Epidemiology and investigation of Legionnaires' Disease (LD) in Hong Kong

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3 April 2019

Background

Legionella

- Gram-negative bacteria
- At least 61 species and >70 distinct serogroups have been identified
- ~30 species cause human infection
- *Legionella pneumophila* serogroup 1 (Lp1) is the most virulent and the most common cause of disease

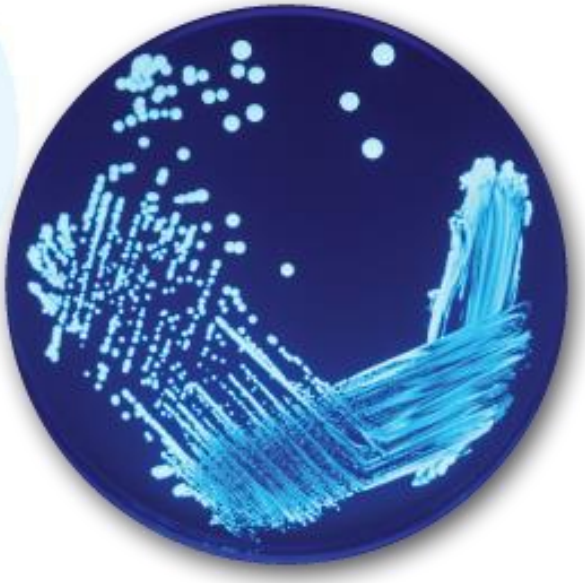


Photo courtesy: USCDC

Legionella

- Ubiquitous in natural and artificial water environment
- Grow well in warm water (~20-45^{o}C)
- Destroyed almost instantly at >70^{o}C

Mode of transmission

- Inhalation of infectious aerosol
- Micro-aspiration of contaminated water particularly in patients who have undergone head and neck surgery[2,3]
- ? Person-to-person
  - An article published in 2016 reported a case of probable person-to-person transmission[4]

2. Blatt SP, et al. Nosocomial Legionnaires' disease: aspiration as a primary mode of transmission. Am J Med. 1993;95:16-22
3. Johnson JT, et al. Nosocomial legionellosis in surgical patients with head-and-neck cancer: implications for epidemiological reservoir and mode of transmission. Lancet. 1985;2:298-300
4. Correia AM, et al. Probable Person-to-Person Transmission of Legionnaires' Disease. N Engl J Med. 2016;374:497-8

Sources of LD outbreaks reported in literature

- Air-conditioning systems notably cooling tower
- Potable water supplies system
- Spa
- Aerosol generating machines/systems, e.g. humidifier
- Water fountain

Incubation period

- 2 to 10 days
- Up to 19 days reported in the literature[5]
- Severely immunosuppressed patients may have a longer incubation period[6]

5. Den Boer JW, et al. A large outbreak of Legionnaires' disease at a flower show, the Netherlands, 1999. Emerg Infect Dis. 2002;8:37-43
6. Turner DP, et al. Community-acquired Legionnaires' disease in an immunocompromised patient masquerading as a hospital-acquired infection. J Hosp Infect. 2001;47:76-7

Risk factors

- Men
- Aged >50 years
- Smokers
- Persons with weakened immunity:
  - Chronic diseases such as cancer, diabetes mellitus, chronic lung or kidney diseases
  - Taking corticosteroids or drugs that suppress body immunity

Clinical presentation

- Fever, cough, shortness of breath, diarrhoea, confusion, etc.
- Pneumonia
- Complication: shock, respiratory failure, renal failure
- Treatment: antibiotics
- Case fatality ratio: ~10%[1]

Photo courtesy: N Engl J Med. 1997;337:682-87

1. Burillo A et al. Microbiology and Epidemiology of Legionnaire's Disease. Infect Dis Clin North Am. 2017;31:7-27

Laboratory diagnosis

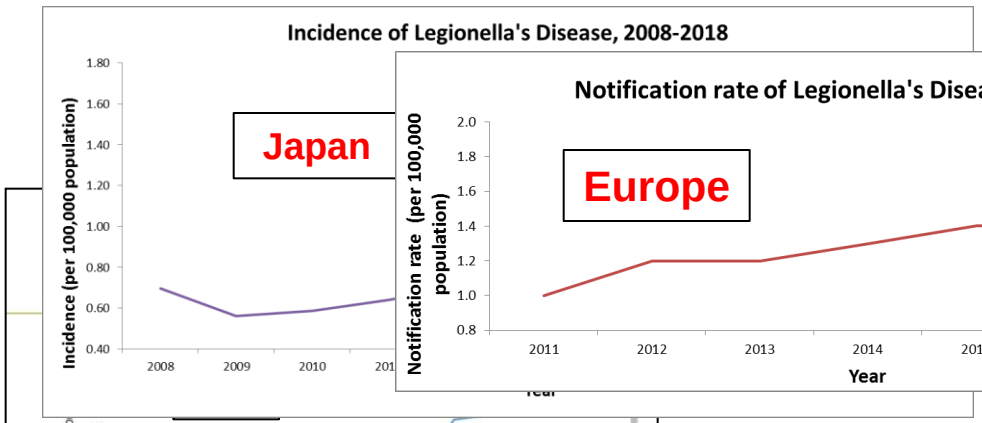
- **Isolation of *Legionella* species** from respiratory specimens
- Demonstration of a **four-fold or greater rise in antibody titre to 64 against *Legionella pneumophila*** between paired acute- and convalescent- phases serum specimens
- Detection of **antigen of *L. pneumophila* in respiratory specimens** by direct fluorescent antibody staining
- Demonstration of **Lp1 antigen in urine**
- Detection of **nucleic acid of *Legionella* species from respiratory specimens** by a validated assay (e.g. PCR)

