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Infectious Disease Notification Practices in Victoria, 2016–17

Cassidy K Nelson, Lucinda J Franklin and Katherine B Gibney

Abstract

Introduction

Infectious disease surveillance in Victoria, Australia is based upon a legislated requirement for doctors and laboratories to notify suspected or diagnosed cases of specific conditions to the Department of Health and Human Services (DHHS). The department undertakes regular audits of notification practices in Victoria typically every two years. The objective of this particular audit was to describe notification practices in 2016 and 2017, assess the effect of enhanced surveillance programs (ESPs) on Indigenous status data completeness and provide a baseline assessment that can be used to monitor the impact of a recent legislative change to notification requirements for several of the notifiable diseases which came into effect on 1 September 2018.

Methods

Notified cases reported to DHHS between 1 January 2016 and 31 December 2017 which met the confirmed and probable national case definitions were analysed by year, notifier type (doctor-only, laboratory-only, or both) and condition category (urgent versus routine). For three notifiable conditions (gonococcal infection and hepatitis B and hepatitis C of unspecified duration) Indigenous status completeness was compared pre- and post ESP commencement.

Results

The number of notified cases in Victoria increased 50% from 76,904 in 2016 to 115,318 in 2017 with a 277% increase in notified influenza alone. Almost half of cases were notified by both laboratory and doctor. Indigenous status was more likely to be complete following the introduction of ESPs (relative risk, RR 1.36 (95%CI: 1.33 – 1.40) $p < 0.001$).

Discussion

DHHS Victoria experienced a 1.5-fold increase in notified cases in 2017 compared with 2016, which was almost entirely attributable to influenza. For three notifiable conditions which had ESPs introduced during this period, Indigenous status reporting significantly improved. Indigenous identifiers on pathology request forms and data linkage are both interventions which are being considered to improve Indigenous status reporting in Victoria.

Keywords: public health surveillance; disease notification; communicable disease control; notifiable conditions; Indigenous population; notification practices; enhanced surveillance program; Victoria

Introduction

Public health surveillance is the ongoing systematic gathering and collation of data for analysis so that information can be communicated and public health action undertaken.¹ In Victoria, under the *Public Health and Wellbeing Act 2008* (the Act), both doctors and pathology laboratories are required to notify DHHS on suspicion or diagnosis of more than seventy conditions specified in Schedule 4 of the Public Health and Wellbeing Regulations 2009 (the Regulations). More than sixty of these conditions are nationally notifiable with standardised case definitions specifying the laboratory, clinical and/or epidemiological evidence required for confirmed and probable case classification.² As the main source of data input in Victorian disease surveillance, doctor and laboratory notifiers serve a fundamental role in outbreak detection, public health interventions and the development of new health programs.

The Act and Regulations categorise the notifiable conditions in Victoria into four groups (A, B, C and D) based on the notification timeframe, information and public health action required. For all conditions, both doctors and laboratories must provide case name, date of birth and address details, with doctors also required to supply Indigenous status and some group-specific clinical information. The Group A conditions require immediate same-day telephone notification on diagnosis or suspicion by both notifier types. This legislated timeframe facilitates prompt public health action, such as vaccine administration to measles case contacts. Group B-D conditions require written notification (via facsimile, post or online) within five days of diagnosis.

Upon receipt at DHHS, notifications are manually entered into the Public Health Event Surveillance System (PHESS) with the exception of chlamydial infection notifications which, since 2013, have been bulk entered using a semi-automated electronic laboratory reporting (ELR) system.³ Active case follow-up by DHHS staff is undertaken for all Group A conditions

and Group B-D conditions that meet pre-defined criteria. A de-identified core dataset of nationally notifiable diseases is forwarded to the National Notifiable Diseases Surveillance System (NNDSS) on a daily basis by DHHS, with the exception of HIV for which data are forwarded to the Kirby Institute quarterly.⁴

Six previous audits of the Victorian surveillance system have been completed from 2004 to 2013.^{5–10} While state legislation requires both doctors and laboratories to notify cases, previous audits found only 42.5–52% of cases were ‘dual notified’ by both doctor and laboratory with 47–49% notified by only a laboratory. Indigenous status was complete in only 44.9–48% of cases in previous audits partially because, unlike doctors, laboratories are not legislatively required to report case Indigenous status nor include Indigenous identifiers on pathology forms.¹¹

