nurses a consult requesting the vascular access team for this study. Five nurses are participating in the traditional insertion group and USGPIV group. Nurses are collecting randomized data and information using traditional coin flip-selections during a 31-day trial. Nurses participating in the project will complete online training modules, followed by didactic and hands-on training. Data is generated for the quality improvement project via nurses completing questionnaires designed to capture USGPIV and traditional PIV success rates, number of attempts required for successful peripheral access, and time used to place PIV's. Proc Mean and Freq used to describe the data. Proc Ttest, Npar1way, and Corr used examine peripheral intravenous access using ultrasound guided. The result indicated that the means of minutes to obtain IV, number of attempts, cost in salary, and cost for equipment were higher for traditional group as compare to USGPIV. The Chi-square and fisher exact test showed there was statistically significant between success rate and group (P value <.0001). All data analyses were performed using SAS/STAT® statistical software, version 9.4

Keywords: SAS, Peripheral intravenous, Ultrasound

Background

Patients with difficult access usually undergo a central line or peripheral inserted central catheter (PICC) placement. Central venous access is more invasive, time consuming and prone to serious complications. Preventing complications related to central lines is an ongoing goal for healthcare providers, insurers, regulators and patient advocates. Complications related to the insertion process or presence of a central line include catheter associated central line infections, thrombosis, hematoma formation, arrhythmias, air embolism and pneumothorax[1]. Central line associated bloodstream infections and sepsis result in 10,426 to 25,145 preventable deaths, and healthcare cost between 1.7 and 21.4 billion dollars annually.[2] Establishing peripheral intravenous (PIV) access is a pivotal step in providing care for patients in hospital settings. The new technique called ultrasound-guided peripheral intravenous (USGPIV) line placement. Using ultrasound to place a PIV improves success rates, reduces complications, increases patient satisfaction and decreases use of central lines in individuals with difficult IV access.[3]

Purpose

The purpose of this paper is to use SAS examine peripheral intravenous access using ultrasound guided.

Methodology

This study analyzed data from a convenient sample of 70 of adult patient being treated in one hospital in South Carolina. One of the nurses identified these patients as having difficult venous access. The current practice to establish PIV access in difficult access patient is three attempts for placing catheters. First nurse and third attempt provide two attempts with second nurse. If the third attempts is not successful vascular access team (VAT) consults or physician assistance been requested. After two failed attempts by nurses a consult requesting the vascular access team for this study. Five nurses are participating in the traditional insertion group and USGPIV group. Nurses are collecting randomized data and information using traditional coin flip-selections during a 31-day trial.

Nurses participating in the project will complete online training modules, followed by didactic and hands-on training. Data is generated for the quality improvement project via nurses completing questionnaires designed to capture USGPIV and traditional PIV success rates, number of attempts required for successful peripheral access, and time used to place PIV's. Our outcome for this study were time, number of attempt, salary cost, equipment cost, and success rate.

Data Analysis

Proc Mean and Freq used to describe the data. Proc Ttest, Npar1way, and Corr used examine peripheral intravenous access using ultrasound guided. Proc T-Test and Npar1way to examine parametric and nonparametric test for the difference of means for time, number of attempt, salary cost, and equipment cost by group. Chi—square and Fisher Exact test used to examine the association between success rate by group. One subject excluded from analysis due to extreme value for time variable. All data analyses were performed using SAS/STAT® statistical software, version 9.4.[4]

Results

Table1 displays the frequency distribution of selected variables. The result indicates that about 62% of patients were female, 46% nurses attempts twice, and 70 % did not have consultation. In addition success rate was 70 % and 35 % were in the traditional group.

Table1. Frequency distribution of selected variables

SEX	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Female	43	62.32	44	62.32
Male	26	37.68	69	100.00

Nattempt	Frequency	Percent	Cumulative Frequency	Cumulative Percent
attempted once	37	53.62	37	53.62
attempted twice	32	46.38	69	100.00

WHO	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Nurse participating in project	12	17.39	13	17.39
Nurse outside of project	57	82.61	69	100.00

VATMD	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No consultation	48	69.57	48	69.57
VAT Consult	17	24.64	65	94.20
Physician Assistance	4	5.80	69	100.00

success	Frequency	Percent	Cumulative Frequency	Cumulative Percent
failure	21	30.43	21	30.43
success	48	69.57	69	100.00

GROUP	Frequency	Percent	Cumulative Frequency	Cumulative Percent
USGPIV	45	65.22	45	65.22
Traditional PIV	24	34.78	69	100.00

Table 2 report means, standard deviation, minimum, and maximum of selected variables. The results showed the average of patients age was 59.74. The average of time in minutes to obtain IV was 31.71. In addition, the average of salary and equipment cost were 13.50 $ per minutes, and 6.69 $; respectively.

Table 2: *N*, means, standard deviation, minimum, and maximum for selected variables.

Variable	Label	N	Mean	Std Dev	Minimum	Maximum
AGE	Age	69	59.74	14.24	29.00	84.00
Mtime	amount of minutes to obtain IV	69	32.58	47.56	2.00	203.00
natt	total number of attempt to obtain IV	69	1.83	1.00	1.00	4.00
scost	total cost for salary /minutes	69	13.50	19.11	0.85	79.63
ecost	Total cost for equipment	69	6.69	3.08	4.28	12.70

Table 3 report means, standard deviation, minimum, and maximum of selected variables by group. The result show the traditional group is four years older than USGPIV group. The result of ttest and Wilcoxon rank sum test did not show significant difference for age by group (P value= .2882 for ttest and .3040 for Wilcoxon). The result indicated that the means of minutes to obtain IV, number of attempts, cost in salary, and cost for equipment were higher for traditional group as compare to USGPIV. Both parametric test (ttest) and nonparametric test (Wilcoxon rank sum) indicated significant results (P value for both test <.0001).

