

Metropolitan Auckland Measles Hospitalisations and Complications Interim Report

Introduction

The current measles outbreak is the largest in two decades in New Zealand and the proportion of people hospitalised in this outbreak, at 35-40%, is higher than anticipated (usually about 10% of cases are hospitalised). To further investigate the hospitalisation rate the Metropolitan Auckland Measles Incident Management Team (IMT) has, using the latest available data, reviewed cases of measles that have been hospitalised since the beginning of the outbreak in February 2019.

Analyses of hospitalisations, if conducted, are usually undertaken on routinely available data (coded data) some time after the outbreak has ended. This report is therefore an interim report to provide the IMT with information about the impact of measles. There is high public and media interest in people who have been hospitalised with measles, particularly children. This reflects a growing public awareness that measles is not a trivial illness, and that serious complications including death are likely given the magnitude of the outbreak. The scale of this outbreak indicates that there is insufficient population level immunity to stop widespread transmission of measles, including to those people unable to be immunised due to age or other medical conditions.

Hospitalisations (ESR data)

The metro Auckland region has been using a count of measles cases as per ESR (EpiSurv) reporting since early September, rather than the previous notifications reported to Auckland Regional Public Health Service (ARPHS) from the case management system NDCMS. Using ESR data allows national consistency in reporting of counts, although there is more potential for a lag as the data completion for metro Auckland region cases in EpiSurv cases is only assured once cases are 'closed' by ARPHS. This does not substantially affect overall counts of 'confirmed' cases (because these are inputted through direct laboratory notification) but will have some impact on data that are gathered through ARPHS case scoping, including hospitalisations.

For the purpose of consistency the metro Auckland IMT has developed a report on cases based on ESR data, broken down by age band, ethnicity and DHB, and has calculated hospitalisations for this cohort. Using this approach, there have been 1,064 cases and 380 hospitalisations as of 17 September 2019 (see Table 1 below).

Table1. Count of measles cases and hospitalisations by age group and DHB of domicile

Age group	Cases				Hospitalisations				%*
	WDHB	ADHB	CMDHB	Total	WDHB	ADHB	CMDHB	Total	
0-4	44	42	245	331	30	17	126	173	52%
5-14	13	3	71	87	3	2	10	15	17%
15-29	87	77	326	490	39	26	87	152	31%
30+	33	29	94	156	12	9	19	40	26%
Total	177	151	736	1,064	84	54	242	380	36%

* Note: Proportion of cases that are hospitalised by age band

The number of hospitalisations is highest for 0-4 year olds at 173 cases, followed by 15-29 year olds at 152 cases. **Overall the hospitalisation rate is 36%**; however by age band it is much higher for **0-4 year olds with 52% hospitalised**. Hospitalisation rates also vary by DHB of Domicile with Counties Manukau DHB hospitalisations at 50%, Waitematā DHB at 47% and Auckland DHB at 35%.

The measles case rate (Table 2 below) is highest for the 0-4 years olds, followed by 15-29 year olds. Table 3 below shows that Pacific are disproportionately affected followed by Māori. Nearly half of the hospitalisations have been Pacific, and 41% of Māori and 37% of Pacific cases are hospitalised – this reflects the higher number of cases in 0-4 year olds for Pacific and Māori, and the associated hospitalisation rates as noted.

Table 2. Measles case rates by age band and DHB of Domicile per 1,000 population

Age group	WDHB	ADHB	CMH	Total
0-4	1.1	1.5	5.9	3.0
5-14	0.2	0.1	0.9	0.4
15-29	0.6	0.5	2.5	1.2
30+	0.1	0.1	0.3	0.2

Table 3. Measles cases and hospitalisations by ethnicity

Ethnicity*	Cases			Hospitalisations		
	Number	% total cases	Rate per 1,000 population	Number	% total hospitalisations	% cases by ethnicity that have been hospitalised
Pacific	496	47%	2.2	183	48%	37%
Māori	258	24%	1.3	106	28%	41%
Euro/Other	229	22%	0.3	70	18%	31%
Asian	81	8%	0.2	21	6%	26%
Total	1,064			380		

* Note: Ethnicity is Prioritised rather than Total Response which has previously been reported

Assessment of measles severity using hospitalisations with complications (NDCMS data)

For the remainder of the report data are based on hospitalisations from NDCMS (Auckland Regional Public Health Service (ARPHS) case and contact management database), updated Wednesday 11 September 2019. This data source was used as it provides more up to date data than closed cases from ESR data (several weeks lag), particularly with the escalation of cases and hospitalisations that has occurred in more recent weeks. The NDCMS data on notified cases with a hospitalisation recorded was cross checked against hospital data sources for confirmation (one was removed as not a case; another viral illness) and to assess complications. The data was checked against each of the three metropolitan Auckland DHBs (for the majority of cases this was via coding; where coding was not available then discharge summaries and notes review were undertaken).

