

Summary report on the

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Meeting on Legionnaires' disease among European travellers to Dubai: Establishing consensus on a public health event through expert review

Cairo, Egypt
24–25 January 2018



**World Health
Organization**

Regional Office for the Eastern Mediterranean

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1. Introduction

From October 2016 to September 2017, a total of 75 travel-associated Legionnaires' disease (TALD) cases with a history of travel to Dubai, United Arab Emirates, were reported to the European Centre for Disease Prevention and Control (ECDC) from 14 European Union (EU)/ European Economic Area (EEA) countries. Until May 2017, the case number of this severe and atypical pneumonia remained unusually high and no single source of transmission could be identified in Dubai. Authorities in the United Arab Emirates in collaboration with experts from ECDC and WHO Collaborating Centre for Health Promoting Water Management and Risk Communication at the Institute for Hygiene and Public Health, University of Bonn (UBIHPH), with support from WHO, conducted a series of investigation, assessment and control activities in Dubai. The gradual return to the baseline level of TALD in the latter half of 2017 suggests that the measures implemented by the Dubai authorities have been effective in containing further transmission.

This unusual international public health event posed multiple challenges. These included those related to coordination, information and communication between jurisdictions, institutions and experts. In addition to technical challenges to identify the source of transmission and institute effective control measures, there was also a reputational risk for all stakeholders involved. Therefore, it was proposed that a consultative meeting be convened by WHO to review the outbreak and experience, draw lessons for future events, and serve as a feasible model for handling complex outbreaks involving multiple sectors and countries. Participants included senior managers and experts from the United Arab Emirates Ministry of Health and concerned Dubai authorities, ECDC and the UBIHPH.

The objectives of the meeting were to:

- discuss the role and function of each concerned institution, focusing on existing systems and practices in surveillance and control of Legionnaires' disease;
- review and conclude the sequence of events, action taken and results of the field investigation and control measures taken to contain the transmission of TALD; and
- further discuss, agree and document what can be improved in managing future outbreaks of TALD.

2. Summary of discussions

Epidemiology, surveillance and control of Legionnaires' disease

The principal mode of transmission of Legionnaires' disease is airborne and the sources of transmission are exclusively artificial water systems. The disease usually occurs among people aged over 50 years. Even a single case of Legionnaires' disease must be reported so that clusters and outbreaks can be detected and managed in a timely fashion.

Like other travel-related infections, Legionnaires' disease has legal implications, as the sources of infection are from artificial water systems, which creates grounds for the responsible authorities and corporations to face litigation, for instance if tour operators are not informed and hotel owners have not taken corrective action in time.

Given the high impact and severity of TALD, European countries have operated the European Legionnaires' Disease Surveillance Network (ELDSNet, previously EWGLINet) since 1986, as a common reporting system for TALD cases, which is unique since among WHO regions. This combined with the travel patterns of EU citizens who

seek warmer climates, such as in Dubai, from October to March, are possible reasons that most cases were reported in Europe. However, there are many unanswered questions, despite United Arab Emirates having one of the best surveillance systems for communicable diseases. For instance, *Legionella* bacteria also cause a milder infection called Pontiac fever, and it is not known whether the Dubai residential population has experienced Pontiac fever.

It is not routine practice in most countries outside Europe to collect information from persons with Legionnaires' disease on their travel history, so there could be underreporting globally. Even where good surveillance systems exist in countries, not all cases are reported. For example, of an estimated 15 000 to 30 000 cases of (mainly sporadic community-acquired) Legionnaires' disease in Germany each year, only 1000 cases are reported. This shows that there is possibly significant underreporting of Legionnaires' disease cases.

An unusual public health event: epidemiological, environmental and laboratory investigations

The outbreak was considered unusual due to a number of factors. In comparison with ELDSNet figures over the past 30 years, the number of cases of TALD reported from Dubai surged over the baseline (at peak more than three-fold). Additionally, there were two rapidly evolving clusters (defined as one accommodation site having three or more TALD cases with symptom onset within a three month period) reported in two consecutive months in October–November 2016, which was another unusual feature and a reason for raising the alarm. A further unusual factor was that about 60 (10%) of Dubai hotels were implicated in one year. The situation was abnormal, unexpected, and required rapid investigation.

