Current Trends of *Clostridioides difficile* Infections (CDI) in the United States: Results From the National Inpatient Sample Database 2012-2017

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Introduction

Clostridioides difficile results in more healthcare-associated infections in the United States than any other pathogen, adding significantly to annual healthcare expenditures. The burden of CDI in the United States is significant and well-established; however, its scope and magnitude continue to evolve, requiring updated analyses to quantify current trends.

Research Question

Our aim was to analyze the current trends of CDI burden in the United States. The variables we utilize to represent burden are incidence, mortality, and length of stay. Secondary outcomes include CDI trends with respect to sex, race, hospital location, size, and ownership.

Materials and Methods

Study Design
- Retrospective analysis of National Inpatient Sample Database

Study Period
- 2012 to 2017

Inclusion Criteria
- All adult discharges (age ≥ 18 years) with CDI

Records Analyzed
- 181,132,460

Variables Analyzed
- Incidence and mortality – overall, sex, race, hospital facility

Statistics
- STATA Statistical Software Release 16
- Pandas statistical package in Python

Results

- From 2012 to 2017, out of over 180 million discharges, 2,088,825 (1.15%) had CDI and were included in the analysis.
- The incidence rate increased from 1.15% to 1.21% between 2012 and 2015 before declining to 1.16% in 2016 and 1.06% in 2017 (Δ -0.09%).
- Mortality rate exhibited a steady decrease from 7.32% to 6.25% (Δ -1.07%) over the 6-year period.
- Average length of stay decreased from 10.6 days to 9.9 days, along with average age of CDI dropping from 67.9 years to 66.2 years.
- Incidence and mortality rates were highest in large-bedded, urban teaching hospitals.
- Incidence and mortality rates were consistently higher in males compared to females, with both sexes demonstrating similar trends.
- Incidence was typically higher in White Americans; however, Asians/Pacific Islanders regularly demonstrated the highest mortality rates during the study period.
- Incidence in Native Americans was higher in 2017 than 2012.

	2012		2013		2014		2015		2016		2017	
Total number hospitalized	30,704,144		29,957,241		29,738,494		30,150,582		30,161,092		30,420,907	
Hospitalizations with CDI, N (%)	352,485 (1.15)		347,835 (1.16)		351,655 (1.18)		363,350 (1.21)		350,960 (1.16)		322,540 (1.06)	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Mortality	25,810	7.32%	25,305	7.28%	23,970	6.82%	24,245	6.68%	22,010	6.28%	20,130	6.25%
95% CI	67.75 – 67.99		67.18 – 67.44		66.45 – 66.70		66.17 – 66.42		65.86 – 66.11		66.08 – 66.34	
LOS (days)	10.6		10.4		10.5		10.2		10.1		9.9	
95% CI	10.51 – 10.71		10.34 – 10.53		10.37 – 10.57		10.07 – 10.26		10.03 – 10.22		9.79 – 9.98	

Table: Overall incidence, mortality, and length of stay trends for adult hospitalizations with CDI from 2012-2017

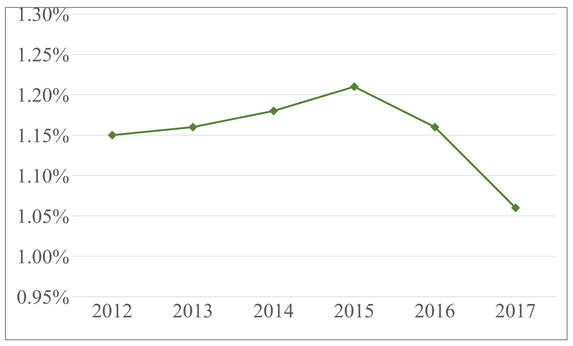

Figure 1: Overall incidence of CDI

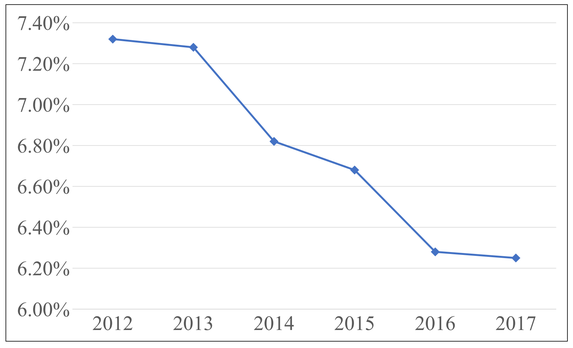

Figure 2: Overall mortality of CDI

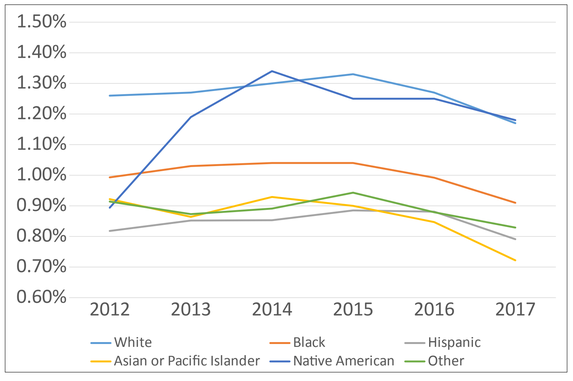

Figure 3: Incidence of CDI with respect to race

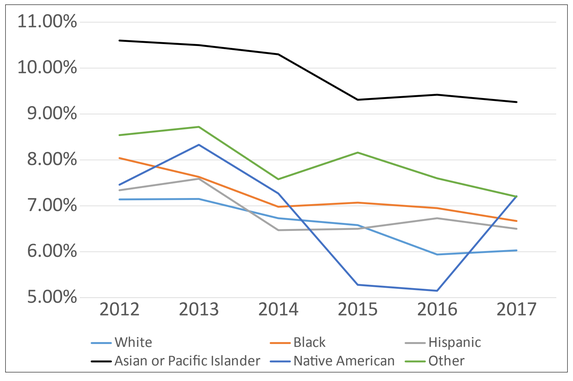

Figure 4: Mortality of CDI with respect to race

Conclusion

Improvement in overall mortality rate (Δ -1.07%) outpaced improvement in the incidence rate (Δ -0.09%), which may be indicative of improved diagnosis and management of CDI. Primary prevention efforts are still struggling to effectively control the spread of CDI, especially in large-bedded, urban teaching hospitals – this may be due in part to a higher acuity patient population.

Summary

- CDI incidence and mortality are decreasing overall, suggesting a lessening of burden
- Average length of stay decreased from 10.6 days to 9.9 days during the study period
- Unlike every other race, the incidence of CDI in Native Americans is higher in 2017 than it was in 2012 – a possible area of focus in the future
- Large-bedded, urban teaching hospitals had higher CDI incidence and mortality rates compared to small-bedded, urban non-teaching, and rural hospitals

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