THE LANCET

Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Nair H, Simões EAF, Rudan I, et al, for the Severe Acute Lower Respiratory Infections Working Group. Global and regional burden of hospital admissions for severe acute lower respiratory infections in young children in 2010: a systematic analysis. *Lancet* 2013; published online Jan 29. http://dx.doi.org/10.1016/S0140-6736(12)61901-1.

Appendix for “Global and regional burden of hospital admissions for severe acute lower respiratory infections in young children in 2010: a systematic analysis”

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I. Search Strategy in Databases

MEDLINE

1. exp Pneumonia/
2. exp Respiratory Tract Infections/ or acute lower respiratory infections.mp.
3. acute respiratory infection$.mp.
4. lower respiratory infection$.mp.
5. exp Bronchiolitis/ or Bronchiolitis, Viral/
6. Pneumococcal Vaccines/ or Haemophilus Vaccines/
7. *Zinc/
8. Vitamin A/
9. exp Incidence/
10. disease burden.mp.
11. exp Morbidity/
12. 1 or 2 or 3 or 4 or 5
13. 6 or 7 or 8
14. 1 and 13
15. 9 or 10 or 11
16. 12 or 14
17. 15 and 16
18. limit 17 to (yr="1990 -Current" and ("all infant (birth to 23 months)" or "preschool child (2 to 5 years)") and humans)

EMBASE

1. exp respiratory tract infection/ or exp lower respiratory tract infection/ or acute lower respiratory tract infection$.mp. or exp pneumonia/
2. lower respiratory infection$.mp.
3. acute lower respiratory infection$.mp.
4. exp BRONCHIOLITIS/ or VIRAL BRONCHIOLITIS/
5. exp Pneumococcus vaccine/
6. exp Haemophilus influenzae type b vaccine/
7. *ZINC/
8. *alpha tocopherol/ or Vitamin A.mp.
9. exp INCIDENCE/
10. disease burden.mp.
11. exp MORBIDITY/

12. 1 or 2 or 3 or 4

13. 5 or 6 or 7 or 8

14. 1 and 13

15. 9 or 10 or 11

16. 12 or 14

17. 15 and 16

18. limit 17 to (human and yr="1990 -Current" and (infant or preschool child <1 to 6 years>))

GLOBAL HEALTH

1. (pneumonia or lower respiratory tract infections).sh.

2. acute respiratory infection$.mp.

3. exp bronchiolitis/

4. vaccines.sh.

5. (retinol or zinc).sh.

6. exp incidence/

7. disease burden.mp. or morbidity.sh.

8. exp children/

9. 1 or 2 or 3

10. 4 or 5

11. 9 and 10

12. 6 or 7

13. 9 or 11

14. 12 and 13

15. 8 and 14

16. limit 15 to yr="1990 -Current"

CINAHL

TI Pneumonia

OR

TI Community Acquired Pneumonia

OR

TI Pneumonia Virus$

OR

TI Pneumonia bacteria$

OR

TI bronchiolitis

OR

TI Acute Lower Respiratory Infection.

AND

TI Children

Limiters: 1990-2012; infants: 1 to 23 months & Child, Preschool 2-5 years

WHO LIS

Title "Pneumonia" OR title "Community acquired pneumonia" OR title "bacterial pneumonia" OR title "viral pneumonia" OR title "acute lower respiratory infection" AND title "children"

LILACS

Pneumonia [Title words] or Community Acquired Pneumonia [Title words] and Children [Title words]

IndMED

(Pneumonia) OR (Community acquired pneumonia) AND (Children)

Web of Knowledge

Title=(Pneumonia) OR Title=(acute lower respiratory infection*) AND Title=(child*)

Timespan=1990-2012

SIGLE

Pneumonia AND Child*

II. Data imputation to deal with missing data

Only 43 of the 89 studies included in this review provided data for the full age range (0-4 years). In order to deal with the missing data, we performed data imputation separately for the developing and industrialised regions for both hospitalised severe ALRI and very severe ALRI as described below. We have assumed that the age structure is similar across all studies from a given region (i.e. developed or industrialised countries).

Developing countries

For ***severe ALRI*** data on full age range were available from 17 published studies[1-17] and 18 unpublished studies [U1, U3, U5-8, U10, U12, U14, U17-20, U22, U23, and U25-27] (for details see pp 14-16 of this webappendix). Using incidence rate data from these studies, we calculated the median incidence rate ratio (IRR) for children in the age group 0-<2 years and 0-<5 years. Relative to an incidence of 1.0 in the age group 0-<1 years, the median IRR for the age group 0-<2 years and 0-<5 years was calculated to be 0.75 and 0.37. This median IRR was then applied to the reported incidence rates of severe ALRI for 0-<1 or 0-<2 or 0-<5 years to estimate the incidence rate for the missing age groups.

Five published studies[5, 7, 14, 16, 17] and 16 unpublished studies [U3, U5-7, U9, U10, U12, U14, U18-20, U22, U23, U25, U26, and U29] (for details see pp 14-16 of this webappendix) reported incidence data for ***very severe ALRI*** for the full age range. Using incidence rate data from these studies, we calculated the median IRR for children in the age group 0-<2 years and 0-<5 years. Relative to an incidence of 1.0 in the age group 0-<1 years, the median IRR for the age group 0-<2 years and 0-<5 years was calculated to be 0.64 and 0.36. We then applied this median IRR to the reported incidence rates influenza episodes for 0-<1 or 0-<2 or 0-<5 years to estimate the incidence rate for the missing age groups.

Industrialised countries

For ***severe ALRI*** data on full age range were available from 7 published studies[18-24] and one unpublished study [U9]. Using incidence rate data from these studies, we calculated the median incidence rate ratio (IRR) for children in the age group 0-<2 years and 0-<5 years. Relative to an incidence of 1.0 in the age group 0-<1 years, the median IRR for the age group 0-<2 years and 0-<5 years was calculated to be 0.70 and 0.45.

Sensitivity analysis

In order to assess the validity of data after imputation, we carried out a sensitivity analysis by including studies which had data for the full age range. We found no difference in the overall rates for hospitalised severe ALRI and very severe ALRI in children aged 0-59 months (Table A1). In general, where there was a difference, the incidence rates were lower after including imputed data (i.e. our estimates are more conservative). This supports our decision and validates our method to impute missing data.

Table A1: Comparison of incidence estimates for the different severity categories of hospitalised ALRI in the year 2008 after excluding imputed data

	Region	0-11 months		0-59 months	
		Incidence meta-estimate including imputed data (episodes /1000 children per year)	Incidence meta-estimate excluding imputed data (episodes /1000 children per year)	Incidence meta-estimate including imputed data (episodes /1000 children per year)	Incidence meta-estimate excluding imputed data (episodes /1000 children per year)
Severe ALRI	**Developing**	51.8 (44.8 to 59.8)*	57.7 (50.9 to 65.3)	19.7 (17.1 to 22.7)	19.7 (16.8 to 23.1)
	Industrialised	19.6 (16.1 to 23.9)	23.7 (18.2 to 31.1)	9.9 (7.4 to 13.3)	8.7 (6.4 to 11.8)
Very severe ALRI	**Developing**	13.7 (10.2 to 18.5)	14 (10.4 to 18.9)	5.1 (3.8 to 6.9)	5.3 (3.9 to 7.3)
	Industrialised	8.6 (8.4 to 8.9)	8.6 (8.4 to 8.9)	3 (2.9 to 3.1)	3 (2.9 to 3.1)

* Data in parentheses indicate 95% CI

III. Adjustment of incidence rates for study from South Africa by Madhi et al., 2005 based on HIV prevalence and access to antiretroviral therapy

Adjustment for IR of severe ALRI in children 0-4 years in placebo group

Reported IR of severe ALRI in all children (HIV pos and neg) in 2002, $I_{sev(2002)}$ = 3565 per 100,000

Prevalence of HIV in 2002, $Prev_{2002}$= 5.5%

IR of severe ALRI in HIV neg (I_{nsev})= 2566 per 100,000

IR of severe ALRI in HIV pos (I_{psev})= 16724 per 100,000

$I_{sev(2002)} = I_{psev} + I_{nsev}$ ----------(1)

Prevalence of HIV in <5 children (p_1) in 2008, p_1 = 3.5%

Thus, IR of overall severe ALRI adjusting for HIV prevalence in 2008, $I_{unadjsev(2008)}$

$= [I_{psev} \times p_1] + [I_{nsev} \times (1-p_1)]$

$= I_{punadjsev(2008)} + I_{nsev(2008)}$

$=[16724x\ 0.035] + [2566 \times 0.965]$

= 585.34 +2476.19

= 3061.53

Now $I_{punadjsev(2008)}$ is a combination of IR in those who receive HRT and those who don't

Proportion of access to ART in 2002, $P_{art(2002)}$ = 9%

Let us assume that risk of severe ALRI in those who receive ART= same as in HIV negative

Risk of severe ALRI in HIV positive (with ART) = X_1

Risk of severe ALRI in HIV positive (without ART) = X_2

Incidence of severe ALRI in HIV positive, $I_{punadjsev(2008)}$

$=585.34= (9*X_1) + (91*X_2)$ ----------(2)

The risk of severe ALRI in HIV positive compared to HIV negative in placebo group = I_{psev}/I_{nsev} = 6.5

Thus, X_2/X_1= 6.5

Substituting these in equation (2)

$I_{punadjsev(2008)} =585.34= 9X_1 + 591.5X_1$

= 600.5X1

Thus, X_1= 0.97

And X_2= 6.31

Prevalence of ART in 2008= 75%

Substituting these values in equation (2)

$I_{padjsev(2008)}$ = 75*0.97+25*6.31

=72.75+157.75

=230.5 ----------(3)

Substitutiting this value in equation (1)

$I_{sev(2008)} = I_{padjsev(2008)} + I_{nsev(2008)}$

=2476.19+230.5

= 2706.7

Incidence of severe ALRI in 2008 after adjusting for HIV prevalence and ART access = 2706.7 per 100,000 person years

Adjustment for IR of very severe ALRI in children 0-4 years in placebo group

Reported IR of very severe ALRI in all children (HIV pos and neg) in 2002, $I_{vsev(2002)}$ = 2259 per 100,000

Prevalence of HIV in 2002, $Prev_{2002}$= 5.5%

IR of very severe ALRI in HIV neg (I_{nvsev})= 1530 per 100,000

IR of very severe ALRI in HIV pos (I_{pvsev})= 12082 per 100,000

$I_{vsev(2002)} = I_{pvsev} + I_{nvsev}$ ----------(7)

Prevalence of HIV in <5 children (p_1) in 2008, p_1 = 3.5%

Thus, IR of overall very severe ALRI adjusting for HIV prevalence in 2008, $I_{unadjvsev\ (2008)}$

= $[I_{pvsev} \times p_1] + [I_{nvsev} \times (1-p_1)]$

= $I_{punadjvsev\ (2008)} + I_{nvsev\ (2008)}$

=[12082 x 0.035] + [1530 x 0.965]

= 422.87 +1476.45

= 1899.32

Now $I_{punadjvsev\ (2008)}$ is a combination of IR in those who receive HRT and those who don't

Proportion of access to ART in 2002, $P_{art(2002)}$ = 9%

Let us assume that risk of very severe ALRI in those who receive ART= same as in HIV negative

Risk of very severe ALRI in HIV positive (with ART) = X_1

Risk of very severe ALRI in HIV positive (without ART) = X_2

Incidence of very severe ALRI in HIV positive, $I_{punadjvsev\ (2008)}$

=422.87= $(9*X_1) + (91*X_2)$ ----------(8)

The risk of very severe ALRI in HIV positive compared to HIV negative in placebo group = I_{pvsev}/I_{nvsev} = 7.9

Thus, X_2/X_1= 7.9

Substituting these in equation (8)

$I_{punadjvsev\ (2008)}$ =422.87= $9X_1 + 718.9X_1$

= 727.9X1

Thus, X_1= 0.58

And X_2= 4.59

Prevalence of ART in 2008= 75%

Substituting these values in equation ()

$I_{padjvsev\ (2008)}$ = 75*0.58+25*4.59

=43.5+114.75

=158.25 ----------(9)

Substitutiting this value in equation (7)

$I_{vsev(2008)} = I_{padjvsev(2008)} + I_{nvsev(2008)}$

=1476.45+158.25

= 1634.7

Incidence of very severe ALRI in 2008 after adjusting for HIV prevalence and ART access = 1634.7 per 100,000 person years

IV. Estimated total episodes of severe ALRI

Approach 1

Estimated number of episodes hospitalised severe ALRI in developing countries= 11.37 (95% CI- 9.87 to 13.10) million - (a)

Proportion of children with suspected "pneumonia" [†] in developing countries taken to a health facility (data from DHS / MICS) - 61 (95% CI- 57 to 65) percent - (b)

Estimated number of total episodes of severe ALRI in developing countries (adjusted for healthcare utilisation) – (c) = (a) x (b)

= 18.6 (95% CI -15.18 to 22.98) million

Estimated number of episodes of severe ALRI in industrialised countries= 0.57 (95% CI- 0.43 to 0.76) million – (d)

Estimated number of total episodes of severe ALRI globally= (e) = (c) + (d)

= 19.21 (95% CI- 15.61 to 23.75) million

Approach 2

Estimated number of episodes hospitalised severe ALRI in developing countries= 11.37 (95% CI- 9.87 to 13.10) million - (a)

Estimated proportion of severe ALRI cases hospitalised following referral from community (health workers) using WHO IMCI case definitions – based on data from studies in Table A6 – 0.49 (IQR 0.36, 0.62) – (f)

Estimated number of total episodes of severe ALRI in developing countries (adjusted for care seeking) – (g) = (a) / (f)

= 23.20 (uncertainty range 20.14 to 26.73)

Estimated number of total episodes of severe ALRI globally= (h) = (g) + (d)

= 23.77 (20.5 to 27.49)

Estimates (e) and (h) are broadly consistent with each other. However, since the data on healthcare utilisation are based on data from 81 developing countries and the proportion of severe ALRI cases hospitalised are based on data from only 4 studies- we decided to adopt the more conservative and data-driven approach.

