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Abstract 131: Effect of environment of care within PIRO sepsis model: is tele-health the answer for health policy?

Donna Lee Armaignac
Baptist Health South Florida, donnawa@baptisthealth.net

Carlos Valle
Baptist Health South Florida, CarlosValle@baptisthealth.net

Julie Lamoureux
West Kendall Baptist Hospital, julieal@baptisthealth.net

Louis Gidel
Baptist Health South Florida, LouisG@baptisthealth.net

Xiaorong Mei
Baptist Health South Florida, xiaorongm@baptisthealth.net

See next page for additional authors

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Authors
Donna Lee Armaignac, Carlos Valle, Julie Lamoureux, Louis Gidel, Xiaorong Mei, and Emir Veledar

Effect of Environment of Care within PIRO Sepsis Model: Is Tele-Health the Answer for Hospital and Health Care Policy?

Donna Lee Armaignac PhD, RN-CNS, CCNS, CCRN; Carlos A. Valle RT; Julie A. Lamoureux DMD, MSc; Louis T. Gidel PhD, MD; Xiaorong Mei MS IT; Emir Veledar PhD

Baptist Health South Florida Telehealth Center

Introduction: As part of a more in-depth study that examined the effect of pre-existing health and acute illness characteristics on sepsis responses and outcomes in Intensive Care Unit (ICU), the purpose of this component was to determine the effect of Hospital and ICU admission source on risk of sepsis severity, mortality, and acutely acquired organ dysfunction (AAOD).

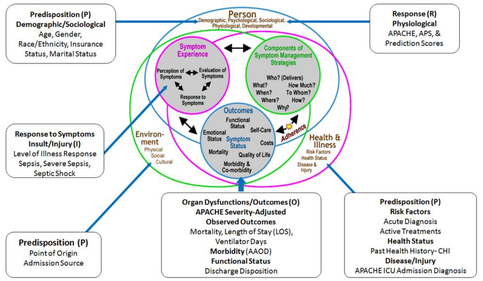


Figure 1. *Armaignac (2013) Adaptation of Symptom Management Theoretical Model to* provide a framework to define, organize, and visualize interrelationships among sepsis Predisposition, Insult/Injury, Response, Organ Dysfunctions/Outcomes (*PIRO) concepts*

Method: Using Tele-health data we created a physiological and severity adjusted observational cohort obtained at 6 hospitals from 2008 to 2013 (*n* = 10,232; 5,643 sepsis, 2,321 severe sepsis, 2,268 septic shock) .

Control Variables CV	Independent Grouping Variables IV = X	Dependent Outcome Variables DV = Y
Sepsis-comparison Control Groups International SCCM/ACCP Consensus Clinical Definitions	**Person Characteristics**	**Outcomes of Sepsis Illness**
Level of Illness	Demographic	Level of Illness
Sepsis	Age	Sepsis
Severe Sepsis	Gender	Severe Sepsis
Septic Shock	Sociological	Septic Shock
	Race/ethnicity	
	Insurance Status	
	Marital Status	
	Physiological	Morbidity (AAOD)
	APACHE Score	
	APS	
	Environmental	Functional Status
	Hospital Admission Source	Discharge Disposition
	ICU Admission Source	
	Health and Illness	
	Acute Diagnosis	
	Active Treatments	
	Past Health History - CHI	
	APACHE ICU Admission Diagnosis	
	APACHE Predictions	Matched Observed Outcomes
	Hospital Mortality	Hospital Mortality
	ICU Mortality	ICU Mortality
	Hospital LOS	Hospital LOS
	ICU LOS	ICU LOS
	Ventilator Days	Ventilator Days

Logic was applied to ICD-9 codes to filter into comparison groups matched to the consensus definitions.

A random standard sample was drawn to determine the validity of the ICD-9 selection criteria compared to both prospective and retrospective methodologies blinded over same period.

-Retrospective 0.8846 (95% CI (0.7102; 0.9600)) indicating 88.5% sensitivity

-Prospective 0.8624 (95% CI [0.6944; 0.9450]) indicating 86.2% sensitivity

-Subsequently, to learn what contributed to the small degree of non-agreement, a sub-set of patient's charts were reviewed.

-Uro-sepsis and pneumonia were the only inconsistencies; therefore, added to logic model to improve agreement.

-All newer CMS HAIs, all infection plus acute organ dysfunction and all sepsis related were included.

-Sampling was also validated through extensive ROI, of method over 15 years including seminal work Angus '01, Martin '03, Dombrovskiy'07, Lagu '12, etc.

Note. X refers to grouping variables or the independent variables (IV), which are the presumed causes, Y refers to the dependent variables (DV), which are the presumed effects or outcomes, and CV refers to the control variables, which are the control groups.

