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Increased Incidence of Legionellosis after Improved Diagnostic Methods, New Zealand, 2000–2020

Appendix

Methods

Surveillance Data

In New Zealand, notification is mandated under the *Health Act 1956*, which requires health professionals and all medical diagnostic laboratories (notification also became a legal requirement for all laboratories in December 2007 under the *Health Amendment Act 2006*) to inform their local medical officer of health of any notifiable disease that they suspect or diagnose. These notifications provide the basis for disease surveillance and public health action, and hence aid in the control of legionellosis and other infectious diseases in New Zealand. Notification data are captured at each Public Health Unit of District Health Boards via a secure web-based portal into a centralized database (EpiSurv), New Zealand's national database for notifiable disease surveillance.

Laboratory-based surveillance and laboratory testing are conducted on clinical specimens referred to the national Legionella Reference Laboratory (LRL) at the Institute of Environmental Science and Research (ESR). These clinical samples are submitted to LRL for confirmatory testing, identification, and typing with results aggregated for analysis as laboratory-identified cases.

The surveillance data are collated by ESR on behalf of the New Zealand Ministry of Health. Data extracted from EpiSurv include case demographics, clinical features, laboratory

identification of the causative agent, and hospitalization status. The case-fatality risk was calculated where legionellosis was reported as the underlying cause of death (on the death certificate), as a measure of disease severity.

Population Data

New Zealand's population of just over 5 million is ethnically diverse. In the 2018 census data, the European ethnic group accounted for 70.2%, Māori 16.1%, Asian 15.1%, Pacific Peoples 8.1%, and Middle Eastern/Latin American/African (MELAA) 1.5% of the total population (*1*). Consistent with most high- and middle-income countries, the proportion of elderly persons (≥ 65 years) in New Zealand is also increasing.

The denominator populations were obtained from the 2001, 2006, 2013 and 2018 New Zealand Censuses, using linear interpolation to provide estimates in the inter-census years; these rates were directly age-standardized to 2013 New Zealand census usually residential population (at 0–4, 5–9, 10–14, 15–19, 20–29, 30–39, 10-years age band, up to 70+ years old). To account for the fact that a person can indicate that they belong to more than one ethnic group on the legionellosis case report form and in the census form, a 'prioritized' classification of ethnicity in accordance with the Ministry of Health's protocols for both numerator and denominator was used. For the 2006 census, the 'Other' category was split into two groups: 'Middle Eastern/Latin American/African' (MELAA); and 'Other Ethnicity'. Four prioritized ethnic groups were used in this analysis. They included the Māori ethnic group at the top of the hierarchy, followed by Pacific peoples (Cook Island, Samoan, Tongan, Niuean, Tokelauan, Tuvaluan, Fijian) 'Other Ethnicity' (Latin American, Asian, Middle Eastern, African) and European (including New Zealander and other European combined).

Ethical approval was not required for this study because persons were not identifiable in the data, and only aggregated data were analyzed and presented.

Geographic Data

Maps were generated to display rates by District Health Board (DHB) area over two time periods (2000–2009 and 2010–2020), using ArcGIS software (version 10.8; ESRI, USA). In New Zealand, all 20 DHBs are responsible for providing of health and disability services within a defined geographic area. The Boards have a mean population of 219 000 and range from 32 000 (largely rural) to 629 000 (metropolitan).

Reference

1. Ministry of Health. Statistics New Zealand. Estimates and projections, 2020; 2017 [cited 2023 Apr 12].
<https://www.stats.govt.nz>

Appendix Table 1. Legionellosis notifications and laboratory-identified cases by year, 2000–2020 with year-on-year % change

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Notified cases	61	46	49	77	62	85	52	64	73	74	173	158	149	155	125	254	247	221	174	169	160
Change from previous year (%)	29.5	−32.6	6.1	36.4	−24.2	27.1	−63.5	18.8	12.3	1.4	57.2	−9.5	−6.0	3.9	−24.0	50.8	−2.8	−11.8	−27.0	−3.0	−5.6
Laboratory identified cases	56	56	48	81	75	83	54	72	73	77	178	160	152	151	135	251	248	221	182	161	161
Change from previous year (%)	16.1	0.0	−16.7	40.7	−5.3	9.6	−53.7	25.0	1.4	5.2	56.7	−11.3	−5.3	−0.7	−11.9	46.2	−1.2	−11.8	−17.6	−11.5	0.0