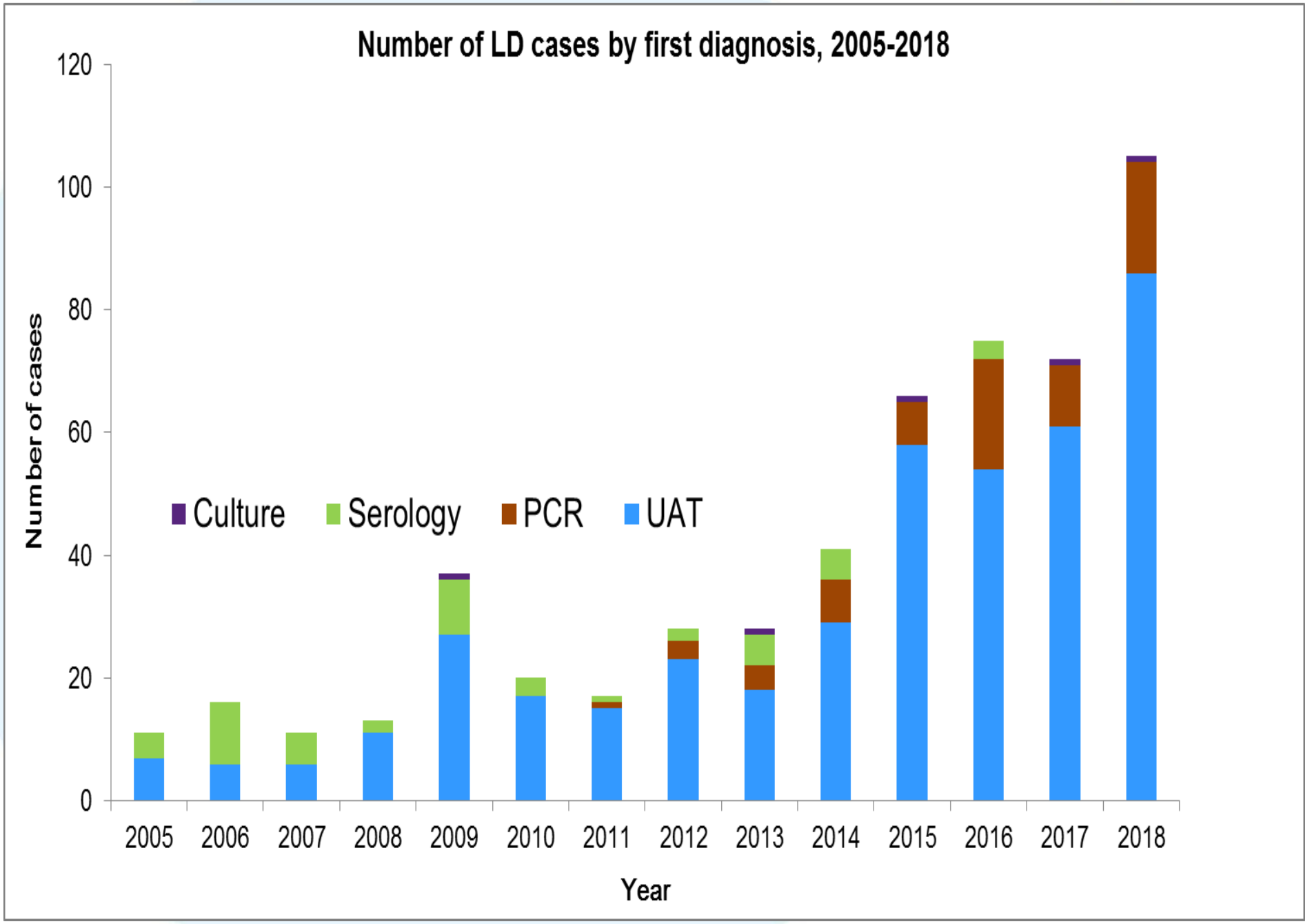
Epidemiology of LD in Hong Kong

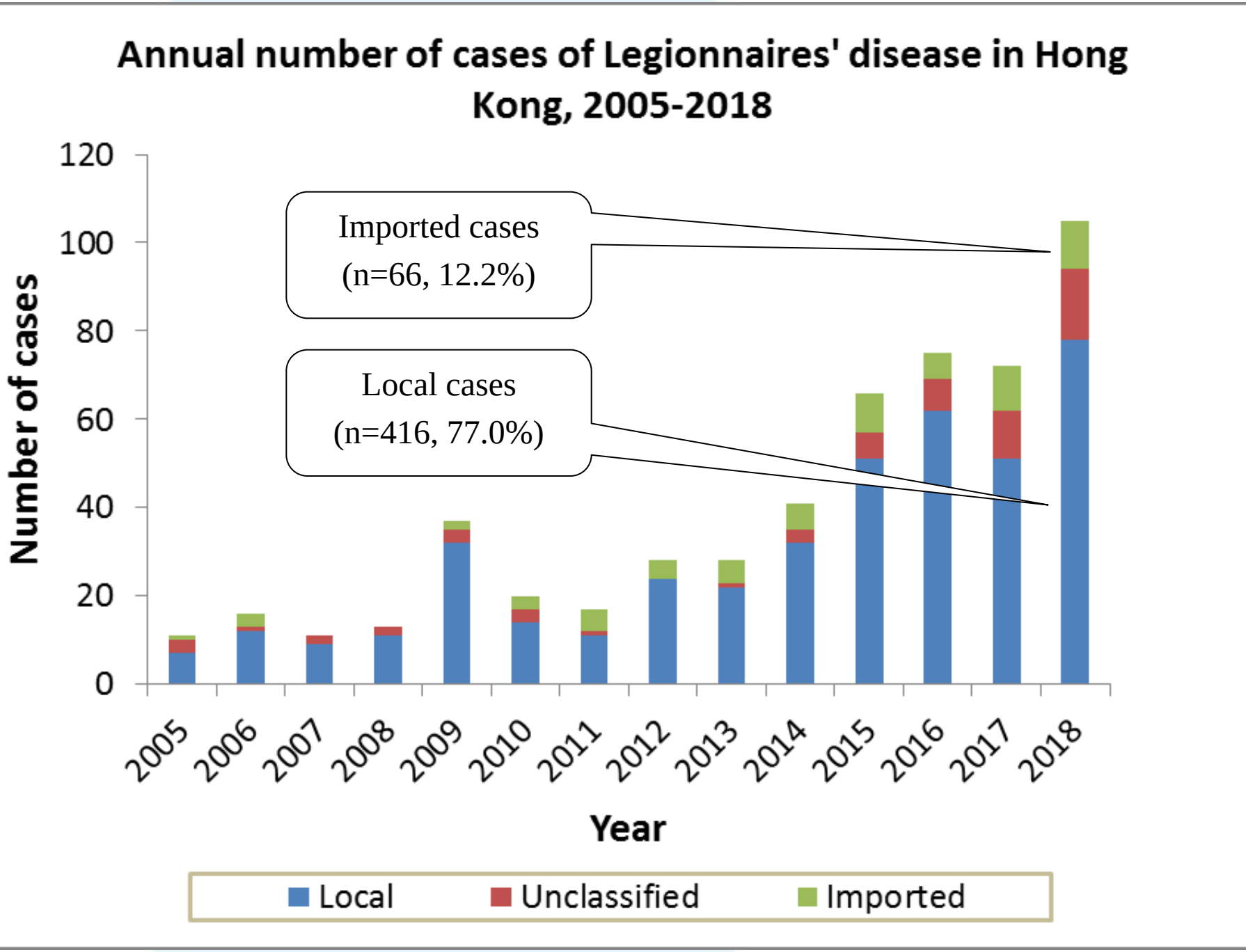
LD in Hong Kong

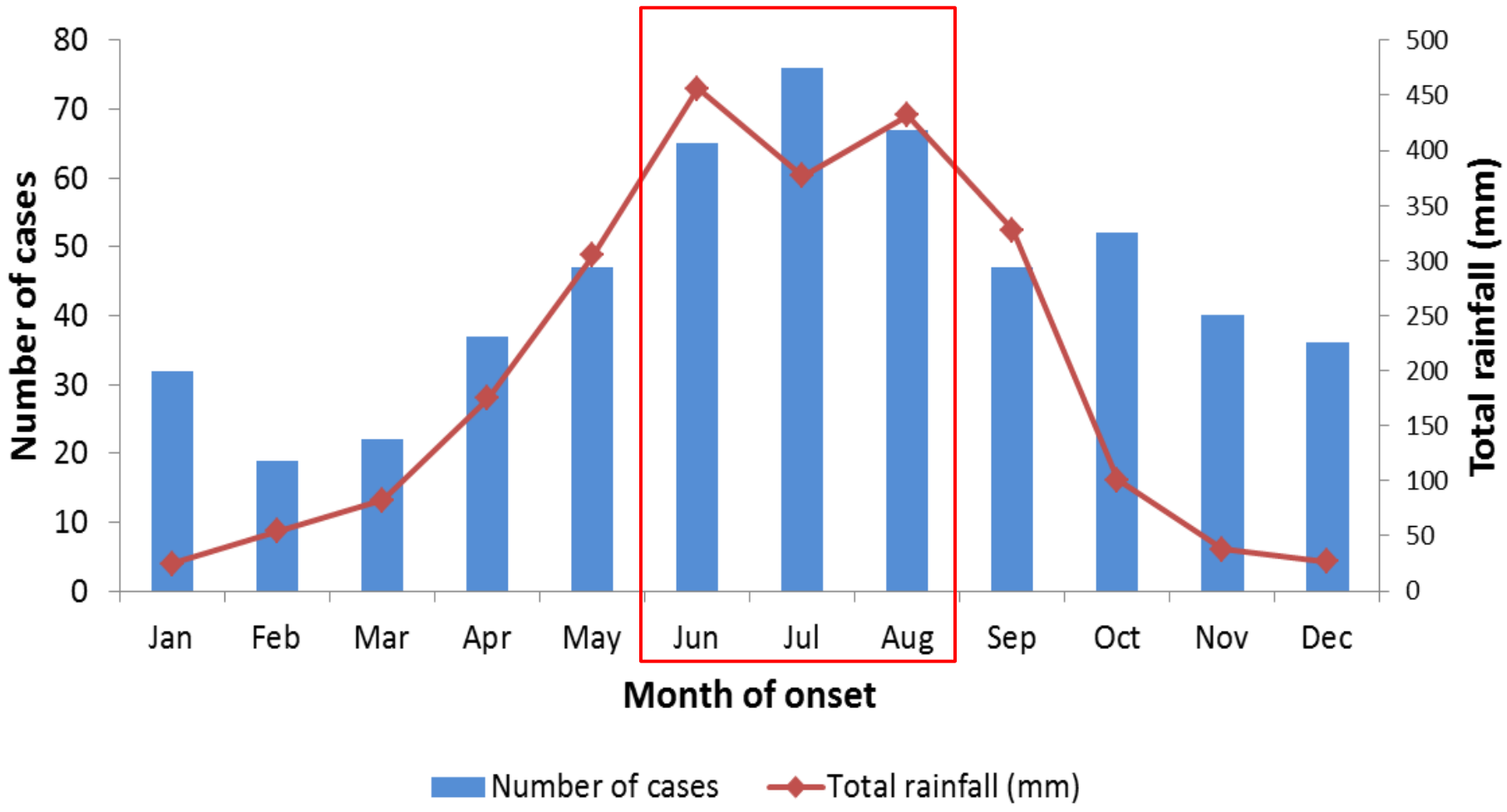
- Notifiable infectious disease since 1994
- Prevention and Control of Disease Ordinance (預防及控制疾病條例) (Cap. 599)
- Medical practitioners are required by law to report suspected / confirmed LD cases to Department of Health