To address low Indigenous status reporting, in 2009 the Communicable Diseases Network Australia (CDNA) set a data completeness target for Indigenous status in all Australian states and territories of $\geq 95\%$ for eighteen priority conditions and $\geq 80\%$ for all other notifiable conditions.⁴ DHHS Victoria has since commenced a number of enhanced surveillance programs (ESPs) for certain priority conditions to improve Indigenous status reporting and other data completeness. On 1 July 2016, ESPs for hepatitis B and C of unspecified duration began in collaboration with The Peter Doherty Institute for Infection and Immunity.¹² A separate ESP for gonococcal infection commenced on 1 January 2017.³ As a part of these programs, after initial notification receipt at DHHS, standardised form questionnaires are sent to medical practitioners to request further risk factor and case demographic information, including Indigenous status.

With the aim of simplifying notification requirements in Victoria, on 1 September 2018 amendments to the Regulations came into effect.¹³ Categorisation of notifiable conditions were reduced to ‘urgent’ (formerly Group A conditions) and ‘routine’ (formerly Group

B-D conditions). Ten notifiable conditions no longer require doctors to notify DHHS: Barmah Forest virus infection, Ross River virus infection, arboviruses (other including flaviviruses), chlamydial infection, influenza, campylobacteriosis, leptospirosis, psittacosis, blood lead >5µg/dL and hepatitis viral (not further specified). These conditions still require laboratory notification and doctors may continue to be contacted by DHHS during case investigation. Rotavirus was added as a 'routine' laboratory-only notifiable condition and AIDS ceased being a notifiable condition in Victoria, with no changes to HIV infection notification requirements. Listeriosis was reclassified as an 'urgent' condition and Chikungunya virus infection became a 'routine' condition. Doctors are no longer required to follow up telephone notifications of 'urgent' conditions in writing.

This audit was conducted to describe doctor and laboratory notification practices in 2016 and 2017, quantify the effect of condition-specific ESPs on Indigenous status data completeness, and provide a baseline reference for changes to notification requirements effective on 1 September 2018.

Methods

All notifications received by the Victorian DHHS between 1 January 2016 and 31 December 2017 and entered into PHESS were included in this audit, excluding blood lead levels >5 µg/dL and foodborne or water-borne illness with two or more related cases. De-identified notification data for the study period were extracted from PHESS in July 2018. In the dataset, a 'case' signified an individual with a notifiable condition while a 'notification' was the report of a case over the phone or in writing from a doctor and/or laboratory; there could be multiple notifications per case.

Cases were classified into six categories: 'Confirmed' and 'Probable' cases meeting the corresponding national case definitions;² 'Rejected' cases did not meet the national case definition; 'Suspected' cases were awaiting

assessment against the national case definition; 'At-risk' cases were contacts of known cases; 'Not notifiable' cases were non-Victorian residents counted in another jurisdiction. To be consistent with the changes to notification requirements from 1 September 2018, Group A conditions were defined as 'urgent' and Group B-D conditions as 'routine.'

The numbers of cases and notifications per case were described for all six case classifications. All remaining analyses were restricted to confirmed and probable cases, consistent with the NNDSS. The notifier-type analysis compared cases notified by doctors, laboratories or both, and excluded influenza case notifications received between 31 July and 31 October 2017 and all chlamydial infection notifications as only laboratory notifications were entered into PHESS for these conditions due to high notification volumes.

Time-to-notification was calculated as the number of days between the earliest 'signature date' (the date the notification was authorised by doctor/laboratory, signifying the day of diagnosis and/or result finalisation) and the 'event date' (the date DHHS received the notification). Notifications with a signature date that was missing or >365 days or <0 days from the event date were excluded from the time-to-notification analysis. The proportions of cases notified within the legislated timeframes (0 days for 'urgent' and within 5 days for 'routine' conditions) were reported. The time-and-notifier-type analysis compared notification delay between notifier types and was completed on all cases included within both the notifier-type and time-to-notification analysis.

Data were analysed in Stata version 15 comparing urgent vs. routine, doctor-notified vs. laboratory-only notifications and 2017 vs. 2016 using chi-square tests with relative risks (RR) and 95% confidence intervals (95%CI) generated. As this audit was conducted on de-identified data collected in accordance with the Act, human research ethics committee review was not required.