[†] The definition used by DHS / MICS was a mother's perception of a child who has cough, is breathing faster than usual with short, quick breaths or is having difficulty breathing, excluding children that had only a blocked nose.

V. Additional Tables

Table A2: Details of unpublished studies included in the meta-analysis

S. No	Location (reference)	Published reference	Remarks
U1	Kassena-Nankana District, Ghana (Morris and colleagues)	VAST study Group Lancet 1993; 342(8862):7-12	Data re-analysed using common case definitions
U2	Upper River Division and Central River Division, The Gambia (Zaman and colleagues)	Cutts et al., Lancet 2005; 365: 1139–46	Data re-analysed using common case definitions
U3	Kilifi District, Kenya (Moïsi and colleagues)	Moïsi et al., Bull World Health Organ. 2011 Feb 1;89(2):102-11	Data re-analysed using common case definitions
U4	Manhiça district, Mozambique (Roca and colleagues)	(1) Roca et al., Vaccine. 2010 Jul 5;28(30):4851-7 (2) Sigauque et al., J Trop Pediatr. 2009 Dec;55(6):379-87	Data re-analysed using common case definitions
U5	Bondo district, Nyanza province, Kenya (Ope and colleagues)	Feikin et al., Bull World Health Organ. 2012 Apr 1;90(4):256-263A	Data re-analysed using common case definitions
U6	Upper River Region, The Gambia (Mackenzie and colleagues)		Data are not yet published
U7	Lwak, Kisumu, Kenya (Breiman and colleagues)	Feikin et al., PLoS One 2011; 6:e16085 Katz MA et al., J Infect Dis 2012 (In press)	Data re-analysed using common case definitions
U8	Soweto, South Africa (Cohen and colleagues)	Pretorius et al. ., J Infect Dis 2012 (In press)	Data re-analysed using common case definitions
U9	Colorado, USA (Simoes and colleagues)		Data are not yet published
U10	Paysandú and Salto, Uruguay (Hortal and colleagues)	Hortal et al., Int J Infect Dis 2007; 11:273-277	Data re-analysed using common case definitions
U11	Yukon Kuskokwim Delta, Alaska, USA (Singleton and colleagues)	(1) Singleton et al, Pediat Infect Dis J 2006;25:1116-25 (2) Singleton et al. J Med Virol 2010;82:1282-90	Data re-analysed using common case definitions
U12	Concordia and Parana, Argentina (Ruvinsky and colleagues)	Ruvinsky RO et al., J Ped Infect Dis 2010; 5: 263-69	Data re-analysed using common case definitions
U13	San Lorenzo & Comitancillo, Guatemala (Bruce and colleagues)	Smith et al., Lancet 2011; 378: 1717–26	Data re-analysed using common case definitions
U14	Pilar, (Buenos Aires Province), Argentina (Gentile and colleagues)		Data are not yet published
U15	San José, Costa Rica (Arguedas and colleagues)	Arguedas et al., Vaccine 30 (2012) 2342– 2348	Data re-analysed using common case

S. No	Location (reference)	Published reference	Remarks
			definitions
U16	Goiânia, Brazil (Andrade and colleagues)	(1) Andrade et al, Vaccine 2012; 1901-09 (2) Thörn L.K. et al., BMC Infect Dis, 2011, 11:180 (3) Andrade A.L. et al., J Infect, 2010, 61(4):314-322	Data re-analysed using common case definitions
U17	Multicentre, El Salvador (Clara and colleagues)	Clara et al., Bull World Health Organ 2012;90:756–763	Data re-analysed using common case definitions
U18	Santa Rosa, Guatemala (McCracken and colleagues)	Nair et al. Lancet. 2011 Dec 3;378(9807):1917-30	Data re-analysed using common case definitions
U19	Paysandú and Salto, Uruguay (Hortal and colleagues)	Hortal et al., Vaccine. 2012; 30:4934	Data re-analysed using common case definitions
U20	Quetzaltenango, Guatemala (McCracken and colleagues)	Nair et al. Lancet. 2011 Dec 3;378(9807):1917-30	Data re-analysed using common case definitions
U21	Lombok, Indonesia (Gessner and colleagues)	Gessner et al., Lancet 2005; 365(9543):43-52	Data re-analysed using common case definitions
U22	Nakhon Phanom and Sa Kaeo provinces, Thailand (Baggett and colleagues)	(1) Olsen et al. Int J Infect Dis. 2006;10(6):439-45 (2) Olsen et al. Epidemiol Infect. 2010; Mar 31:1-12 (3) Baggett et al. Clin Inf Dis 2009; 48 (Suppl 2): S65.	Data re-analysed using common case definitions
U23	Mirzapur, Bangladesh (Arifeen and colleagues)	Arifeen SE. et al., Clin Infect Dis. 2009 Mar 1;48 Suppl 2:S103-13.	Data re-analysed using common case definitions
U24	Multicentre, India (Chandran and colleagues)	Gupta et al., Indian J Med Res, May 2010; 131: 649-658	Data re-analysed using common case definitions
U25	Kamalapur, Bangladesh (Brooks and colleagues)	(1) Brooks et al., Am. J. Trop. Med. Hyg. 2007; 77(5): 795-801 (2) Brooks et al., Pediatr Inf Dis J. 2010; 29(3): 216-21	Recent data re-analysed using common case definitions
U26	Multicentre, Bangladesh (Azziz-Baumgartner and colleagues)	Azziz-Baumgartner et al., Bull World Health Organ. 2012 January 1; 90(1): 12–19.	Data re-analysed using common case definitions
U27	Ballabgarh, Haryana, India (Krishnan and colleagues)	Dawood et al., Lancet Infect Dis 2012; 12(9):687-695	Data are not yet published
U28	Bohol, Philippines (Lucero and colleagues)	Lucero et al. Pediatr Infect Dis J 2009; 28: 455–462.	Data re-analysed using common case

S. No	Location (reference)	Published reference	Remarks
			definitions
U29	Goiânia, Brazil (Andrade and colleagues)	Andrade et al, Int J Epi 2004;33:173-181	Data re-analysed using common case definitions
U30	Soweto, South Africa (Madhi and colleagues)	Madhi et al., Clin Infect Dis. 2005; 40(10): 1511-8.	Data re-analysed using common case definitions
U31	Kibera, Nairobi, Kenya (Breiman and colleagues)	Feikin et al., PLoS One 2011; 6:e16085 Katz MA et al., J Infect Dis 2012 (In press)	Data re-analysed using common case definitions
U32	Multicentre, Bangladesh (Naheed and colleagues)	Naheed et al., Clin Infect Dis. 2009 Mar 1; 48 Suppl 2:S82-9.	Data re-analysed using common case definitions

Table A3: Incidence estimates of hospitalised severe ALRI in children younger than 5 years from published and unpublished studies by World Health Organization regions

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised severe ALRI[‡] (per 1000 children per year)[§]	
			0-11 months	0-59 months
Africa				
Kassena-Nankana District, Ghana; rural; Jun 1990- Aug 1991 (Morris and colleagues)	Defined population base (n=1439)	Physician diagnosed ALRI	56.8	20.9
Western Region, The Gambia; mixed rural-urban; Mar 1993 - Mar 1996[25 **]	Defined population base (n=21358)	Physician diagnosed ALRI	(21.6)	(8)
Soweto, South Africa; urban; Mar 1998 - Nov 2001[26 ††‡‡]	Defined population base (n=19914)	Physician diagnosed ALRI	(96.5)	35.7
Manhiça, Mozambique; rural; Feb 1999 - Jan 2000[9]	Defined population base (n=6020)	Physician diagnosed ALRI	126	68
Bamako, Mali; urban; Jan 2000 - Dec 2000[1]	Census-derived estimate (n=200160)	Physician diagnosed ALRI	10	3.5
Agincourt, South Africa; rural; Apr 2000 - Mar 2001[9]	Defined population base (n=8258)	Physician diagnosed ALRI	332	80
Bondo district, Kenya; rural; Jan 2001 - Dec 2003[10]	Census-derived estimate (n=52200)	Physician diagnosed ALRI	13.7	7
Upper River Division and Central River Division, The Gambia; rural; Feb 2002-Apr 2004 (Zaman and colleagues)[‡]	Defined population base (n=5040)	Cough or difficulty breathing and chest wall indrawing or grunting	27.8	(10.3)
Kilifi District, Kenya; rural; Apr 2002 - Dec 2008 (Moisi and colleagues)[§§]	Defined population base (n=45600)	Acute cough / difficulty in breathing AND chest indrawing or tachypnea (>60 breaths per minute) in infants aged <2 months	61.1	19.9

[‡] ALRI= acute lower respiratory infection
[§] Data in parentheses are computed incidence estimates from data imputation
[**] Included children from 2 months of age
[††] Excluded neonates (0-27 days)
[‡‡] Incidence rates adjusted for HIV prevalence (0-4 years) and HAART coverage in 2008 included in meta-analysis
[§§] Day 0 excluded

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised severe ALRI[‡] (per 1000 children per year)[§]	
			0-11 months	0-59 months
Manhiça district, Mozambique; rural; Mar 2004 - Mar 2006 (Roca and colleagues)	Defined population base (n=4954)	Age≥2 months- cough or difficult breathing with chest wall indrawing in hospitalised children. Age<2 months- cough or difficult breathing with tachypnea or chest wall indrawing	65.3	(24.2)
Bondo district, Nyanza province, Kenya; rural; Jun 2007 - May 2009 (Ope and colleagues)[‡]	Census-derived estimate (n=160417)	Physician diagnosed ALRI	28.6	16.8
Upper River Region, The Gambia; rural; 12 May 2008 - 11 May 2009 (Mackenzie and colleagues)[‡]	Defined population base (n=27086)	Cough or difficult breathing with / without chest wall indrawing	86.4	33.2
Lwak, Kisumu, Kenya; rural; Jun 2008 - May 2009 (Breiman and colleagues)	Census-derived estimate (n=4215)	Physician diagnosed ALRI OR Age ≥2 months- Cough or difficult breathing with chest wall indrawing; Age <2 months- Tachypnea (>60 breaths/ min) or chest wall indrawing	72.9	98.9
Soweto, South Africa; urban; Feb 2009 - Jan 2010 (Cohen and colleagues)[***]	Census-derived estimate (n=123572)	Physician diagnosed ALRI	46.6	14.9
Lwak, Kisumu, Kenya; rural; Jun 2009 - May 2010 (Breiman and colleagues)	Census-derived estimate (n=4428)	Physician diagnosed ALRI OR Age ≥2 months- Cough or difficult breathing with chest wall indrawing; Age <2 months- Tachypnea (>60 breaths/ min) or chest wall indrawing	83.6	86
Americas				
American Indians and Alaska Natives, USA; rural; Jan 1990- Dec 1995[3]	Census-derived estimate (n=678782)	Hospitalised bronchiolitis (Discharge code- ICD-9 CM 466.1)	61.4	11.3
Tennessee, USA; mixed rural-urban; 1995-2008[27]	Census-derived estimate (n=12260)	Hospitalised bronchiolitis (Discharge code ICD-9 CM 466.1 and / or 480.1)	70.7	(31.8)