Annual incidence and number of cases of Legionnaires' disease in Hong Kong, 1994-2018




Number of LD cases by first diagnosis, 2005-2018
120
100
80
60
40
20
0
Number of cases
Culture
Serology
PCR
UAT
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year


Annual number of cases of Legionnaires' disease in Hong Kong, 2005-2018
Number of cases
120
100
80
60
40
20
0
Imported cases
(n=66, 12.2%)
Local cases
(n=416, 77.0%)
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
Local
Unclassified
Imported


Monthly average of rainfall, 1981-2010 and number of LD cases by month of onset, 2005-2018
Number of cases
Total rainfall (mm)
0
10
20
30
40
50
60
70
80
0
50
100
150
200
250
300
350
400
450
500
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month of onset
Number of cases
Total rainfall (mm)

Epidemiological characteristics (N=540)

- Male: 462 cases (85.6%)
- Age: 25 to 99 years (median: 66 years), 491 cases aged >= 50 years (90.9%)
- History of chronic illnesses: 437 cases (80.9%)
  - Hypertension, 287 (53.1%)
  - Diabetes, 191 (35.4%)
  - Heart diseases, 119 (22.0%)
  - Hyperlipidaemia, 102 (18.9%)
  - Chronic renal diseases, 82 (15.2%)
- Case fatality ratio: 66/540 (12.2%)

Epidemiological & environmental investigation

Epidemiological investigation

- Conducted by outbreak team of the Centre for Health Protection for every case notified
- Aims
  - Confirm diagnosis
  - Identification of epi-linked cases or potential sources of infection to advise on further investigations, control and prevention measures
  - Identification of other cases for early intervention

Epidemiological investigation

- Contact attending physician
  - Clinical presentation and progress
    - CXR findings
    - Complications
    - Treatment
    - Patient's condition
  - Past medical history
  - Diagnostic tests done for LD
    - Urinary antigen test (UAT), polymerase chain reaction (PCR) or serological testing for LD
    - Lower respiratory specimen for *Legionella* culture e.g. sputum, tracheal aspirate

Epidemiological investigation

- Interview patient or patient's proxy
  - Detailed information on travel history and local movements during the incubation period (2-10 days before onset of symptoms)
  - High risk exposure e.g. water fountain, humidifier, spa, respiratory equipment, other aerosol generating devices, visit to dental clinic, etc.
  - Information on collaterals
  - Social history: smoking status, occupation

Environmental investigation

- According to the recommendation of the CHP's Scientific Committee on Emerging and Zoonotic Diseases, CHP adopted risk-based strategy to conduct environmental investigations
- In principle, environmental investigation and sampling from potential sources will be carried out for the following scenario:

Risk-based strategy for environmental investigation

- A **single definite or possible nosocomial case** associated with **high-risk areas of a hospital**
- The patient spent the **whole IP as a resident of a residential institution** or as **an in-patient in low-risk areas of a hospital**
- **Two patients with onset within six months** and who had **common exposure for a portion of the IP** to either a **residential institution** such as RCHE/RCHD, or **low-risk areas of a hospital**

Risk-based strategy for environmental investigation

- A **cluster** which is defined as two or more confirmed cases with onset within six months and **common exposure to the same potential source of infection** during the IP e.g. a cooling tower, living in the same building, etc.
- The patient had **exposure to a high-risk source**, such as aerosol-generating device (e.g. respiratory equipment), during the IP
- The patient **visited a high-risk venue**, such as spa, jacuzzi or whirlpool, during the IP