Results

In 2016–2017, DHHS received and entered into PHESS 373,206 notifications for 204,801 cases of notifiable conditions included in this audit. Of these cases, 186,758/204,801 (91.2%) were classified as confirmed, 5,464 probable (2.7%), 4,865 (2.4%) rejected, 3,206 at-risk (1.6%) and 117 (0.06%) suspected. A further 4,391 (2.1%) cases were classified as not notifiable. Hereafter only cases classified as confirmed and probable are included in the analysis as ‘cases.’

The total number of notifications received by the DHHS increased 35.5% from 158,487 in 2016 to 214,719 notifications in 2017. 303,976 (81.5%) notifications were received from laboratories, 66,434 (17.8%) from doctors, and 2,796 (0.7%) from health departments including DHHS. Of laboratory notifications, 62,010 (20.4%) were received from public health reference laboratories. The median number of notifications per case was one (IQR 1-2) with a range of 1 – 45. Six conditions (78 cases) had individual cases for which >25 notifications per case were received: legionellosis, pneumococcal infection, Q Fever, Shiga-toxin and verotoxin producing *Escherichia coli*, tuberculosis and typhoid, reflecting repeat testing practices for these conditions.

A total of 192,222 cases were notified to the Victorian DHHS in 2016–2017. Greater than 90% of notified cases originated from ten conditions (Table 1). Overall, the number of cases increased 1.5-fold in 2017 compared with 2016, with a 277% increase in the number of notified cases of influenza and a 4.5% increase in all remaining notifiable conditions.

Notifier Type

For cases included in the notifier-type analysis (n=104,045 cases), a total of 49,939 cases (47.9%) were dual notified, 49,933 cases (47.9%) were notified by laboratory alone and 4,173 cases (4.0%) by doctor alone. The proportion of cases dual notified varied by condition (Figure 1). For cases notified by a doctor alone, more than half

(56.2%; 2,346 cases) were for two conditions for which the probable case definition does not require laboratory evidence: varicella zoster infection (shingles and chickenpox). For routine conditions in 2016 and 2017, the most common method of doctor notification was facsimile (60.0%) followed by online (23.9%).

Days to Notification

For cases included in the time-to-notification analysis (n=190,765), the median time-to-notification for urgent conditions was 0 days (IQR 0–1 day) and for routine conditions was 0 days (IQR 0–2 days). For conditions included in the time-and-notifier-type analysis (n=102,927), the overall proportion of urgent cases received by DHHS on the same date they were authorised by the notifying laboratory or doctor was significantly higher in 2017 compared with 2016 (71.9% vs. 59.6%; RR 1.21 (95%CI: 1.08 – 1.35) $p<0.001$) (Table 2). In contrast, routine cases were less likely to be notified within the legislated five day timeframe in 2017 compared with 2016 (84.1% vs. 85.1%; RR 0.99 (95%CI: 0.98 – 0.99), $p<0.001$). For routine conditions notified by a doctor, the proportion of notifications received within the legislated timeframe varied by method, ranging from 79.4% for post to 96.4% for online.

Indigenous Status Reporting

Indigenous status was more likely to be complete for cases in 2017 than 2016 (53.0% vs. 45.7%; RR 1.16 (95%CI: 1.15 – 1.17) $p<0.001$). For cases included in the time-and-notifier-type analysis, Indigenous status was more likely to be complete in cases with a doctor notification (both dual and doctor-only) than laboratory-only cases (87.9% vs. 7.2%, RR 12.2 (95%CI: 11.8 – 12.6), $p<0.001$) (Table 3). This difference was attenuated when limited to urgent cases; however, Indigenous status was still more likely to be reported in urgent doctor-notified cases than in laboratory-only cases (RR 1.18 (95%CI: 1.12 – 1.25), $P<0.001$).

In both 2016 and 2017, notifications were received for 15 of the 18 CDNA priority conditions for Indigenous status reporting (Table 4).⁴

Table 1. Top ten notified conditions (number and proportion of cases) by year in Victoria, 2016 and 2017.