[***] Day 0 and day 1 excluded

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised severe ALRI[‡] (per 1000 children per year)[§]	
			0-11 months	0-59 months
USA; mixed rural-urban; 1997 - 1999[20] [†††]	Census-derived estimate	Physician diagnosed ALRI (Discharge code ICD-9 CM 480-487.0)	15	7.4
USA; mixed rural-urban; Nov 1996 - Oct 1998[28]	Census-derived estimate	Physician diagnosed ALRI (Discharge code ICD-9 CM 480-487.0)	(40.4)	18.2
USA; mixed rural-urban; 1997-2000[21]	Census-derived estimate (n=48127200)	Physician diagnosed ALRI (Discharge code ICD-9 CM 480-487.0)	11.6	5.2
American Indians and Alaska Natives, USA; rural; 1999 - 2001[2] [§]	Census-derived estimate (n=348486)	Physician diagnosed ALRI (ICD-9 CM 466.1 and / or 480 - 486)	128.7	32.9
Colorado, USA; mixed rural-urban; Jan 2000 - Dec 2008 (Simoes and colleagues)	Census-derived estimate (n=374169)	Physician diagnosed ALRI	43.1	16.9
Monroe County (New York), Davidson County (Tennessee) and Hamilton County (Ohio), USA; mixed rural-urban; Oct 2000 - Sep 2004[19]	Census-derived estimate (n=183839)	Physician diagnosed ALRI	43.9	15.2
USA; mixed rural-urban; 2001 - 2007[20] [§§]	Census-derived estimate	Physician diagnosed ALRI (Discharge code ICD-9 CM 480-487.0)	10.2	5.8
Paysandú and Salto, Uruguay; mixed rural-urban; Jun 2001 - May 2004 (Hortal and colleagues)	Census-derived estimate (n=61950)	Physician diagnosed ALRI	77.8	34.5
Yukon Kuskokwim Delta, Alaska, USA; rural; Jul 2001 - Jun 2007 (Singleton and colleagues)	Census-derived estimate (n=1850)	Physician diagnosed ALRI (Discharge diagnosis ICD-9 CM 480-486, 507.0 and 487.0)	223.4	(82.6)
Concordia and Parana, Argentina; urban; Nov 2002 - Oct 2005 (Ruvinsky and colleagues)	Census-derived estimate (n=12500)	Acute cough / difficulty in breathing AND chest indrawing or tachypnea (>60 breaths per minute) in infants aged <2 months	30.3	14.2
San Lorenzo & Comitancillo, Guatemala; rural; Dec 2002 - Dec 2004 (Bruce and colleagues) [‡‡‡]	Defined population base (n=518)	Cough or difficult breathing with lower chest wall indrawing in children >2 months of age OR cough or difficult breathing with tachypnea (60 breaths / min.) in a child <2 months of age	49.8	(18.4)

[†††] Detailed age specific incidence estimates obtained directly from authors

[‡‡‡] All eligible subjects were followed up weekly at home by trained field workers who referred children with findings suggestive of respiratory disease to the community clinics and 70-80% of these were attended by a physician

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised severe ALRI[‡] (per 1000 children per year)[§]	
			0-11 months	0-59 months
United States; 2003[29]	Census-derived estimate	Physician diagnosed ALRI (Discharge code ICD-9 CM 022.1, 031.0, 033, 095.1, 466, 480-487, 510, 511.1, 513, 517.1, 770.0)	41.4	18.6
Pilar, (Buenos Aires Province), Argentina; mixed rural-urban; 2003 - 2005 (Gentile and colleagues) [§]	Census-derived estimate (n=40814)	Physician diagnosed ALRI	35.5	10.5
USA; mixed rural-urban; 2003-2006[21]	Census-derived estimate	Physician diagnosed ALRI (Discharge code ICD-9 CM 480-487.0)	9.3	4.8
San José, Costa Rica; urban; Apr 2007 - Apr 2009 (Arguedas and colleagues) [§]	Census-derived estimate (n=64992)	Physician diagnosed ALRI	10	(3.7)
Goiânia, Brazil; urban; May 17 2007 - May 16 2009 (Andrade and colleagues) [§]	Census-derived estimate (n=56146)	Physician diagnosed ALRI	58.4	(21.6)
Multicentre, El Salvador; mixed rural-urban; Jan 2007 - Dec 2008 (Clara and colleagues)	Census-derived estimate (n=557088)	Hospitalised ALRI (Discharge diagnosis ICD-10 CM J10, J11, J09-J18.9, J20, J21, J22, J80, J96. For new-borns also P23-P23.9)	95.3	28
Santa Rosa, Guatemala; mixed rural-urban; Nov 2007 - Dec 2008 (McCracken and colleagues)	Census-derived estimate (n=12700)	Physician diagnosed ALRI OR age 2-59 months- cough or difficulty breathing with chest wall indrawing; age < 2months- RR>60/min or chest wall indrawing	38.6	14.7
Paysandú and Salto, Uruguay; mixed rural-urban; Jan 2009 - Dec 2009 (Hortal and colleagues)	Census-derived estimate (n=20650)	Physician diagnosed ALRI	126.1	44.7
Colorado, USA; mixed rural-urban; Jan 2009 - Dec 2009 (Simoes and colleagues)	Census-derived estimate (n=360188)	Physician diagnosed ALRI	37.9	17.6
Santa Rosa, Guatemala; mixed rural-urban; Jan 2009 - Nov 2010 (McCracken and colleagues)	Census-derived estimate (n=21950)	Physician diagnosed ALRI OR age 2-59 months- cough or difficulty breathing with chest wall indrawing; age < 2months- RR>60/min or chest wall indrawing	99.8	30.8
Quetzaltenango, Guatemala; mixed rural-urban; Feb 2009 - Nov 2010 (McCracken and colleagues)	Census-derived estimate (n=53030)	Physician diagnosed ALRI OR age 2-59 months- cough or difficulty breathing with	33.2	9.8

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised severe ALRI[‡] (per 1000 children per year)[§]	
			0-11 months	0-59 months
		chest wall indrawing; age < 2months- RR>60/min or chest wall indrawing		
Yukon Kuskokwim Delta, Alaska, USA; rural; Jul 2009 - Jun 2010 (Singleton and colleagues)	Census-derived estimate (n=1850)	Hospitalised ALRI (Discharge diagnosis ICD-9 CM 480-486, 507.0 and 487.0)	173.7	(64.3)
Multicentre, El Salvador; mixed rural-urban; Jan 2009 - Dec 2010 (Clara and colleagues)	Census-derived estimate (n=562170)	Hospitalised ALRI (Discharge diagnosis ICD-10 CM J10, J11, J09-J18.9, J20, J21, J22, J80, J96. For new-borns also P23-P23.9)	106.9	33.7
Eastern Mediterranean				
Multicentre, Pakistan; peri-urban; Feb 2002 - Jan 2003[4 ‡]	Census-derived estimate (n=13364)	Cough or difficulty breathing plus any danger sign (inability to feed or drink, vomiting everything, convulsions, lethargy or unconsciousness) or chest indrawing or stridor	19.8	10.3
Karachi, Pakistan; mixed mixed rural-urban; Feb 2007-May 2008[5]	Defined population base (n=3950)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing or stridor or general danger signs (inability to breast feed or drink, vomits everything, convulsion, lethargy, loss of consciousness)	40	14.7
Europe				
Scotland, United Kingdom; mixed rural-urban; Jan 1981 - Dec 2005[30]	Census-derived estimate (n=7679789)	Physician diagnosed ALRI (Discharge code-ICD-9 CM 480-486.0 and ICD-10-AM J12-18)	3.7	2.2
Kuopio, Finland; mixed rural-urban; Sep 1981 - Aug 1982[31] [§]	Census-derived estimate (n=2917)	Physician diagnosed ALRI	(41.9)	18.9
Spain; mixed rural-urban; Jan 1995 - Dec 1996[32]	Census-derived estimate (n=3213968)	Physician diagnosed ALRI (Discharge code- ICD-9 CM 480-486.0)	(11)	4.9
Spain; mixed rural-urban; 1995-1998[33]	Census-derived estimate (n=7684928)	Physician diagnosed ALRI (Discharge code- ICD-9 CM 003.22, 052.1, 055.1, 073.0, 083.0, 480-487.0)	(9.3)	4.2
Valencia, Spain; urban; Jan 1995- Dec 2000[34]	Defined population base (n=654)	Physician diagnosed ALRI	(15.6)	7
Valencia, Spain; mixed rural-urban; 1995 - 2001[35]	Census-derived estimate (n=1582398)	Physician diagnosed ALRI (Discharge code- ICD-9 CM 481, 485, 486)	(11.5)	5.2

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised severe ALRI‡ (per 1000 children per year)§	
			0-11 months	0-59 months
Gipuzoka, Spain; mixed rural-urban; Jul 1996 - Jun 2000[36]	Census-derived estimate (n=62800)	Physician diagnosed ALRI (Discharge code-ICD-9 CM 466.1)	(22.5)	10.1
Kiel, Germany; urban; Jul 1996 - Jun 2000[18]	Census-derived estimate (n=53655)	Physician diagnosed ALRI	11.1	6.8
Netherlands; mixed rural-urban; May 1999 - Apr 2000[37]	Census-derived estimate (n=971471)	Physician diagnosed ALRI (Discharge code-ICD-9 CM 480-486.0)	(6.9)	3.1
Multicentre, Germany; mixed rural-urban; Nov 1999 - Oct 2001[23] §§	Census-derived estimate (n=2374600)	Physician diagnosed ALRI	51.7	(23.2)
Liguria, Italy; mixed rural-urban; May 2000 - Apr 2004[38]	Census-derived estimate (n=16973)	Physician diagnosed ALRI (Discharge code- ICD-9 CM 480-487.0)	(9.2)	(4.1)
Gipuzoka, Spain; mixed rural-urban; Jul 2004 - Jun 2007[22]	Census-derived estimate (n=135135)	Physician diagnosed ALRI	46	(20.7)
Netherlands; mixed rural-urban; May 2006 - Apr 2007[37]	Census-derived estimate (n=971471)	Physician diagnosed ALRI (Discharge code- ICD-9 CM 480-486.0)	(7.6)	3.4
Limousin, France; mixed rural-urban; Sep 2007 - Aug 2008[39]	Census-derived estimate (n=7292)	Hospitalised bronchiolitis	17.7	(8)
South East Asia				
Matlab, Bangladesh; rural; May 1988 - Apr 1989[40]	Defined population base (n=503)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	(145)	53.6
Kamalapur, Bangladesh; urban; Apr 1999 - Aug 2000[41] ‡^ §§§	Defined population base (n=511)	Crepitations on inspiration, with respiratory rate >50 breaths / min, with chest indrawing or other danger signs (lethargy, cyanosis, inability to drink)	(109.6)	(40.5)
Lombok, Indonesia; rural; 1999 - 2002 (Gessner and colleagues)	Defined population base (n=38653)	Cough or difficult breathing with chest wall indrawing OR infant aged < 2 months with increased respiratory rate (≥60 / min.)	83.6	(30.9)
Matlab, Bangladesh; rural; Jul 1999 - Jun 2001[6]	Defined population base	Cough and / or difficult breathing with or without tachypnea AND chest indrawing or stridor or general danger signs (inability to breast feed or drink, vomits	101.1	50.2

^ Rates do not include cases with wheezing or rhonchi without crepitations (as these were labelled as bronchiolitis)

§§§ All eligible subjects were followed up weekly at home by trained Field Research Assistants (FRAs) who referred children with findings suggestive of respiratory disease to the clinic

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised severe ALRI[‡] (per 1000 children per year)[§]	
			0-11 months	0-59 months
	(n=12451)	everything, convulsion, lethargy, loss of consciousness)		
Bhaktapur, Nepal; mixed rural-urban; Jan 2004 - Jun 2007[42 ‡]	Defined population base (n=2100)	Cough and / or difficult breathing combined with lower chest wall indrawing and admittance to hospital	(11.7)	(4.3)
Kathmandu, Nepal; urban; Nov 2004 - Mar 2007[43 ‡^]	Census-derived estimate (n=243345)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	(16.8)	6.2
Nakhon Phanom and Sa Kaeo provinces, Thailand; rural; Jan 2004 - Dec 2008 (Baggett and colleagues)	Census-derived estimate (n=427163)	Children having evidence of acute infection (reported fever or chills, documented T>38.2C or <35.5C, or abnormal WBC count or abnormal differential count) and at least one sign or symptom of lower respiratory tract disease (abnormal breath sounds on chest auscultation, tachypnea, cough, sputum production, hemoptysis, chest pain, or dyspnea)	83.4	55.2
Mirzapur, Bangladesh; rural; Oct 2004 - Sept 2008 (Arifeen and colleagues)[§]	Defined population base (n=41040)	Cough or difficult breathing with / without chest wall indrawing OR infant aged < 2 months with increased respiratory rate (≥60 / min.)	73.9	19
Patan, Nepal; urban; Apr 2005 - Dec 2006[44 ‡^]	Census-derived estimate (n=56875)	Tachypnea AND chest indrawing	(17.1)	6.3
Multicentre, India; rural; Jul 2005 - Mar 2007 (Chandran and colleagues)[§]	Defined population base (n=15460)	Cough or difficulty breathing or fast breathing or chest retractions or chest wall indrawing or nasal flaring or grunting or abnormal auscultation	69.3	(25.6)
Bangalore, India; urban; Jan 2006 - Dec 2006[45]	Census-derived estimate (n=150945)	Physician diagnosed ALRI	(17.3)	6.4
Kamalapur, Bangladesh; urban; Jan 2008 - Dec 2008 (Brooks and colleagues)[†††]	Defined population base (n=4547)	History of cough with or without documented fever (axillary temperature - ≥ 38°C), WHO specified age specific elevated respiratory rate (0 - <2 months of age RR = ≥60/min, 2 - <12 months of age RR ≥ 50/min and 12 - <60 months of age RR ≥40/min) and chest indrawing	71.7	24
Multicentre, Bangladesh; rural; Jan 2008 - Dec 2008 (Azziz-Baumgartner and colleagues)	Defined population base (n=6864)	Cough or difficult breathing with chest in-drawing or requiring hospitalization	51.3	14
Kamalapur, Bangladesh; urban; Jan 2009 - Dec 2010 (Brooks and colleagues)[†††]	Defined population base (n=7200)	History of cough with or without documented fever (axillary temperature - ≥ 38°C), WHO specified age specific elevated respiratory rate (0 - <2 months of age RR = ≥60/min, 2 - <12 months of age RR ≥ 50/min and 12 - <60 months of age RR ≥40/min) and chest indrawing	58.9	21