Environmental investigation

- Conduct field visit with
  - Electrical and Mechanical Services Department (EMSD)
  - Relevant departments e.g. Hospital Authority
  - Organization/ Person in charge of the premises concerned
- Collection of water and environmental samples from suspected source of infection for *Legionella* culture

Case 1

Case 1

- 3 confirmed LD cases with onset date within 2 weeks (11, 13 and 22 November 2018)
- Epidemiological investigation revealed that
  - 2 of the patients live in the same estate while the remaining patient had visited the estate concerned daily from Monday to Friday during the IP
  - The respiratory specimens of all cases were tested positive for the same SBT results (ST481)

Case 1

- There were 2 water fountains in the common area of G/F and 1/F of the estate respectively
- All patients reported passing by the fountains during IP

Risk-based strategy for environmental investigation

- A **cluster** which is defined as two or more confirmed cases with onset within six months and **common exposure to the same potential source of infection** during the IP e.g. a cooling tower, living in the same building, etc.
- The patient had e… **…re to a high-risk source**, such as aero… …ipment), duri…
- The… …, jacuzzi or v…

1. Cooling towers of the hotels
2. Water fountain on the G/F
3. Water fountain on the 1/F

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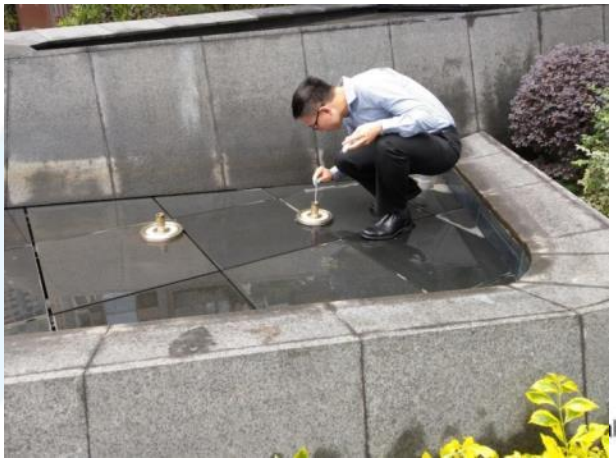
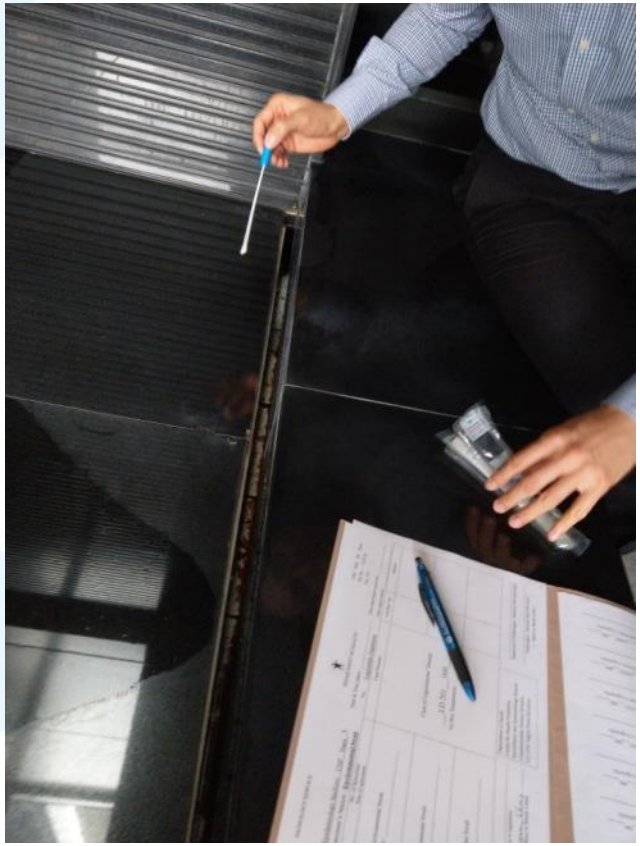
Case 1

- Collect water samples and environmental swabs from a water fountain (G/F) of the estate



Case 1

- Collect water samples and environmental swabs from water fountain (1/F) of the estate



Case 1

- Collect water samples from cooling towers identified

Case 2

Case 2

- 71 years old male
- Date of onset: 29/08/2018
- Epidemiological investigation revealed that
  - He stayed in the same bed of a rehabilitation ward of a public hospital during the whole IP
  - Had took shower in assisted bathing room in the ward during the IP