Appendix Table 2. *Legionella* strains for laboratory-identified clinical cases, 2000–2020 (N = 2675)

<i>Legionella</i> species and serogroup (%)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Percentage (%)
<i>L. longbeachae</i>	28 (50)	31 (55.4)	12 (25.0)	26 (32.1)	23 (30.7)	25 (30.1)	19 (35.2)	26 (36.1)	38 (52.1)	32 (41.6)	72 (40.4)	70 (43.8)	78 (51.3)	76 (50.3)	73 (54.1)	131 (52.2)	167 (67.3)	152 (68.8)	91 (50.0)	98 (60.9)	106 (65.8)	51.0
<i>L. longbeachae</i> sg 1	22 (78.6)	26 (83.9)	8 (66.7)	8 (30.8)	8 (34.8)	14 (56.0)	6 (31.6)	8 (30.8)	19 (50.0)	23 (71.9)	34 (47.2)	29 (41.4)	20 (25.6)	20 (26.3)	19 (26.0)	60 (45.8)	70 (41.9)	67 (44.1)	42 (46.2)	46 (46.9)	43 (40.6)	22.1
<i>L. longbeachae</i> sg 2	2 (7.1)	0	1 (8.3)	3 (11.5)	3 (13.0)	4 (16.0)	1 (5.3)	7 (26.9)	1 (2.6)	4 (12.5)	5 (6.9)	3 (4.3)	13 (16.7)	9 (11.8)	10 (13.7)	15 (11.5)	11 (6.6)	3 (1.9)	2 (2.2)	5 (5.1)	0	3.8
<i>L. longbeachae</i> sg 1 and 2 *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (0.6)	0	0	0	0	0.0
<i>L. longbeachae</i> /L. <i>bozeman</i> ae sg 1	0	0	0	1 (3.8)	0	1 (4.0)	0	0	0	0	0	0	0	0	0	0	0	0	1 (1.1)	0	2 (1.9)	0.3
<i>L. longbeachae</i> /L. <i>jordanis</i>	0	0	0	0	0	0	0	0	0	0	1 (1.4)	0	0	0	0	0	0	2 (1.3)	0	0	0	0.04
<i>L. longbeachae</i> /L. <i>dumoffii</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2 (1.3)	1 (1.1)	0	0	0.11
<i>L. longbeachae</i> sg not determined	4 (14.3)	5 (16.1)	3 (25.0)	14 (53.8)	12 (52.2)	6 (24.0)	3 (15.8)	11 (42.3)	18 (47.4)	5 (15.6)	32 (44.4)	38 (54.3)	45 (57.7)	47 (61.8)	44 (60.3)	56 (42.7)	85 (50.9)	78 (51.3)	45 (49.5)	47 (48.0)	61 (57.5)	24.7
<i>L. pneumophila</i>	15 (26.8)	9 (16.1)	18 (37.5)	29 (35.8)	30 (40.0)	49 (59.0)	31 (57.4)	29 (40.3)	24 (32.9)	34 (44.2)	51 (28.7)	48 (30.0)	51 (33.6)	42 (27.8)	46 (34.1)	73 (29.1)	51 (20.6)	53 (23.9)	61 (33.5)	50 (31.1)	44 (27.3)	31.2
<i>L. pneumophila</i> sg 1	5 (33.3)	2 (22.2)	9 (50.0)	5 (17.2)	19 (63.3)	40 (81.6)	22 (70.9)	17 (58.6)	20 (83.3)	25 (73.5)	32 (62.7)	38 (79.2)	39 (76.5)	31 (73.8)	23 (50.0)	44 (60.3)	29 (56.9)	34 (64.2)	49 (80.3)	31 (62.0)	29 (65.9)	20.3