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised severe ALRI[‡] (per 1000 children per year)[§]	
			0-11 months	0-59 months
Nakhon Phanom and Sa Kaeo provinces, Thailand; rural; Jan 2009 - Dec 2009 (Baggett and colleagues)	Census-derived estimate (n=80240)	Hospitalised ALRI- children having evidence of acute infection (reported fever or chills, documented Temperature >38.2ºC or <35.5C, or abnormal WBC count or abnormal differential count) and at least one sign or symptom of lower respiratory tract disease (abnormal breath sounds on chest auscultation, tachypnea, cough, sputum production, hemoptysis, chest pain, or dyspnea)	72.9	53.9
Ballabgarh, Haryana, India; rural; Aug 2009 - Jul 2010 (Krishnan and colleagues)	Census-derived estimate (n=4840)	Hospitalised cases with either difficulty breathing / shortness of breath OR diagnosis of pneumonia or respiratory infection	15	3.7
Multicentre, Bangladesh; rural; Jan 2009 - Dec 2009 (Azziz-Baumgartner and colleagues)	Defined population base (n=14037)	Cough or difficult breathing with chest in-drawing or requiring hospitalization	49.8	13.3
Western Pacific				
Alabang (Metro Manila), Philippines; urban; Apr 1985 - Mar 1987[46]	Defined population base (n=709)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	(64.8)	24
Western Australia, Australia; mixed rural-urban; 1988-1993[11]	Census-derived estimate (n=757610)	Physician diagnosed ALRI	32.1	10.2
Zhejiang, China; mixed rural-urban; Apr 1990 - Mar 1991[13]	Defined population base (n=7472)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	25	8.6
Zhejiang, China; rural; Apr 1990 - Mar 1991[47]	Defined population base (n=1215)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	(26.7)	9.9
Heilongjiang, China; rural; 1991 - 1993[48]	Census-derived estimate (n=9901)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	(137.3)	50.8
Shangdong, China; mixed rural-urban; Jan 1992 - Jan 1993[49]	Defined population base (n=16751)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	(5.5)	2
Chongqing, China; mixed rural-urban; Feb 1992 - Jan 1993[14]	Census-derived estimate (n=2246)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	69.5	31.2
Heilongjiang, China; rural; Jan 1993 - Dec 1993[50]	Census-derived estimate (n=5812)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	(17.2)	6.4

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised severe ALRI[‡] (per 1000 children per year)[§]	
			0-11 months	0-59 months
Auckland, New Zealand; urban; Jul 1993 - Jun 1996[51]	Census-derived estimate (n=50280)	Physician diagnosed ALRI	(24.2)	10.9
Fujian, China; rural; 1994 - 1995[52]	Census-derived estimate (n=9323)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	(65.5)	24.2
Henan, China; rural; Jan 1994 - Dec 1994[17]	Defined population base (n=7917)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	52.1	23.2
Jiangsu, China; rural; Feb 1994 - Jan 1995[15]	Census-derived estimate (n=11729)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	33.8	9.4
Henan, China; rural; Jul 1994 - Jun 1996[53]	Census-derived estimate (n=29590)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	(128.1)	47.4
Fujian, China; mixed rural-urban; Oct 1994 - Sep 1995[16]	Census-derived estimate (n=4665)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	52.5	24
Yunnan, China; rural; Jan 1995 - Dec 1997[54]	Census-derived estimate (n=6966)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	(529.2)	195.9
Shandong, China; mixed rural-urban; Jan 1995 - Dec 2001[55]	Census-derived estimate (n=375629)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	(41.9)	15.5
Shangdong, China; mixed rural-urban; 1995 - 2004[56]	Census-derived estimate (n=537734)	Cough and / or difficult breathing with or without tachypnea AND chest indrawing	(34.8)	12.9
Western Australia, Australia; mixed rural-urban; 1996-2005[24]	Census-derived estimate (n=911520)	Physician diagnosed ALRI (Discharge codes ICD-10 J12-J18, B59, B05.2, B37.1, B01.2)	52	20.9
Taiwan; 1997-2004[57] ****	Census-derived estimate	Physician diagnosed ALRI (Discharge codes ICD-9 CM 480-487)	49.8	39.7
Bohol, Philippines; mixed rural-urban; Jul 2000 - Dec 2004 (Lucero and colleagues)[§]	Defined population base (n=6094)	Cough or difficulty breathing with chest wall indrawing	89.7	(33.2)
Tongatapu, Tonga; mixed rural-urban; Jan 2000 - Dec 2004[58] §^	Census-derived estimate	Physician diagnosed ALRI	(27.2)	10.1

**** Excluded pneumonia in children aged 0-3 days

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised severe ALRI[‡] (per 1000 children per year)[§]	
			0-11 months	0-59 months
Hong Kong, urban; Jan 2000 - Dec 2005[59]	Census-derived estimate (n=2131182)	Physician diagnosed ALRI (Discharge codes ICD-9 CM 481 and 486)	(19.1)	8.6
Suva, Fiji; urban; Jan 2001 - Dec 2002[60 §]	Census-derived estimate (n=20954)	Physician diagnosed ALRI	(40)	18
NhaTrang district, Vietnam; mixed rural-urban; Apr 2005 - Aug 2006[7]	Census-derived estimate (n=24641)	Physician diagnosed ALRI	69.5	22.6
Tongatapu, Tonga; mixed rural-urban; 2006 - 2007[58 §]	Census-derived estimate (n=10322)	Physician diagnosed ALRI	(19.5)	7.2
NhaTrang city, Vietnam; urban; Mar 2007 – Feb 2008[8]	Census-derived estimate (n=13941)	Physician diagnosed ALRI	65.8	34

Table A4: Incidence of hospitalised very severe ALRI in children younger than 5 years from published and unpublished studies by World Health Organization regions

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised very severe ALRI (per 1000 children per year) [*†]	
			0-11 months	0-59 months
Africa				
Soweto, South Africa; urban; Mar 1998 - Nov 2001[26] [‡§]	Defined population base (n=19914)	Cough with lower chest wall indrawing and or any of the following signs: feeding difficulties, convulsions, central cyanosis, or encephalopathy	(62.8)	22.6
Kilifi District, Kenya; rural; Apr 2002 - Dec 2008 (Moisi and colleagues) [**]	Defined population base (n=45600)	Acute cough / difficulty in breathing AND unconscious or prostrated OR SpO_2 <90% in children aged ≥2months and 88% in children aged <2 months	18.2	6.5
Manhiça district, Mozambique; rural; Mar 2004 - Mar 2006 (Roca and colleagues)	Defined population base (n=4954)	Cough or difficulty in breathing with one danger sign (difficulty in breastfeeding or drinking, lethargy, or unconsciousness) OR SpO_2 <90% in children aged ≥2months and 88% in children aged <2 months)	33.7	(12.1)
Bondo district, Nyanza province, Kenya; rural; Jun 2007 - May 2009 (Ope and colleagues) [††]	Census-derived estimate (n=160417)	Cough or difficulty in breathing with one danger sign (cyanosis, difficulty in breastfeeding or drinking, vomiting everything, convulsions, lethargy, or unconsciousness, head nodding)	24.2	13.5
Upper River Region, The Gambia; rural; 12 May 2008 - 11 May 2009 (Mackenzie and colleagues) [††]	Defined population base (n=27086)	Cough or difficulty in breathing with one danger sign (cyanosis, difficulty in breastfeeding or drinking, vomiting everything, convulsions, lethargy, or unconsciousness, head nodding)	35.7	15.4
Lwak, Kisumu, Kenya; rural; Jun 2008 - May 2009 (Breiman and colleagues)	Census-derived estimate (n=4215)	Cough or difficulty in breathing with chest wall in-drawing AND any one danger sign (difficulty in breastfeeding or drinking, vomiting everything, convulsions, lethargy, or unconsciousness) OR SpO_2 <90% in children aged ≥2months and 88% in children aged <2 months	23.6	21.3
Lwak, Kisumu, Kenya; rural; Jun 2009 - May 2010 (Breiman and colleagues)	Census-derived estimate (n=4428)	Cough or difficulty in breathing with chest wall in-drawing AND any one danger sign (difficulty in breastfeeding or drinking, vomiting everything, convulsions, lethargy, or unconsciousness) OR SpO_2 <90% in children aged ≥2months and 88% in children aged <2 months	46.9	31.6
Americas				
Colorado, USA; mixed rural-urban; Jan 2000 - Dec 2008 (Simoes and colleagues)	Census-derived estimate (n=374169)	Colorado Hospital Association (CHA) severity codes 3 and 4 (the codes range from 0 to 4, 0=Not Applicable, 1=Minor, 2=Moderate, 3=Major, 4=Extreme). This classification system was developed by the Pediatric Health Information system (PHIS) team of the Child Health Corporation of America.	8.6	3
Goiânia, Brazil; urban; May 2000 - Aug 2001 (Andrade and colleagues) [††]	Census-derived estimate (n=87705)	Hospitalised ALRI with cyanosis or nasal flaring	1.2	0.4
Paysandú and Salto, Uruguay; mixed rural-urban; Jun 2001 - May 2004 (Hortal and colleagues)	Census-derived estimate (n=61950)	Hospitalised ALRI admitted to intensive care unit	5.9	1.6

[*] ALRI= acute lower respiratory infection
[†] Data in parentheses are computed incidence estimates from data imputation
[‡] Excluded neonates (0-27 days)
[§] Incidence rates adjusted for HIV prevalence (0-4 years) and HAART coverage in 2008 included in meta-analysis
[**] Day 0 excluded
[††] Included children from 2 months of age

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised very severe ALRI (per 1000 children per year) *†	
			0-11 months	0-59 months
Yukon Kuskokwim Delta, Alaska, USA; rural; Jul 2001 - Jun 2007 (Singleton and colleagues)	Census-derived estimate (n=1850)	Hospitalised ALRI who were mechanically ventilated	14.9	(5.4)
Concordia and Parana, Argentina; urban; Nov 2002 - Oct 2005 (Ruvinsky and colleagues)	Census-derived estimate (n=12500)	Cough or difficulty in breathing AND one danger sign (cyanosis, difficulty in breastfeeding or drinking, vomiting everything, convulsions, lethargy, or unconsciousness, head nodding) OR SpO_2 <90% in children aged ≥2months and 88% in children aged <2 months	3.4	0.9
San Lorenzo & Comitancillo, Guatemala; rural; Dec 2002 - Dec 2004 (Bruce and colleagues) ‡‡	Defined population base (n=518)	Cough or difficult breathing with lower chest wall indrawing with inability to drink, or central cyanosis, or convulsions, or unconscious / very drowsy or persistent vomiting	49.8	(18.4)
Pilar, (Buenos Aires Province), Argentina; mixed rural-urban; 2003 - 2005 (Gentile and colleagues) ‡	Census-derived estimate (n=40814)	Hospitalised ALRI with SpO_2 <90% in children aged ≥2months and 88% in children aged <2 months	2.4	0.9
Goiânia, Brazil; urban; May 17 2007 - May 16 2009 (Andrade and colleagues) ‡	Census-derived estimate (n=56146)	Hospitalised ALRI admitted to intensive care unit	1.2	(0.4)
Santa Rosa, Guatemala; mixed rural-urban; Nov 2007 - Dec 2008 (McCracken and colleagues)	Census-derived estimate (n=12700)	Cough or difficulty breathing with danger sign (inability to feed or drink, convulsions, lethargic, vomiting) OR SpO_2 <90% in children aged ≥2months and 88% in children aged <2 months	35.8	12.9
Paysandú and Salto, Uruguay; mixed rural-urban; Jan 2009 - Dec 2009 (Hortal and colleagues)	Census-derived estimate (n=20650)	Hospitalised ALRI admitted to intensive care unit	8.8	2.3
Colorado, USA; mixed rural-urban; Jan 2009 - Dec 2009 (Simoes and colleagues)	Census-derived estimate (n=360188)	Colorado Hospital Association (CHA) severity codes 3 and 4	8.8	3.2
Santa Rosa, Guatemala; mixed rural-urban; Jan 2009 - Nov 2010 (McCracken and colleagues)	Census-derived estimate (n=21950)	Cough or difficulty breathing with danger sign (inability to feed or drink, convulsions, lethargic, vomiting) OR SpO_2 <90% in children aged ≥2months and 88% in children aged <2 months	51.1	15.6
Quetzaltenango, Guatemala; mixed rural-urban; Feb 2009 - Nov 2010 (McCracken and colleagues)	Census-derived estimate (n=53030)	Cough or difficulty breathing with danger sign (inability to feed or drink, convulsions, lethargic, vomiting) OR SpO_2 <90% in children aged ≥2months and 88% in children aged <2 months	30	8.9
Yukon Kuskokwim Delta, Alaska, USA; rural; Jul 2009 - Jun 2010 (Singleton and colleagues)	Census-derived estimate (n=1850)	Hospitalised ALRI who were mechanically ventilated	4.7	(1.7)
South-East Asia				
Kathmandu, Nepal; urban; Nov 2004 - Mar 2007[43] ††§§	Census-derived estimate (n=243345)	Tachypnea AND any of the following danger signs: convulsion, lethargy, central cyanosis	(2.2)	0.8