Table 3: *N*, means, standard deviation, minimum, and maximum for selected variables by groups.

GROUP	Variable	Label	N	Mean	Std Dev	Minimum	Maximum
USGPIV	AGE	Age	45	58.40	14.68	31.00	83.00
	Mtime	amount of minutes to obtain IV	45	12.82	30.03	2.00	203.00
	natt	total number of attempt to obtain IV	45	1.33	0.64	1.00	4.00
	scost	total cost for salary /minutes	45	4.89	9.17	0.85	60.89
	ecost	Total cost for equipment	45	5.01	1.60	4.28	12.28
Traditional PIV	AGE	Age	24	62.25	13.32	29.00	84.00
	Mtime	amount of minutes to obtain IV	24	69.63	52.60	2.00	187.00
	natt	total number of attempt to obtain IV	24	2.75	0.90	1.00	4.00
	scost	total cost for salary /minutes	24	29.65	22.40	0.85	79.63
	ecost	Total cost for equipment	24	9.84	2.68	4.49	12.70

Table 4. Showed the frequency distribution of success rate by group. The result indicated the USGPIV had 96% success as compare to traditional group (21 %). The Chi-square and fisher exact test showed there was statistically significant between success rate and group (P value <.0001).

Table 4. Frequency distribution of success rate by group.

Table of GROUP by success			
GROUP	**success(success)**		
Frequency Percent Row Pct Col Pct	**failure**	**success**	**Total**
USGPIV	2 2.90 4.44 9.52	43 62.32 95.56 89.58	45 65.22
Traditional PIV	19 27.54 79.17 90.48	5 7.25 20.83 10.42	24 34.78
Total	21 30.43	48 69.57	69 100.00

Statistic	DF	Value	Prob
Chi-Square	1	41.2774	<.0001
Likelihood Ratio Chi-Square	1	43.8741	<.0001
Continuity Adj. Chi-Square	1	37.8235	<.0001
Mantel-Haenszel Chi-Square	1	40.6791	<.0001
Phi Coefficient		-0.7734	
Contingency Coefficient		0.6118	
Cramer's V		-0.7734	

Fisher's Exact Test	
Cell (1,1) Frequency (F)	2
Left-sided Pr <= F	<.0001
Right-sided Pr >= F	1.0000
Table Probability (P)	<.0001
Two-sided Pr <= P	<.0001

Conclusion

We used SAS® to examine peripheral intravenous access using ultrasound guided. Preventing complications related to central lines is an ongoing goal for healthcare providers, insurers, regulators and patient advocates. Establishing peripheral intravenous (PIV) access is a pivotal step in providing care for patients in hospital settings. Proc Mean and Freq used to describe the data. Proc Ttest, Npar1way, and Corr used examine peripheral intravenous access using ultrasound guided. The result indicated that the means of minutes to obtain IV, number of attempts, cost in salary, and cost for equipment were higher for traditional group as compare to USGPIV. The Chi-square and fisher exact test showed there was statistically significant between success rate and group (P value <.0001). SAS is power tool to assist clinician to analysis data in any levels. In this study simple procedures in SAS help clinician to examine and evaluate her/his question

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SAS Syntax

Data steps:

```
Proc format;
Value successf      1= "success"      0= "failure";

Data one;
Set ven.venoussp18;
If id=. then delete;
scosth = 25.55;
scostm = scosth/60;
if request=3 then success=1;
  else if request=1 or request=2 then success=0;

natt = sum (of nattempt vatmd);
scost = mtime * scostm;

label
scosth =" average salary per hour"
scostm =" average salary per minutes"
mtime =" amount of minutes to obtain IV"
success =" success"
natt = " total number of attempt to obtain IV"
scost =" total cost for salary /minutes"
ecost = " Total cost for equipment";

format success successf.; run;

data two;  set one;  if id=4 then delete;  run;
```

Proc steps:

```
ods rtf;   ods listing close;
proc freq data =two;
tables id -- cusgpiv success ;
title ' Frequency tables  /   '    ; run;

proc means data=two maxdec=2;
var age mtime natt  scost ecost;
TITLE1 'Mean'; run;

ods rtf close; ods listing;  quit; run;

ods rtf;  ods listing close;

%macro avg (q,t);
proc means data=two maxdec=2;
  class &q;
var   age mtime natt scost ecost
                    ;
     TITLE 'means exculde id 4 / ' &t;  run;
%mend avg;
%avg (group , by group); run;
ods rtf close; ods listing;  quit; run;

ods rtf; ods listing close;
proc freq data =two;
tables group *(success) /chisq;
title ' Frequency tables  /   '    ; run;
%macro ttest (q,t);
proc ttest data=two ;
  class &q;
var   age mtime natt  scost ecost;
     TITLE 'ttest / ' &t;      run;
%mend ttest;
%ttest (group , by group);run;
ods rtf close; ods listing; quit; run;

ods rtf; ods listing close;

%macro npar (q,t);
proc npar1way data=two ;
class &q;
var   age mtime natt  scost ecost;
    TITLE 'Non Parametric / ' &t; run;
%mend npar;
%npar (group , by group);
ods rtf close;  ods listing;  quit;  run;
```