Population-based mortality rate trends of potential pneumococcal pneumonia in Brazil from 2006-2019

Cintia I. Parellada, MD, PhD[1]; Ana Luiza Bierrenbach, MD, PhD[2]; Carolina Zampirolli, MSc[3]; Ariane J.L. Abreu, MSc[3]; Guilherme S. Julian, MSc[3]; Thais N.F. Moreira, MD, MSc[1]; Licieri Figueiredo, MD[1]; Juan C. Orengo, MD, MPH, PhD[4]

[1]MSD Brazil, São Paulo, SP; [2]Hospital Sirio Libanês; Brazil; [3]IQVIA, São Paulo, SP, Brazil; [4]MSD (IA) LLC, Guaynabo, Puerto Rico

Contact information: Cintia I. Parellada; cintia.parellada@merck.com

Background

- Pneumococcal disease is an important public health problem affecting mainly the extremes of age[1]

- In 2010, childhood pneumococcal vaccination with the 10-valent conjugate vaccine (PCV10) using 3+1 schedule was introduced in the Brazilian National Immunization Program (NIP). In 2016, the schedule changed to 2+1 schedule. A vaccination coverage rate of ≥82% was achieved from 2011-2019[2]

- For older adults, routine pneumococcal vaccination is not available in the NIP. Few public centers across the country offer pneumococcal vaccine for at-risk populations[3,4]

Objective

- To assess trends in mortality rate due to potential pneumococcal pneumonia from 2006-2019 in Brazil

Methods

- Ecological time-series study using local databases evaluating the period before (2006-2009) and after (2011-2019) the childhood introduction of PCV10 in the NIP. The year 2010 was excluded (transition period with low vaccination coverage)

- Information on the number of deaths, by basic cause, were obtained using ICD-10 codes J13 and J15-J18. Annual mortality rate was calculated per 100,000 people and stratified by age groups. The percentual difference of change in mortality was the difference between the average rates in the pre- and post-vaccination periods

- Joinpoint regression was performed to assess annual percentual change (APC) for each line segment and average APC (AAPC) for 2 fixed intervals: all study period (2006 to 2019) and post-PCV10 period (2011 to 2019)

Results

- During 2006-2019, 887,304 deaths by potential pneumococcal pneumonia occurred in all age groups. Nearly all cases (99.8%) were reported as unspecific pneumonia

- The annual mortality rates (MR) for groups aged 60 to 64 and ≥65 years were consistently higher in the post-PCV period compared to pre-PCV10 period (Figure 1). In the post-PCV10 period, mean mortality rates substantially decreased in children aged <1 and 1-4 years and increased in adults aged 50 to 59, 60 to 64, and ≥65 years compared to pre-PCV10 period (Table 1)