‡‡ All eligible subjects were followed up weekly at home by trained field workers who referred children with findings suggestive of respiratory disease to the community clinics and 70-80% of these were attended by a physician

§§ Rates do not include cases with wheezing or rhonchi without crepitations as these were labelled bronchiolitis

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised very severe ALRI (per 1000 children per year) *†	
			0-11 months	0-59 months
Nakhon Phanom and Sa Kaeo provinces, Thailand; rural; Jan 2004 - Dec 2008 (Baggett and colleagues)	Census-derived estimate (n=427163)	Hospitalised ALRI with SpO_2 <90% or requiring intubation	5.3	1.7
Mirzapur, Bangladesh; rural; Oct 2004 - Sept 2008 (Arifeen and colleagues) **	Defined population base (n=41040)	Hospitalised ALRI with any of danger signs -cyanosis, inability to feed or drink, convulsions	26.7	5.7
Patan, Nepal; urban; Apr 2005 - Dec 2006[44 ††§§]	Census-derived estimate (n=56875)	Tachypnea AND any of the following danger signs: convulsion, lethargy, central cyanosis	(2.6)	0.9
Multicentre, India; rural; Jul 2005 - Mar 2007 (Chandran and colleagues) ‡	Defined population base (n=15460)	Hospitalised ALRI with at least one of the following: feeding difficulty or lethargy or seizure or central cyanosis or head nodding	56.7	(20.4)
Kamalapur, Bangladesh; urban; Jan 2008 - Dec 2008 (Brooks and colleagues) ***	Defined population base (n=4547)	Hospitalised ALRI with danger signs (unable to drink/eat, convulsion, cyanosis, lethargy etc.)	9.6	4.8
Multicentre, Bangladesh; rural; Jan 2008 - Dec 2008 (Azziz-Baumgartner and colleagues)	Defined population base (n=6864)	Hospitalised ALRI and any danger sign (i.e. convulsions, cyanosis, inability to drink or feed, intractable vomiting, lethargy, and mental status changes)	32.5	8.7
Kamalapur, Bangladesh; urban; Jan 2009 - Dec 2010 (Brooks and colleagues) ***	Defined population base (n=7200)	Hospitalised ALRI with danger signs (unable to drink/eat, convulsion, cyanosis, lethargy etc.)	13.5	3.2
Nakhon Phanom and Sa Kaeo provinces, Thailand; rural; Jan 2009 - Dec 2009 (Baggett and colleagues)	Census-derived estimate (n=80240)	Hospitalised ALRI with SpO_2 <90% or requiring intubation	6.5	2.8
Multicentre, Bangladesh; rural; Jan 2009 - Dec 2009 (Azziz-Baumgartner and colleagues)	Defined population base (n=14037)	Hospitalised ALRI and any danger sign (i.e. convulsions, cyanosis, inability to drink or feed, intractable vomiting, lethargy, and mental status changes)	31.1	8.4
Western Pacific Region				
Heilongjiang, China; rural; 1991 - 1993[48]	Census-derived estimate (n=9901)	Hospitalised ALRI and any danger sign (i.e. convulsions, cyanosis, inability to drink or feed, intractable vomiting, lethargy, and loss of consciousness)	(64.3)	23
Shangdong, China; mixed rural-urban; Jan 1992 - Jan 1993[49]	Defined population base (n=16751)	Hospitalised ALRI and any danger sign (i.e. convulsions, cyanosis, inability to drink or feed, intractable vomiting, lethargy, and loss of consciousness)	(1)	0.4
Chongqing, China; mixed rural-urban; Feb 1992 - Jan 1993[14]	Census-derived estimate (n=2246)	Hospitalised ALRI and any danger sign (i.e. convulsions, cyanosis, inability to drink or feed, intractable vomiting, lethargy, and loss of consciousness)	19	6.2
Heilongjiang, China; rural; Jan 1993 - Dec 1993[50]	Census-derived estimate (n=5812)	Hospitalised ALRI and any danger sign (i.e. convulsions, cyanosis, inability to drink or feed, intractable vomiting, lethargy, and loss of consciousness)	(7.2)	2.6
Fujian, China; rural; 1994 - 1995[52]	Census-derived estimate (n=9323)	Hospitalised ALRI and any danger sign (i.e. convulsions, cyanosis, inability to drink or feed, intractable vomiting, lethargy, and loss of consciousness)	(30.7)	11.1

*** All eligible subjects were followed up weekly at home by trained field research assistants who referred children with findings suggestive of respiratory disease to the clinic

Location; population characteristic; study period (reference)	Study population (n)	Case definition	Incidence of hospitalised very severe ALRI (per 1000 children per year) *†	
			0-11 months	0-59 months
Henan, China; rural; Jan 1994 - Dec 1994[17]	Defined population base (n=7917)	Hospitalised ALRI and any danger sign (i.e. convulsions, cyanosis, inability to drink or feed, intractable vomiting, lethargy, and loss of consciousness)	30.7	14.4
Henan, China; rural; Jul 1994 - Jun 1996[53]	Census-derived estimate (n=29590)	Hospitalised ALRI and any danger sign (i.e. convulsions, cyanosis, inability to drink or feed, intractable vomiting, lethargy, and loss of consciousness)	(18.9)	6.8
Fujian, China; mixed rural-urban; Oct 1994 - Sep 1995[16]	Census-derived estimate (n=4665)	Hospitalised ALRI and any danger sign (i.e. convulsions, cyanosis, inability to drink or feed, intractable vomiting, lethargy, and loss of consciousness)	24.1	11.2
Yunnan, China; rural; Jan 1995 - Dec 1997[54]	Census-derived estimate (n=6966)	Hospitalised ALRI and any danger sign (i.e. convulsions, cyanosis, inability to drink or feed, intractable vomiting, lethargy, and loss of consciousness)	(118.4)	42.6
Bohol, Philippines; mixed rural-urban; Jul 2000 - Dec 2004 (Lucero and colleagues) ‡	Defined population base (n=6094)	Child with cough or difficult breathing and central cyanosis or inability to drink	10.3	(3.7)
Suva, Fiji; urban; Jan 2001 - Dec 2002[60‡]	Census-derived estimate (n=20954)	Presence of one or more of the following: cyanosis, SpO_2<90%, altered consciousness, admission to ICU, ventilation, seizures	(12.5)	4.5
NhaTrang district, Vietnam; mixed rural-urban; Apr 2005 - Aug 2006[7]	Census-derived estimate (n=24641)	(i) Cough or difficulty breathing and any pneumonia danger sign (central cyanosis, severe respiratory distress, tachypnea, chest indrawing in children <2 months, inability to feed or drink, vomiting everything, convulsions, prostration/lethargy) and chest X-ray not performed or negative; (ii) Central cyanosis or severe respiratory distress or tachypnea / chest indrawing in a child aged <2months and chest X-ray not performed or negative	8.5	2

Table A5: Incidence of hospitalised severe and very severe ALRI in neonates (aged 0-27 days) from published and unpublished studies by World Health Organization regions

Location; population characteristic; study period (reference)	Incidence of hospitalised ALRI* (per 1000 neonates per year)† 0-27 days	Incidence of hospitalised very severe ALRI (per 1000 neonates per year)† 0-27 days
Africa		
Kassena-Nankana District, Ghana; rural; Jun 1990- Aug 1991 (Morris and colleagues)	161.3	NA‡
Kilifi District, Kenya; rural; Apr 2002 - Dec 2008 (Moisi and colleagues)§	217.8	86.2
Manhiça district, Mozambique; rural; Mar 2004 - Mar 2006 (Roca and colleagues)	58.7	37.6
Lwak, Kisumu, Kenya; rural; Jun 2008 - May 2009 (Breiman and colleagues)	21.2	21.2
Lwak, Kisumu, Kenya; rural; Jun 2009 - May 2010 (Breiman and colleagues)	121.1	121.1
Americas		
Paysandú and Salto, Uruguay; mixed rural-urban; Jun 2001 - May 2004 (Hortal and colleagues)	8.6	1.2
Yukon Kuskokwim Delta, Alaska, USA; rural; Jul 2001 - Jun 2007 (Singleton and colleagues)	200.7	20.1
San Lorenzo & Comitancillo, Guatemala; rural; Dec 2002 - Dec 2004 (Bruce and colleagues)	100.51	100.51
Santa Rosa, Guatemala; mixed rural-urban; Nov 2007 - Dec 2008 (McCracken and colleagues)	20	20
Paysandú and Salto, Uruguay; mixed rural-urban; Jan 2009 - Dec 2009 (Hortal and colleagues)	51.7	11.1
Santa Rosa, Guatemala; mixed rural-urban; Jan 2009 - Nov 2010 (McCracken and colleagues)	116	52.2
Quetzaltenango, Guatemala; mixed rural-urban; Feb 2009 - Nov 2010 (McCracken and colleagues)	28.8	21.6

* ALRI= acute lower respiratory infection
† Data in parentheses are computed incidence estimates from data imputation
‡ NA= Not available
§ Day 0 excluded

Location; population characteristic; study period (reference)	Incidence of hospitalised ALRI* (per 1000 neonates per year)† 0-27 days	Incidence of hospitalised very severe ALRI (per 1000 neonates per year) † 0-27 days
Yukon Kuskokwim Delta, Alaska, USA; rural; Jul 2009 - Jun 2010 (Singleton and colleagues)	119.1	0
South-East Asia		
Lombok, Indonesia; rural; 1999 - 2002 (Gessner and colleagues)	51.3	NA
Matlab, Bangladesh; rural; Jul 1999 - Jun 2001[6]	28.3	NA
Nakhon Phanom and Sa Kaeo provinces, Thailand; rural; Jan 2004 - Dec 2008 (Baggett and colleagues)	58.1	24.8
Kamalapur, Bangladesh; urban; Jan 2008 - Dec 2008 (Brooks and colleagues)	16.2	0
Multicentre, Bangladesh; rural; Jan 2008 - Dec 2008 (Azziz-Baumgartner and colleagues)	264.2	0
Kamalapur, Bangladesh; urban; Jan 2009 - Dec 2010 (Brooks and colleagues)	30.6	10.2
Nakhon Phanom and Sa Kaeo provinces, Thailand; rural; Jan 2009 - Dec 2009 (Baggett and colleagues)	69.3	20.8
Ballabgarh, Haryana, India; rural; Aug 2009 - Jul 2010 (Krishnan and colleagues)	69.4	NA
Multicentre, Bangladesh; rural; Jan 2009 - Dec 2009 (Azziz-Baumgartner and colleagues)	73.4	18.4
Western Pacific		
Fujian, China; mixed rural-urban; Oct 1994 - Sep 1995[16]	134.6	44.9
Western Australia, Australia; mixed rural-urban; 1996-2005[24]	41.5	NA
NhaTrang district, Vietnam; mixed rural-urban; Apr 2005 - Aug 2006[7]	137.3	NA

Table A6: Comparative Incidence of severe and very severe ALRI from studies reporting data using community-based active case ascertainment as well as hospital-based passive case ascertainment

Study	Incidence* of WHO severe pneumonia† in the community (active case ascertainment)	Incidence of hospitalised severe ALRI in the community (passive case ascertainment)	Incidence of WHO very severe disease‡ in the community (active case ascertainment)	Incidence of hospitalised very severe ALRI (passive case ascertainment)
Lwak, Kisumu, Kenya; rural; Jun 2008 - May 2009 (Breiman and colleagues)	140.8	98.9	32.3	21.3
Lwak, Kisumu, Kenya; rural; Jun 2008 - May 2009 (Breiman and colleagues)	129.2	86	51.1	31.6
San Lorenzo & Comitancillo, Guatemala; rural; Dec 2002 - Dec 2004 (Bruce and colleagues)§	(55.3)**	(18.4)	(52.4)	(18.4)
Mirzapur, Bangladesh; rural; Oct 2004 - Sept 2008 (Arifeen and colleagues)	108.3	19	20.3	5.7
Kamalapur, Bangladesh; urban; Jan 2008 - Dec 2008 (Brooks and colleagues)	47.7	24	5.5	4.8
Kamalapur, Bangladesh; urban; Jan 2009 - Dec 2010 (Brooks and colleagues)	43.7	21	3.8	3.2

* Incidence rates are per 1000 children per year

† WHO severe pneumonia= Children aged 2-59 months- cough or difficulty in breathing with lower chest wall indrawing; Children aged <2months- increased respiratory rate (>60 breaths/ minute) OR lower chest wall indrawing