<i>L. pneumophila</i> sg 2	0	1 (11.1)	0	8 (27.6)	1 (3.3)	1 (2.0)	0	1 (3.4)	1 (4.2)	2 (5.9)	2 (3.9)	3 (6.3)	1 (1.9)	0	1 (2.2)	1 (1.4)	3 (5.9)	1 (1.9)	2 (3.3)	2 (4.0)	0	1.2
<i>L. pneumophila</i> sg 3	0	0	1 (5.6)	0	0	0	0	0	0	0	0	0	1 (1.9)	1 (2.4)	1 (2.2)	1 (1.4)	0	0	0	0	0	0.2
<i>L. pneumophila</i> sg 4	1 (6.7)	0	0	2 (6.9)	3 (10.0)	2 (4.1)	4 (12.9)	0	0	3 (8.8)	8 (15.7)	2 (4.2)	2 (3.9)	1 (2.4)	2 (4.3)	1 (1.4)	1 (1.9)	1 (1.9)	1 (1.6)	1 (2.0)	0	1.3
<i>L. pneumophila</i> sg 5	3 (20.0)	0	0	0	0	0	1 (3.2)	1 (3.4)	1 (4.2)	0	0	0	0	1 (2.4)	0	3 (4.1)	0	1 (1.9)	0	0	1 (2.3)	0.5
<i>L. pneumophila</i> sg 6	0	0	0	0	0	0	0	0	1 (4.2)	1 (2.9)	4 (7.8)	0	0	0	1 (2.2)	0	1 (1.9)	0	0	0	1 (2.3)	0.3
<i>L. pneumophila</i> sg 7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (1.9)	1 (1.6)	1 (2.0)	0	0.1
<i>L. pneumophila</i> sg 8	0	0	1 (5.6)	0	0	0	0	1 (3.4)	0	0	0	0	0	0	0	2 (2.7)	0	1 (1.9)	0	0	0	0.2
<i>L. pneumophila</i> sg 10	0	0	0	1 (3.4)	0	0	0	0	0	0	1 (1.9)	0	0	2 (4.8)	0	0	0	1 (1.9)	0	0	0	0.2
<i>L. pneumophila</i> sg 11	0	1 (11.1)	0	0	0	0	0	0	0	0	0	0	0	0	1 (2.2)	0	0	0	0	0	0	0.1
<i>L. pneumophila</i> sg 12	0	1 (11.1)	3 (16.7)	8 (27.6)	1 (3.3)	0	0	3 (10.3)	1 (4.2)	0	4 (7.8)	3 (6.3)	4 (7.8)	3 (7.1)	12 (26.1)	13 (17.8)	8 (15.7)	3 (5.7)	1 (1.6)	0	0	2.5
<i>L. pneumophila</i> sg 13	0	2 (22.2)	1 (5.6)	0	0	0	0	1 (3.4)	0	1 (2.9)	0	2 (4.2)	0	1 (2.4)	1 (2.2)	0	1 (1.9)	1 (1.9)	1 (1.6)	0	1 (2.3)	0.5
<i>L. pneumophila</i> sg 14	0	0	0	3 (10.3)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (2.3)	0.1
<i>L. pneumophila</i> sg 15	0	0	0	0	1 (3.3)	0	0	2 (6.9)	0	0	0	0	0	0	1 (2.2)	1 (1.4)	0	0	0	0	0	0.2
<i>L. pneumophila</i> strain 97–2898	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (1.6)	0	0	0.0
<i>L. pneumophila</i> strain 91–033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (1.9)	0	0	0	0.0
<i>L. pneumophila</i> sg not determined	6 (40.0)	2 (22.2)	2 (11.1)	2 (6.9)	5 (16.7)	6 (12.2)	4 (12.9)	3 (10.3)	0	0	0	0	4 (7.8)	2 (4.8)	3 (6.5)	7 (9.6)	8 (15.7)	8 (15.1)	6 (9.8)	15 (30.0)	11 (25.0)	3.5