The data on hospitalisations includes some of the Emergency Department (ED) presentations using a standard definition of hospitalisation of more than 3 hours in ED. The dataset for this report therefore includes the spectrum of those who stayed in ED but may not have been admitted overnight as well as those admitted to a ward and those who needed ICU support. The data does not include the number of cases who presented to ED, were assessed and may have had a swab taken to check for measles, and were subsequently discharged under 3 hours.

The hospitalisations reported for notified cases may underestimate the hospitalisation rate as it does not necessarily include those for whom there was a community (e.g. GP) notification where ARPHS gathered information at the time, and then there was a subsequent hospitalisation event. All hospital admission data would have to be analysed to find these cases, which may be undertaken as a specific analysis at the end of this outbreak.

Although all cases that presented to hospital were considered to be moderate severity; hospitalisations were further categorised into uncomplicated and complicated. Complicated cases included known severe complications such as encephalitis and pneumonia as well as admissions for symptoms such as conjunctivitis, dehydration and pain.

Using NDCMS data, since January 2019 there have been 465 hospitalisations for 423 individuals, which is higher than the 380 reported using ESR data for the reasons outlined. Table 4 and 5 shows this data by ethnicity, age band and DHB of Domicile.

Using DHB of Domicile (Table 4) Counties Manukau DHB has the largest number of people hospitalised (admissions and ED attendances) for measles with 267 so far this year, while Auckland DHB has 60 and Waitemata DHB has 90 – with 6 cases admitted to a metro Auckland hospital but from elsewhere in the country. However, some of these patients attended more than once before measles was diagnosed; the other attendances are not included. The largest numbers of hospitalisations were for 0-4 year olds and for 15-29 year olds (Table 5); and for Pacific and Māori when examined by ethnicity (Table 4; similar proportions to the ESR data reported in Table 3).

Overall those hospitalised with measles were classified as being **complicated for 22%** (as shown in Table 6); however by age band **28% of 0-4 year olds** had a complication compared with 17% of >5 year olds. Overall **27% of cases in Auckland DHB** are complicated compared to 20-22% for Waitemata DHB and Counties Manukau DHB.

Table 6 shows that for the approximately 1,000 measles cases reported in the metro Auckland region there have been **3 cases of encephalitis** (all in children <4 years old and all of whom also had pneumonia) and **65 cases of pneumonia** (most cases of pneumonia have been in 0-4 year olds). Similar to the background hospitalisation rate, the rate for the main measles complications is higher than the 'expected' event rate of 1:1,000 cases with encephalitis and 1:20 cases with pneumonia.

Table 6 also shows that there have been **five recorded cases of pregnant women** admitted with measles, with **two fetal losses associated** with the hospitalisations. Both fetal losses occurred in the second trimester. One fetal loss was associated with a range of other complications. The maternal age band has been further aggregated in Table 6, and the time period, weeks' gestation and DHB of these events have not been reported as they are potentially identifiable, in order to protect patient privacy. The fetal loss events were not recorded as cases of measles and therefore were not notified to ARPHS. For this report the cases have been assessed by an ARPHS Medical Officer of Health and

determined to not meet the measles case definition; they have been **classified as serious complications potentially related to maternal measles**. 'Related to' does not denote causality, this is unable to be determined. Miscarriage, preterm birth and low birth weight are known potential complications of maternal measles. Unlike Rubella there is no evidence of congenital malformation associated with measles in pregnancy.

Table 4. Hospitalisations by DHB of domicile and ethnicity

Ethnicity	WDHB	ADHB	CMDHB	Other	Grand Total
Pacific	23	34	143	1	201
Māori	37	6	84	3	130
Euro/Other	26	13	22	1	62
Asian	4	7	18	1	30
Grand Total	90	60	267	6	423

Table 5. NDCMS data hospitalisations by ethnicity and age band

Age band	Pacific	Māori	Euro/Other	Asian	Grand Total
0-4	108	54	13	12	187
5-14	9	7	1		17
15-29	69	59	30	12	170
30+	15	10	18	6	49
Grand Total	201 (48%)	130 (31%)	62 (15%)	30 (7%)	423

Table 6. Uncomplicated and complicated hospitalisations by age band

Age band #	Uncomplicated	Complicated						Grand Total
		Encephalitis *	Pneumonia	Intestinal	Other **	Pregnancy	Pregnant with fetal loss	
0-4	134	3	39		11			187
5-29	155		20	1	6	3	2	187
30+	42		6		1			49
Subtotal	331	3	65	1	18	3	2	423
Grand total	331 (78%)	92 (22%)						

Note: Age bands have been further aggregated to protect patient privacy

* Note: The three cases of encephalitis all also had pneumonia.