Environmental characteristics were examined as part of PIRO multivariate regression models that included socio-demographic and acute physiologic factors. Examination of environmental characteristics revealed:
There were 10,232 cases of sepsis, of any severity, in the database analyzed. Of the 10,232 patients in this sample, 5,643 met criteria for sepsis only (55.1%), 2,321 met criteria for severe sepsis (22.7%) and 2,268 met criteria for septic shock (22.2%). Patients only exist in one sepsis-comparison control group; therefore, the highest level of illness is the default grouping.

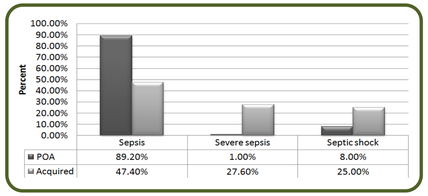


Figure 6. Relative Frequency of Levels of Sepsis by POA or Acquired (non-POA) (*n* = 10,232)

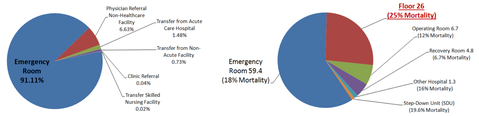
Figure 6 shows the proportion of each level of sepsis between the groups that were present-on-admission (POA) and those acquired during the hospital stay (non-POA).There was a significantly larger proportion of sepsis POA cases (89.2%) compared to non-POA (47.4%), severe sepsis POA (1%), non-POA (27.6%); septic shock POA (8%); non POA (25%).

Table 8 - Hospital Admission Source (n = 10,232)

Hospital Admission Source	Freq.	Percent	Cum.
Clinic Referral	1	0.04	0.04
Emergency Room	9,322	91.11	91.15
Physician Referral Non-Healthcare Facility	678	6.63	97.77
Transfer from Non-Acute Facility	75	0.73	98.5
Transfer from Acute Care Hospital	151	1.48	99.98
Transfer Skilled Nursing Facility	2	0.02	100
Total	10,232	100	

Table 9 - ICU Admission Source (n = 10,208)

ICU Admission Source	Freq.	Percent	Cum.
Direct Admit	83	0.81	0.81
Emergency Room	6060	59.37	60.18
Floor	2657	26.03	86.21
Operating Room	682	6.68	92.89
Other Hospital	131	1.28	94.17
Recovery Room	493	4.83	99
Step-Down Unit (SDU)	102	1	100
Total	10,208	100	



Results: The vast majority of this sample arrived from the emergency department (91.1%). A chi-square test shows there is a significant difference in the mortality rates depending on the hospital admission source ($\chi 22df = 16.535$, $p < 0.001$). The rate is significantly higher for those transferred from another hospital (22.8%). The most frequent ICU admission source was the emergency room (59.4%) followed by a transfer from the floor (26.0%). A chi-square test shows there is a significant difference in the mortality rates depending on the ICU admission source ($\chi 26df = 139.188$, $p < 0.001$). The mortality rates are significantly higher for those coming from the floor (25.1%).

Significant Effects of Person Characteristics on Level of Sepsis Response (n = 10, 232)

IV	Person Characteristics	Level of Sepsis DV OR	z	p>|z|	[95% CI]	
Demographic						
	Gender Male	1.17	3.86	0.000	1.08	1.28
Sociological						
	Race/Ethnicity Hispanic	1.16	3.68	0.000	1.07	1.25
	Insurance Self-pay	0.65	-2.36	0.019	0.46	0.93
	Charity	0.74	-2.41	0.016	0.59	0.94
	Marital Widowed	0.85	-2.72	0.007	0.76	0.95
Physiological	APS	1.03	35.05	0.000	1.03	1.03
Environmental						
	ICU Admit Floor	1.19	3.88	0.000	1.09	1.31
	Operating Room	1.52	5.67	0.000	1.32	1.77

Those admitted to ICU from the floor had higher likelihood of having a more severe level of sepsis (OR = 1.19, p = 0.000, 95% CI = [1.09; 1.31]). Those transferred from other acute care centers had higher odds of expiring during their hospital stay (OR = 1.71, p = 0.006, 95% CI = [1.16; 2.52]). Those admitted to ICU from the floor had the greatest odds of expiring (OR = 1.48, p = 0.000, 95% CI = [1.31; 1.68]).
Those coming from the floor to ICU are were more likely to develop AAOD (OR = 3.19, p = 0.000, 95% CI = [2.89; 3.53]), transfers from another hospital to ICU were more likely to develop AAOD (OR = 1.70, p = 0.006, 95% CI = [1.16; 2.40]), and those coming from a step-down unit SDU were also more likely to develop AAOD (OR = 2.35, p = 0.000, 95% CI = [1.55; 3.55]).