Other <i>Legionella</i> species with id (%)	9 (16.1)	11 (19.6)	18 (37.5)	23 (28.4)	18 (24.0)	7 (8.4)	6 (11.1)	14 (19.4)	11 (15.1)	11 (14.3)	37 (20.8)	30 (18.8)	20 (13.2)	22 (14.6)	14 (10.4)	33 (13.1)	21 (8.5)	13 (5.9)	19 (10.4)	12 (7.5)	7 (4.3)	13.5
<i>L. anisa</i>	1 (11.1)	0	0	1 (4.3)	0	0	1 (16.7)	0	0	0	0	0	0	0	0	2 (6.1)	0	0	0	0	0	0.2
<i>L. anisa</i> /L. <i>bozeman</i> ae sg 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
<i>L. bozeman</i> ae sg 1	1 (11.1)	0	3 (16.7)	3 (13.0)	3 (16.7)	2 (28.6)	0	1 (7.1)	2 (18.2)	1 (9.1)	7 (18.9)	1 (3.3)	0	4 (18.2)	0	4 (12.1)	3 (14.3)	1 (7.7)	2 (10.5)	2 (16.7)	1 (14.3)	1.5
<i>L. bozeman</i> ae sg 2	3 (33.3)	0	0	1 (4.3)	1 (5.6)	0	0	0	0	0	1 (2.7)	2 (6.7)	0	0	0	0	1 (4.8)	1 (7.7)	0	0	0	0.4
<i>L. bozeman</i> ae sg not determined	0	0	2 (11.1)	1 (4.3)	0	0	0	0	0	0	0	1 (3.3)	0	0	0	0	0	0	0	0	0	0.1
<i>L. dumoffii</i>	0	6 (54.5)	3 (16.7)	2 (8.7)	3 (16.7)	1 (14.3)	3 (50.0)	1 (7.1)	5 (45.4)	5 (45.4)	13 (35.1)	12 (40.0)	5 (25.0)	3 (13.6)	2 (14.3)	5 (15.2)	2 (9.5)	3 (23.1)	3 (15.8)	4 (33.3)	0	3.0
<i>L. feeleii</i> sg 1	0	0	1 (5.6)	0	1 (5.6)	0	0	0	1 (9.1)	0	2 (5.4)	0	0	0	0	1 (3.0)	0	0	1 (5.3)	0	0	0.3
<i>L. gormaii</i>	2 (22.2)	3 (27.3)	4 (22.2)	0	4 (22.2)	3 (42.9)	1 (16.7)	3 (21.4)	2 (18.2)	2 (18.2)	2 (5.4)	2 (6.7)	0	2 (9.1)	1 (7.1)	3 (9.1)	0	1 (7.7)	0	0	0	1.3
<i>L. hackeliae</i>	0	0	3 (16.7)	7 (30.4)	1 (5.6)	1 (14.3)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6
<i>L. harrisonii</i> sp. nov.	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (4.5)	0	0	0	0	2 (10.5)	1 (8.3)	0	0.2
<i>L. jordanis</i>	0	0	1 (5.6)	1 (4.3)	1 (5.6)	0	0	2 (14.3)	0	0	4 (10.8)	3 (10.0)	4 (20.0)	1 (4.5)	1 (7.1)	4 (12.1)	1 (4.8)	0	2 (10.5)	0	1 (14.3)	1.0
<i>L. maceachernii</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (8.3)	0	0.0
<i>L. micdadei</i>	2 (22.2)	2 (18.2)	1 (5.6)	7 (30.4)	4 (22.2)	0	0	5 (35.7)	1 (9.1)	2 (18.2)	6 (16.2)	3 (10.0)	9 (45.0)	9 (40.9)	8 (57.1)	9 (27.3)	5 (23.8)	1 (7.7)	5 (26.3)	1 (8.3)	2 (28.6)	3.2
<i>L. oakridgensis</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2 (2.5)	0	0	0	0	0.1