When reviewing the genotyping results of cases, it was found that the *Legionella* sequence type was 616, which has been predominantly associated with Dubai. In previous Legionnaires' disease cases reported to ECDC, sequence type 616 has not been isolated from other parts of the world, indicating that the Legionnaires' disease was travel-related and not acquired from the countries of residence (altogether 14 countries). As this finding requires further study, ECDC is gathering information regarding the source of infection for all cases/strains reported with sequence type 616 in the Sequence-Based Typing (SBT) Database.

Furthermore, isolating the identical *Legionella* sequence type 616 in TALD cases and in the public water distribution system of Dubai under investigation in 2016–2017 implies that the public water system is a plausible common source feeding *Legionella* into the plumbing systems of buildings. *Legionella* should therefore be monitored in a more detailed way in the public water distribution system, even taking into account that until today such requirements are not proposed in international guidelines. By this monitoring, a solid scientific basis can be built up for future risk assessment and risk regulation. If the internationally-accepted technical rules for the management of plumbing system in buildings are not fulfilled, a regrowth of *Legionella* in plumbing systems and in the last metre of water taps and shower heads can result. In this case, travellers could be exposed to high concentrations of *Legionella* bacteria and thereafter develop Legionnaires' disease.

In discussion on why there were so many cases in a small area such as Dubai, it was pointed out that the majority of Legionnaires' disease clusters can get concentrated in a relatively small geographical location if there is a common source. The latest increase in cases of Legionnaires' disease in Dubai in November 2017 can be attributed to

an increase in the number of tourists in the country during the so-called “shoulder season” when retired people travel, since it is more expensive to travel in December which is peak tourism season. There is no connection between the Legionnaires’ disease cases reported and the influenza season in Europe, which starts in January/February.

When considering why all cases were among European travellers, it was pointed out that European travellers were largely older, retired people – a demographic group that is at higher risk for Legionnaires’ disease – whereas the resident population of Dubai is younger. Additionally, there has been an increase in travel from European countries to United Arab Emirates, which may be influenced by insecurity in other tourist destinations formerly popular with European travellers. More importantly, even if there had been TALD among non-European travellers there is no international surveillance scheme (similar to ELDSNet) to detect them.

It was noted that TALD reporting has increased throughout the WHO Eastern Mediterranean Region, and not only in the United Arab Emirates. It is unusual to find Legionnaires’ disease in people under 50, and TALD tends to affect slightly older populations. There are perhaps other influencing factors that have caused so many cases of Legionnaires’ disease, and this outbreak is an opportunity to identify them. It is also important to know the trend of Legionnaires’ disease in local populations.

There was discussion on why the local population and hotel staff were not affected. It was hypothesized that Dubai residents have developed a certain level of immunity to the disease, and that only tourists are affected when exposed for the first time. More research needs to be done into this area.

There was also discussion about why TALD was getting so much attention despite the low number of cases. It was noted that ELDSNet had been created to prevent Legionnaires' disease in EU citizens while travelling, and that ECDC had a mandate to communicate risks for EU citizens. It was postulated that in future more cases may be reported in general due to increased awareness and reporting in Europe.

It is likely that more TALD cases will be reported from United Arab Emirates, and TALD cases and clusters have also been reported from other countries in the Region. However, regardless of where TALD is found, the situation is a golden opportunity to improve the prevention and response to Legionnaires' disease in United Arab Emirates.

Multiagency collaboration, information-sharing and communication

The issue of communication and information-sharing among stakeholders was extensively discussed. United Arab Emirates stated that the alert came late initially. This delayed analysis of data, and key details were missing, which contributed to a slow response. As per the ELDSNet scheme, ECDC sent standard ELDSNet notifications (containing the minimum amount of information needed to identify and issue the cluster/site notification report) to the national ELDSNet focal points, rather than the WHO International Health Regulations (IHR) focal point, in the country of residence of the cases. The United Arab Emirates received information only through ECDC, and not from the country of residence of cases, and there were details (such as complete travel history of the cases) missing or unclear.

