

The effects of non-pharmaceutical interventions (NPIs) on the epidemiology of notifiable infectious diseases in Poland 2015-2022, a cross-sectional study

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Introduction

The COVID-19 pandemic has significantly affected both the world's population and healthcare systems. In an effort to mitigate the virus from spreading, nations responded to the pandemic by enacting non-pharmaceutical interventions (NPIs), such as lockdowns, face covering, school closures, and travel bans.

In addition to successfully curtailing the transmission of SARS-CoV-2, NPIs were also found to be effective in reducing the incidence of the majority of other notifiable infectious diseases.

Aim of the study

Statistically analyze the relationship between the number of implemented NPIs and the incidence trends of selected notifiable infectious diseases in Poland from Jan 1, 2015, to December 31, 2022.

Methodology: Data collection



Methodology: Data collection



Methodology: Data Categorization

Four yearly periods:

2015-2019 average

2020

2021

2022

- Data on biweekly reported cases were categorized based on the concurrent number of applied NPIs.

Methodology: Data pre-processing



- Statistical analysis of the implementation of one NPI was not considered in this study as it was only applied for three biweekly periods.

Methodology: Statistical analysis



Methodology: Statistical analysis



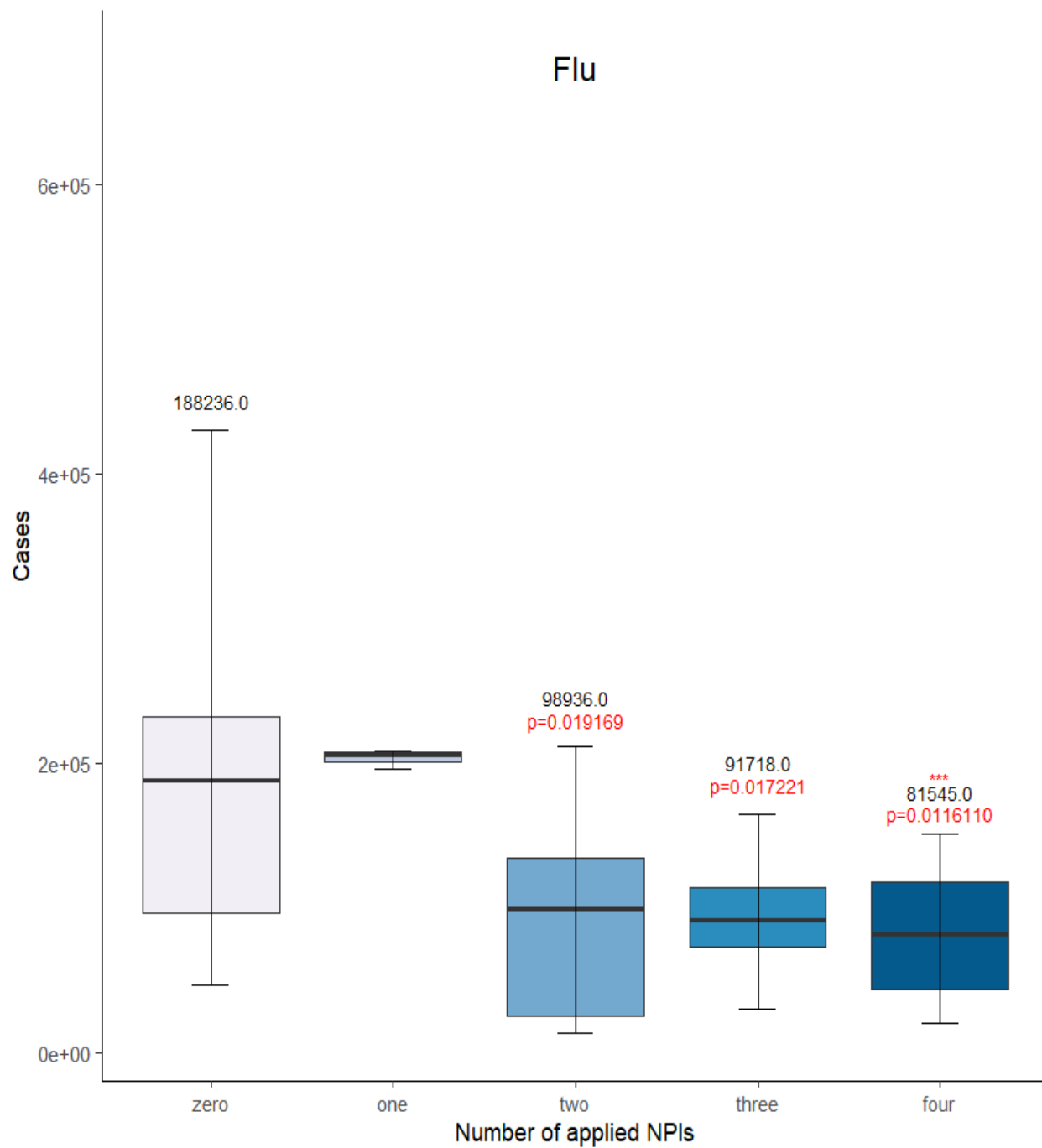
Results

- ANOVA Kruskal Wallis revealed significant correlations in all selected diseases except for C. difficile
- Post hoc analysis revealed a significant inverse correlation between the number of applied NPIs and the incidence of all air-borne diseases and oral-fecal diseases.
- All sexually transmitted & blood-borne diseases showed the highest incidence of decrease when 3 NPIs were applied
- The implementation of 2 NPIs was most effective in Lyme disease