Figure 1. Mortality rate of pneumonia by age group in parallel with infant vaccination coverage, 2006-2019
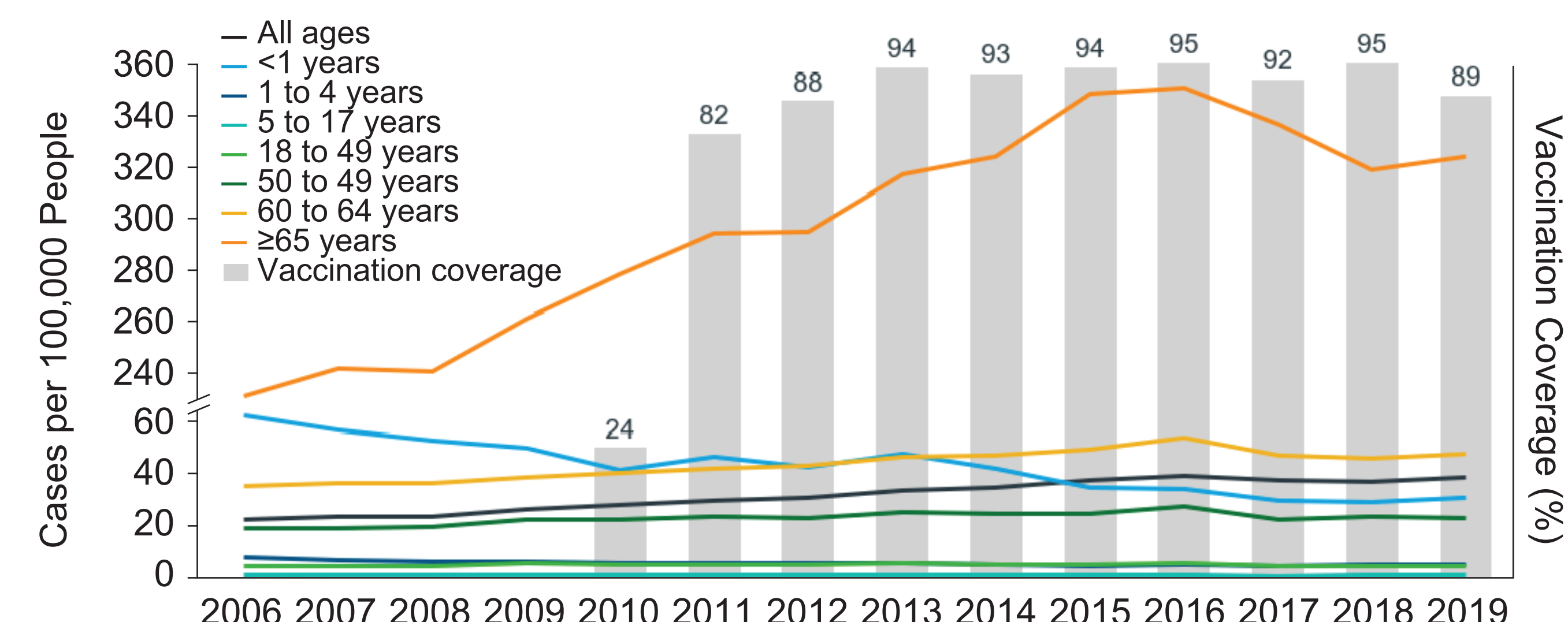

Table 1. Mean mortality rate by age groups for potential pneumococcal pneumonia in the pre-PCV10 period (2006-2009) and in the post-PCV10 period (2011-2019) in Brazil

Age group (years)	Pre-PCV10 period (2006-2009) Mean (95% CI)	Post-PCV10 period (2011-2019) Mean (95% CI)	% change (95% CI)
All ages	23.91 (23.80, 24.02)	35.57 (35.49, 35.66)	48.80 (48.03, 49.58)
<1	55.77 (54.44, 57.13)	37.40 (36.67, 38.14)	-32.94 (-35.00, -30.82)
1 to 4	6.85 (6.62, 7.08)	5.45 (5.31, 5.59)	-20.44 (-23.76, -16.96)
5 to 17	1.33 (1.28, 1.39)	1.22 (1.19, 1.26)	-8.20 (-12.68, -3.48)
18 to 49	4.94 (4.87, 5.01)	5.15 (5.10, 5.20)	4.16 (2.40, 5.95)
50 to 59	20.04 (19.71, 20.38)	23.97 (23.75, 24.19)	19.63 (17.37, 21.94)
60 to 64	36.96 (36.18, 37.74)	47.30 (46.80, 47.81)	27.99 (25.01, 31.06)
≥65	244.37 (243.03, 245.72)	324.03 (323.13, 324.93)	32.60 (31.78, 33.41)

Table 2. Joinpoint analysis for mortality rate trends due to potential pneumococcal pneumonia in Brazil, 2006-2019