Significant Effects of Person Characteristics on Sepsis Outcomes (n = 10, 232)

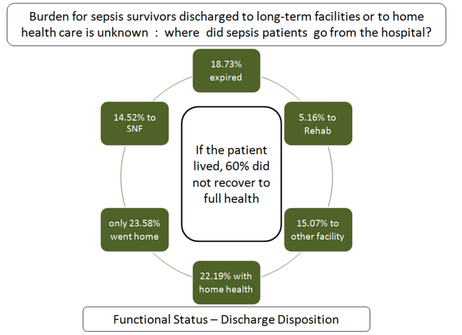
IV	Person Characteristics	Sepsis Outcomes DV OR	z	p>|z|	[95% CI]	
		Hospital Mortality				
Demographic	Male Gender	1.19	3.14	0.002	1.06	1.33
Sociological						
Insurance	Self-pay	1.63	2.25	0.025	1.06	2.50
Physiological	APACHE Score	1.03	33.77	0.000	1.03	1.04
Environmental						
Hospital Source	Other Hospital	1.71	2.74	0.006	1.16	2.52
ICU Source	OR	0.71	-2.48	0.013	0.55	0.93
	Recovery	0.51	-3.40	0.001	0.35	0.75
	Floor	1.48	6.35	0.000	1.31	1.68
		ICU Mortality				
Demographic						
Sociological						
Insurance	Medicare/HMO	1.22	2.18	0.029	1.02	1.46
	Self-pay	2.18	2.93	0.003	1.29	3.69
	HMO/PPO/Other	1.57	3.57	0.000	1.22	2.02
	Medicaid/HMO	1.88	3.66	0.000	1.34	2.65
Physiological	APACHE Score	1.04	30.08	0.000	1.03	1.04
Environmental						
		AAOD				
Demographic	Male Gender	1.18	3.71	0.000	1.08	1.29
Sociological						
Physiological	APS	1.01	15.49	0.000	1.01	1.01
Environmental						
ICU Source	Other Hospital	1.70	2.76	0.006	1.16	2.4
	Recovery	2.26	7.98	0.000	1.85	2.76
	SDU	2.35	4.06	0.000	1.55	3.55
	Floor	3.19	22.81	0.000	2.89	5.53
	OR	4.65	18.28	0.000	3.94	5.49

Operating room higher risk sepsis severity (OR 1.52 p<.000), lower mortality (OR 0.71 p=.013), but highest risk of AAOD (OR 4.65 p=.000); and recovery room aligned with OR for lower mortality (OR 0.51 p=0.001), but higher risk AAOD (OR 2.26 p<.000). Surgical and Recovery environments are least likely to go home and most likely to go to a skilled nursing facility.

Display of Significant Effects of Environment Characteristics on Discharge Dispositions (n = 10,232)

Person Characteristics	IV	Discharge Disposition Outcome DV of those who survived (81.12%) Home (24.5%)	Home Health (21.0%)	Acute Facility (14.4%)	Rehab (6.0%)	SNF (14.4%)
Environment	ICU Admission Source	Operating Room (Odds Ratio 0.51, p<.000) Other Hospital (OR 0.63, p=.049) Recovery (OR 0.71, p=.004) Floor (OR 0.78, p<.000)	Operating Room (ORI1.72, p<.000) Recovery (ORI1.33, p=.011)	Operating Room (OR 0.69, p=.004) Recovery (OR 0.55, p<.000) Floor (OR 0.78, p<.000)	Operating Room (OR 1.74, p=.016) Other Hospital (OR 2.08, p<.000) Recovery (OR 1.70, p=.001)	Operating Room (OR 1.64, p<.000) Recovery (OR 1.67, p<.000)

Conclusions: In all prediction models, environmental characteristics were highly significant independent predictors of worse outcomes. **The floor patients are the highest risk overall, for higher level of sepsis, mortality, to develop AAOD, and are least likely to go home. Dismal conclusion** that if a patient did not expire or go home; the remaining 60% did not recover to health. A key recommendation is to examine what happens after discharge disposition.



Health/Public Policy: Considering, that 81.5% of sepsis was acquired during hospitalization in this study, and that these cases were of greater severity with the worst outcomes, **astute surveillance of all in-hospital patients is imperative.**

This risk of not intervening places patients in grave danger and negatively affects healthcare organizations; therefore, an examination of floor practice needs undertaking; what is occurring during the course of care delivery that places patients at risk?

The hypothesis is that floor care is not conducive to keep patients safe from sepsis as the current health care environment demands exceed the necessary threshold.

Telehealth surveillance theoretically may create a more ideal practice environment. Tele-health's live predictive analytics and cognitive affordances, can and may support efforts to prevent floor patients from descending into ICU.
Telehealth surveillance has demonstrated decreased mortality, decreased length of stay, enhanced quality and lives saved.