A Pediatric Urgent Care Length of Stay Predictability Model Based on Correlating Physician & Nursing Team Staffing

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Purpose

- To determine whether Volume, Nurse Hours Per Unit of Service (NHPUOS) and Medical Hours Per Unit of Service (MDHPUOS) significantly affect daily median Length of Stay (LOS) in pediatric urgent care centers.
- To determine whether there is a significant interaction effect between volume, NHPUOS and MDHPUOS to predict daily Length of Stay in pediatric urgent care centers.

Review of Literature

1. During a review of the Enterovirus-D68 outbreak in 2014 experienced at a single children's hospital within 2 pediatric Emergency Departments and 2 Urgent Care Departments, "no significant change in mean of length of stay occurred."
2. "Overall, at all study sites, there was a statistically significant decline in median LOS in patients treated exclusively via MDI-spacer compared to albuterol via nebulizer (MDI-spacer, 135.3 minutes, nebulizer, 154.2 minutes; p=0.0005).
3. "Wait times at an urgent care center may vary depending on patient volume."

Definitions

LOS- Length of Stay is the door entry digital stamp when quick registration starts to the time the patient exits as discharge papers are signed digitally with subsequent escort to the exit door. LOS is represented as the median.

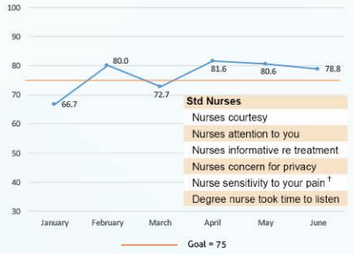
NHPUOS- Worked hours of the nursing team (RN/LPN) per patient encounter as counted by the total number of hours of nursing on shift during the hours of operation divided by the number of patients registered for the hours of operation.

MDHPUOS- Worked hours of the physician team (MD/ARNP/PA) per patient encounter as counted by the total number of hours of physician team on shift during the hours of operation divided by the number of patients registered for the hours of operation.

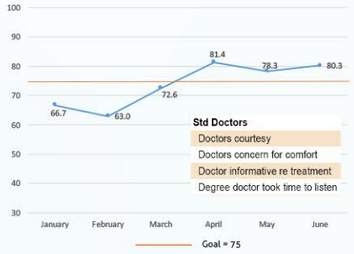
Background

Length of the Stay in an Urgent Care is typically a dis-satisfier to the consumer if perceived to be "too long." Managing wait times and facilitating efficiencies to reduce the door to door time is an important value-based initiative. LOS is likely to be included on a metric driven quality dashboard as well as satisfaction survey questions posed to the consumer. These indicators may disclose areas of opportunity with regard to efficiency and comfort perceptions.

Patient Satisfaction with Nursing

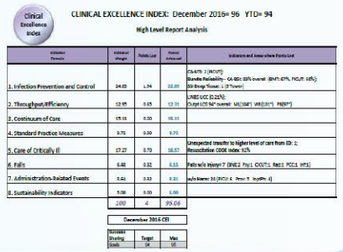


Patient Satisfaction with Doctors



Patient Satisfaction with Length of Stay

Key Performance Indicator Quality Dashboard is Through-put/ LOS



Study Design

5,584 data elements studied among nine (9) urgent care centers within the Nicklaus Children's Hospital Out-patient structure. These 9 centers span three counties in South Florida. Data elements included: center, daily volume, daily median LOS, calculated worked NHPUOS & MDHPUOS.

Method

- Descriptive statistics, including median and quartiles of daily median length of stay, volume, NHPUOS, MDHPUOS were calculated, Table 1
- Median and quartiles were used due to non-normal distribution of the variables
- Generalized linear modeling (fixed effects) was applied to assess effects of volume, NHPUOS, MDHPUOS, controlled by year and site on daily median length of stay. Adjusted models using volume, NHPUOS, MDHPUOS, site, year, as well as interactions between volume and NHPUOS to predict median length of stay were built, Table 2
- Based on the adjusted generalized linear model, expected daily median of stay was calculated using quartiles of volume and NHPUOS, Table 3
- All statistical analysis were performed at 0.05 level of significance

Results

Table 1.

Descriptive statistics of the sample by UCC* (N=5584)