<i>Legionella</i> species and serogroup (%)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Percentage (%)
<i>L. saintelensi</i>	0	0	0	0	0	0	1 (16.7)	2 (14.3)	0	1 (9.1)	2 (5.4)	6 (20.0)	2 (10.0)	2 (9.1)	2 (14.3)	5 (15.2)	5 (23.8)	5 (38.5)	4 (21.1)	2 (16.7)	3 (42.9)	1.5
<i>L. wadsworthii</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (7.7)	0	0	0	0.0
<i>Legionella</i> strain D5382	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2 (9.5)	0	0	0	0	0.1
<i>Legionella</i> species unidentified	4 (7.1)	5 (8.9)	0	3 (3.7)	2 (2.7)	2 (2.4)	3 (5.6)	3 (4.2)	0	2 (2.6)	18 (10.1)	12 (7.5)	3 (1.9)	11 (7.3)	2 (1.5)	14 (5.6)	9 (3.6)	3 (1.4)	11 (6.0)	2 (1.2)	4 (2.5)	4.3
Total	56	56	48	81	75	83	54	72	73	77	178	160	152	151	135	251	248	221	182	161	161	100

* = dual infection

Appendix Table 3. Number of laboratory-identified cases by initial method of diagnosis by year, 2000–2020*

Year	Culture only	LUAT		Molecular		Serology only			Annual Total	Annual Confirmed (%)	Annual crude incidence rate (confirmed)	Annual Probable (%)	Annual crude incidence rate (probable)
	Culture only (%)	UAT only (%)	UAT plus other (%)	PCR only (%)	PCR plus other (%)	SC/4fr (%)	2fr/stable High Titer (%)	Single High Titer (%)					
2000	8 (14.3)	1 (1.8)	0	0	7 (12.5)	17 (30.4)	15 (26.8)	8 (14.3)	56	33 (58.9)	0.9	23 (41.1)	0.6
2001	7 (12.5)	1 (1.8)	0	0	1 (1.8)	18 (32.1)	22 (39.3)	7 (12.5)	56	27 (48.2)	0.7	29 (51.8)	0.7
2002	4 (8.3)	0	5 (10.4)	0	1 (2.1)	15 (31.3)	18 (37.5)	5 (10.4)	48	25 (52.1)	0.6	23 (47.9)	0.6
2003	5 (6.2)	1 (1.2)	0	2 (2.5)	5 (6.2)	23 (28.4)	33 (40.7)	12 (14.8)	81	36 (44.4)	0.9	45 (55.6)	1.1
2004	8 (10.7)	1 (1.3)	1 (1.3)	2 (2.7)	1 (1.3)	20 (26.7)	30 (40.0)	12 (16.0)	75	33 (44.0)	0.8	42 (56.0)	1.0
2005	8 (9.6)	17 (20.5)	7 (8.4)	2 (2.4)	1 (1.2)	12 (14.5)	25 (30.1)	11 (13.6)	83	47 (56.6)	1.3	36 (43.4)	0.9
2006	3 (5.6)	1 (1.9)	7 (13.0)	2 (3.7)	1 (1.9)	11 (20.4)	19 (35.2)	10 (18.5)	54	25 (46.3)	0.6	29 (53.7)	0.7
2007	7 (9.7)	1 (1.4)	4 (5.6)	1 (1.4)	3 (4.2)	22 (30.6)	29 (40.3)	5 (6.9)	72	38 (52.8)	0.9	34 (47.2)	0.8
2008	12 (16.4)	5 (6.8)	6 (8.2)	2 (2.7)	7 (9.6)	15 (20.5)	23 (31.5)	3 (0.4)	73	47 (64.4)	1.1	26 (35.6)	0.6
2009	8 (10.4)	12 (15.6)	9 (11.7)	0	9 (11.7)	16 (20.8)	20 (26.0)	3 (3.9)	77	54 (70.1)	1.3	23 (29.9)	0.5
2010	4 (2.2)	11 (6.2)	11 (6.2)	16 (9.0)	22 (12.4)	36 (20.2)	57 (32.0)	21 (11.8)	178	100 (56.2)	2.3	78 (43.8)	1.8
2011	0	7 (4.4)	16 (10.0)	16 (10.0)	33 (20.6)	31 (19.4)	50 (31.3)	7 (4.4)	160	103 (64.4)	2.3	57 (35.6)	1.3
2012	0	10 (6.6)	23 (15.1)	27 (17.8)	22 (14.5)	19 (12.5)	35 (23.0)	16 (10.5)	152	101 (66.4)	2.3	51 (33.5)	1.2
2013	0	10 (6.6)	17 (11.3)	34 (22.5)	29 (19.2)	21 (13.9)	35 (23.2)	5 (3.3)	151	111 (73.5)	2.5	40 (26.5)	0.9
2014	0	10 (7.4)	11 (8.1)	30 (22.2)	27 (20.0)	17 (12.6)	30 (22.2)	10 (7.4)	135	95 (70.4)	2.1	40 (29.6)	0.9
2015	1 (0.4)	9 (3.6)	25 (10.0)	59 (23.6)	66 (26.4)	33 (13.2)	36 (14.4)	21 (8.4)	250	193 (77.2)	4.2	57 (22.8)	1.2
2016	0	0	15 (6.0)	93 (37.5)	66 (26.6)	36 (14.5)	33 (13.3)	5 (2.0)	248	210 (84.7)	4.5	38 (15.3)	0.8
2017	1 (0.5)	13 (5.9)	15 (6.8)	84 (38.0)	54 (24.4)	25 (11.3)	22 (10.0)	7 (3.2)	221	192 (86.9)	4.0	29 (13.1)	0.6
2018	2 (1.1)	28 (15.4)	19 (10.4)	58 (31.9)	31 (17.0)	32 (17.6)	11 (6.0)	1 (0.5)	182	170 (93.4)	3.5	12 (6.6)	0.2
	0	17 (10.5)	7 (4.3)	91 (56.5)	23 (14.2)	10 (6.2)	12 (7.4)	1 (0.6)	161	148 (91.9)	3.0	13 (8.0)	0.3
2019													
2020	0	15 (9.3)	9 (5.6)	87 (54.0)	31 (19.3)	11 (6.8)	6 (3.7)	2 (1.2)	161	153 (95.0)	3.2	8 (5.0)	0.2
Total	78 (2.9)	170 (6.4)	207 (7.7)	607 (22.7)	440 (16.4)	440 (16.4)	561 (21.0)	172 (7.4)	2675	1942 (72.6)		733 (27.4)	

