

1 **Invasive Pneumococcal Disease in Calgary During the Sars-CoV-2 Pandemic 2020**

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14 **Abstract – 97 words**

15         During the Sars-CoV-2 pandemic in 2020, many countries shut down schools and  
16 businesses in an effort to slow transmission of the virus. As some businesses reopened,  
17 increased public health protocols, mask wearing, hand sanitizer, and personal protective  
18 equipment use remained. The shut down and public health restrictions for person-to-person  
19 interaction, resulted in a decline of other transmissible diseases as well as Sars-CoV-2. In  
20 Calgary, the incidence of invasive disease due to *Streptococcus pneumoniae* declined to much  
21 lower levels than would be expected in early spring and remained low until December 2020.  
22 This decline occurred despite no changes in vaccine use and uptake.

## 23 Introduction

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25 On March 11, 2020 the World Health Organization declared the Sars-CoV-2 outbreak to  
26 be a pandemic (1). As cases spread globally, Alberta began to lock down by shutting down  
27 schools on March 16, 2020 in an attempt to slow the spread of the novel Sars-CoV-2 virus. This  
28 shut down of schools, followed by further lock down of businesses, and increased use of  
29 personal protective equipment and hand sanitizer in public places, led to a decline in other  
30 infectious diseases. We were interested in what affect the public health measures would have  
31 on invasive pneumococcal disease (IPD) in Calgary during a time when there were no changes in  
32 vaccination rates or vaccines offered. The 7-valent pneumococcal conjugate vaccine (PCV7)  
33 was introduced in Alberta in 2002 and the 13-valent pneumococcal conjugate vaccine (PCV13)  
34 was introduced in 2010 (2). Therefore, both vaccines were widely used by 2020. Normally,  
35 with pneumococcal disease, some seasonal variation is present with the lowest incidence  
36 occurring in summer and highest in winter months, similar to many infectious diseases.

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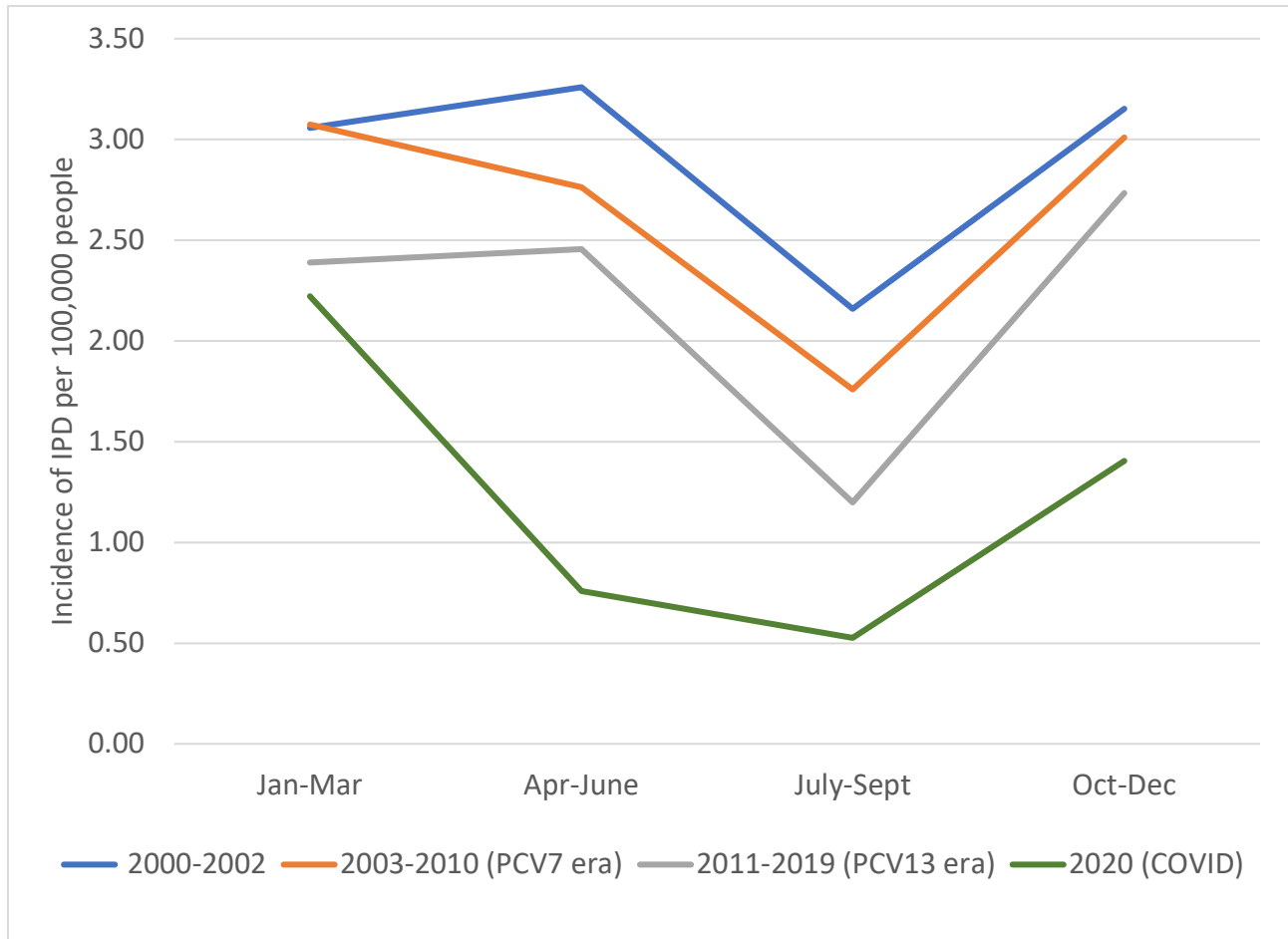
## 38 Methods

