URBAN AIR QUALITY IN UTAH: CORRELATIONS WITH EMERGENCY MEDICAL SERVICE RESPONSE UTILIZATION

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INTRODUCTION

Exposure to poor air quality is a well-established factor for exacerbation of respiratory distress and hospital admissions. Utah consistently ranks as one of the poorest air quality states nationwide. Utah's poor air quality is exacerbated by active wildfire seasons and its mountainous topography, causing pollution to build in the mountain's valleys especially during winter inversions. The relationship of poor air quality days in Utah on the demand for pre-hospital services utilization for respiratory distress has not been well studied.

OBJECTIVE

To understand the association of air quality and pre-hospital care resource utilization for respiratory distress incidents in Utah.

METHODS

- Using the Utah EMS dataset, we analyzed 9-1-1 incidents from winter months 2022 (December, January, February, and March).

- This data was linked with air quality index (AQI) data by date, county, and the highest recorded AQI reading for that day.

- AQI was grouped into lower AQI days (AQI≤ 50: Healthy) and high AQI days (AQI≥51: Unhealthy).

- Respiratory distress incidents were identified utilizing a modified version of NEMSQA's definition (addition of all J45(asthma) and exclusion of T17.9 (Foreign body in respiratory tract)).

- Descriptive statistics and chi-square p-values were calculated for patient level (e.g. age, biological sex), clinician level (e.g. provider impression, patient disposition), and incident level (e.g. county, Social Deprivation Index Score(SDI)) variables in this analysis.

- Daily mean incident rate was calculated and tested using an independent t-test.

Table 1. Characteristics of Respiratory Distress[1] Incidents Attended by 9-1-1 Response EMS in Urban areas of Utah[2] by Air Quality Index, 2022[3]

Variable	AQI ≤50(Daily High)[4]		AQI ≥51(Daily High)[4]		Resp % Diff	P-value
	All Incidents	Respiratory Distress	All Incidents	Respiratory Distress		
All Incidents	18,412	1,573(8.5%)	12,741	1,177(9.2%)	+8.2%	0.04*
Mean Incidents Per Day	266.8	22.8	277.0	25.6	+12.3%	<0.01*
Age	50.4[IQR 39]	53.1[IQR 37]	50.7[IQR 38]	53.2[IQR 35]	0.2%	-
Missing	39	0	46	3	-	-
Sex						
Female	9,192	811(8.8%)	6,372	599(9.4%)	+6.8%	0.22
Male	9,159	760(8.3%)	6,327	578(9.1%)	+9.6%	0.22
Missing	61	2	42	0	-	-
Patient Disposition						
Transported	13,092	1,304(10.0%)	8,783	925(10.5%)	+5.0%	0.17
Not Transported	5,106	263(5.2%)	3,784	248(6.6%)	+26.9%	<0.01*
Death (Transported/Not Transported)	213	6(2.8%)	174	4(2.3%)	-17.9%	-
Top Respiratory Primary Impressions						
Acute Resp Distress Syndrome (J80)	-	536(34.1%)	-	430(36.5%)	+7.0%	-
Abnormalities of Breathing (R06)	-	319(20.3%)	-	189(16.1%)	-20.7%	-
Other Resp Disorder(J98)	-	187(11.9%)	-	141(12.0%)	+0.8%	-
Chronic obstructive pulmonary disease (J44)	-	65(4.1%)	-	45(3.8%)	-7.3%	-
Asthma (J45)	-	58(3.7%)	-	53(4.5%)	+21.6%	-
County						
Davis	3,103	289(9.3%)	1,440	167(11.6%)	+24.7%	0.02*
Salt Lake	8,819	658(7.5%)	8,167	639(7.8%)	+4.0%	0.37
Utah	3,715	308(8.3%)	1,337	126(9.4%)	+13.3%	0.21
Weber	2,775	318(11.5%)	1,797	245(13.6%)	+18.3%	0.03*
Social Deprivation Index Score by Postal Code[5-6]						
<25 (Least Deprived)	5,882	492 (8.4%)	3,537	312 (8.8%)	+4.8%	0.44
25-49	5,183	514 (9.9%)	3,344	332 (9.9%)	0.0%	-
50-74	3,483	307 (8.8%)	2,280	247 (10.8%)	+22.7%	0.01*
75+ (Most Deprived)	3,650	243 (6.7%)	3,436	274 (8.0%)	+19.4%	0.03*
Missing	214	17	144	12	-	

IMAGE*TREND*

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[1]Includes NEMSQA definition of Respiratory Distress excluding T17.9(Foreign body in respiratory tract) and including all J45(asthma)
[2]Counties include Davis, Salt Lake, Utah, and Weber (4 most populous counties)
[3]Included months December through March as this is when Moderate/Unhealthy Air quality days are most prevalent
[4]In Winter 2022, there were 79 AQI ≤50 days and 46 AQI ≥51 days documented
[5]https://www.graham-center.org/rgc/maps-data-tools/sdi/social-deprivation-index.html
[6]Glassman, B., & Branch, P. S. (2020). The Multidimensional Deprivation Index Using Different Neighborhood Quality Definitions. In Prepared for the Western Economic Association Annual Conference.
*Significant p-value <0.05

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RESULTS

- Of the 31,153 incidents, 2,750 (8.8%) respiratory distress incidents were identified.

- Days that had an AQI ≤50 (69 days) had a mean respiratory distress incidence rate of 22.8 while AQI ≥51 (46 days) had a mean of 25.6, a 12.3% increase (p<0.01).

- There was an increase of incidence seen in all these counties on days with AQI ≥51, with Davis and Weber counties being most impacted (p=0.02 and p=0.03).

- Furthermore, patients in the highest social deprivation index categories (most deprived) were most affected by high AQI days (50-74 SDI, p=0.01 and ≥75 SDI, p=0.03).

- There was no significant difference in transport rates on high AQI days (p=0.17).

LIMITATIONS

- Not all days in the study time frame had a reported AQI value excluding EMS incidents on those days.

- Severity of respiratory distress incidents was not assessed.

CONCLUSION

Despite interventions to improve air quality, Utah remains at the highest AQI level nationwide. This provides challenges in respiratory distress for patients and represents high resource utilization in the pre-hospital setting. EMS resources are impacted as the rate of AQI increases. Thus, it behooves communities with high AQI to ensure that responders are properly trained and equipped with resources to treat the increased burden from respiratory distress. Furthermore, public health air quality interventions in populations of high social deprivation should also be considered.