As ECDC had no voluntary direct contact point in United Arab Emirates for notifications from ELDSNet, unlike other countries worldwide, direct communication from ECDC to United Arab Emirates had to be established. This was effectively facilitated by WHO,

allowing communication between United Arab Emirates and ECDC to gradually improve and was efficient by the end. However, the noting in a ECDC report of Burj Khalifa as a likely location for a potential infection was a problem, as this information had political, economic and scientific ramifications, and United Arab Emirates considered it needed to be cleared by the country prior to sharing with the public. ECDC clarified that the statement was part of a confidential report made available only to national authorities participating in supplementary data collection implemented by ECDC to support investigations in the United Arab Emirates, and stated that it was unlikely that Burj Khalifa was a site of infection. Although the wording and placement had created confusion, it gave all parties a chance to consider how such information should be shared and worded.

While there was no delay in sharing information from ECDC, it was found that the person at WHO previously responsible for sending out notifications was no longer in the position to perform the task as needed (hence some delay). This has now been addressed and rectified. Notifications now go to all concerned parties through IHR focal points, which in the case of United Arab Emirates is also the nominated voluntary ELDSNet contact point, which has improved communications tremendously.

One of the challenges Dubai faced in implementing timely control measures was the lack of sufficient epidemiological data guiding field/site investigation. For better collaboration in future, in addition to minimum data (already contained in standard ELDSNet notifications provided by ECDC), supplementary information (as needed in an event warranting further investigation) should be identified and the mechanism to obtain this information directly through national ELDSNet focal points should be agreed upon. Complete history of travel, in particular, is an essential piece of

information important for identifying the source and implementing the most appropriate control measures.

A lot of information needed to fully comprehend the outbreak is still missing, including epidemiological information on all cases belonging to the same cluster, which can last for up to two years. Nevertheless, this can be considered a success story in terms of communication and transparency for investigative missions.

Control measures implemented

The Dubai municipality took additional control measures after receiving the notifications and according to the recommendations made by the WHO missions. They introduced the requirement for an automated chlorine dosing system at the entry point of hotel plumbing systems from the public distribution system. Additionally, they increased the frequency of sampling and inspections to ensure that the quality of results is high. They have also unified their accredited laboratories in the use of one standard control methodology: ISO 11731. The Dubai municipality central laboratory was used as the reference laboratory per the recommendation of WHO. In addition, the introduction of genetic sequencing of *Legionella* isolates into Dubai laboratories is being considered. Currently, there is a proposal in place to have the sequencing laboratory as the reference laboratory for the United Arab Emirates. To further enhance surveillance in Dubai, new guidelines for *Legionella* control are being developed and community awareness campaigns are being implemented.

The root cause (ultimate source) of this novel disease emergence in the country is still unknown. However, it is clear that the water system has been contaminated and that *Legionella* has accumulated over time. The authorities continue to investigate this to identify the source(s) for better

control measures. Although the current control measures were sufficient to contain the outbreak and return to baseline level for a period of time, further prevention and control initiatives should be explored.

Managing future events

Legionella must be addressed at the public water system level, and avoiding colonization (in building plumbing systems) must be a key part of the strategy to reduce Legionnaires' disease. Flushing and other precautionary actions taken at the consumer end (hotels, hospitals, large buildings) were suggested to mitigate the risk of Legionnaires' disease. There may be sporadic cases of Legionnaires' disease in a city, hence hotels must have a robust system to maintain low levels of *Legionella* bacteria in their water systems to prevent cases and outbreaks.

As a risk regulation approach, Germany has developed a system that has resulted in low concentration of *Legionella* in central parts of building plumbing systems. However, it was noted that the stagnation of water at the end points of the route, for example in showerheads and water tanks, should not be overlooked. Individual prevention methods should be encouraged, one of which is flushing out before using the water facility. Thus, a flushing policy was discussed and proposed accordingly.

The control measures suggested were as follows.

- Hotel cleaning staff could run the water during their regular day-clean and most importantly, during the check-in cleaning.
- Facilities can be flushed on a daily basis even if the room is not occupied.
- ECDC's published recommendations for hotel managers should be followed: run all taps and showers in guest rooms for several

minutes at least once a week if they are unoccupied and always prior to occupation.