39 The Calgary Area *Streptococcus pneumoniae* Epidemiology Research team (CASPER) has  
40 been collecting information on invasive pneumococcal disease in the Calgary Zone of Alberta  
41 Health Services for over two decades (3-6). Our surveillance is reported through a central  
42 laboratory system and is population-based. When the Calgary Laboratory services notifies us of  
43 a case positive by culture for IPD, a research nurse conducts a chart review to collect clinical  
44 information. We also receive microbial susceptibility and serotyping data. Serotyping is done  
45 through the Quellung reaction (7). All cases of IPD occurring in the Calgary Zone between 2000  
46 and 2020 were included the analysis. Here we report our quarterly incidence of invasive  
47 disease in the era of the Sars-CoV-2 pandemic in 2020 compared to quarterly incidence in the  
48 years pre and post conjugate vaccine introduction. Incidence was calculated using the number  
49 of cases per 100,000 people. Population estimates for each year came from the Alberta  
50 Interactive Health Data application (8). We took the average incidence per quarter for 2000-  
51 2002 to (the pre-vaccine era), 2003-2010 (PCV7 era), and 2011-2019 (PCV13 era) and 2020

52 (Sars-CoV-2 pandemic) and graphed them to see how the average incidence per quarter in 2020  
53 compared to past eras. We also stratified by age groups (<18 and >=18 years old).

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55 **Figure 1.** Average Incidence per quarter of IPD for pre-vaccine (2000-2002), PCV7 era (2003-  
56 2010), PCV13 era (2011-2019) and Sars-CoV-2 pandemic (2020), all ages.