** Note: 'Other' complications include: breathing difficulty not diagnosed as pneumonia, conjunctivitis, ear infections, dehydration, and two cases recorded as abdominal pain later confirmed as measles.

Table 7. Uncomplicated and complicated hospitalisations by DHB of domicile

DHB of domicile	Uncomplicated	Complicated	Grand Total	% complicated
WDHB	70	20	90	22%
ADHB	44	16	60	27%
CMDHB	214	53	267	20%
Other	3	3	6	
Total	331	92	423	

In total to date this year there have been **908 bed days** and **935 ICU** hours for hospitalised measles cases. Uncomplicated cases have a 1.3 day average Length of Stay (LOS), while **complicated cases have a 4.5 day** average LOS. The cases of pneumonia have the highest total ICU hours and total bed days, followed by encephalitis. Cases of encephalitis however have the longest length of stay (LOS) at an average of 16.0. Even uncomplicated cases account for nearly half of the total bed days if they stay longer than one day.

The **average daily bed occupancy** across the region for measles since March 2019 is **4.6**.

Table 8. Measles hospitalisation parameters by complexity

Complexity	Main diagnoses	Total bed days	Average of length of stay (LOS)	Total ICU hours
Complicated	Pneumonia	320	4.9	526
	Encephalitis (with pneumonia)	48	16.0	357
	Other	81	3.1	52
Complicated subtotal		449	4.5	935
Uncomplicated subtotal		459	1.3	
Grand Total		908	2.0	935

Table 9. Measles hospitalisations split by complexity and Length of Stay (LOS)

Complexity	LOS category	Total bed days	Average LOS	Total ICU hours
Uncomplicated	0-1 day	77	0.3	
	>1 day	382	3.6	
Complicated	0-1 day	12	0.6	22
	>1 day	437	5.5	913

Hospitalisation rate comment

Previous hospitalisation rates have been approximately 10% for measles outbreaks, consistent with overseas evidence. This outbreak has seen a hospitalisation rate of 35-40%. It is noted that for the 2014 large measles outbreak in New Zealand a paper did report a higher than expected hospitalisation rate of 23% although this was only related to 26 hospitalised cases.¹ Similar to this analysis the definition of hospitalisation included ED presentations that were not then admitted overnight. This could potentially inflate the hospitalisation rate. Some international jurisdictions (eg France and elsewhere in Europe) are also reporting higher hospitalisation rates than in previous outbreaks.

There is no evidence internationally that the current measles strains causing outbreaks are more virulent than previously. It is likely that the higher hospitalisation rate seen so far in this outbreak is a combination of a high number and rate of cases being in children aged 0-4 years old who consequently have a very high hospitalisation rate (52%), as well as counting ED presentations (over 3 hours stay) alongside admissions.

Interim Report Summary

- Children aged 0-4 years are disproportionately affected by the measles outbreak (3.0 cases per 1,000 population), as are 20-24 year olds (1.6 per 1,000) and 15-19 year olds (1.3 per 1,000)
- Pacific are disproportionately affected by the measles outbreak (2.2 cases per 1,000 population) as are Māori (1.3 per 1,000 population) compared to NZ European/Other (0.3 per 1,000 population) and Asian (0.2 per 1,000 population)
- Of the 1,064 confirmed measles cases (ESR data) 380 have been hospitalised; 36% overall. This is higher than the 'expected' hospitalisation rate of 10% in previous outbreaks
 - Hospitalisation is higher for 0-4 year olds (52%)
 - Hospitalisation is higher for Māori (41%) and for Pacific (37%)
 - Counties Manukau DHB has the largest number of hospitalisations and proportion hospitalised (50%) while Auckland DHB has the highest proportion of hospitalisations categorised as complications (27%) compared to 20-22% at Waitematā DHB and Counties Manukau DHB.
- Of the 423 recorded hospitalisations using the most up to date data (NDCMS), 22% (92) have been categorised as complicated
- Both the proportion hospitalised, and the number of hospitalisations related to known complications (see below) are higher than previous outbreaks and higher than 'expected' (encephalitis 1:1,000 and pneumonia 1:20)
 - The most common complication is pneumonia where there have been 65 hospitalisations (1:16)
 - There have also been three hospitalisations for encephalitis, all three of which have also had pneumonia (1:350)
- Although there have not been any deaths of measles cases, it is noted that there have been five pregnant woman hospitalised and two fetal losses associated with these events. These events are not measles cases, however they have been classified as serious complications potentially related to maternal measles

¹ See Reynolds et al 2015: <https://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2015/vol-128-no-1422-25-september-2015/6666>