Mortality Among Patients with Implantable Drug Delivery Pumps: A Retrospective Analysis

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Introduction

Pain pumps are frequently used to manage acute and postoperative pain in hospitalized patients and are an important component of analgesic care. Prior research has demonstrated that demographic and socioeconomic factors may contribute to disparities in hospital outcomes. Ohashi et al. found that socioeconomic factors, including income and insurance status, were associated with differences in in-hospital mortality and hospital readmission rates.[1] In patients with implantable drug delivery systems, Konrad et al. identified complications including catheter occlusion, dislodgement, and deformation, which may require device revision or removal.[2] However, less is known about whether outcomes among hospitalized patients with implantable infusion device complications differ according to demographic, socioeconomic, geographic, and hospital characteristics. Building upon prior research, this study examines multiple variables, including race, sex, insurance status, geographic region, county population, hospital teaching status, and median household income, to identify potential disparities in in-hospital mortality among patients with implantable infusion device complications. By evaluating these factors, we sought to further characterize populations in which mortality differences may exist and provide a foundation for future investigation into factors contributing to these disparities.

Results

Results showed that among hospitalizations involving pain pump revision/removal, those with Other Insurance were 1.34 times more likely than those with Medicare to die in the hospital (95% CI: 1.33–1.35; p<0.001). White individuals were 1.27 times more likely than those who identified as Other race to die in the hospital, while those in micropolitan counties were 1.23 times more likely to die in the hospital than those in central counties of metropolitan areas. In addition, as median household income quartiles increased, there was an increased likelihood of in-hospital mortality. Significant differences in mortality were also observed across hospital region and hospital teaching status, further demonstrating geographic and hospital-level variation in outcomes. In Table 3, total hospital charges and length of stay were significantly associated with in-hospital mortality (p<0.05), whereas age was not significantly associated with mortality (p>0.05)

Methods

Data from the 2022 Healthcare Cost and Utilization Project - National Inpatient Sample(HCUP-NIS) were analyzed. The outcome of interest was in-hospital mortality among patients with infection/inflammatory (T85.7x), mechanical (T85.6X), or other complications (T85.8X) of implantable infusion devices. Univariate statistics were analyzed, and categorical variables were reported as frequency and percentage. Bivariate analysis using chi-square and t-tests examined variables including race, sex, insurance status, geographic region, county population, hospital teaching status, and median household income to determine if they were independently associated with in-hospital mortality.

Table 1

Variable (total n)	OUTCOME YES n (%)	OUTCOME NO n (%)	p-value
Race			**<0.001**
White	5 (0.50)	1460 (0.78)	
Black	0 (0.00)	230 (0.12)	
Hispanic	5 (0.50)	145 (0.08)	
Asian or Pacific Islander	0 (0.00)	10 (0.01)	
Native American	0 (0.00)	0 (0.00)	
Other	0 (0.00)	35 (0.02)	
Sex			0.213
Female	5 (0.33)	960 (0.49)	
Primary Payer			**0.014**
Medicare	15 (1.0)	1,055 (0.54)	
Medicaid	0(0.00)	370 (0.19)	
Private Insurance	0(0.00)	410 (0.21)	
Self-pay	0(0.00)	10 (0.005)	
No charge	0(0.00)	0 (0.00)	
Other	0(0.00)	90 (0.04)	
Location Urban-Rural			**<0.001**
"Central" counties of MA ≥ 1 mil	0 (0.00)	370 (0.19)	
"Fringe" counties of MA ≥ 1 mil	0 (0.00)	575 (0.30)	
Counties MA 250,000-999,999	15 (1.00)	455 (0.24)	
Counties MA 50,000-249,999	0 (0.00)	225 (0.12)	
Micropolitan counties	0 (0.00)	155 (0.08)	
Not metro or micro counties	0 (0.00)	155 (0.08)	
Median Household Income (1,925)			**<0.001**
0–25th percentile	5 (0.33)	455 (0.23)	
26th–50th percentile	0 (0.00)	510 (0.26)	
51st–75th percentile	0 (0.00)	520 (0.27)	
76th–100th percentile	10 (0.66)	440 (0.23)	
Died during Hospitalization			
Died	15 (0.01)	1940 (0.99)	
Region			**<0.001**
Northeast	0 (0.00)	360 (0.19)	
Midwest or North Central	5 (0.33)	540 (0.28)	
South	0 (0.00)	675 (0.35)	
West	10 (0.00)	375 (0.19)	
Location/Teaching status of Hospital			0.433
Rural	0 (0.00)	35 (0.02)	
Urban Nonteaching	0 (0.00)	160 (0.08)	
Urban teaching	15 (1.00)	1745 (0.90)	