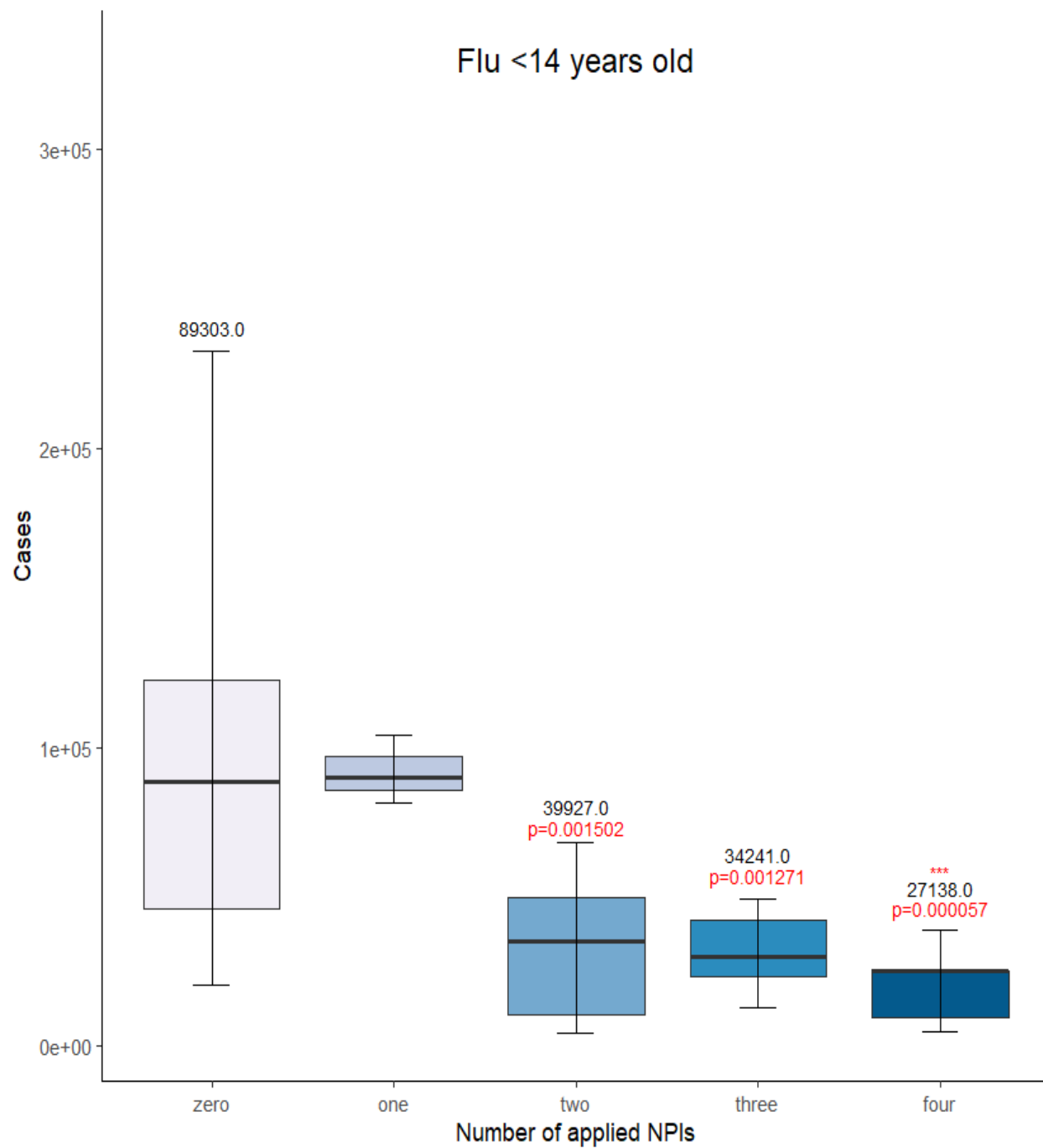
Results: Air-borne & droplet transmissible

Disease	0	2	3	4
Flu > 14-year-old	188236.0 (135157.0)	98936.0 (109205.0)	91718.0 (45862.0)	81545.0 (73934.0)
	-	0.020169	0.019221	0.012110
Flu < 14-year-old	89303.0 (69118.0)	39927.0 (26002.0)	34241.0 (44901.0)	27138.0 (19153.0)
	-	0.002571	0.001202	0.000057
Chickenpox	7365.6 (7428.6)	2948.0 (4186.0)	1780.0 (1841.0)	1627.0 (945.0)
		0.027572	0.008008	0.003214
Scarlet fever	564.0 (872.0)	108.0 (76.0)	98.0 (99.0)	97.0 (38.1)
	-	0.000899	0.000538	0.000146
Mumps	50.5 (40.0)	16.0 (5.0)	16.0 (13.0)	16.0 (6.0)
	-	0.000003	0.000012	0.000010
Whooping cough	42.5 (136.4)	14.0 (3.0)	10.00 (4.0)	5.0 (3.0)
	-	0.030357	0.000013	0.000001

Flu



Flu <14 years old



Results: Oral-fecal transmission

Disease	0	2	3	4
Salmonella	355.0 (299.0)	179.0 (255.0)	161.0 (114.0)	150.0 (73.0)
	-	0.041416	0.014205	0.002719
Bacterial enteritis > 2-year-old	781.0 (398.0)	921.0 (604.0)	568.0 (575.0)	432.0 (256.0)
	-	1.000000	0.985818	0.005130
C. Difficile enteritis	683.0 (443.0)	866.0 (597.0)	461.0 (556.0)	397.0 (236.0)
	-	1.000000	1.000000	0.066480
Other specified & unspecified enteritis	72.0 (47.0)	40.0 (17.0)	34.0 (20.0)	31.0 (21.0)
	-	0.000994	0.000372	0.000043
Bacterial enteritis < 2-year-old	51.0 (28.0)	31.0 (6.0)	27.0 (17.0)	24.0 (14.0)
	-	0.001330	0.000176	0.000082