Age (years)	Per time trend inflection		Entire period 2006-2019	Post-PCV10 period 2011-2019
	Period	APC (95% CI)	AAPC (95% CI)	AAPC (95% CI)
All ages	2006 - 2016	5.9* (5.4, 6.5)	4.3* (3.5, 5.0)	3.2* (2.2, 4.3)
	2016 - 2019	-1.2 (-4.0, 1.8)		
<1	2006 - 2019	-5.5* (-5.5*, -4.4)	-5.5* (-5.5*, -4.4)	-5.5* (-5.5*, -4.4)
1 to 4	2006 - 2019	-2.9* (-2.9*, -1.9)	-2.9* (-2.9*, -1.9)	-2.9* (-2.9*, -1.9)
5 to 17	2006 - 2019	-1.6* (-1.6*, -0.3)	-1.6* (-1.6*, -0.3)	-1.6* (-1.6*, -0.3)
18 to 49	2006 - 2019	0.1 (0.1, 1.4)	0.1 (0.1, 1.4)	0.1 (0.1, 1.4)
50 to 59	2006 - 2016	3.1* (3.1*, 4.1)	1.0 (1.0, 2.3)	-0.3 (-2.1, 1.5)
	2016 - 2019	-5.7* (-5.7*, -0.5)		
60 to 64	2006 - 2016	4.0* (4.0*, 4.5)	2.2* (2.2*, 2.7)	1.0* (0.3, 1.8)
	2016 - 2019	-3.8* (-3.8*, -1.7)		
≥65	2006 - 2015	4.8* (4.8*, 5.5)	2.7* (2.7*, 3.3)	1.4* (0.5, 2.2)
	2015 - 2019	-2.0* (-2.0*, -0.1)		

- In Joinpoint analysis, among those younger than 18 years old, significant decreasing trends in APC from 2006-2019 were observed. APC reductions of 5.5%, 2.9%, and 1.6% in age groups <1, 1 to 4, and 5 to 17 years old were observed, respectively (Table 2)

- Although the AAPC increased by 1.0% (95% CI: 0.3%; 1.8%) and 1.4% (95% CI: 0.5%; 2.2%) in the post PCV10 period for age groups 60-64 years and ≥65 years, a significant decreasing trend was observed in APC in the late post-PCV period (2016-2019) in the same age groups (Table 2)

Discussion

- For older adults, a significant increasing APC was seen from 2006-2016, followed by a significant downward trend in the late post-PCV10 period (2016-2019). Impacting these observations may be consider the following:
  1. Increased use of mortality garbage from 2006-2016 in older adults secondary to an aging population (pneumonia unspecified – J15.9, J18.9 – rated as top 5 ill-defined causes). Workshops were held in 60 cities to improve the quality of coding data[5-7]
  2. Successful implementation of public policies aiming to reduce the prevalence of smokers in the last decade (from 34.8% in 1989 to 10.5% in 2015)[5,6]

Conclusions

- In the post-PCV10 period, the mortality rate due to potential pneumococcal pneumonia declined mostly for infants. For older adults, the mortality trends have been consistently higher compared to groups younger than 18 years old

- A significant downward trend was seen in older adults in 2016-2019 period in population ≥50 years, but this was confounded by garbage codes. Further studies should evaluate indirect effects in older adults

- These findings may inform policy decisions focused on the need for pneumococcal disease prevention strategies in older adults

References

1. Brooks LRK, et al. Front Immunol. 2018;9:1366.
2. Domingues CMAS, et al. Cad Saude Publica. 2020;35(suppl 2):e00222919.
3. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. ISBN 978-85-334-2048-9.
4. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Manual Dos Centros de Referência para Imunobiológicos Especiais. https://sbim.org.br/images/calendarios/manual-centros-referencia_imunobiologicos-especiais-5ed-web.pdf
5. Corrêa RA, et al. Rev Bras Epidemiol. 2017;20(suppl 01):171-181.
6. Lima R, et al. Rev Bras Epidemiol. 2019;22(suppl 3):e19004.supl.3.
7. França E, et al. Popul Health Metr. 2020;18(Suppl 1):20.