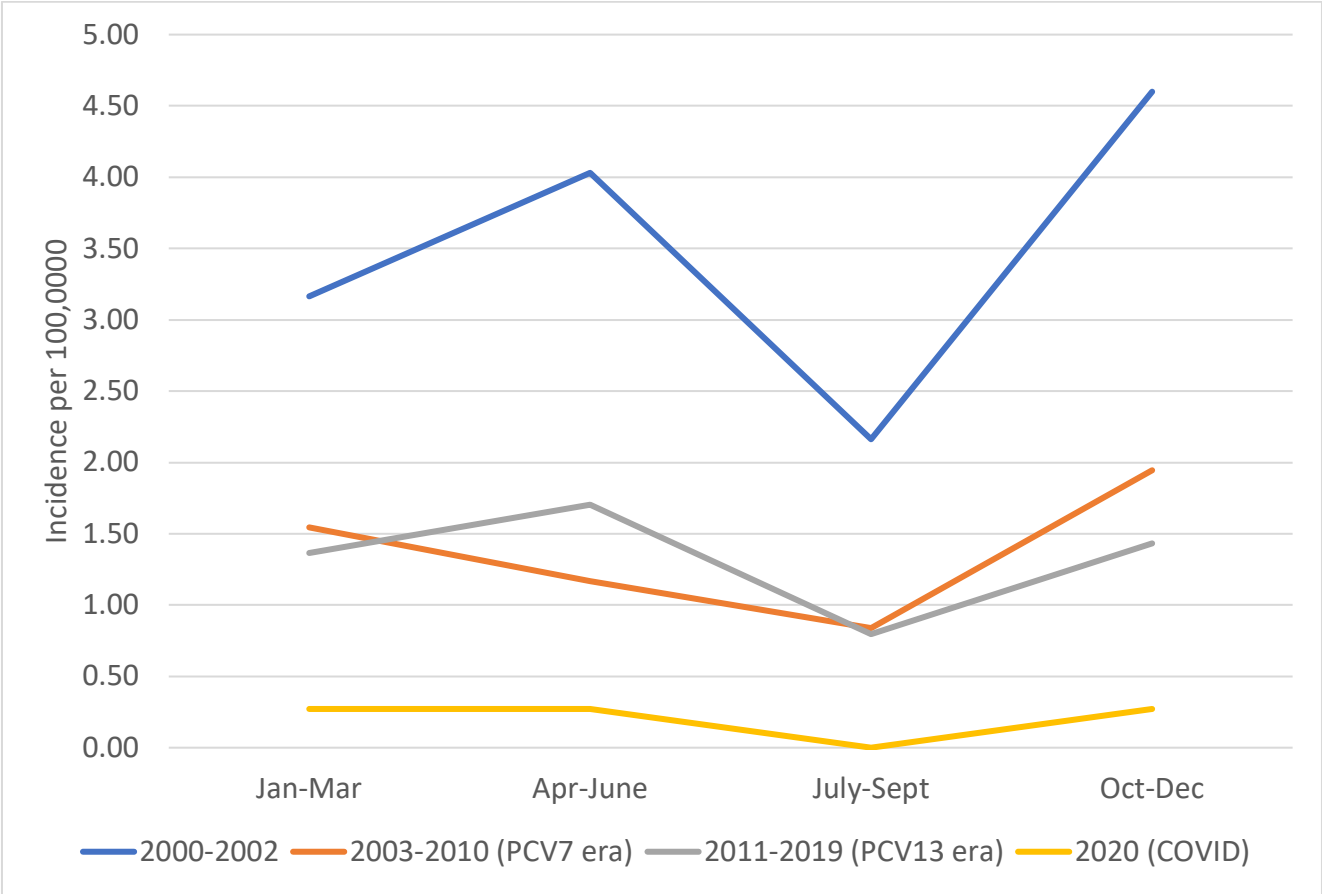


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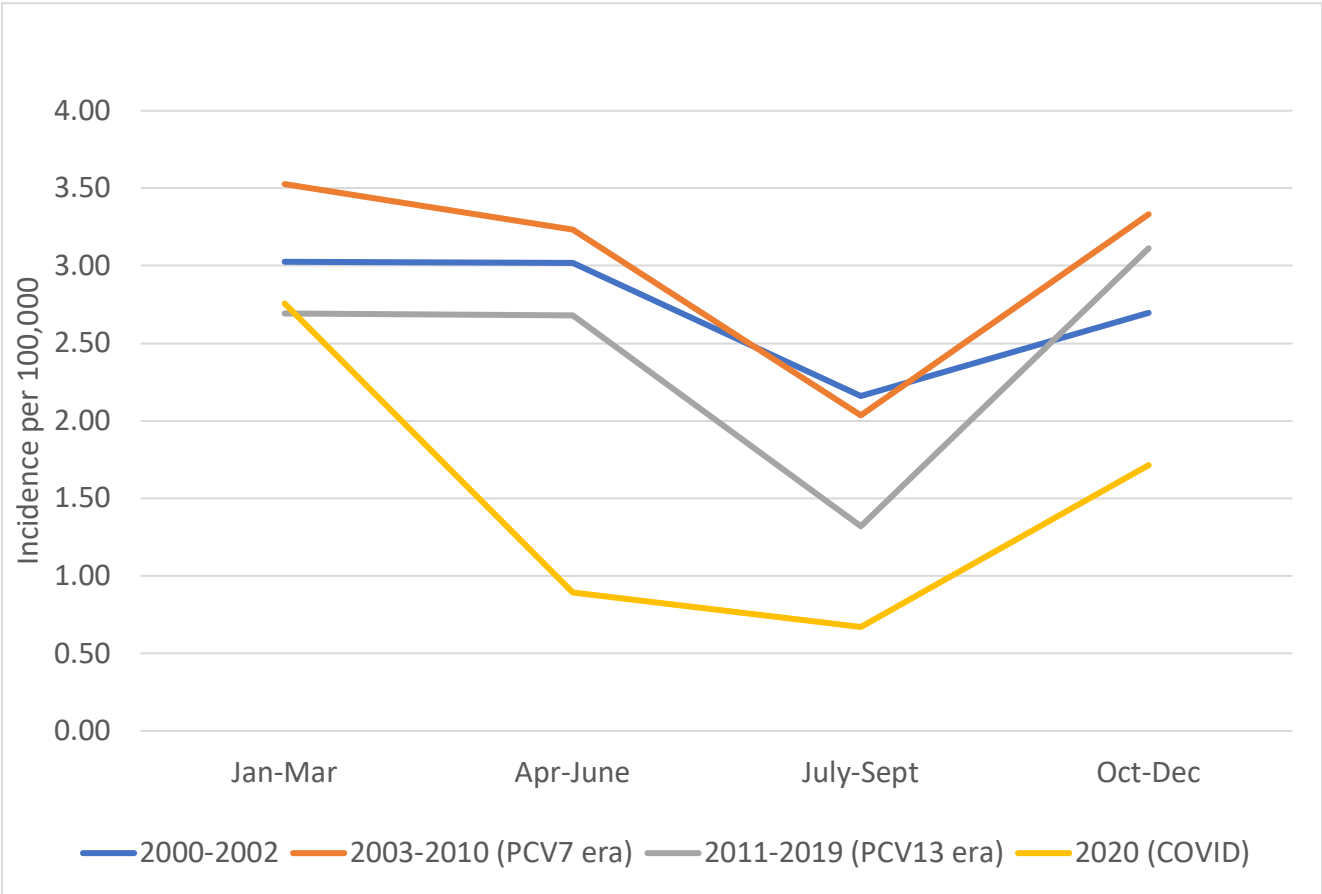
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60 **Figure 2a.** Average Incidence per quarter of IPD for pre-vaccine (2000-2002), PCV7 era (2003-  
61 2010), PCV13 era (2011-2019) and Sars-CoV-2 pandemic (2020) in children less than 18 years of  
62 age.



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66 **Figure 2b.** Average Incidence per quarter of IPD for pre-vaccine (2000-2002), PCV7 era (2003-  
67 2010), PCV13 era (2011-2019) and Sars-CoV-2 pandemic (2020) in adults 18 years and older.