Condition	2016		2017	
	n	%	n	%
Influenza	12,784	16.6	48,199	41.8
Chlamydial infection	22,747	29.6	25,172	21.8
Campylobacteriosis	8,238	10.7	6,857	5.9
Gonococcal infection	6,269	8.2	7,281	6.3
Varicella zoster infection (Unspecified)	5,837	7.6	6,470	5.6
Salmonellosis	4,090	5.3	3,230	2.8
Varicella zoster infection (Shingles)	2,401	3.1	2,720	2.4
Pertussis	2,881	3.7	1,998	1.7
Hepatitis C – Unspecified	2,339	3.0	1,889	1.6
Hepatitis B – Unspecified	1,816	2.4	1,759	1.5
<i>All other notifiable conditions^a</i>	7,502	9.8	9,743	8.4
All Conditions^a	76,904		115,318	

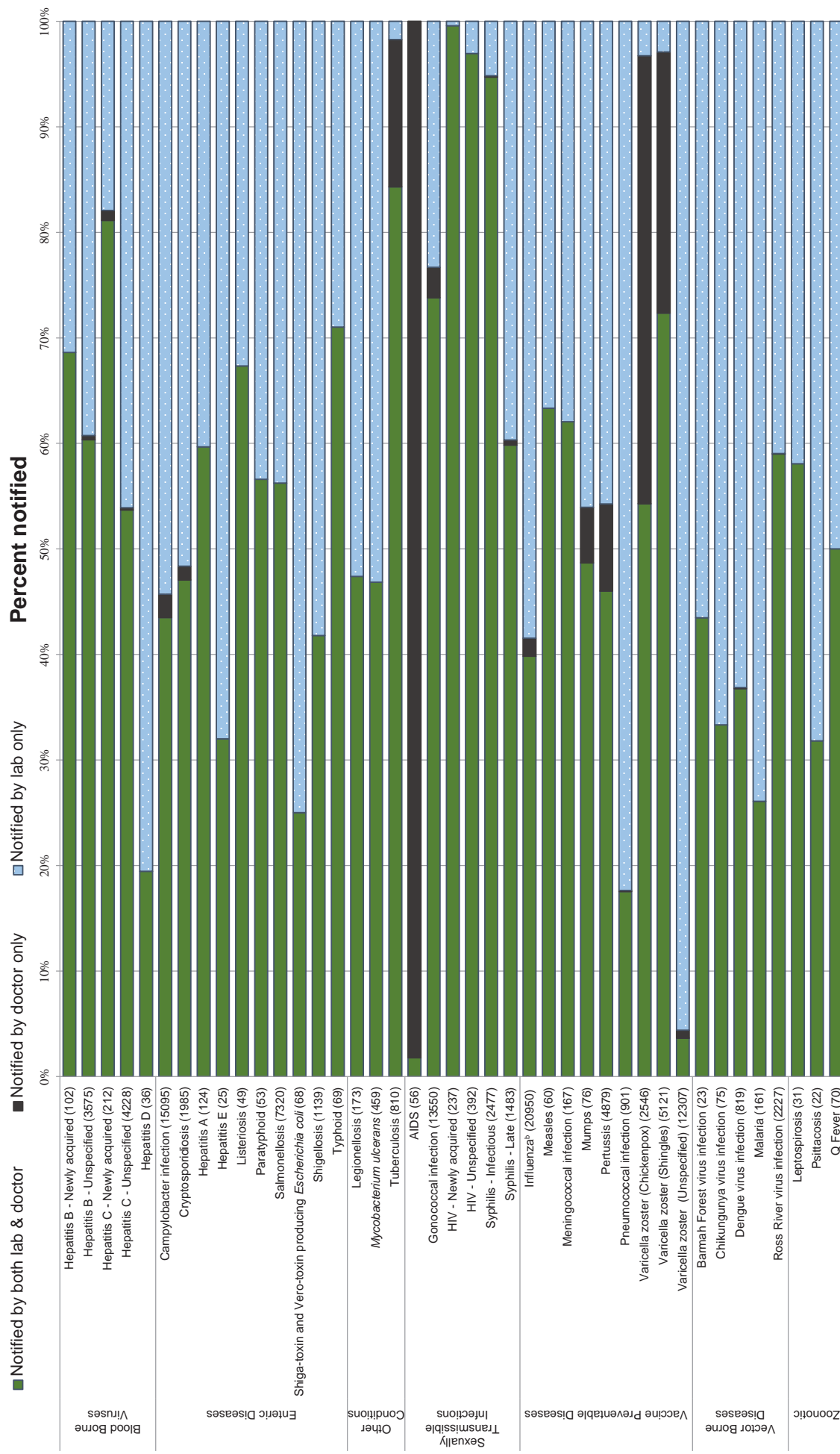
a Excludes blood lead levels >5 µg/dL and food and water-borne illnesses with two or more related cases

Table 2. Cases notified within 0 days, 1–5 days, and >5 days of the earliest signature date, by condition group and notifier type, Victoria 2016 and 2017.