Table 2

Variable	Odds Ratio (95% CI)	P-value
Race	**Odds Ratio**	
White	1.27 (1.26-1.29)	<0.001
Black	1.05 (1.03-1.06)	<0.001
Hispanic	0.77 (0.76-0.78)	<0.001
Asian	1.12 (1.10-1.14)	<0.001
Native American	1.21 (1.18-1.24)	<0.001
Other	1.0 (REF)	-
Urban- Rural Code		
Central counties of metro areas of >=1 million population	1.0 (REF)	-
Fringe counties of metro areas of >=1 million population	1.01 (1.00-1.01)	0.027
Counties in metro areas of 250,000-999,999 population	1.07 (1.07-1.08)	<0.001
Counties in metro areas of 50,000-249,999 population	1.13 (1.11-1.14)	<0.001
Micropolitan counties	1.23 (1.22-1.24)	<0.001
Not metropolitan or micropolitan counties	1.31 (1.30-1.32)	<0.001
Region of Hospital		
Northeast	1.02 (1.01-1.03)	<0.001
Midwest or North Central	0.97 (0.97-0.98)	<0.001
South	0.98 (0.97-0.98)	<0.001
West	1.0 (REF)	-
Median Household Income (1,925)		
0–25th percentile	1.14 (1.13, 1.15)	<0.001
26th–50th percentile	1.09 (1.09, 1.10)	<0.001
51st–75th percentile	1.04 (1.03, 1.05)	<0.001
76th–100th percentile	1.0 (REF)	-
Primary Payer		
Medicare	1.0 (REF)	-
Medicaid	0.30 (0.30-0.30)	<0.001
Private Insurance	0.36 (0.36-0.36)	<0.001
Self-pay	0.51 (0.50-0.51)	<0.001
No charge	0.45 (0.42-0.47)	<0.001
Other	1.34 (1.33-1.35)	<0.001

Table 3

Continuous Variables	Mean (± SD)	Mean (± SD)	P value
Total charges (dollars)	226858.66 (± 148217.87)	130718.22 (± 146094.21)	**0.006**
Length of stay (days)	19.33 (± 17.35)	7.11 (± 8.43)	**0.008**
Age in years	50.67 (± 23.79)	48.34 (± 19.48)	0.323

Discussion

Prior research has demonstrated that implantable drug delivery systems can be associated with serious complications and mortality, while disparities have also been identified in the utilization of these devices.[3–5] Our findings extend these observations by demonstrating that mortality may differ across demographic, socioeconomic, geographic, and hospital-level characteristics. Differences across insurance categories may reflect variations in patient populations, access to care, comorbidities, or healthcare utilization. Geographic and hospital-level differences, including those observed across county population classifications and hospital teaching status, may similarly reflect differences in access to specialized care, referral patterns, or the complexity of patients treated at larger urban centers. The differences observed across income groups suggest that the relationship between socioeconomic status and mortality may be complex and not explained by income alone. Together, these findings highlight the importance of considering multiple patient- and hospital-level factors when evaluating disparities in outcomes following implantable infusion device complications. Further investigation is needed to determine which factors may contribute to the concentration of mortality within these populations.

Conclusion

With increasing use of implantable infusion devices, understanding factors associated with complications and mortality is important. Several demographic and socioeconomic variables were significantly associated with mortality, including race, insurance status, geographic population classification, median household income, and region. These findings highlight potential disparities and may help guide future risk-reduction strategies.

References

1. Ohashi S, Austin SB, Richmond T, Kawachi I. Socioeconomic disparities in in-hospital mortality and 30-day hospital readmission rates among people with eating disorders: a retrospective cohort study. *J Eat Disord.* 2025;13(1):245. doi:10.1186/s40337-025-01422-8
2. Konrad PE, Huffman JM, Stearns LM, et al. Intrathecal drug delivery systems (IDDS): the Implantable Systems Performance Registry (ISPR). *Neuromodulation.* 2016;19(8):848-856. doi:10.1111/ner.12524
3. Coffey RJ, Owens ML, Broste SK, et al. Mortality associated with implantation and management of intrathecal opioid drug infusion systems to treat noncancer pain. *Anesthesiology.* 2009;111(4):881-891. doi:10.1097/ALN.0b013e3181b64ab8
4. Deer TR, Levy R, Prager J, et al. Polyanalgesic Consensus Conference–2012: recommendations to reduce morbidity and mortality in intrathecal drug delivery in the treatment of chronic pain. *Neuromodulation.* 2012;15(5):467-482. doi:10.1111/j.1525-1403.2012.00486.x
5. Goel V, Kumar V, Blaes A, Gulati A. Intrathecal drug delivery systems for cancer pain control: insights on current contemporary practices in the US. *Neuromodulation.* 2023;26(6):1256-1262. doi:10.1016/j.neurom.2023.05.001