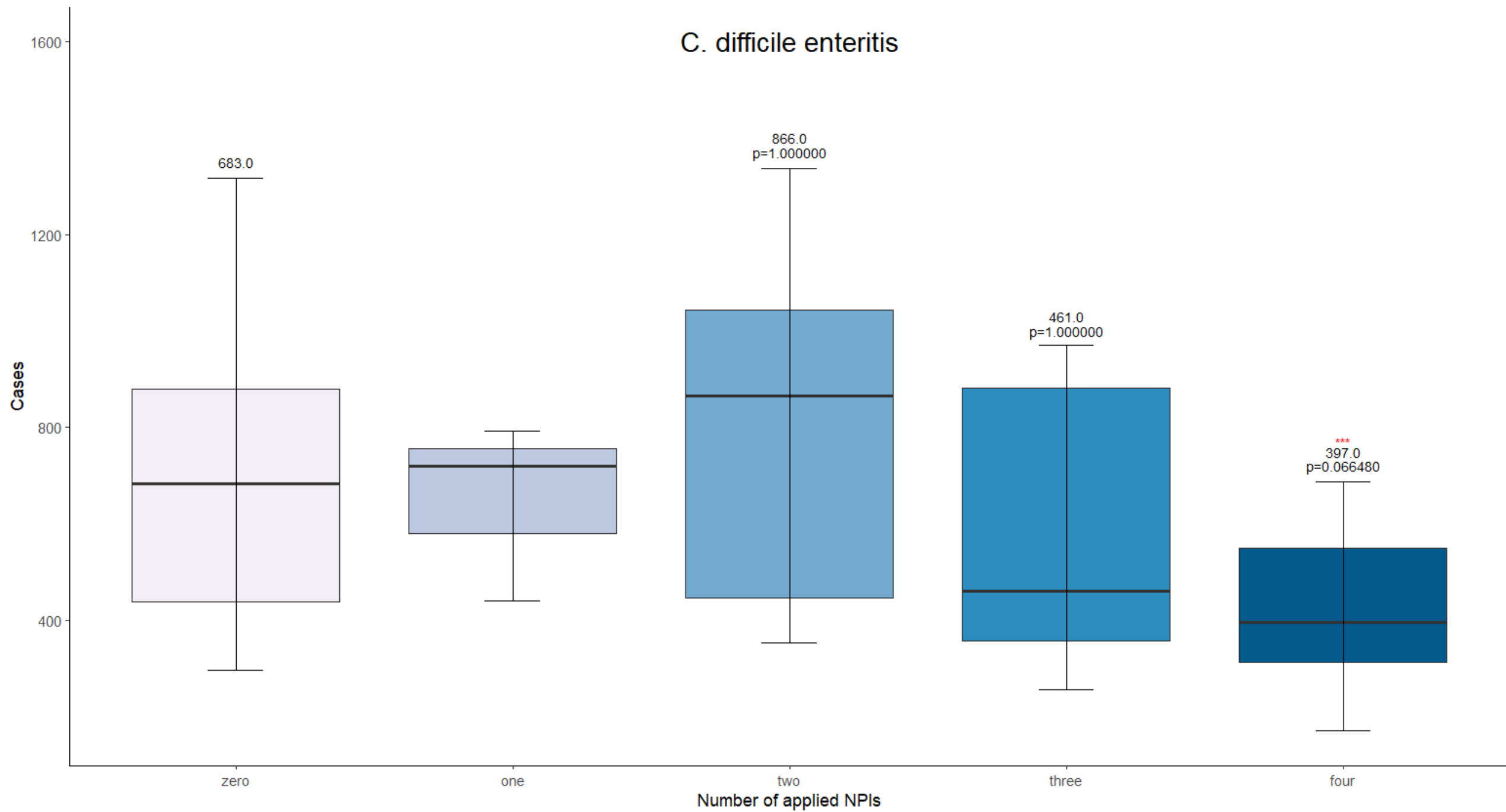
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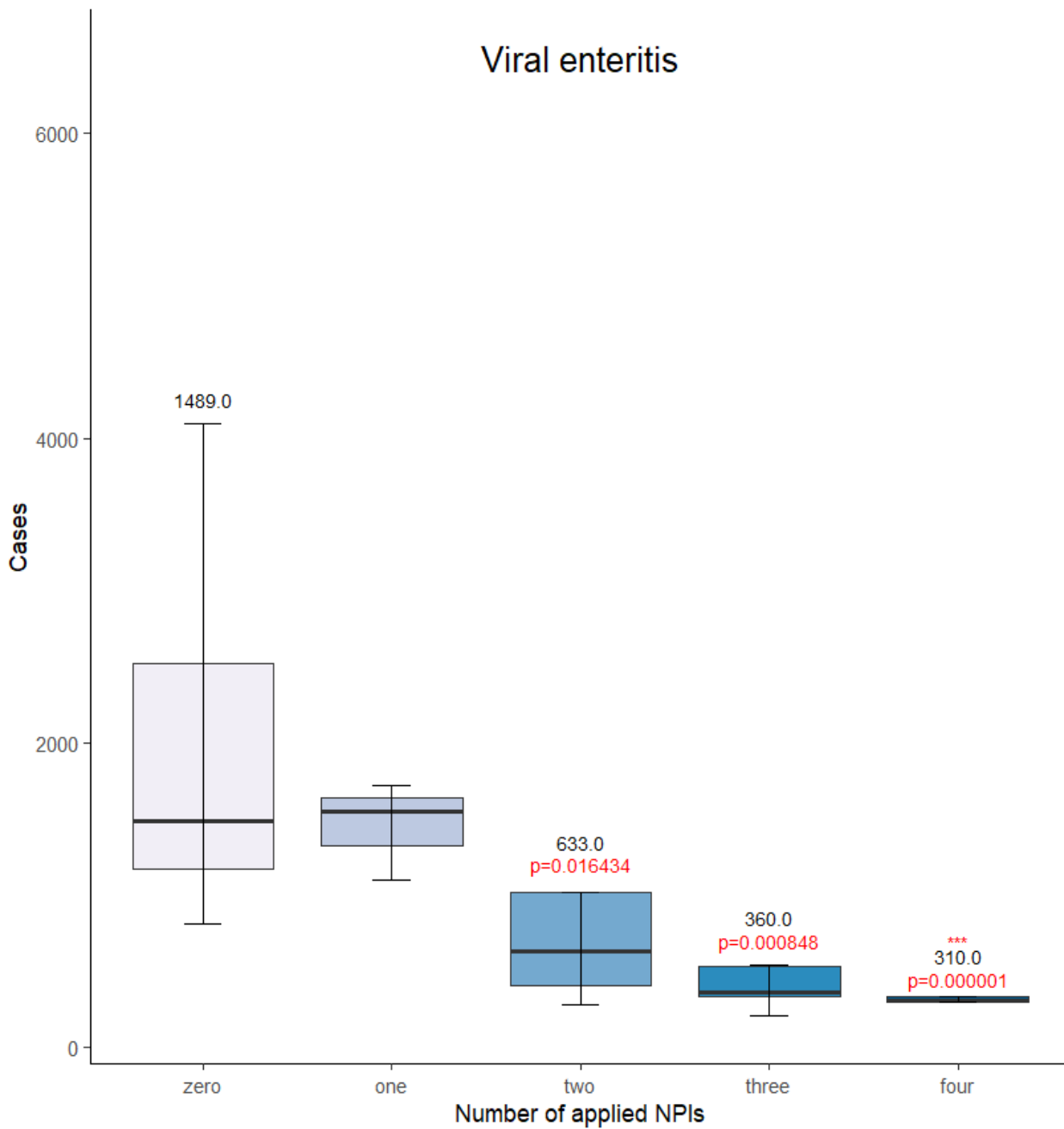
C. difficile enteritis