- Stringent policies could be placed on hotels to advance their cleaning standards.
- Educational material could be distributed to raise awareness.

A concern was raised about the sustainability of a flushing policy due to the scarcity of water in the Region. Another concern is the risk to the individual standing next to the facility while it is being flushed of inhaling *Legionella*.

While one of the ways to mitigate the risk of *Legionella* growth is the ultraviolet treatment of water, in United Arab Emirates this was tested and found to be unfeasible due to the size of the public water distribution pipes. It is also not advisable to increase water chlorination as this is ineffective against *Legionella*, which can stay protected in biofilm.

Sediment in reservoirs is another growth/colonization point for *Legionella*. Checking sediment and reviewing the reservoir cleaning process was suggested, as it can disrupt biofilm and may release higher levels of *Legionella* into the water system.

Even though the Dubai municipality has internationally comparable standards and practices for the control of *Legionella* in water systems, testing for *Legionella* in the public water distribution system is not part of routine public water quality control in any country at present. However, testing is necessary to establish a baseline for *Legionella* case figures in countries, and United Arab Emirates has a plan to test sites for *Legionella*, and welcomes additional recommendations for *Legionella* testing. Moreover, given that tracing the source of *Legionella* is complex, and there could be an increase of potential

sources in all fast growing cities, additional investigative measures must be adopted to fully understand the nature of *Legionella*.

It was pointed out that guidelines for community tap water must include guidelines on *Legionella* testing, which are presently different in each country. Participants requested that WHO publish standard guidelines on acceptable *Legionella* levels in water systems.

With public water systems in warm countries, the risk for harbouring *Legionella* is higher, where water is at the ideal temperature for *Legionella* growth, making it important to test for *Legionella* and maintain low levels of *Legionella* bacteria. There are no known markers for virulence or infectious doses of *Legionella* as yet because individual host susceptibility plays a critical factor in developing Legionnaires' disease.

Routine bacterial testing for faecal organisms does not help in identifying the presence of aquatic micro-organisms such as *Legionella* in water systems. It has become necessary to identify new ways to test water for additional micro-organisms that presently go undetected.

The suggestion was made to analyse water for amoeba (protozoa), as *Legionella* is known to hide in amoeba where it cannot be detected. *Legionella* can live and grow amoeba, making it more virulent when released into water systems. Hence, it is important to look for amoeba in sediment or biofilm. It could also be useful to look for amoeba in the public distribution system and in buildings, but is not proposed for normal verification.

Little is known about the presence of amoeba in seawater and it was proposed that it may be easier to test water at the user end. Nevertheless, it was suggested that there is indeed scientific basis for

checking water for amoeba to locate *Legionella*. While such practices do not exist, this is an exceptional opportunity, given the unusual outbreak, and would serve as a pioneering step in expanding global understanding of *Legionella*.

Attention was drawn to the routine use of urine antigen test for *Legionella pneumophila* serogroup 1, as it is the most prevalent disease-causing variant. The significant rise in the number of notified cases in 2016 was noted and it was suggested that this is due to increased clinical awareness for diagnosing *Legionella*. However, *Legionella* infection testing was established before 1997 in Dubai and has been done using serological testing. It was noted that the turnover for serological results requires weeks, making urine antigen testing more time efficient and specific. However, the urine antigen test detects only *L.pneumophila* serogroup 1. In this case, environmental sampling and testing using cultured isolates can also detect other *Legionella* species and serogroups. A disadvantage of the urine antigen test is that it does not require cultured isolates (a urine sample is enough). It is therefore critical that *Legionella* cultures from both patients and the environment are available for comparison in the event of an outbreak.

A request was made that WHO and the EU innovate a quicker diagnostic test for *Legionella*, as it presently takes up to 10 days to diagnose culturable *Legionella* in water systems (a PCR test can be run in a couple of hours, but it detects both live and dead bacteria).

3. Conclusions

The meeting was a model of cooperation for how multiple stakeholders can come together to review an international public health event and agree on the way forward for continued collaboration. All participants

agreed that the outbreak had been handled in a satisfactory manner by all stakeholders.

The importance of confidentiality was emphasized. There was general consensus on the need to increase trust and communication between stakeholders.