	% Notified Cases Received within Stated Days of Signature Date ^a							
	Both Laboratory and Doctor		Doctor Only		Laboratory Only		Total	
	2016	2017	2016	2017	2016	2017	2016	2017
Urgent (Group A)								
0 days	60.7	71.4	-	100	58.1	71.9	59.6	71.9
1–5 days	32.6	26.2	-	0	29.1	19.6	31.0	23.2
> 5 days	6.6	2.4	-	0	12.8	8.5	9.4	4.9
Cases	181	210	-	3	148	153	329	366
Routine (Group B, C, D)								
0 days	33.6	32.5	61.6	69.5	33.9	35.3	34.9	35.3
1–5 days	54.4	54.3	33.8	27.6	47.8	48.8	50.2	48.8
> 5 days	12.0	13.2	4.6	2.9	18.3	15.9	14.9	15.9
Cases	23,808	25,261	2,233	1,757	27,052	22,121	53,093	49,139

a For cases included in the time-and-notifier-type analysis (n=102,927 cases)

Figure 1. Type of notifier by condition and disease grouping for notified cases in Victoria, 2016 and 2017.^a



a Total number of confirmed and probable cases notified in parentheses excluding notified cases of chlamydia infection, elevated blood lead levels >5 µg/dL, food and water-borne illnesses with two or more related cases and cases notified by only DHHS and other health departments. The following conditions, not included in the above figure, had 1–20 cases notified: Creutzfeldt-Jakob disease (19 cases), flavivirus (17 cases), haemolytic uraemic syndrome (7 cases), Haemophilus influenzae type b infection (6 cases), rubella (4 cases), diphtheria (3 cases), syphilis – congenital (2 cases), leprosy (2 cases), Cholera (1 case), brucellosis (1 case), Kurjin virus infection (1 case), Japanese encephalitis (1 case). No confirmed or probable notifications were received for 14 notifiable conditions: Anthrax, Arbovirus, Botulism, Donovanosis, hepatitis (viral), lyssavirus, Murray Valley encephalitis, MERS-CoV, plague, poliomyelitis, rabies, severe acute respiratory syndrome (SARS), smallpox, tularemia, viral haemorrhagic fevers, yellow fever

b Excludes notified cases of influenza with an event date between 31 July – 31 October 2017.

Indigenous status was more likely to be complete for priority vs. non-priority conditions (75.0% vs. 43.0%; RR 1.74 (95%CI: 1.72 – 1.76) $p<0.001$). Indigenous status reporting was more likely to be complete in 2017 vs. 2016 for both priority (80.3% vs. 69.0%; RR 1.16 (95%CI: 1.14 – 1.18) $p<0.001$) and non-priority conditions (45.6% vs. 40.7%; RR 1.12 (95%CI: 1.10 – 1.14), $p<0.001$).

Impact of Enhanced Surveillance Programs on Data Completeness

After the introduction of an ESP for gonococcal infection on 1 January 2017, Indigenous status was more likely to be complete vs. in 2016 (74.4% vs. 57.7%; RR 1.29 (95%CI 1.26 – 1.32) $p<0.001$) (Table 5). For all unspecified hepatitis B and C notified cases, Indigenous status was more likely to be completed after the introduction of the ESP on 1 July 2016 compared with the preceding 6 months (61.6% vs. 32.3%; RR 1.91 (95%CI 1.79 – 2.03), $p<0.001$).

Conditions with Changing Notification Requirements

For conditions included in the notifier-type analysis and no longer requiring doctor notification from 1 September 2018, the proportion of cases notified by a doctor in 2016 and 2017 ranged from 31.8% for psittacosis to 59.1% for Ross River virus infection (Table 6). The proportion of cases with Indigenous status complete for these conditions ranged from 30.4% (Barmah Forest virus infection) to 100% (leptospirosis).