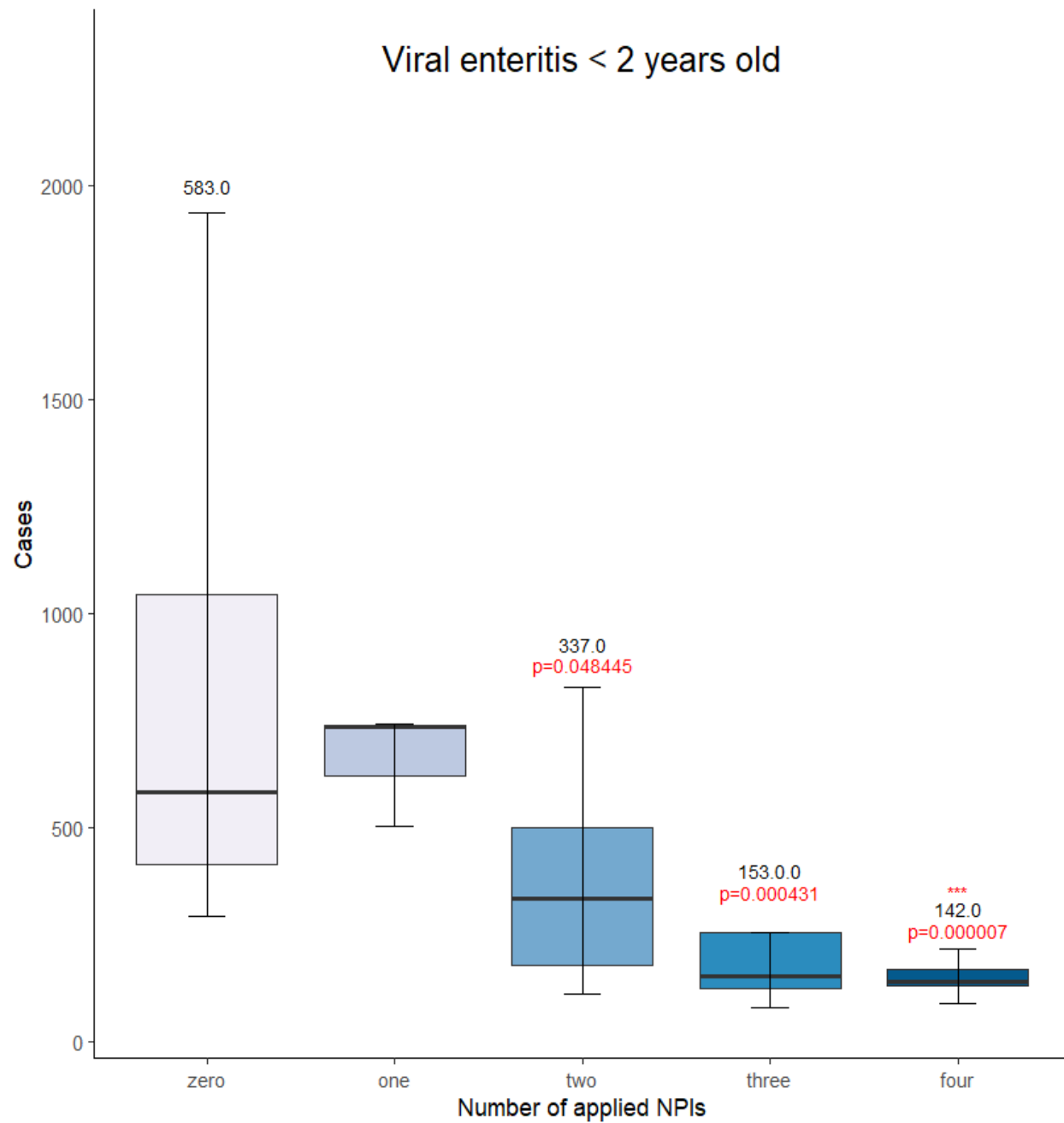
Results: Oral-fecal transmission

Disease	0	2	3	4
Viral enteritis >2-year-old	1489.0 (1358.0)	633.0 (605.0)	360.0 (220.0)	310.0 (31.0)
	-	0.016434	0.000848	0.000001
Rotavirus enteritis	474.0 (1163.0)	181.0 (407.0)	121.0 (228.0)	96.0 (52.0)
	-	0.052898	0.001389	0.000007
Norovirus enteritis	228.1 (131.8)	163.0 (156.0)	38.0 (139.0)	33.0 (21.0)
	-	0.093705	0.002463	0.000014
Other specified & unspecified enteritis	704.0 (352.0)	299.0 (147.0)	186.0 (77.0)	157.0 (19.0)
	-	0.000204	0.000008	0.000000
Viral enteritis < 2-year-old	583.0 (637.0)	337.0 (320.0)	153.0 (133.0)	142.0 (36.0)
		0.048445	0.000431	0.000007