Risk-based strategy for environmental investigation

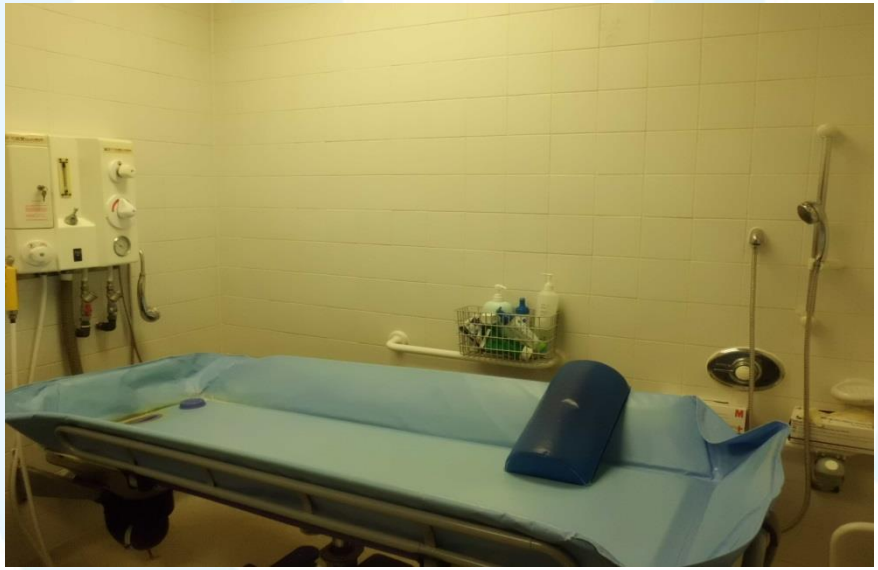
- A **single definite or possible nosocomial case** associated with **high-risk areas of a hospital**
- The patient spent the **whole IP as a resident of a residential institution** or as **an in-patient in low-risk areas of a hospital**
- **Two patients with onset within six months** and who had **com** either a **res** **ow-risk** **are**

Suspected source of infection:

Water from the shower and basin of the assisted bathing room

Case 2

- Collect water samples and environmental swab samples from the assisted bathroom of the hospital



Case 2

- Collect water samples and environmental swab samples from the assisted bathroom of the hospital

Case 3

Case 3

- 60 years old male
- Date of onset: 19/06/2018
- Epidemiological investigation revealed that
  - He travelled on a cruise during IP and had used the Jacuzzis located on the Deck

Risk-based strategy for environmental investigation

- A **cluster** which is defined as two or more confirmed cases with onset within six months and **common exposure to the same potential source of infection** during the IP e.g. a cooling tower, living in the same building, etc.
- The patient had **exposure to a high-risk source**, such as aerosol-generating device (e.g. respiratory equipment), during the IP
- The patient **visited a high-risk venue**, such as spa, jacuzzi or whirlpool, during the IP

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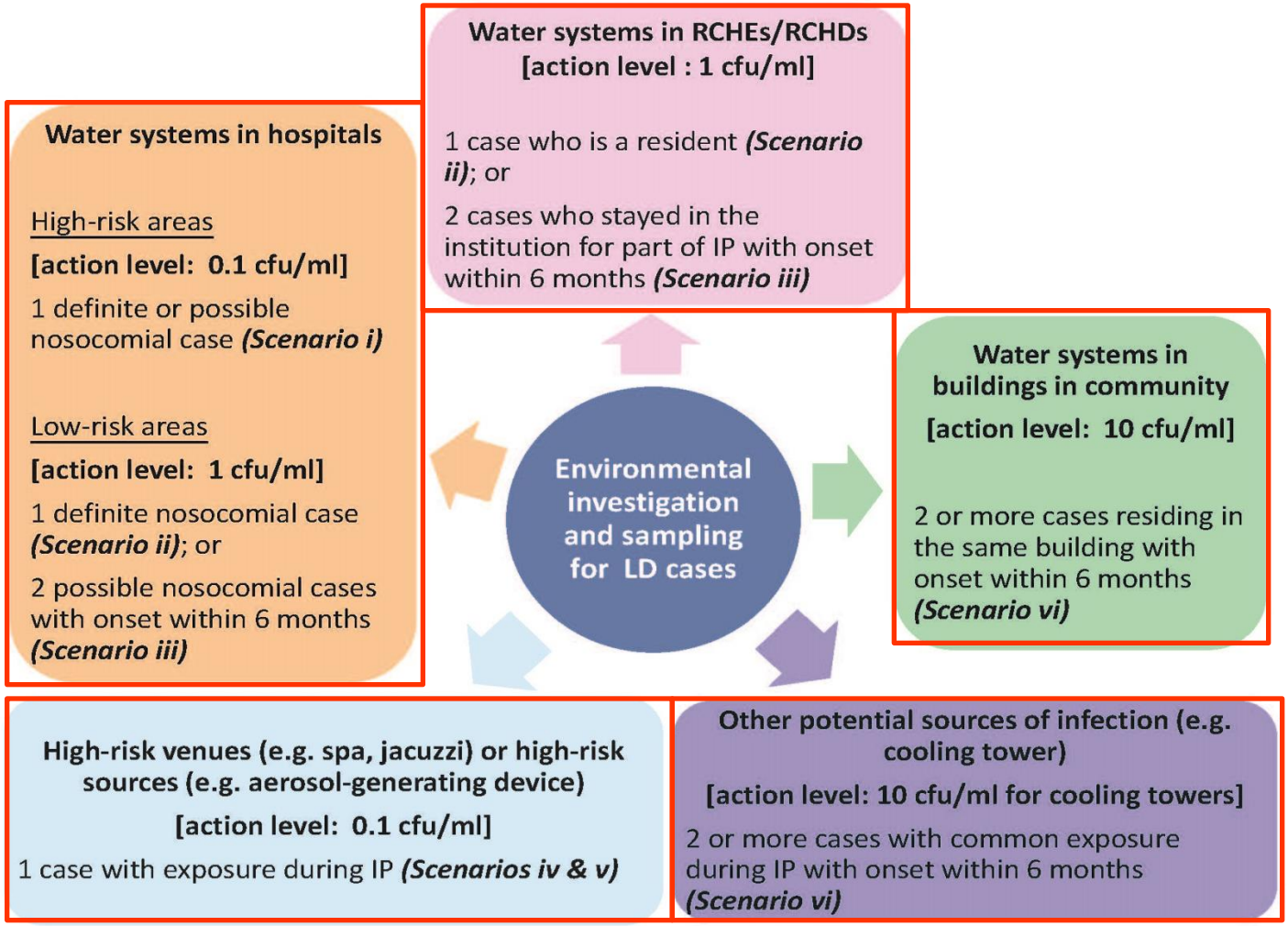
Case 3