Discussion

The Victorian DHHS observed a 1.5-fold increase in notified cases of infectious disease in 2017 compared with 2016, with the majority of the increase attributable to influenza. Victoria experienced very high seasonal influenza activity in 2017 with record numbers of laboratory-confirmed cases reported across most of Australia accompanied by relatively low influenza vaccine effectiveness.¹⁴ With a 277% increase in notified cases of influenza in 2017 compared with 2016, DHHS elected not to enter

influenza notifications from doctors during the period 31 July to 31 October 2017 into PHESS, while continuing to enter laboratory-notified cases. An unprecedented volume of notifications presents a major logistical challenge for public health departments when notification data is manually entered. Flexibility in operational procedures is a core component of surveillance systems so that the functional capacity to provide timely information is retained during periods of new demand.¹⁵ Recently, the necessity for doctor notifications for certain conditions has been reviewed with the aim of simplifying disease surveillance in Victoria, and following 1 September 2018 influenza and nine other conditions no longer require doctors to notify cases to DHHS.¹³

Chlamydial infection was another condition which contributed a large number of notifications in 2016 and 2017. Since 2013, a semi-automated ELR system has allowed bulk upload of chlamydial infection notifications from some laboratories into PHESS.³ ELR requires information technology infrastructure to code disease diagnoses and transfer data from pathology laboratory databases.¹⁶ While implementation can be challenging for public health departments, ELR has been credited with improving the timeliness of infectious disease surveillance internationally.^{17,18} Given the benefits of ELR, at the DHHS a staged commencement of a larger-scale ELR system is currently underway.¹³

Timely notification of certain conditions has been found to significantly reduce the number of secondary cases and improve outbreak control, demonstrating the public health importance of reducing reporting delays.²⁰ In Victoria in 2017, an increase was seen in the proportion of same-day notifications of urgent conditions in 2017 vs. 2016 (71.9% vs. 59.6%; RR 1.21 (95%CI 1.0 – 1.35), $p<0.001$) and compared to 59% in 2013.¹⁰ The cause of this improvement was not definitively identified in this audit; while outbreaks of hepatitis A and legionellosis resulted in more notified cases in 2017 than 2016 with increases seen for both in same-day reporting, neither condition alone demonstrated a statistically sig-

Table 3. Indigenous status reporting completeness for case notifications by condition group and notifier, Victoria 2016 and 2017.^a

Condition Urgency	Year	All Notifications ^a						Indigenous Status Completeness						RR ^c	(95% CI)	p-value
		n	N	%	n	N	%	n	N	%	n	N	%			
Urgent	2016	309	341	90.6	178	184	96.7	131	157	83.4	1.16	1.08 – 1.25	<0.001			
	2017	348	397	87.7	215	227	94.7	133	170	78.2	1.21	1.11 – 1.31	<0.001			
	Total	657	738	89.0	393	411	95.6	264	327	80.7	1.18	1.12 – 1.25	<0.001			
Routine	2016	24,337	53,681	45.3	22,684	26,386	86.0	1,653	27,295	6.1	14.2	13.5 – 14.9	<0.001			
	2017	26,175	49,626	52.7	24,493	27,315	89.7	1,682	22,311	7.5	11.9	11.4 – 12.5	<0.001			
	Total	50,512	103,307	48.9	47,177	53,701	87.9	3,335	49,606	6.7	13.1	12.6 – 13.5	<0.001			
Total Combined	51,169	104,045	49.2	47,570	54,112	87.9	3,599	49,933	7.2	12.2	11.8 – 12.6	<0.001				

a Excluding notified cases of elevated blood lead levels > 5 µg/dL, food and water-borne illnesses with two or more related cases, chlamydial infection, influenza with an event date between 31 July – 31 October 2017 and cases notified by only DHHs and other health departments

b Doctor-notified cases include both dual (doctor and laboratory) and doctor-only notified cases

c The relative risk for Indigenous status reporting complete if a case was notified by a doctor vs. laboratory-only notified cases.

Table 4. Indigenous status reporting completeness for eighteen priority conditions and all non-priority notifiable conditions for cases notified in Victoria, 2016 and 2017.

