



# A Novel Method to Assess Virulence of *Clostridioides difficile*: Focus on *C. difficile* Ribotype 106

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## BACKGROUND

- Clostridioides difficile* infection (CDI) is one of the major threats to public health in the United States (US) (1)
- C. difficile* ribotype (RT) 106 has been identified as the most prevalent ribotype causing community-associated (CA) CDI and the second most prevalent in healthcare-associated (HA) CDI in the US (2)
- CDI caused by RT 027 was associated with double mortality rate within thirty days compared to other RTs (3)
- In an endemic setting in Houston TX, RT 014-020 was associated with decreased CDI disease severity and outcomes compared to RT 027(4)
- A systematic review evaluating the current literature about RT 106 concluded more data was needed regarding clinical outcomes with RT 106 (5)

## OBJECTIVE

To evaluate and compare the clinical outcomes of RTs 106, 014-020, and 027, including severity of disease, mortality rate, and recurrence rate

## METHODS

### Study design

- We conducted a multicenter retrospective study of patients infected with *C. difficile* RT 106, RT 027, and RT 014-020 between 2016-2019 in Houston, Texas
- Electronic medical records were reviewed for patient demographics, laboratory data, exposure to CDI risk factors, and treatment outcomes including initial clinical cure, recurrence, and mortality

### Culture and ribotyping

- C. difficile* stool was plated onto cefoxitin cycloserine-fructose agar (CCFA) plates and anaerobically incubated for 48–72 hours
- Isolates were ribotyped using fragment analysis PCR based on a standardized published method (6)

### Statistical analysis

- Chi-square test, t-test, and logistic regression analysis were used in data analysis
- SPSS software version 26 was used to analyze data

## RESULTS

Table 1. Baseline characteristics

Characteristic	RT 014-020 N=152	RT 106 N= 128	p*	RT 027 N=116	p**
Age (years), mean (SD)	65 (16)	64 (16)	0.50	69 (13)	<0.01
Female sex, no. (%)	93 (61.2)	82 (64.1)	0.62	64 (55.2)	0.15
White, no. (%)	112 (73.7)	92 (73.6)	0.84	74 (64.9)	0.03
CCI score, mean (SD)	2.9 (2.3)	2.7 (2.2)	0.46	3.1 (1.9)	0.17
CDI episode, no. (%)			0.65		0.42
1	111 (73)	99 (77.3)		82 (70.7)	
2	25 (16.4)	19 (14.8)		20 (17.2)	
≥3	16 (10.5)	10 (7.8)		14 (12.1)	
CDI classification, no. (%)			0.63		<0.01
CO	54 (35.5)	41 (32.0)		17 (14.7)	
HO	57 (37.5)	46 (35.9)		44 (37.9)	
CO-HCFA	41 (27.0)	41 (32.0)		55 (47.4)	
Antibiotic exposure in past 30 days, no. (%)	124 (81.6)	107 (83.6)	0.66	98 (85.2)	0.73
Risk category of antibiotic, no. (%)			0.05		0.47
High	110 (90.2)	92 (86.8)		87 (88.8)	
Medium	1 (0.8)	7 (6.6)		3 (3.1)	
Low	11 (9.0)	7 (6.6)		8 (8.2)	
PPI use, no. (%)	82 (53.9)	60 (46.9)	0.24	63 (54.3)	0.25
Continued antibiotic use following diagnosis, no. (%)	100 (66.2)	88 (68.8)	0.65	82 (70.7)	0.74
Steroids, no. (%)	22 (14.5)	23 (18.0)	0.43	18 (15.5)	0.60
ICU	31 (20.4)	30 (23.4)	0.53	30 (25.9)	0.66
Hypo-albuminemia	82 (64.6)	64 (66)	0.82	73 (81.1)	0.01
GI surgery in past 6 months, no. (%)	24 (15.8)	20 (15.6)	0.97	14 (12.1)	0.42

Abbv: CCI, Charlson Comorbidity Index; CO, community-onset; HO, hospital-onset; CO-HCFA, community-onset, healthcare facility acquired; ICU, Intensive care unit; PPI, proton-pump inhibitor; \*RT 106 vs RT 014-020; \*\*RT 106 vs RT 027