‡ WHO very severe disease= Cough or difficulty breathing with at least one danger sign (cyanosis, difficulty in breastfeeding or drinking, vomiting everything, convulsions, lethargy, or unconsciousness, head nodding)

§ Passive facilitated referral

** Data in parentheses are imputed estimates

Table A7: Details of the 37 studies reporting in-hospital case fatality ratios in children (0-59 months) hospitalised for severe ALRI

Location (reference)	Study Period	CFR (%)
Africa		
Kassena-Nankana District, Ghana (Morris and colleagues)	Jun 1990 - Aug 1991	3.3
Soweto, South Africa (Madhi and colleagues)	Mar 1998 - Oct 2005	6.2
Bondo district, Kenya[10]	Jan 2001 - Dec 2003	11.0
Kilifi District, Kenya (Moisi and colleagues)	Apr 2002 - Dec 2008	9.5
Upper River Division and Central River Division, The Gambia (Zaman and colleagues)	Feb 2002-Apr 2004	12.0
Manhiça district, Mozambique (Roca and colleagues)	Mar 2004 - Mar 2006	8.7
Bondo district, Kenya (Ope and colleagues)	Jun 2007 - May 2009	4.3
Lwak, Kisumu, Kenya (Breiman and colleagues)	Jun 2008 - May 2009	1.5
Kibera, Nairobi, Kenya (Breiman and colleagues)	Jun 2008 - May 2009	1.4
Upper River region, The Gambia (Mackenzie and colleagues)	12 May 2008 - 11 May 2009	3.7
Soweto, South Africa (Cohen and colleagues)	Feb 2009- Jan 2010	0.8
Lwak, Kisumu, Kenya (Breiman and colleagues)	Jun 2009 - May 2010	1.0
Kibera, Nairobi, Kenya (Breiman and colleagues)	Jun 2009 - May 2010	0.6
Americas		
USA[20]	1997-2004	0.2
Paysandú and Salto, Uruguay (Hortal and colleagues)	Jan 2000 - Dec 2004	0.3
Goiânia, Brazil (Andrade and colleagues)	May 2000 - Aug 2001	1.1
Colorado, USA (Simoes and colleagues)	Jan 2000 - Dec 2008	0.6
Concordia and Parana, Argentina (Ruvinsky and colleagues)	Nov 2002 - Oct 2005	1.1
Pilar, Argentina (Gentile and colleagues)	Jan 2003 - Dec 2005	0.2
Goiânia, Brazil (Andrade and colleagues)	May 17 2007 - May 16 2009	0.3
Santa Rosa, Guatemala (McCracken and colleagues)	Nov 2007 - Dec 2008	4.8
Multicentre, El Salvador (Clara and colleagues)	Jan 2007- Dec 2007	1.1
Paysandú and Salto, Uruguay (Hortal and colleagues)	Jan 2009 - Dec 2009	5.1
Colorado, USA (Simoes and colleagues)	Jan 2009 - Dec 2009	0.8
Santa Rosa, Guatemala (McCracken and colleagues)	Jan 2009 - Nov 2010	5.0
Quetzaltenango, Guatemala (McCracken and colleagues)	Feb 2009 - Nov 2010	3.5
Eastern Mediterranean		
Sana'a, Yemen[61]	Jan1991-Dec 1995	8.7
Karachi, Pakistan[5]	Feb 2007- May 2008	3.7
Europe		
Spain[32]	Jan 1995 - Dec 1996	0.4
South East Asia		
Matlab, Bangladesh[40]	May 1988 - Apr 1989	7.4
Lombok, Indonesia (Gessner and colleagues)	1999 - 2002	11.0

Mirzapur, Bangladesh (Arifeen and colleagues)	Oct 2004 - Sept 2008	2.2
Multihospital surveillance, Bangladesh (Naheed and colleagues)	May 2004 - Apr 2008	8.0
Patan, Nepal[44]	Apr 2005 - Dec 2006	2.2
Multicentre, India (Chandran and colleagues)	Jul 2005 - Mar 2007	0.3
Nakhon Phanom and Sa Kaeo provinces, Thailand (Baggett and colleagues)	Jan 2006 - Dec 2008	0.8
Bangalore, India[45]	Jan 2006 - Dec 2006	5.8
Kamalapur, Bangladesh (Brooks and colleagues)	Jan 2008 - Dec 2008	0.9
Nakhon Phanom and Sa Kaeo provinces, Thailand (Baggett and colleagues)	Jan 2009 - Dec 2009	0.4
Kamalapur, Bangladesh (Brooks and colleagues)	Jan 2009 - Dec 2009	0.7
Western Pacific		
Bohol, Philppines (Lucero and colleagues)	Jul 2000 - Dec 2004	1.6
NhaTrang district, Vietnam[7]	Apr 2005 - Aug 2006	2.6
Suva, Fiji [60]	Jan 2001 - Dec 2002	2.8

Table A8: Details of the 16 studies reporting in-hospital case fatality ratios in children (0-59 months) hospitalised for very severe ALRI

Location (reference)	Study Period	CFR (%)
Africa		
Soweto, South Africa (Madhi and colleagues)	Mar 1998 - Oct 2005	8.7
Kilifi District, Kenya (Moisi and colleagues)	Apr 2002 - Dec 2008	19.0
The Greater Banjul area and Upper River region, The Gambia (Mackenzie and colleagues)	12 May 2008 - 11 May 2009	3.6
Lwak, Kisumu, Kenya (Breiman and colleagues)	Jun 2008 - May 2009	2.1
Lwak, Kisumu, Kenya (Breiman and colleagues)	Jun 2009 - May 2010	0.9
Americas		
Concordia and Parana, Argentina (Ruvinsky and colleagues)	Nov 2002 - Oct 2005	9.1
Pilar, Argentina (Gentile and colleagues)	Jan 2003 - Dec 2005	2.6
Goiânia, Brazil (Andrade and colleagues)	May 17 2007 - May 16 2009	6.7
Colorado, USA (Simoes and colleagues)	Jan 2000 - Dec 2008	3.5
Santa Rosa, Guatemala (McCracken and colleagues)	Nov 2007 - Dec 2008	3.0
Santa Rosa, Guatemala (McCracken and colleagues)	Jan 2009 - Nov 2010	6.4
Quetzaltenango, Guatemala (McCracken and colleagues)	Feb 2009 - Nov 2010	3.4
Paysandú and Salto, Uruguay (Hortal and colleagues)	Jan 2009 - Dec 2009	2.1
Colorado, USA (Simoes and colleagues)	Jan 2009 - Dec 2009	4.4
South East Asia		
Nakhon Phanom and Sa Kaeo provinces, Thailand (Baggett and colleagues)	Jan 2006 - Dec 2008	13.4
Multicentre, India (Chandran and colleagues)	Jul 2005 - Mar 2007	0.4
Mirzapur, Bangladesh (Arifeen and colleagues)	Oct 2004 - Sept 2008	6.0
Multihospital surveillance, Bangladesh (Naheed and colleagues)	May 2004 - Apr 2008	14.5
Nakhon Phanom and Sa Kaeo provinces, Thailand (Baggett and colleagues)	Jan 2009 - Dec 2009	6.3
Western Pacific		
Bohol, Philppines (Lucero and colleagues)	Jul 2000 - Dec 2004	8.8

VI. Additional Figures

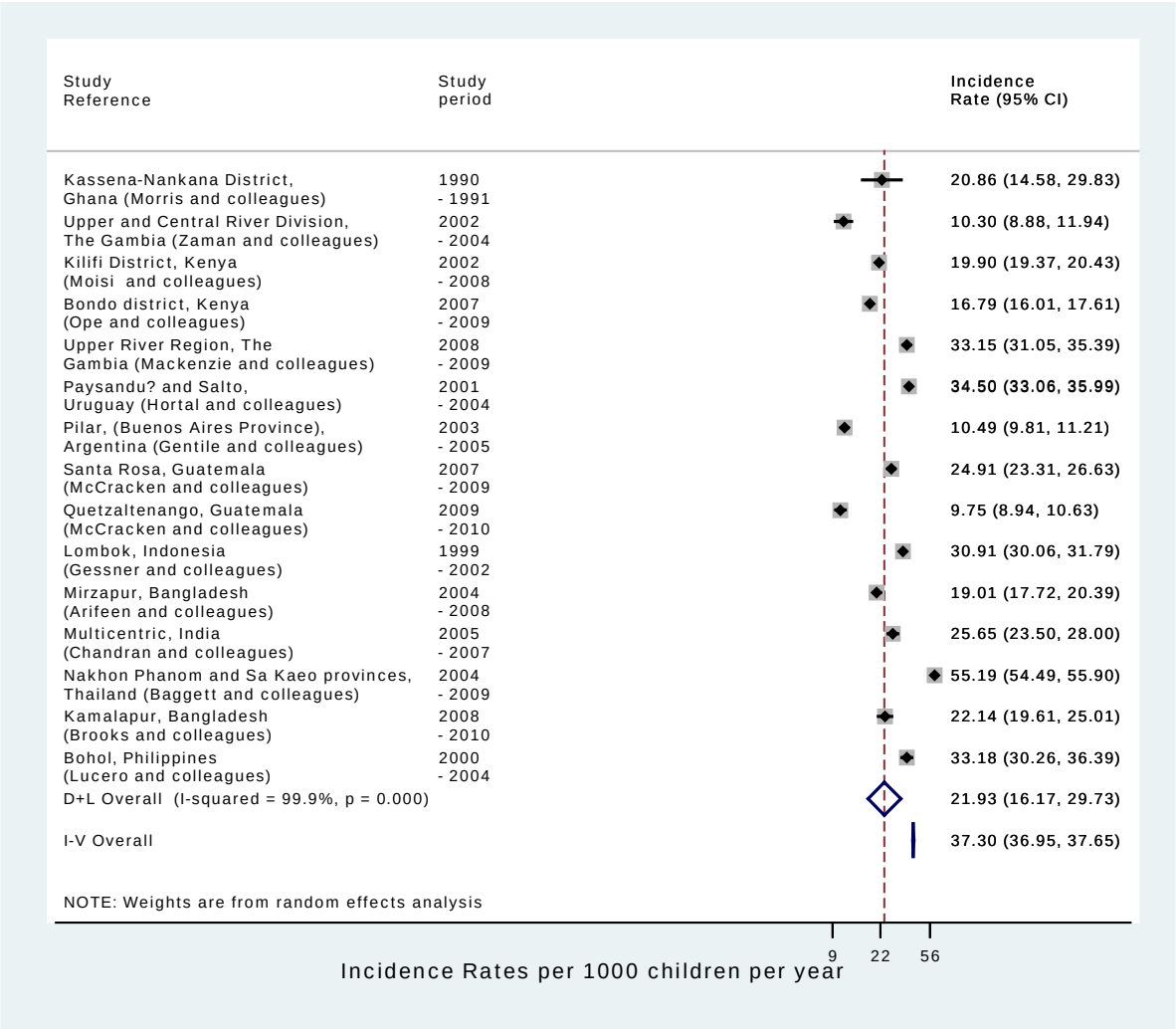

Figure A1: Incidence of hospitalised severe ALRI (per 1000 children per year) in children aged 0-4 years with / without lower chest wall indrawing

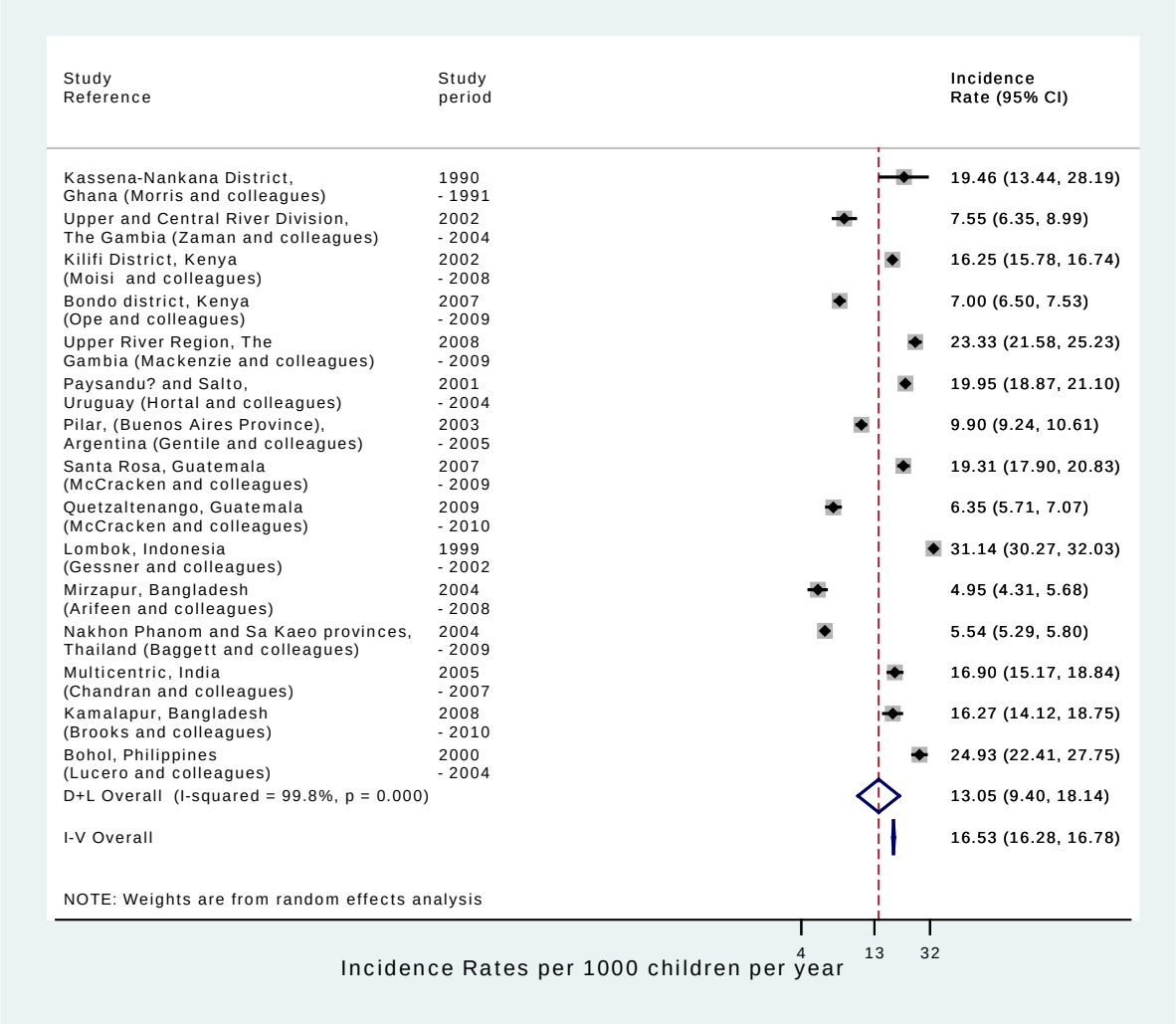

Figure A2: Incidence of hospitalised severe ALRI (per 1000 children per year) in children aged 0-4 years with lower chest wall indrawing