Priority Condition	2016		2017	
	Cases Notified	% Indigenous Status Complete	Cases Notified	% Indigenous Status Complete
Dengue virus infection (locally-acquired ^b)	0	-	0	-
Donovanosis	0	-	0	-
Gonococcal infection	6,269	57.7	7,281	74.4
<i>Haemophilus influenzae</i> type b	4	100 ^a	2	100 ^a
Hepatitis A	46	93.5	78	83.3
Hepatitis B - Newly acquired	58	89.7	44	93.2
Hepatitis C - Newly acquired	123	84.6	89	89.9
HIV ^c	359	99.2 ^a	326	97.6 ^a
Leprosy	2	100 ^a	0	-
Measles	38	92.1	22	100 ^a
Meningococcal infection	78	100 ^a	89	95.5 ^a
Pertussis < 5 years	221	73.8	125	73.6
Pneumococcal infection < 5 years	50	100 ^a	62	93.6
Pneumococcal infection ≥ 50 years	259	96.1 ^a	320	89.1
Shigellosis	600	89.0	539	89.2
Syphilis - Congenital	0	-	2	100 ^a
Syphilis - Infectious	1,131	85.9	1,346	93.1
Tuberculosis	366	100 ^a	444	100 ^a
All priority conditions	9,604	69.0	10,769	80.3
<i>All non-priority conditions^d</i>	<i>44,553</i>	<i>40.7</i>	<i>39,344</i>	<i>45.6</i>
Total	54,157	45.7	50,113	53.0

a Target of ≥ 95% Indigenous status reporting completeness achieved

b Locally-acquired is defined as cases of dengue virus infection acquired in Australia

c HIV is inclusive of HIV infections that are newly acquired, unspecified and AIDS

d Excluding notified cases from the following conditions: elevated blood lead levels >5 µg/dL, food and water-borne illnesses with two or more related cases, chlamydial infection and influenza with an event date between 31 July – 31 October 2017

Table 5. Completeness of Indigenous status and country of birth reporting for cases notified before and after enhanced surveillance programs commenced for hepatitis B and C and gonococcal infection in Victoria.^a

Reporting Complete	Condition	Prior to ESP ^a (%)	After ESP ^a (%)	RR	(95% CI)	p-value
Indigenous Status	Gonococcal Infection	57.7	74.4	1.29	1.26 – 1.32	<0.001
	Hepatitis B - Unspecified	42.3	67.1	1.59	1.47 – 1.72	<0.001
	Hepatitis C - Unspecified	24.3	56.9	2.34	2.11 – 2.59	<0.001
	All Combined	51.1	68.8	1.35	1.31 – 1.38	<0.001
Country of Birth	Gonococcal Infection	56.9	72.2	1.27	1.24 – 1.30	<0.001
	Hepatitis B - Unspecified	25.4	61.3	2.42	2.16 – 2.70	<0.001
	Hepatitis C - Unspecified	18.9	51.4	2.72	2.40 – 3.07	<0.001
	All Combined	47.8	65.1	1.36	1.33 – 1.40	<0.001

^a For hepatitis B and C, the enhanced surveillance program commenced 1 July 2016; enhanced surveillance for gonococcal infection commenced 1 January 2017.

nificant improvement in notification within the legislatively-required timeframe. It may be that outbreak awareness led to improved notification timeliness in 2017, but that this audit was underpowered to detect this effect given the low number of cases for each condition.

In contrast to urgent cases, 85% of routine cases in 2016 and 84% in 2017 were notified within the legislated five-day timeframe, a drop compared to 90% in 2013.¹⁰ According to a 2018 systematic review, electronic reporting and web-based systems results in more timely notifications than post and facsimile.¹⁶ This is consistent with the results of this audit which demonstrated that 96.4% of routine cases notified by doctors online were received within five days. However, only 23.9% of routine cases in 2016 and 2017 were notified via this method. Integrated notification general practice software and online smart forms were released by DHHS on 31 December 2017;¹⁹ these may further encourage electronic reporting for routine conditions and improve the timeliness of notifications in future audits.

Overall, seven priority conditions in 2016 and six in 2017 achieved the CDNA target of $\geq 95\%$ Indigenous status completeness.⁴ In comparison, only five priority conditions in 2013 met or

exceeded the target.¹⁰ While still below the target, Indigenous status reporting completeness for priority conditions significantly improved in 2017 compared with 2016 (80.3% vs. 69.0%; RR 1.16 (95%CI: 1.14 – 1.18) $p < 0.001$) and was higher than the 71% completeness found in 2013. This improvement is likely attributable to commencement of an ESP for gonococcal infection on 1 January 2017: Indigenous status completeness for this priority condition increased from 58% in 2013 and 57.7% in 2016 to a post-ESP level of 74.4% in 2017, showcasing the data capture capability of enhanced surveillance forms sent to medical practitioners.