- Collect water samples from the Jacuzzi which the patient had visited during IP

Action levels

- A risk-based approach is adopted rather than using a single action level for control measures universally
  - Variable degree of risk in different settings
  - Ubiquitous nature of legionellae
- Total legionella count: >= 0.1, >= 1 or >= 10 cfu/ml

Risk-based action levels



Control measures

Suspected source of infection	Before Laboratory results available	After Laboratory results available and above action level
Air-conditioning systems e.g. Cooling tower	Suspend usage	Disinfection
Potable water supplies system	-Suspend usage -Installation of point-of-use bacterial filter (0.2μm)	-Disinfection -Discard replaceable items (if applicable)
Spa	Suspend usage	-Disinfection -Discard replaceable items (if applicable)
Aerosol generating machines/systems, e.g. humidifier, mist machine	Suspend usage	-Disinfection -Discard (if applicable)
Water fountain	Suspend usage	Disinfection

Control measures

- Follow-up water samples will be collected from the positive sites after actions taken to evaluate the effectiveness of the control measures

Risk communication

- Weekly press release for community-acquired LD cases

The Government of the Hong Kong Special Administrative Region

Press Releases

GovHK 香港政府一站通 繁體版 简体版

Update on cases of Legionnaires' disease GO

Update on cases of Legionnaires' disease

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The Centre for Health Protection (CHP) of the Department of Health today (December 12) reported the latest number of cases of Legionnaires' disease (LD) in Hong Kong, and stressed the importance of using and maintaining properly designed man-made water systems, and that susceptible groups should strictly observe relevant precautions.

From December 4 to 10, five community-acquired LD cases were reported. They are:

1. A female patient, aged 55 with underlying illness, who lives in Foon Yan House, Tung Yan Court, Sai Wan Ho;
2. A male patient, aged 70 with underlying illness, who lives in Ying On House, Choi Ying Estate, Kwun Tong;
3. A male patient, aged 53 with underlying illness, who lives in On Foo Building, Lo Tak Court, Tsuen Wan;
4. A male patient, aged 55, who lives in Block 2, Nan Fung Plaza, Tseung Kwan O; and
5. A female patient, aged 76 with underlying illness, who lives in Block C, Metropole Building, King's Road, North Point.

"Epidemiological investigations are ongoing to identify potential sources of infection, high-risk exposure and clusters, if any," a spokesman for the CHP said.

Risk communication

- Press release e.g. definite nosocomial case

Press Releases

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CHP investigates case of Legionnaires' disease in hospital

The Centre for Health Protection (CHP) of the Department of Health is today (June 17) investigating a case of Legionnaires' disease (LD) in St Teresa's Hospital (STH), and stressed the importance of using and maintaining properly designed man-made water systems and that susceptible groups should strictly observe relevant precautions.

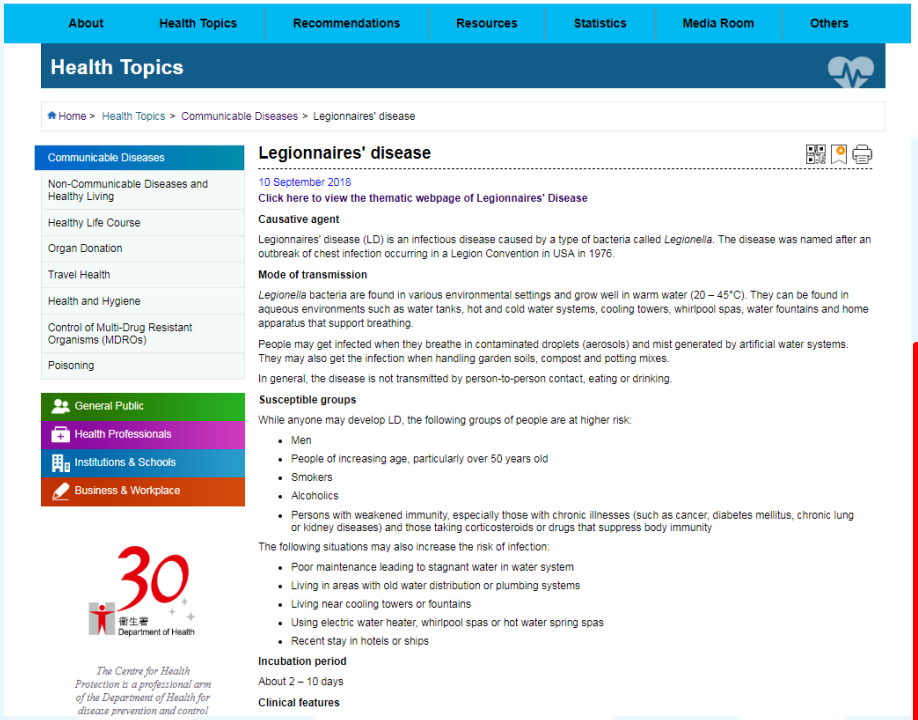
The male patient, aged 59, has been admitted to STH for management of his underlying illnesses since mid-December 2015. He has developed oxygen desaturation since June 8, 2016, and was transferred to the Special Care Unit for further treatment on the same day. The clinical diagnosis was pneumonia and he was in critical condition.