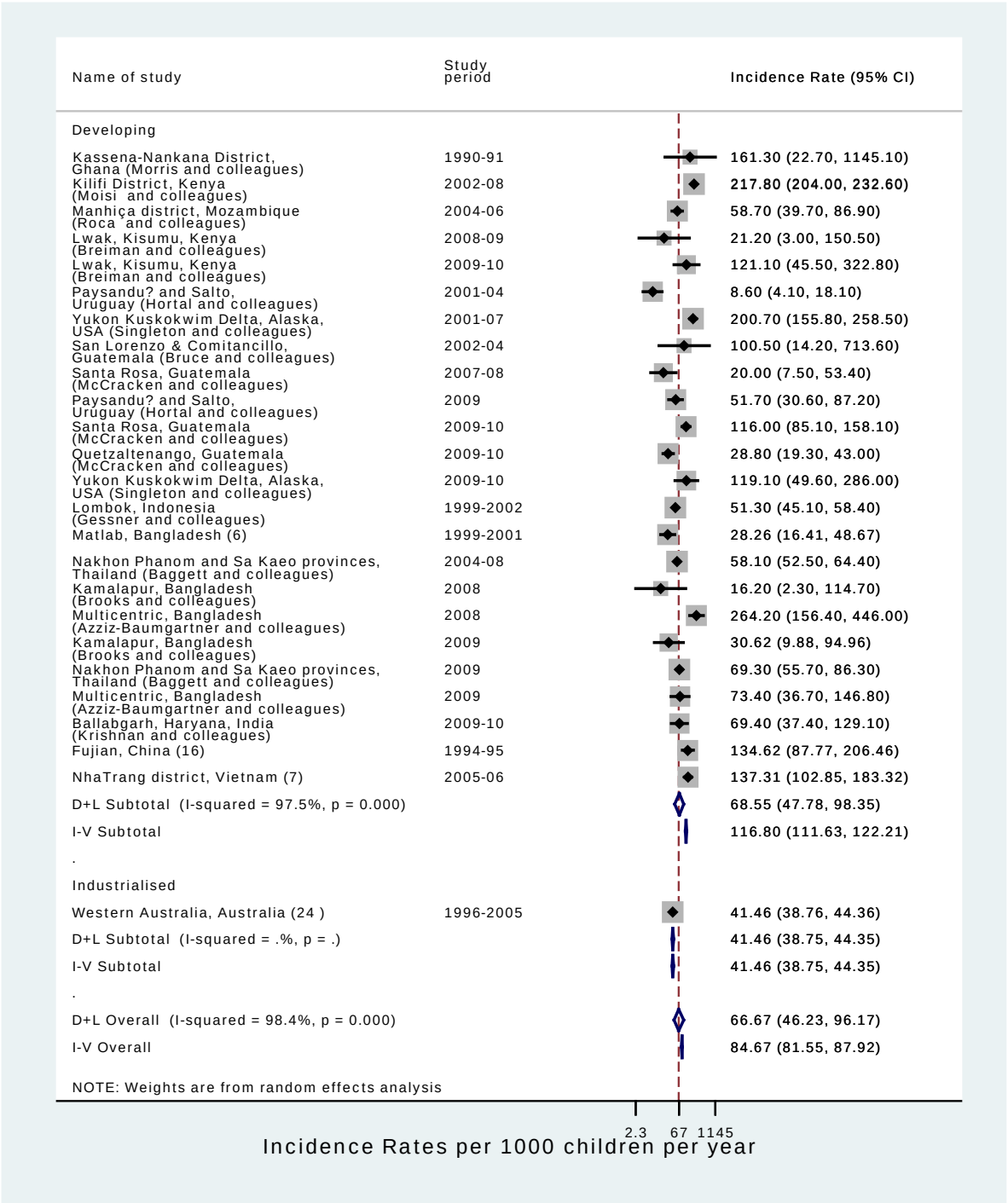

Figure A3: Incidence of hospitalised severe ALRI in children aged 0-27 days

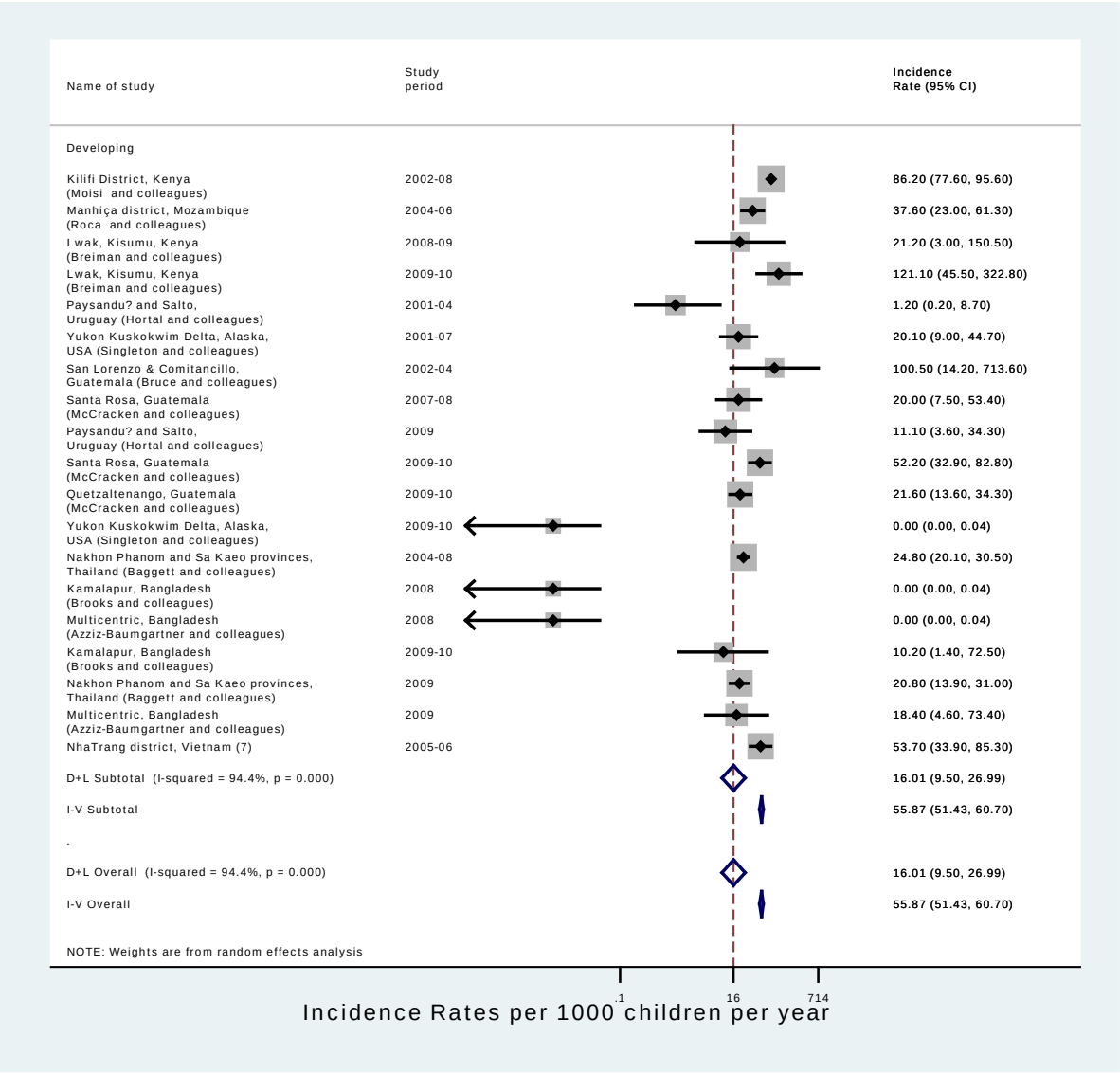

Figure A4: Incidence of hospitalised very severe ALRI in children aged 0-27 days

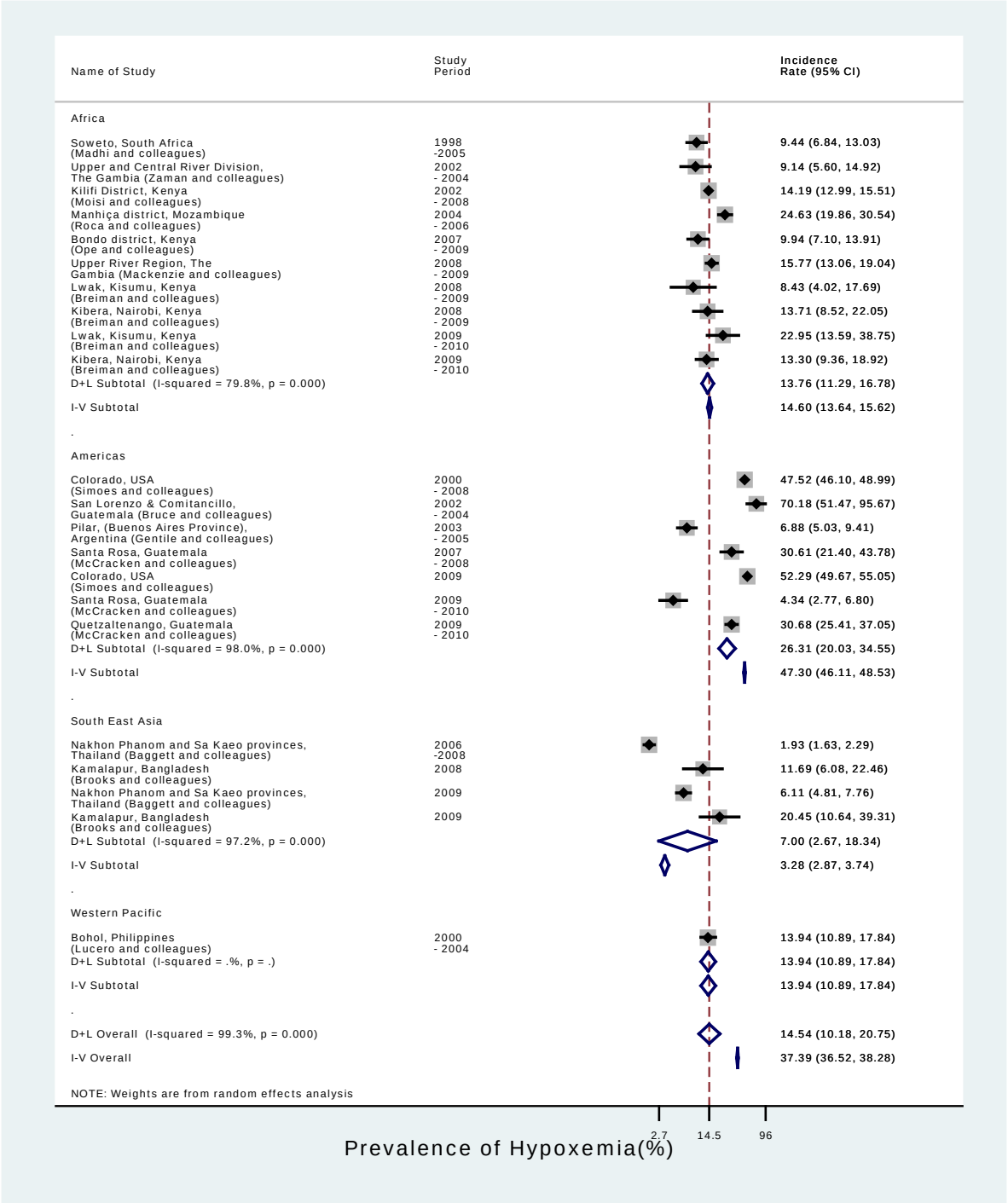

Figure A5: Prevalence of hypoxemia in children aged 0-11 months hospitalised for severe ALRI (n=22 studies)