Viral enteritis



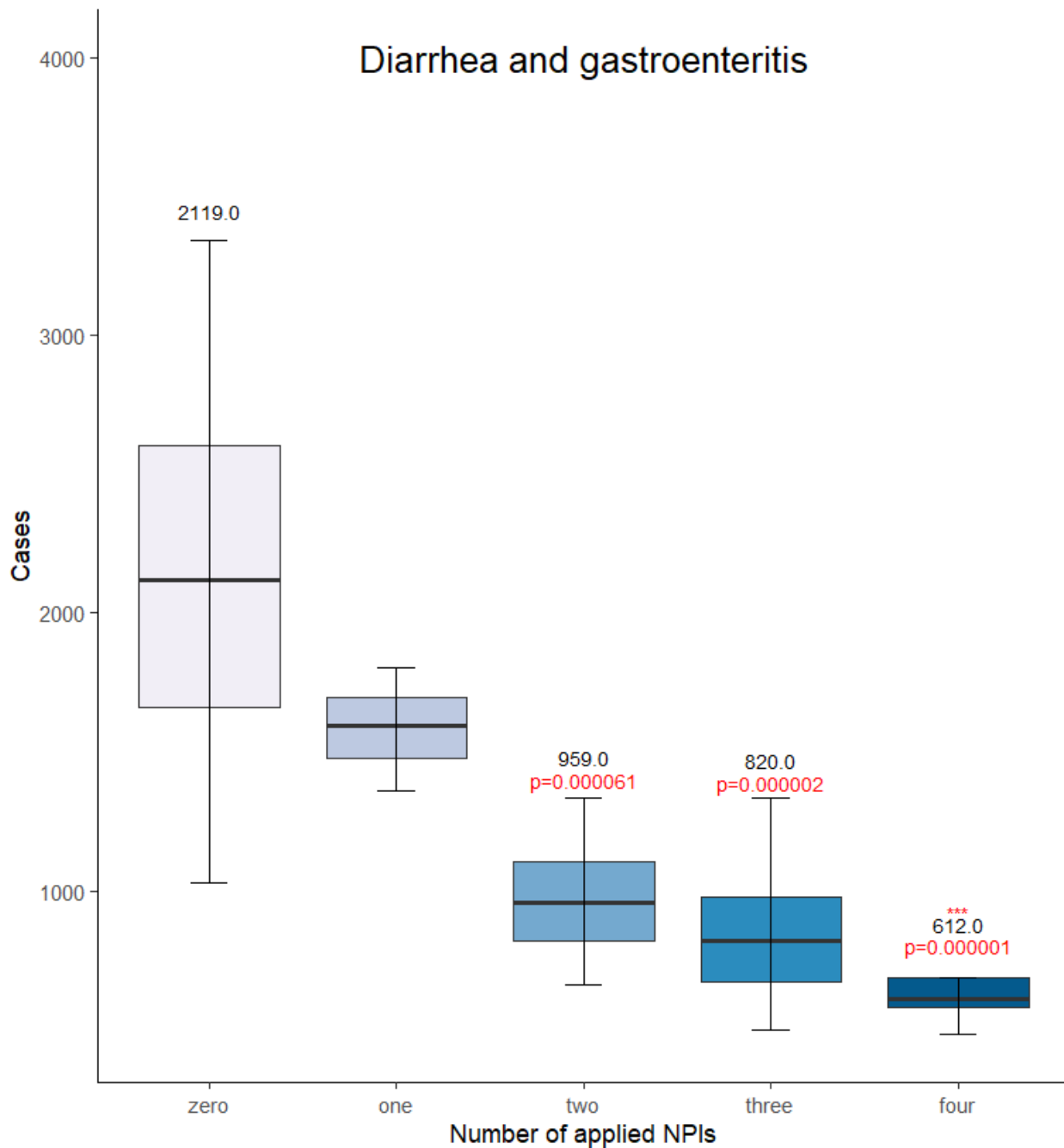
Viral enteritis < 2 years old



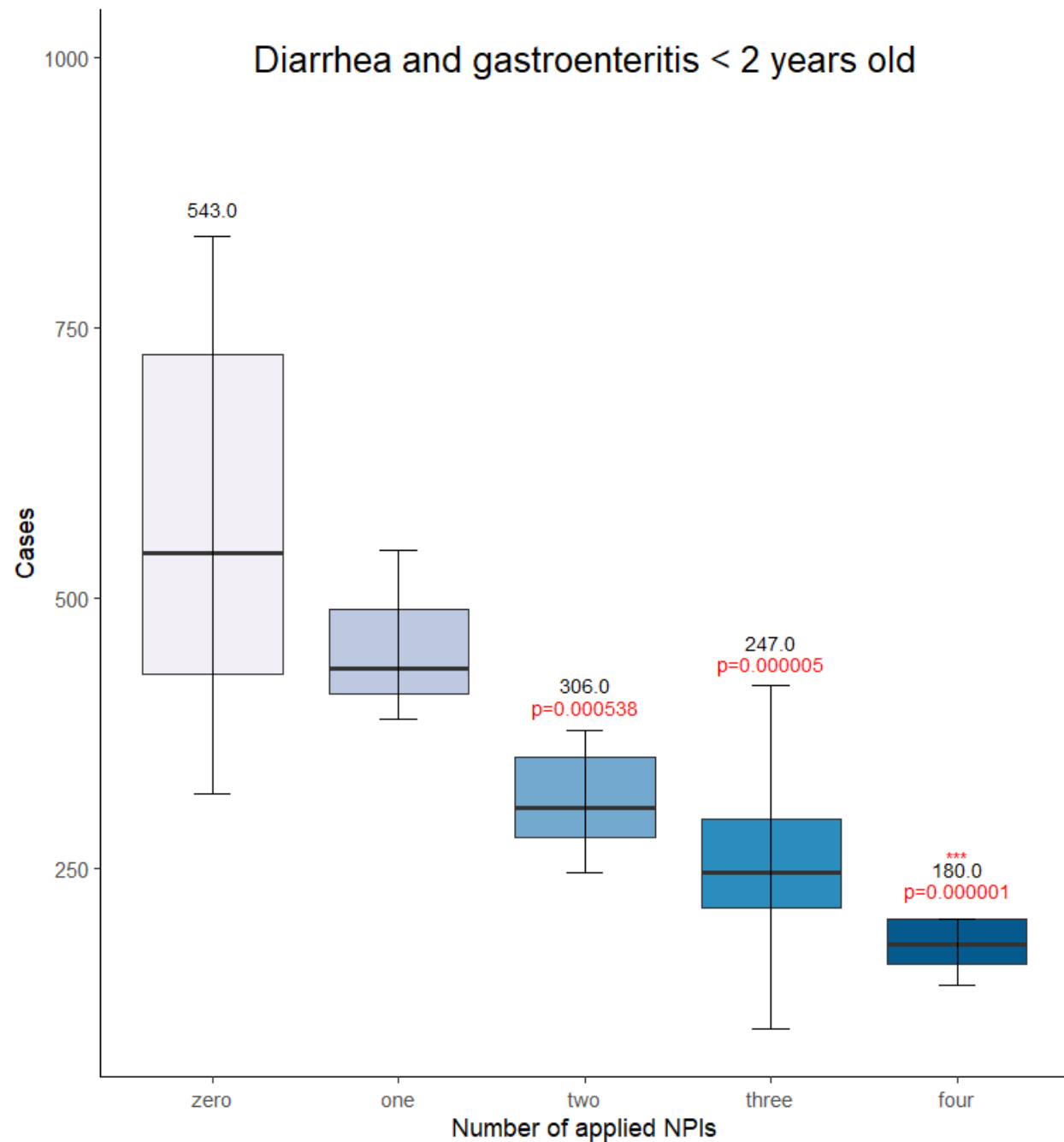
Results: Oral-fecal transmission

Disease	0	2	3	4
Giardiasis	49.1 (23)	15.0 (7.0)	11.0 (14.0)	7.0 (13.0)
	-	0.000012	0.000009	0.000004
Hepatitis A	28.0 (36.0)	4.0 (14.0)	3.00 (6.0)	3.0 (3.0)
		0.00665	0.000158	0.000045
Diarrhea & gastroenteritis	2119.0 (946.5)	959.0 (285.0)	820.0 (489.0)	612.0 (106.0)
	-	0.000061	0.000002	0.000001
Diarrhea & gastroenteritis < 2-year-old	542.0 (299.0)	306.0 (74.0)	247.0 (125.0)	180.0 (41.0)
	-	0.000538	0.000005	0.000001