*† includes culture and or molecular and or serology; ‡: includes culture &/or UAT &/or serology. Note each laboratory identified case has only been counted once. SC = seroconversion; 4fr = 4-fold titer rise; 2fr = 2-fold titer rise. Probable cases include 561+172 = 733.

*Rate per 100 000 population

Rate per 100 000 population, age-standardized to the New Zealand population age-structure at the 2013 census

IRR = incidence rate ratio, compared with European rate, age standardized to the New Zealand population age-structure at the 2013 census

Appendix Table 4. Legionellosis number and incidence rate (notified cases) by ethnicity and age group (prioritized), New Zealand, 2000–2009

Aged band	Māori			Pacific Peoples			Other Ethnicity			European		
	2000–2009			2000–2009			2000–2009			2000–2009		
	No	Pop	Rate*	No	Pop	Rate*	No	Pop	Rate*	No	Pop	Rate*
0–4	1	65 958	0.2	0	25 134	0	0	59 595	0	0	124 404	0
/5–9	1	66 396	0.2	1	25 368	0.4	0	62 340	0	0	132 408	0
10–14	0	66 390	0	0	25 020	0	0	65 322	0	1	149 223	0.1
15–19	0	58 344	0	0	22 854	0	1	65 340	0.2	1	153 717	0.1
20–29	4	80 610	0.5	1	34 638	0.3	1	150 300	0.1	13	247 842	0.5
30–39	6	77 847	0.8	5	33 690	1.5	2	151 791	0.1	33	314 730	1.0
40–49//	4	69 024	0.6	4	27 204	1.5	2	158 523	0.1	87	352 290	2.5
/50–59	6	42 687	1.4	0	17 043	0	3	119 442	0.3	115	306 990	3.7
60–69	3	22 947	1.3	2	9 645	2.1	2	70 539	0.3	113	224 982	5.0
70+	2	12 888	1.6	0	5 700	0	6	49 335	1.2	154	279 081	5.5
Total	27	565 091	0.5	13	226 296	0.6	17	952 527	0.2	517	2 285 667	2.3
Age standardize d rate#			0.7 (0.4–1.1)			0.7 (0.3–1.1)			0.2 (0.1–0.4)			2.1 (1.9–2.3)
IRR (95% CI)			0.35 (0.22–0.55)			0.32 (0.17–0.58)			0.11 (0.07–0.19)			1.0

*Rate per 100 000 population

Rate per 100 000 population, age-standardized to the New Zealand population age-structure at the 2013 census

IRR = incidence rate ratio, compared with European

Appendix Table 5. Legionellosis number and incidence rate (notified cases) by ethnicity and age group (prioritized), New Zealand, 2010–2020