Similar improvements in Indigenous status reporting completeness was found following commencement of enhanced surveillance for hepatitis B and C of unspecified duration on 1 July 2016. Unlike cases of newly acquired hepatitis B and C which always undergo active follow-up by DHHS staff, prior to this ESP's introduction notified cases of hepatitis B and C of unspecified duration were not routinely followed up.¹⁰ For both conditions, Indigenous status was significantly more likely to be complete after ESP commencement compared with before (RR 1.91 (95%CI 1.79 – 2.03), $p < 0.001$). This improvement is consistent with similar ESPs

Table 6. Cases notified in 2016 and 2017 for conditions undergoing legislative changes to notification requirements as at 1 September 2018 in Victoria, excluding notified cases of elevated blood lead levels > 5 µg/dL and chlamydial infection.

Notification Requirement Change	Condition	2016 and 2017 Cases									
		Notifier Type (%) ^a		Days to Notification (%) ^b			Indigenous Status Complete (%)	Total Number of Cases			
		Doctor Notified	Laboratory Only	0	1-5	> 5	(%)	2016	2017		
No longer requires medical practitioner ^a (Laboratory notification requirements remain)	Barmah Forest virus infection	56.5	43.5	27.3	63.6	9.1	30.4	4	19		
	Ross River virus infection	59.1	40.9	35.2	57.3	7.5	61.9	263	1,964		
	Arbovirus (other including Flavivirus)	41.2	58.8	12.5	62.5	25.0	82.4	16	1		
	Influenza ^c	41.6	58.4	66.9	26.5	6.6	34.3	12,784	48,199		
	Campylobacteriosis	45.7	54.3	40.9	46.5	12.6	41.8	8,238	6,857		
	Leptospirosis	58.1	41.9	29.0	54.8	16.1	100.0	17	14		
	Psittacosis	31.8	68.2	59.1	40.9	0	90.9	10	12		
	Hepatitis viral (not further specified)	-	-	-	-	-	-	-	-	-	
	Chikungunya virus infection	33.3	66.7	23.0	41.9	35.1	70.7	41	34		
	Listeriosis	67.4	32.6	51.0	46.9	2.1	79.6	30	19		
Removed	AIDS	100	0	12.5	44.6	42.9	83.9	34	22		

^aCases included in the notifier-type analysis

^bCases included in the time-to-notification analysis

^cExcluding influenza notifications (n=40,033 cases) with an event date between 31 July – 31 October 2017

elsewhere in Australia, although in a study such programs have been found to be very labour intensive.²¹

Given the resources required, ESPs would not be feasible for every condition currently notifiable in Victoria. Data linkage, if acceptable to the community from a privacy perspective, could offer a solution to the difficulty in achieving adequate levels of Indigenous status reporting.¹⁰ Data linkage involves securely linking individual de-identified surveillance data to routinely captured datasets and can be a cost-effective method to improve Indigenous status completeness.¹¹ In New South Wales and Western Australia, data linkage has been used extensively to improve Indigenous status completeness in disease surveillance.²²

In a 2016 Victorian study, data linkage achieved 99.8% Indigenous status completeness for notified cases of hepatitis B, C and gonococcal infection.²³ This resulted in the Indigenous notification rate ratio increasing from 1.62 to 4.08 (95%CI 2.55 – 5.42), indicating that without identifiers in the notification dataset the burden of infectious disease can be drastically underestimated in the Victorian Indigenous population. Ongoing under-identification of Indigenous status prevents accurate measurement of the health gaps between Indigenous and non-Indigenous Australians and could hinder important public health initiatives. Given this, Victoria DHHS is considering routine data linkage to improve Indigenous status data completeness.

The notification requirement changes that come into effect 1 September 2018 aim to simplify the process of notifying certain conditions.¹³ While none of the conditions undergoing changes to notification requirements are priority diseases for Indigenous status reporting, in 2016 and 2017 some were under the 80% CDNA target for non-priority conditions.⁴ For some of these conditions, routine DHHS follow-up with doctors, including requesting Indigenous status information, will continue for cases that meet pre-defined criteria. Future audits of the infec-

tious disease surveillance system in Victoria are recommended to monitor the effects of changes to notification requirements.

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