Diarrhea and gastroenteritis



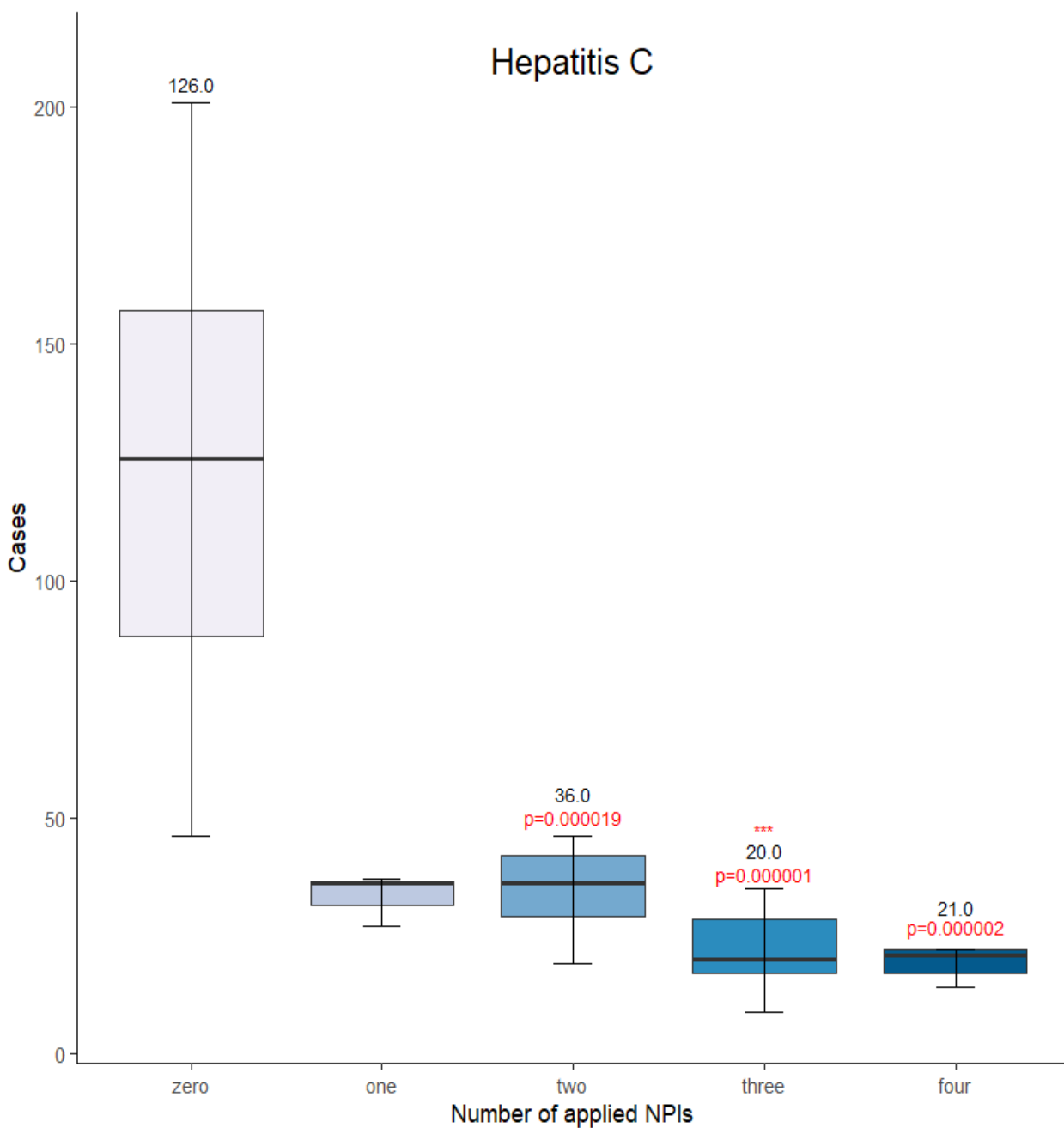
Diarrhea and gastroenteritis < 2 years old