His tracheal aspirate tested positive for Legionella pneumophila (non-serogroup 1) upon laboratory testing by Queen Mary Hospital.

The patient had no travel history during the incubation period.

"Epidemiological investigations with STH are ongoing to identify potential sources of infection, high-risk exposure and clusters, if any. Relevant water samples and environmental swabs will be collected from potential sources for laboratory testing," a spokesman for the CHP said.

Health education



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The Centre for Health Protection is a professional arm of the Department of Health for disease prevention and control

Legionnaires' disease

10 September 2018

Click here to view the thematic webpage of Legionnaires' Disease

Causative agent

Legionnaires' disease (LD) is an infectious disease caused by a type of bacteria called *Legionella*. The disease was named after an outbreak of chest infection occurring in a Legion Convention in USA in 1976.

Mode of transmission

Legionella bacteria are found in various environmental settings and grow well in warm water (20 – 45°C). They can be found in aqueous environments such as water tanks, hot and cold water systems, cooling towers, whirlpool spas, water fountains and home apparatus that support breathing.

People may get infected when they breathe in contaminated droplets (aerosols) and mist generated by artificial water systems. They may also get the infection when handling garden soils, compost and potting mixes.

In general, the disease is not transmitted by person-to-person contact, eating or drinking.

Susceptible groups

While anyone may develop LD, the following groups of people are at higher risk:

- Men
- People of increasing age, particularly over 50 years old
- Smokers
- Alcoholics
- Persons with weakened immunity, especially those with chronic illnesses (such as cancer, diabetes mellitus, chronic lung or kidney diseases) and those taking corticosteroids or drugs that suppress body immunity

The following situations may also increase the risk of infection:

- Poor maintenance leading to stagnant water in water system
- Living in areas with old water distribution or plumbing systems
- Living near cooling towers or fountains
- Using electric water heater, whirlpool spas or hot water spring spas
- Recent stay in hotels or ships

Incubation period

About 2 – 10 days

Clinical features

Clinical features

Mostly presents with fever, dry cough, shortness of breath, tiredness, headache, muscle pain, abdominal pain and diarrhoea. In severe cases, neurological symptoms (e.g. confusion) and respiratory failure may appear and some may cause death.

Some patients infected with *Legionella* bacteria may have a milder, non-pneumonic form of disease called Pontiac fever, which is a self-limiting febrile illness of short duration.

Management

It can be treated with antibiotics.

Prevention

Currently, there is no vaccine available for LD.

It is most important to operate and maintain properly designed man-made water systems to prevent LD. For more information about the good practices in handling man-made water systems, please visit the website of the Electrical and Mechanical Services Department at http://www.emsd.gov.hk for the Code of Practice for Prevention of LD and the Housekeeping Guidelines for Cold and Hot Water Systems for Building Management published by the Prevention of LD Committee.

Members of the public should observe the following advice to reduce the risk of infection:

- Observe personal hygiene.
- Do not smoke and avoid alcohol consumption.
- Strainers in water taps and shower heads should be inspected, cleaned, descaled and disinfected regularly or at a frequency recommended by the manufacturer.
- If fresh water plumbing system is properly maintained, it is not necessary to install domestic water filters. Use of water filter is not encouraged as clogging occurs easily, which can promote growth of microorganisms. In case water filters are used, the pore size should be 0.2 micrometer (μm) and the filter needs to be changed periodically according to the manufacturer's recommendations.
- Drain and clean water tanks of buildings at least quarterly.
- Drain or purge for at least 1 minute the infrequently used water outlets (e.g. water taps, shower heads, hot water outlets etc.) and stagnant points of the pipework weekly or before use.
- Seek and follow doctor's professional advice regarding the use and maintenance of home respiratory devices and use only sterile water (not distilled or tap water) to clean and fill the reservoir. Clean and maintain the device regularly according to manufacturer's instructions. After cleaning/disinfection, rinse the device with sterile water, cooled freshly boiled water or water filtered with 0.2 μm filters. Never leave stagnant water in the device. Empty the water tank, keep all surface dry, and change the water daily.
- When handling garden soils, compost and potting mixes:
  - wear gloves and a face mask.
  - water gardens and compost gently using low pressure.
  - open composted potting mixes slowly and make sure the opening is directed away from the face.
  - wet the soil to reduce dust when potting plants.
  - avoid working in poorly ventilated places such as enclosed greenhouses.
- In addition, immunocompromised persons should:
  - use sterile water or boiled water for drinking, tooth brushing and mouth rinsing.
  - avoid using humidifiers, or other mist- or aerosol-generating devices. Shower may also generate small aerosols.
  - if using humidifiers, or other mist- or aerosol-generating devices, fill the water tank with only sterile or cooled freshly boiled water, and not water directly from the tap. Besides, clean and maintain humidifiers/devices regularly according to manufacturers' instructions. Never leave stagnant water in a humidifier/device. Empty the water tank, wipe all surface dry, and change the water daily.

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Thank you

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Department of Health