	n (%)	Median of Daily Median Length of Stay in Minutes (Q1-Q3)	Median of Daily Volume (Q1-Q3)	Median of NHPUOS (Q1-Q3)	Median of MDHPUOS (Q1-Q3)
P Bay	697 (12.48%)	92.00 (80.00-104.00)	61.00 (53.00-70.00)	0.94 (0.82-1.07)	0.57 (0.50-0.67)
Doral	697 (12.48%)	73.00 (64.00-83.00)	35.00 (29.00-44.00)	0.86 (0.72-1.00)	0.52 (0.41-0.66)
Kendall	692 (12.39%)	86.00 (76.00-101.00)	40.00 (33.00-50.00)	0.92 (0.78-1.04)	0.56 (0.48-0.66)
Miramar	697 (12.48%)	75.00 (64.00-87.00)	20.00 (16.00-26.00)	0.93 (0.77-1.17)	0.71 (0.54-0.93)
PBG	697 (12.48%)	67.00 (56.00-82.00)	14.00 (11.00-19.00)	1.71 (1.26-2.18)	0.86 (0.64-1.09)
MID	697 (12.48%)	74.50 (62.00-86.00)	32.00 (26.00-38.00)	0.81 (0.68-0.98)	0.62 (0.50-0.77)
M. Lakes	697 (12.48%)	90.00 (77.00-106.00)	54.00 (44.00-63.00)	0.88 (0.77-1.01)	0.56 (0.48-0.66)
Main	423 (7.58%)	65.00 (55.00-78.00)	26.00 (19.00-33.00)	0.95 (0.74-1.26)	0.64 (0.50-0.84)
W. Bird	287 (5.14%)	77.00 (66.00-89.00)	19.00 (16.00-24.00)	1.17 (0.96-1.44)	0.84 (0.65-1.13)
Overall	5584 (100.00%)	79.00 (65.00-93.00)	33.00 (21.00-48.00)	0.94 (0.78-1.18)	0.61 (0.50-0.80)

Note. *Median and interquartile range was used because of non-normal distribution of the variables.

Table 2.

Results from Generalized Linear Model for predicting Median Length of Stay in Minutes (N=5566)

Predictor	Estimate (95% CI)*	p-Value
Volume	1.010 (1.009 - 1.011)	<0.001
NHPUOS	0.975 (0.959 - 0.992)	0.004
MDHPUOS	0.999 (0.995 - 1.002)	0.482
Year 2016 vs. 2015	1.028 (1.014 - 1.041)	<0.001
Site		<0.001
Doral	Reference	
Kendall	1.168 (1.139 - 1.198)	<0.001
M. Lakes	1.109 (1.079 - 1.141)	<0.001
Main	1.002 (0.973 - 1.032)	0.881
MID	1.037 (1.011 - 1.063)	0.005
Miramar	1.139 (1.109 - 1.169)	<0.001
P Bay	1.082 (1.048 - 1.116)	<0.001
PBG	1.184 (1.15 - 1.219)	<0.001
W. Bird	1.201 (1.159 - 1.243)	<0.001
Volume*NHPUOS	0.996 (0.995 - 0.997)	<0.001

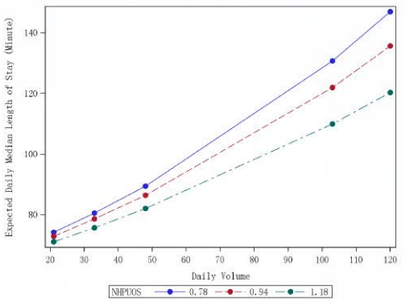
Note. *Estimates are exponentials of coefficients from SAS PROC GENMOD.

Table 3.

Expected daily median length of stay with 95% confidence limits with corresponding volume and NHPUOS using adjusted fixed effects model

Volume	NHPUOS	Expected Daily Median Length of Stay in Minutes	Lower 95% Confidence Limit	Upper 95% Confidence Limit
21.00	0.78	74.25	73.18	75.34
33.00	0.78	80.66	79.94	81.37
48.00	0.78	89.44	88.59	90.30
21.00	0.94	72.98	72.06	73.92
33.00	0.94	78.68	78.13	79.23
48.00	0.94	86.42	85.49	87.36
21.00	1.18	71.11	70.34	71.90
33.00	1.18	75.80	75.13	76.47
48.00	1.18	82.08	80.63	83.57

LOS Predictability Model with NHPUOS & Volume



Implication

Staffing Model

Expect LOS (overall goal <90 minutes)

Volume (quartile)	NHPUOS	MDHPUOS	Expected Median LOS
21	1.18	0.5	69.08
33	1.18	0.5	75.66
48	1.18	0.5	79.74
103	1.18	0.5	109.75

Conclusion

- Results from the adjusted fixed effects model showed volume, NHPUOS, site as well the interaction between volume and NHPUOS significantly predicts median length of stay ($p<0.05$)
- By using median, 25% and 75% quartiles of volume and NHPUOS, the expected daily median length of stay is the lowest when NHPUOS is as high as 1.18 and volume is as low as 21.
- By using median, 25% and 75% quartiles of volume and NHPUOS, the expected daily median length of stay is the highest when NHPUOS is as low as 0.78 and volume is as high as 120.
- MDHPUOS was not significantly associated with daily median length of stay ($p>0.05$)

References

1. Conners G., Doyle S., Fowler M., Schroeder L., Tryon T., System stresses in 2 pediatric emergency departments and 2 pediatric urgent care departments during the 2014 Enterovirus-D68 outbreak. *Pediatric Emergency Care.* Vol.00/No.00, May 2016.
2. Dilts J., Humiston G., Lee B., Allen N., Michael J., Effect of an asthma guildeline in 2 pediatric emergency departments and an urgent care center. *Wolters Kluwer Health, Inc.* 2017.
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