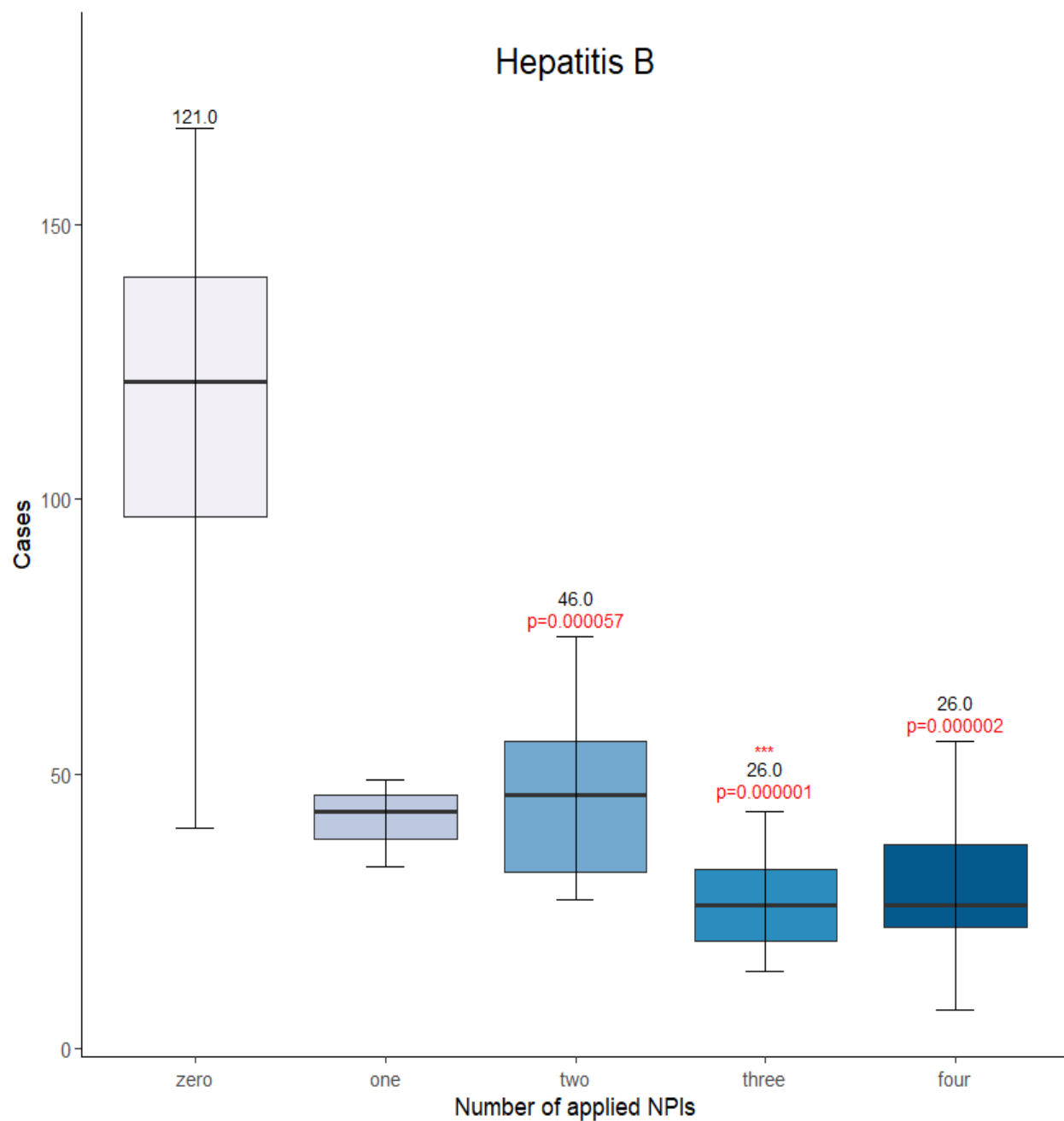
Results: Sexually-transmitted & blood-borne

Disease	0	2	3	4
Syphilis	62.0 (28.0)	38.0 (17.0)	25.0 (22.0)	27.0 (20.0)
	-	0.000101	0.000001	0.000024
Hepatitis B	121.0 (44.0)	46.0 (24.0)	26.0 (15.0)	26.0 (15.0)
	-	0.000057	0.000001	0.000002
Hepatitis C	126.0 (70.0)	36.0 (13.0)	20.0 (14.0)	21.0 (5.0)
	-	0.000019	0.000001	0.000002
HIV	67.0 (46.0)	26.0 (35.0)	21.0 (32.0)	24.0 (39.0)
	-	0.006309	0.000375	0.000594