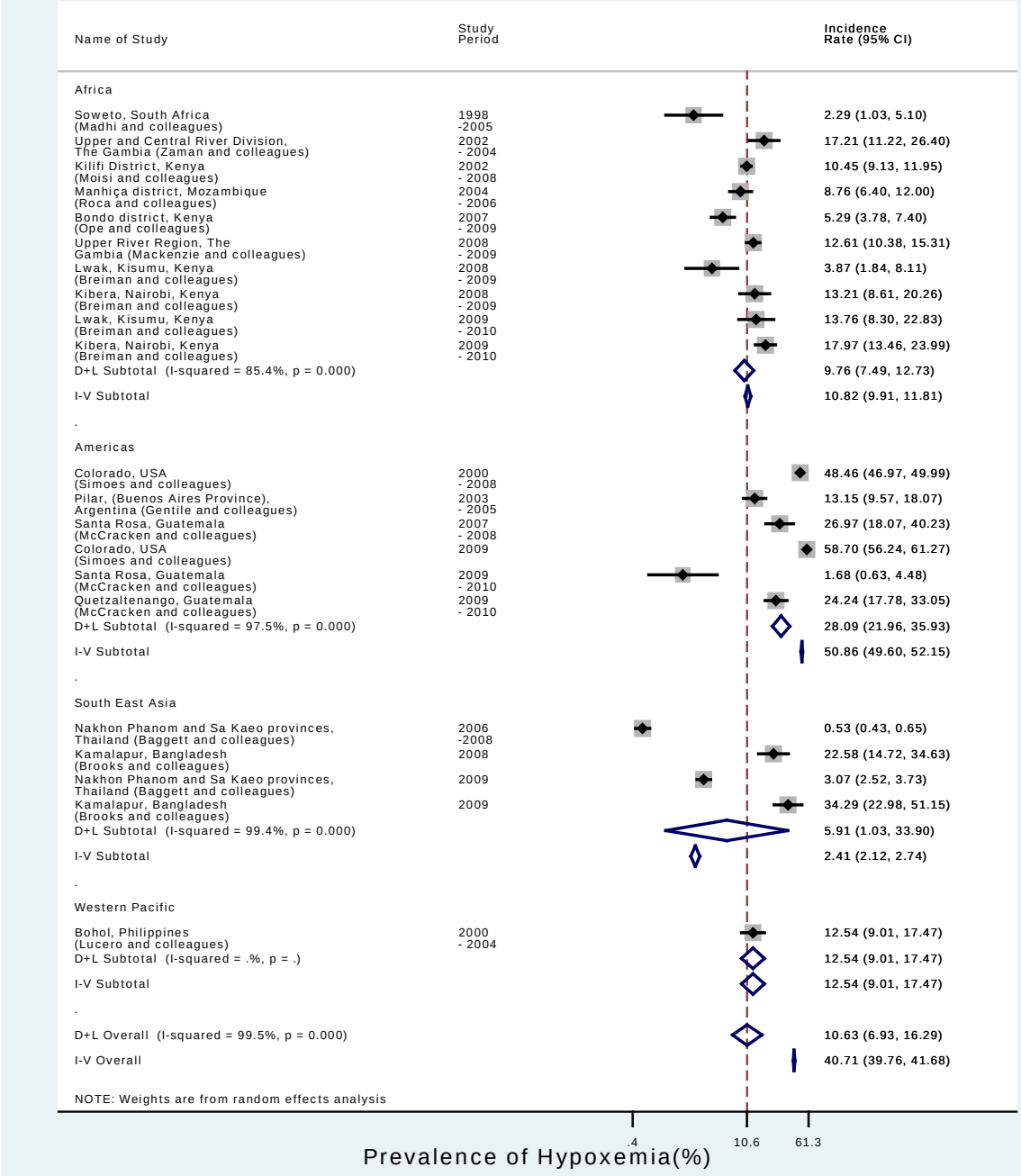

Figure A6: Prevalence of hypoxemia in children aged 12-59 months hospitalised for severe ALRI (n=21 studies)

Figure A7: Relationship between incidence of hospitalised severe ALRI and in-hospital CFR in Africa

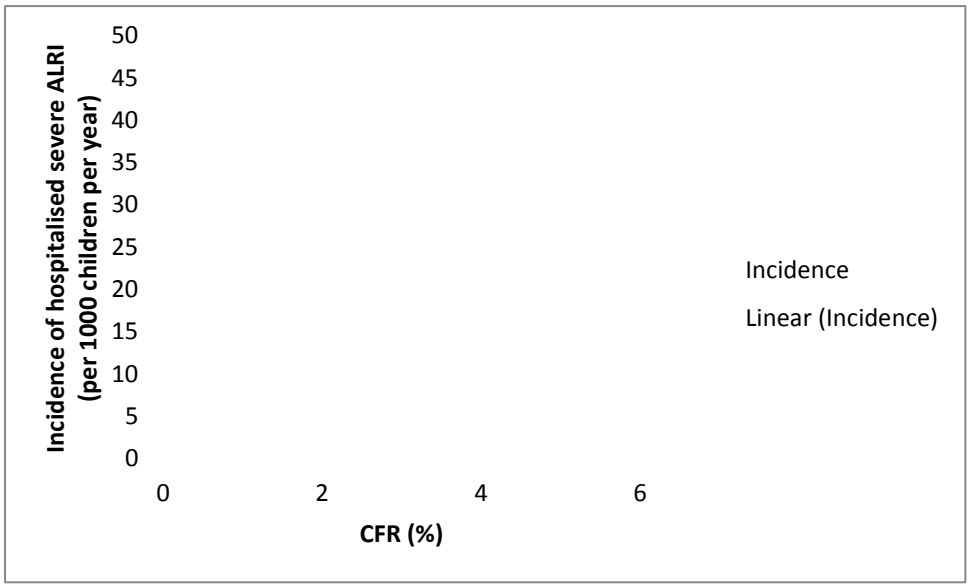

Figure A8: Relationship between incidence of hospitalised severe ALRI and in-hospital CFR in Americas

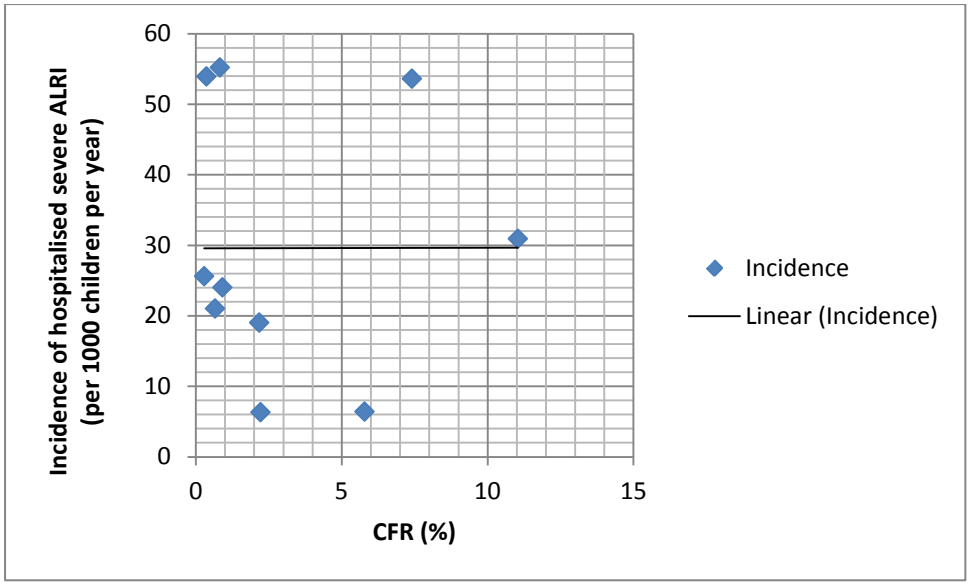

Figure A9: Relationship between incidence of hospitalised severe ALRI and in-hospital CFR in South-East Asia

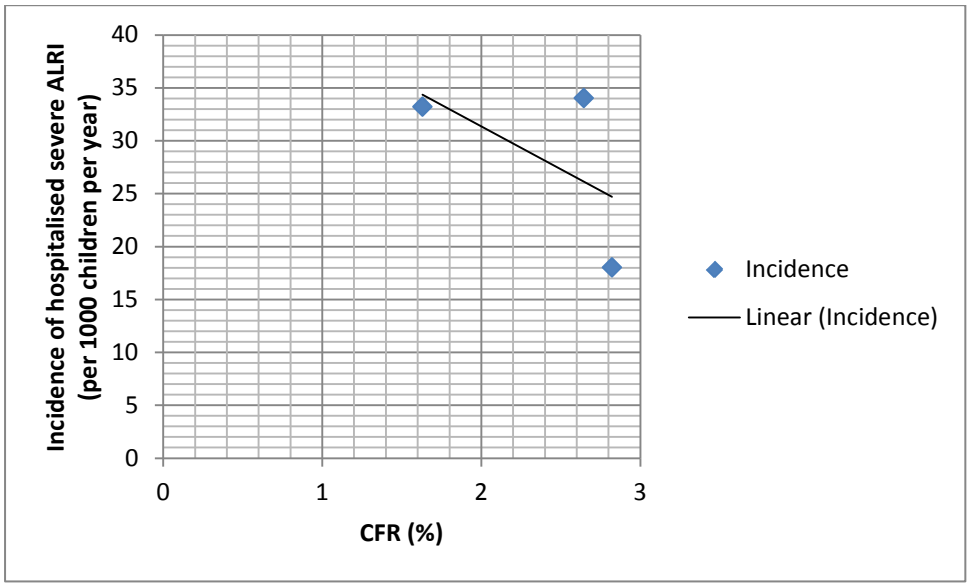

Figure A10: Relationship between incidence of hospitalised severe ALRI and in-hospital CFR in Western Pacific Region

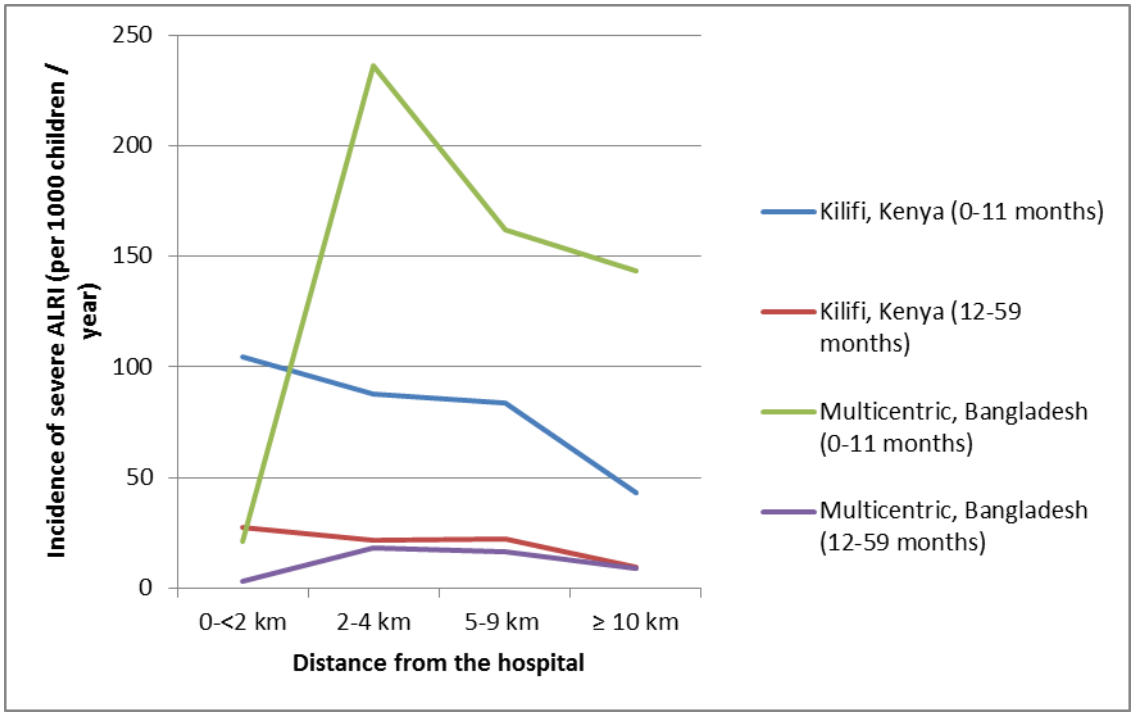

Figure A11: Variation in incidence (per 1000 children per year) of hospitalised severe ALRI by distance from hospital in children aged below 5 years

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