Figure 1. CDI 90-day recurrence

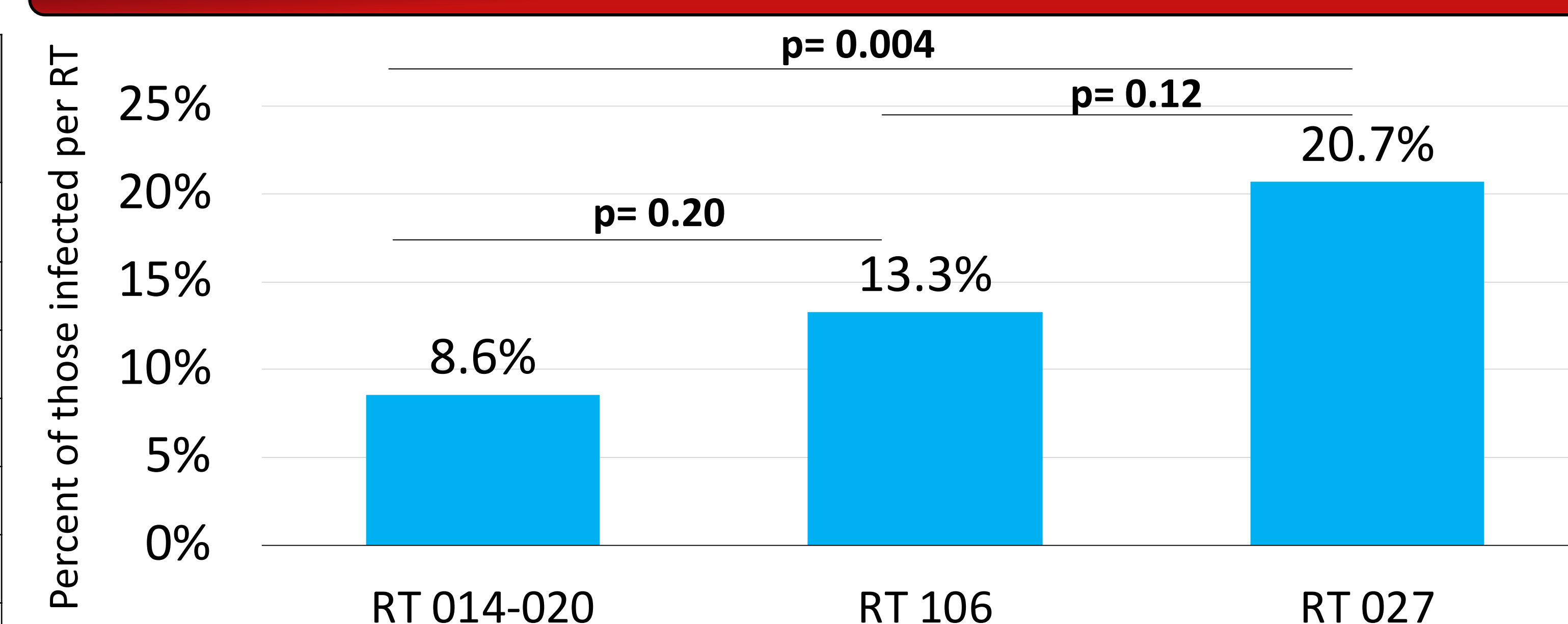


Table 2: CDI outcomes

CDI outcome	RT 014-020 N=152	RT 106 N= 128	p*	RT 027 N=116	p**	All RTs p
Severe episode, no. (%)	71 (46.7)	61 (47.7)	0.90	75 (64.7)	<0.01	0.01
Initial clinical failure, no. (%)	20 (14.2)	25 (20.7)	0.29	27 (25.2)	0.33	0.08
90-day recurrence, no. (%)	13 (8.6)	17 (13.3)	0.20	24 (20.7)	0.12	0.01
Poor prognosis*, no. (%)	83 (54.6)	75 (58.6)	0.50	84 (72.4)	0.02	<0.01
30-day all-cause mortality, no. (%)	16 (10.5)	13 (10.2)	0.51	14 (12.1)	0.63	0.87

\*Composite outcome including initial severe infection, initial clinical failure, and 90-day recurrence  
\*RT 106 vs RT 014-020; \*\*RT 106 vs RT 027

Table 3: Multivariable analysis of poor prognosis

Variable	OR	95% CI	p
RT 027	2.37	1.28 - 4.38	<0.01
RT 106	1.29	0.74 - 2.2	0.36
ICU admission within 72 hrs	2.11	1.13 - 3.93	0.01
Hypo-albuminemia	2.4	1.4 - 4	<0.01

## CONCLUSIONS

- A novel framework of contrasting emerging *C. difficile* ribotypes to other locally endemic strains demonstrated RT 106 to be moderately virulent when compared to RTs 027 and 014-020.

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