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The PneumoNIA Study Group

Incidence of WHO-defined radiographic endpoint pneumonia in children with clinically diagnosed pneumonia at Patan Hospital, Nepal

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INTRODUCTION

- Use of WHO criteria for the interpretation of chest radiographs from children <5 years of age with pneumonia allows comparison of primary endpoint pneumonia (PEP) incidence across settings and over time[1].
- We applied these criteria to chest radiographs from children hospitalised with clinician diagnosed pneumonia before and shortly after the introduction of pneumococcal conjugate vaccine (PCV10) into the Nepal routine infant immunisation schedule from August 2015.
- *Haemophilus influenzae* type b vaccine has been given since 2009.

METHODS

- We analysed admission chest radiographs from 650 children (2 months to 14 years of age) consecutively admitted to Patan Hospital with a clinical diagnosis of pneumonia between March 2014 and April 2016.
- Clinical details were recorded at presentation.
- All radiographs were read by a paediatrician (Rater 1) and a radiologist (Rater 2) using WHO methods. Both were trained in the reading methodology and blinded to clinical details.
- A senior radiologist (Arbiter) arbitrated all films with discordant readings and reviewed a random 10% of chest radiographs with concordant readings.

TABLE 1

Definitions of clinical and radiographic findings used here

	Definition	Age	Details
Clinical	Pneumonia (WHO 2008)[2]	≥2m and <5y	Cough/difficulty breathing with fast breathing (not chest indrawing)
	Severe pneumonia (WHO 2008)[2]	≥2m and <5y	Cough/difficulty breathing with chest indrawing (regardless of fast breathing)
	Pneumonia (WHO 2014)[3]	≥2m and <5y	Cough/difficulty breathing with fast breathing and/or chest indrawing
	All patients	≥2m and <14 y	Discretionary clinician diagnosis of pneumonia on admission
Radiographic	Normal[1]	–	No consolidation/effusion/infiltrate
	Other infiltrate[1]	–	Linear and patchy densities (interstitial infiltrate)
	Primary endpoint pneumonia (PEP)[1]	–	Dense or fluffy opacity occupying at least a portion of a lung, or pleural effusion (with or without other infiltrate)

RESULTS

- Of 650 children admitted, 51 radiographs were missing/uninterpretable.
- Primary endpoint pneumonia was present in 38.7% radiographs (Figures 1 and 2).

FIGURE 1

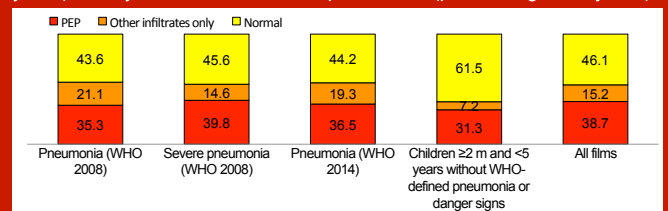Representative chest radiographs from the case series

a) "Normal" b) "Other infiltrates" c) "PEP"

FUNDING STATEMENT

FIGURE 2

Final radiographic outcome (%) for all radiographs (patients aged 0–14 years) and by WHO clinical criteria pneumonia (patients aged <5 years)

	PEP	Other infiltrates only	Normal
Pneumonia (WHO 2008)	35.3	21.1	43.6
Severe pneumonia (WHO 2008)	39.8	14.6	45.6
Pneumonia (WHO 2014)	36.5	19.3	44.2
Children ≥2 m and <5 years without WHO-defined pneumonia or danger signs	31.3	7.2	61.5
All films	38.7	15.2	46.1

- Of 542 children ≥2 months and <5 years of age, 407 (75.1%) met WHO (2014) criteria for pneumonia.
- 293 (54.1%) met WHO (2008) criteria for pneumonia, and 114 (21.0%) met WHO (2008) criteria for severe pneumonia.
- Results for interpretable chest radiographs are shown in Figure 2.
- Agreement between Raters, and both with the Arbiter was moderate to good (Rater 1) or good to very good (Rater 2) for description of PEP (Table 2).

TABLE 2

Agreement between Raters and Arbiter for presence of PEP versus "normal" or "other infiltrates"

Rater 1	Arbiter		
	Normal/other infiltrates	PEP	Total
Normal/other infiltrates	147	28	175
PEP	34	105	139
Total	181	133	314

Observed agreement: 80.3%
Kappa: 0.60 (95% CI 0.50, 0.68)
Test for symmetry: p = 0.47

Rater 2	Arbiter		
	Normal/other infiltrates	PEP	Total
Normal/other infiltrates	157	20	177
PEP	24	116	140
Total	181	136	317

Observed agreement: 86.1%
Kappa: 0.72 (95% CI 0.63, 0.77)
Test for symmetry: p = 0.55

CONCLUSION

- 38% of children admitted with pneumonia (by various definitions) had PEP on chest radiographs in this setting (6 years following introduction of routine infant Hib immunisation).
- Other settings with a high pneumonia burden, but routine Hib vaccination, have a similar[4,5] or lower[6] proportion of PEP in children admitted with pneumonia.
- Ongoing collection of radiographic data is useful to assess the impact of routine PCV10 immunisation on pneumonia in Nepal.

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