It was agreed that the details of the outbreak would be compiled and consolidated to be published as a success story. The United Arab Emirates authorities will obtain appropriate authorization before committing to any publication activities. The United Arab Emirates authorities were invited to present the case at the ELDSNet meeting in Lyon, France, in August 2018.

The recommendations proposed by the meeting and detailed below will be added to the work plans of the respective authorities and institutions.

4. Recommendations

Actions to minimize bacterial growth at risk points

1. Concerned regulatory authorities should ensure the minimizing of bacterial growth/colonization in central points of building plumbing systems of hotels and large buildings. The level of *Legionella* should be monitored and kept at the lowest.
2. As an immediate precautionary measure, hotel managers should introduce a flushing policy in hotels with recent cases to avoid growth in the last metre (shower or tap outlets). As a long-term measure, the flushing policy should be instituted by a directive to large hotels.
3. The Dubai authorities should complete the programme of testing, control and cleaning up of the risk points in the public water

distribution system. As part of these additional measures, amoeba testing should be included as a proxy to detect *Legionella*.

4. The Dubai authorities should consider introducing mandatory regulations for newly-built buildings to test leakage through the use of nitrogen gas instead of water.

Surveillance and control measures

5. Concerned authorities of United Arab Emirates should develop genetic sequence typing capacity. Where there are sporadic cases in a hotel, it will be beneficial to have environmental monitoring to compare the patient strain with the environmental strain; therefore, laboratory capacity should be developed to perform molecular epidemiology analysis.
6. The Dubai authorities should establish a routine *Legionella* surveillance scheme for the public water distribution system.
7. The Dubai authorities should monitor enforcement of all surveillance and control measures (with performance indicators) by hotel owners, and ensure they are compliant and motivated for implementation.
8. WHO should update its guidelines *Legionella and the prevention of legionellosis* (2007), covering prevention and control of *Legionella* in public water distribution systems.

Notification, information and data-sharing

9. Timely notification and information-sharing should be ensured between ELDSNet and the national focal points of concerned countries, including both country of residence (such as countries in the EU) and country of travel destination (such as United Arab Emirates).

10. Additional technical documents that are not available in the public domain (such as round table reports, mission reports) should be shared between concerned authorities/institutions.
11. More data should be provided to the authorities of the country of travel destination, as needed, to guide field investigation. Supplementary data not currently available in standard ELDSNet notifications should be agreed upon, which can be requested from the reporter of the notification.
12. The concerned authorities/institutions should ensure common understanding of the data sets shared.

Communication

13. National authorities should regulate communication between technical departments/institutions of country of destination and country of residence to be solely through the focal point. All other communication between stakeholders needs to be well-regulated in order to ensure the information arrives at the right time and to the right people.
14. The concerned authorities/institutions should ensure explicit clarification of what documents (or parts of documents) shared are confidential and what can be communicated publically.
15. Tour operators should be used for communicating travel risk to the public and informing them about the urgency of visiting a practitioner upon noticing unusual symptoms, especially the most vulnerable travellers
16. National authorities should adopt the ECDC recommendation to ensure that the named person is trained in control of *Legionella* and other staff are trained to be aware of the importance of their role in controlling *Legionella*. There is an ECDC leaflet available on what should be included in this training. ECDC will send this

to the Dubai Health Authority. The IHR office should be the focal point for this new guideline.

Future research and publications for documenting the case

17. To identify the ultimate source, the Dubai authorities should consider investigating the presence of *Legionella* in sewage, water reservoir and other water installations beyond the public water distribution system.
18. To assess disease prevalence, the Dubai authorities should consider conducting a sero-epidemiological study in the Dubai population as part of other studies on the etiology of severe pneumonia.
19. The Dubai authorities together with ECDC, UBIHPH and WHO should publish a peer-reviewed research paper on this unusual outbreak with contributions from all the consultation participants and relevant stakeholders.
20. WHO should generate a case study to be used for operational learning, for example, as part of training events or operational policy in other countries.
21. WHO should publish a case report to show how the IHR framework has been used to manage this unusual event. The transparency of the country, the maintenance of the channel, and the containment of the outbreak needs to be highlighted.



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