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71 **Results and Discussion**

72 In Calgary, January to March of 2020 began with normal post-PCV incidence rates of  
73 invasive pneumococcal disease (IPD), followed by a sharp decline in incidence for quarters 2  
74 and 3 in April to September. The incidence rate ratio for 2020 compared to 2019 incidence in  
75 the first quarter was 1.2 (95% CI: 0.8 to 2.1; p=0.3675) for the second quarter the incidence rate  
76 ratio was 0.22 (95% CI 0.1-0.4); p<0.001). Indicating that 2020 started off with normal incidence  
77 in the first quarter, but declined to significantly lower incidence in 2020 compared to 2019 for  
78 April to June. Incidence increased in the October to December quarter, but not to normal rates.  
79 The incidence rate ratio for October to December 2020 compared to 2019 was 0.6 (95%CI: 0.3-  
80 1.0; p=0.0402). Incidence in children, which was already much lower in the vaccine era  
81 compared to pre-vaccine, declined to almost nothing for 2020 and was low for the entire year,  
82 with a total of 3 cases occurring in under 18-year-olds. The decline was seen in adults as well  
83 but in adults it occurred in the second quarter of the year. This change in incidence occurred  
84 within the context of normal, continued surveillance for pneumococcal disease and normal  
85 vaccine uptake within the community. Likely the decline was a result of the combination of  
86 decreased transmission due to the closure of schools and businesses as well as other public  
87 health measures. But there may have also been a reduction in presentation to hospital for  
88 those with less severe IPD, as many people avoided hospitals during the beginning of the Sars-  
89 CoV-2 pandemic (9).

90 The public health efforts to mitigate the spread of Sars-CoV-2 also resulted in historically  
91 low rates of influenza in multiple countries (10), including in Canada (11). A prospective cohort  
92 study examining co-infection of pneumococcus and Sars-CoV-2 also reported declines in  
93 pneumococcal disease following the initial lock down during March to June 2020 (12). Similar  
94 reports came from Taiwan and Singapore (13, 14). Surveillance in the United Kingdom showed  
95 large reductions in IPD in all age groups during March to June 2020 when lockdowns were  
96 initiated (15). In Calgary, rates were normal in the first quarter of the year then dropped  
97 substantially in the second quarter. The normal seasonal effect of IPD would have cases staying  
98 high through April to June and then declining in the summer quarter, but in 2020 the decline  
99 happened immediately after public health measures took effect in March. There was an

100 increase again in the last quarter, but not to pre-COVID rates. This may be due to a combination  
101 of some businesses re-opening through the summer months when Sars-CoV-2 was more  
102 controlled, and due to the normal seasonal rise of invasive pneumococcal disease seen in the  
103 winter months.

104 Association of pneumococcal infection with Sars-CoV-2 is uncommon but not impossible  
105 from what has been described in the literature so far (15-20). There is an increasing number of  
106 reports to show this lack of association (15, 19, 21). In a systematic review of coinfection by  
107 Sars-CoV-2 and other respiratory pathogens, the results showed influenza A to be the most  
108 common pathogen to appear in co-infection with Sars-CoV-2 (16). However, Amin-Chowdhury  
109 et al. showed the odds of death to be over 7-fold higher in cases where co-infection with  
110 pneumococcus did occur, particularly in older adults (15).

111 We were limited in this analysis in that we only have population numbers for each year,  
112 not per quarter, so we had to assume the same population for every quarter of that year. We  
113 also have low numbers of pneumococcal disease within the Calgary region each year; therefore,  
114 we did not have the numbers to look more closely at children.

115 This ecological variation in IPD incidence is important in the vaccine era. The United  
116 Kingdom modified their vaccine schedule to 1+1 doses in 2020; therefore, data will need to be  
117 cautiously interpreted from these years of vaccine schedule change in the climate of the Sars-  
118 CoV-2 pandemic (22). This dramatic decline in incidence in a Calgary, where vaccination has not  
119 changed, suggests that 2020 data will not be reliable in a place where schedules may have been  
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