Hepatitis C



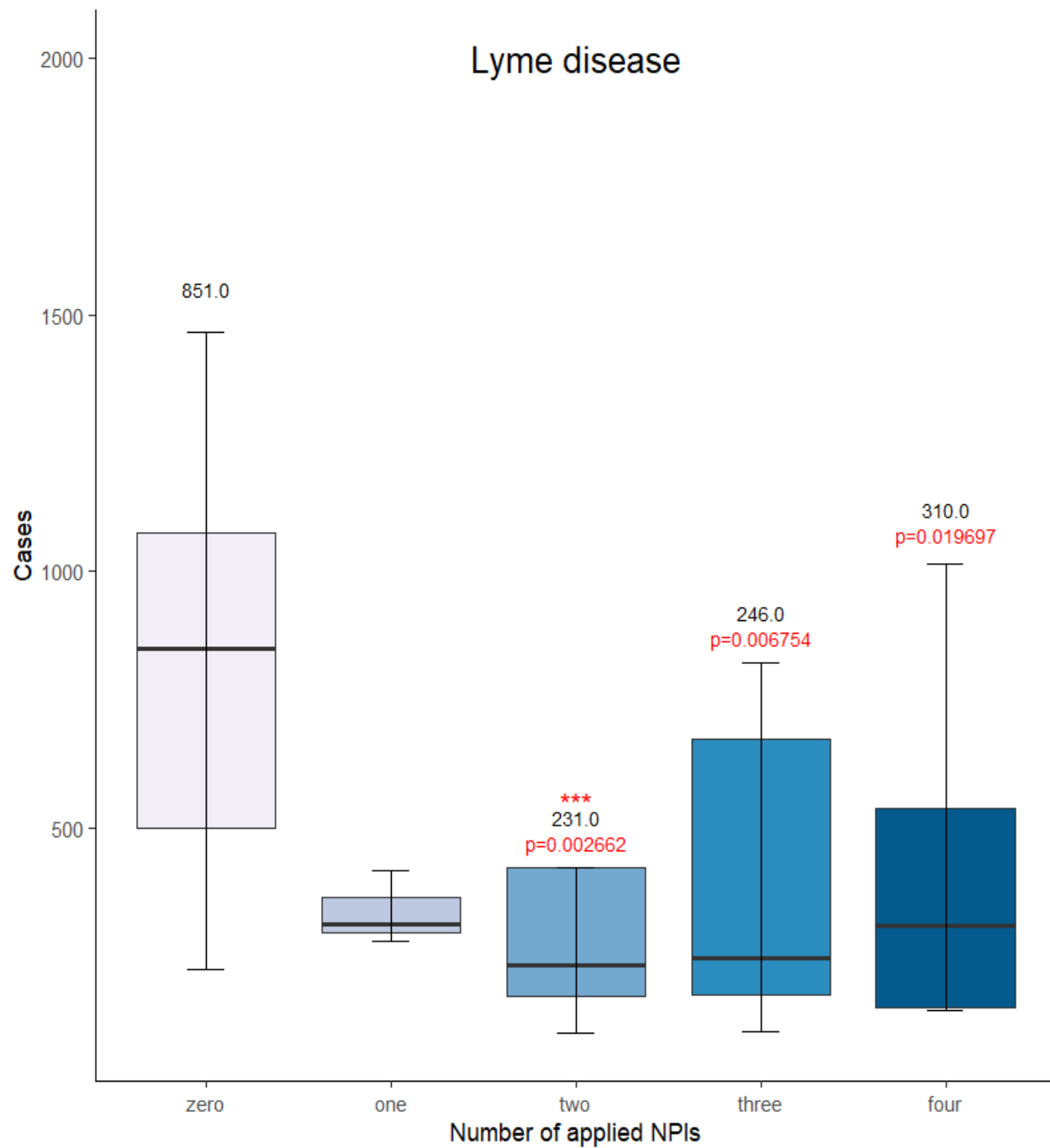
Hepatitis B



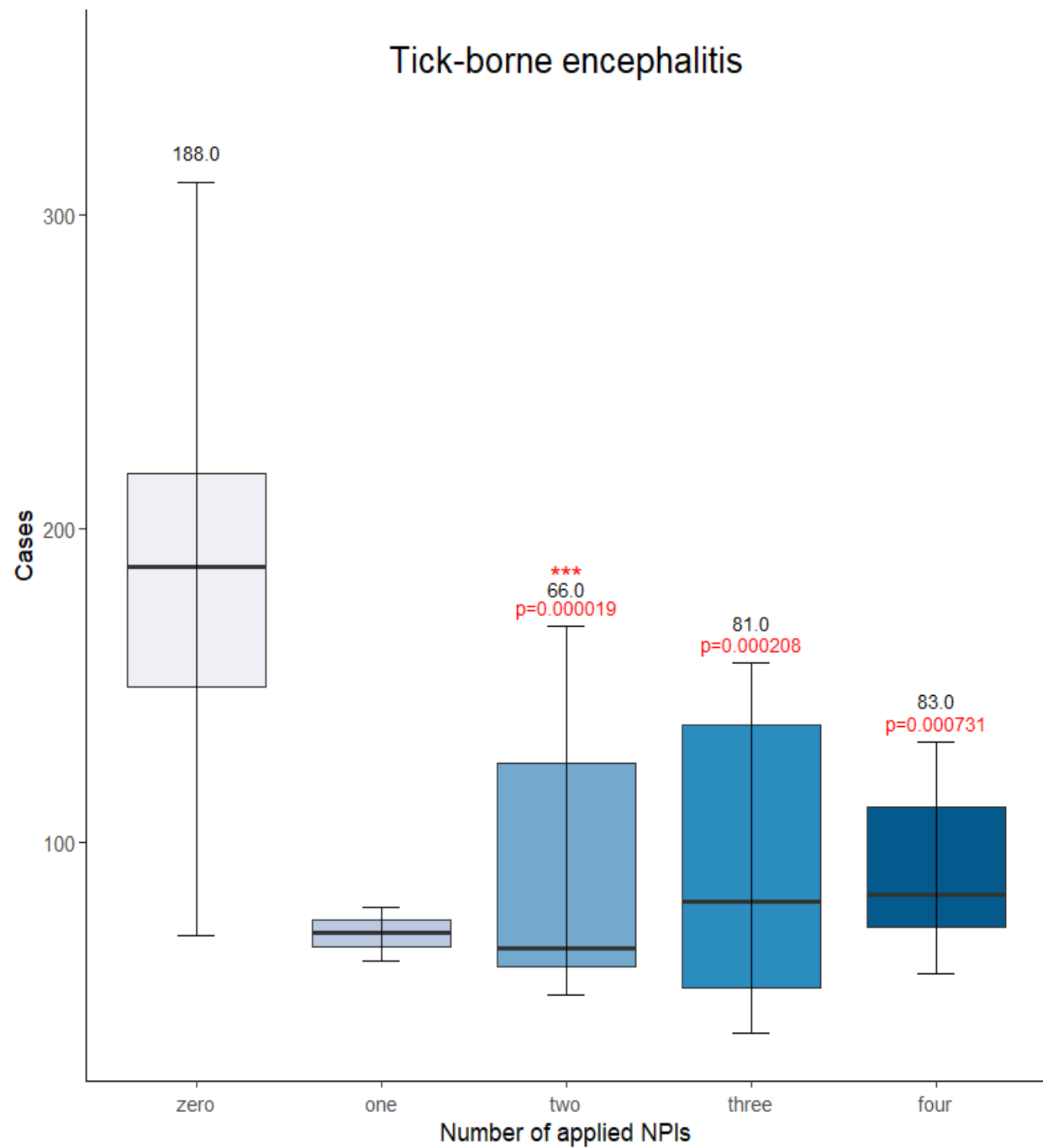
Results: Tick-borne

Disease	0	2	3	4
Lyme disease	850.5 (588.0)	231.0 (250.0)	246.0 (545.0)	310.0 (388.0)
	-	0.002662	0.006754	0.019697
Tick-borne encephalitis	188.0 (70.0)	66.0 (65.0)	81.0 (99.0)	83.0 (38.0)
		0.000019	0.000208	0.000731

Lyme disease



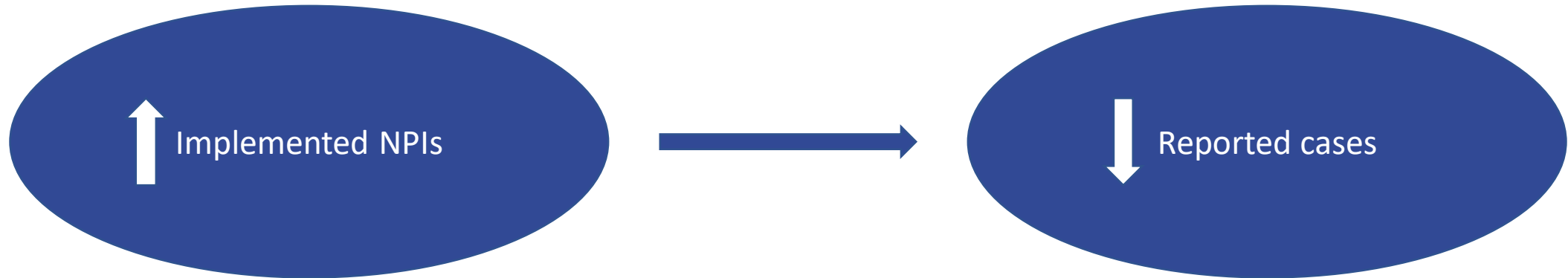
Tick-borne encephalitis



Conclusions

- The outlined changes in the number of reported cases are multicausal and can not be fully explained by our statistical analysis
- The decrease in reported cases could be attributed to alterations in people's behavior towards seeking medical attention at hospitals because of apprehension regarding potential exposure to COVID-19. Additionally, there may have been an impact from laboratories reaching their capacity due to the high demand for COVID testing.

Conclusions



Future implementations:

- The implementation of the highest number of restrictions for shorter periods appears to be a more effective strategy than imposing less restrictions for longer durations
- Some NPIs such as school closure and face covering could be used during the Flu season to mitigate the rise in cases