Aged band	Māori			Pacific Peoples			Other Ethnicity			European		
	2010–2020			2010–2020			2010–2020			2010–2020		
	No	Pop	Rate*	No	Pop	Rate*	No	Pop	Rate*	No	Pop	Rate*
0–4	2	81207	0.2	0	42255	0	0	60360	0	2	194130	0.1
5–9	1	87822	0.1	0	45531	0	0	55101	0	4	217206	0.2
10–14	1	79758	0.1	0	40371	0	0	45567	0	2	210216	0.1
15–19	0	71079	0	1	38247	0.2	2	48558	0.4	6	202020	0.3
20–29	4	122067	0.3	6	65505	0.8	5	157311	0.3	19	404349	0.4
30–39	9	90480	0.9	6	46323	1.2	7	164067	0.4	54	367321	1.3
40–49	22	88578	2.3	12	40659	2.7	11	99210	1.0	155	428979	3.3
50–59	42	78984	4.8	16	32298	4.5	25	71571	3.2	285	457368	5.7
60–69	36	47994	6.8	17	18858	8.2	23	48033	4.4	452	389742	10.5
70+	32	27873	10.4	14	12141	10.5	20	28176	6.5	641	426426	13.7
Total	149	775 836	1.7	72	381 642	1.7	93	777 954	1.1	1620	194130	4.5
Age standardiz ed rate#			2.8 (1.4–3.3)			3.1 (2.3–3.9)			1.7 (1.4–2.1)			3.9 (3.7–4.1)
IRR (95% CI)			0.73 (0.61–0.88)			0.80 (0.62–1.03)			0.45 (0.36–0.56)			1.0

*Rate per 100 000 population

Rate per 100 000 population, age-standardized to the New Zealand population age-structure at the 2013 census

IRR = incidence rate ratio, compared with European rate, age standardized to the New Zealand population age-structure at the 2013 census

Appendix Table 6. Legionellosis number (notified) and incidence rate by District Health Board, New Zealand, 2000–2020

District Health Board	2000–2009		2010–2020	
	Total		Total	
	Number	Rate	Number	Rate
Auckland	66	5.5	149	3.3
Bay of Plenty	47	4.1	122	4.8
Canterbury	103	9.1	568	9.8
Capital and Coast	44	2.2	42	1.5
Counties Manukau	58	5.1	205	3.5
Hawke's Bay	21	1.9	31	1.7
Hutt Valley	30	2.3	33	2.1
Lakes	6	0.8	23	1.9
MidCentral	13	1	52	2.7
Nelson-Marlborough	12	1	68	3.8
Northland	26	2	114	6.0
South Canterbury	10	1.7	21	3.3
Southern	38	1.5	152	4.3
Tairāwhiti	12	2.6	2	0.3
Taranaki	13	1.3	24	1.9
Waikato	46	1.9	85	2
Wairarapa	16	3.7	8	1.7
Waitemata	81	8.4	242	4.3
West Coast	9	2	38	10.6
Whanganui	9	1.2	6	0.8

Appendix Table 7. Legionellosis case fatality risk (CFR) by age group, sex, ethnicity and Legionella spp. New Zealand, 2000–2009 and 2010–2020

Time period	2000–2009 (N = 643)			2010–2020 (N = 1985)			Risk ratio of CFR in 2010–20 to 2000–09
	No. deaths	No. cases	Case-fatality risk (%)	No. deaths	No. cases	Case-fatality risk (%)	(95%CI)
Age group							
Total all ages	26	643	4.0	35	1985	1.8	0.4 (0.3–0.7)
0–39	1	46	2.2	-	99	-	-
40–59	5	219	2.3	5	619	0.8	0.4 (0.1–1.2)
≥60	20	378	5.3	30	1267	2.4	0.5 (0.3–0.8)
Sex							
Male	18	383	4.7	25	1265	2.0	0.4 (0.2–0.8)
Female	8	254	3.1	10	720	1.4	0.4 (0.2–1.1)
Unknown	-	6	-	-	0	-	-
Ethnicity							
European	24	517	4.6	31	1620	1.9	0.4 (0.2–0.7)
Māori	-	27	-	-	149	-	-
Pacific Peoples	-	13	-	3	72	4.2	-
Other	1	17	5.9	1	93	1.1	0.2 (0.0–3.1)
Unknown	1	69	1.5	-	51	-	-
Legionella spp. (all ages)							
<i>L. pneumophila</i>	8	256	3.1	14	527	2.7	0.9 (0.4–2.1)
<i>L. longbeachae</i>	7	161	4.3	11	1062	1.0	0.2 (0.09–0.6)
Other <i>Legionella</i> spp.	2	87	2.3	1	251	0.4	0.2 (0.0–1.9)
Unknown	9	139	6.5	9	145	6.2	1.0 (0.4–2.5)