Draft Highlights of Web-Meeting

Technical Discussion on COVID-19 and Swimming Pools 14th of May 2020

During this technical meeting, an international group of pool experts had an online discussion about what we know about COViD-19 and chlorinated Swimming Pools.

List of participants	Video participants
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After a short social talk, we started the discussion.

1. Release of COVID-19 during swimming (respiratory droplets, saliva, mucus, swim diapers).

According to recent (yet unpublished) research by Richard Falk[1], it seems that the transmission of COVID-19 through the air is more important than the transmission by contaminated surfaces. This suggests that there should be more focus on respiratory droplets than saliva, mucus or swim diapers in swimming pools. Besides coughing and sneezing, respiratory droplets are also released during talking. According to Ferretti (2020), this publication was shared by Richard and will be added to the minutes, infectiousness of COVID-19 will be highest from pre-symptomatic and symptomatic swimmers. The symptomatic only have mild symptoms, so it will not be easy to reduce the release of COVID-19.

Although it is known that the COVID-19 appears in fecal matter, it is a respiratory virus. Nevertheless, accidental fecal releases should be monitored and when it occurs, measures are needed, mainly to reduce the risk of spreading Crypto or Giardia, rather than COVID-19. Still it is wise to only allow swim diapers to be used in separated pool basins, that can easily be cleaned and decontaminated.

2. Dilution of viruses in the pool water, the influence of swimming and circulation.

In order to have a good dilution of released COVID-19 it is important to remain the recirculation of the pool water at 100%, at least during swimming hours. Recirculation is also important the mix the free chlorine, which is needed for inactivation of COVID-19.

[1] Richard and his team finished the research and hopes to start writing asap.

3. Disinfection of COVID-19 in chlorinated swimming pool water

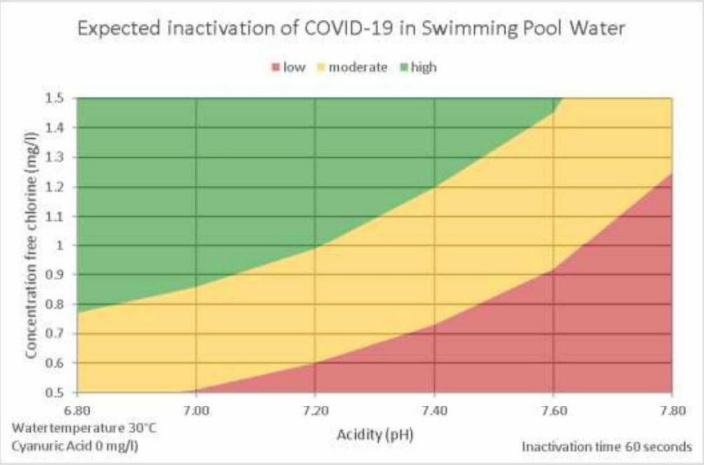
Unfortunately, there is no scientific evidence for the effectivity of chlorination on COVID-19. To deal with this, two approaches can be followed.

a) SARS-CoV-1 is more sensitive to chlorination than E.coli, measured at high chlorine levels in wastewater (Wang et al. 2005). Therefore use the Ct value for E.coli to inactivate COVID-19 in swimming pools.
b) As an enveloped virus, COVID-19 is more sensitive to chlorination than the Adenovirus, a non-enveloped virus (Arduino et al. 2020). Therefore use the Ct value for Adenovirus to inactivate COVID-19 in swimming pools.

According to approach a), a Ct value of 0.25 mg.min/l results in a 4-log reduction of VOCID-19 (0.5 mg/l free chlorine during 0.5 minutes, at pH 7.0 and 23°C). For approach b), a Ct value of 0.75 mg.min/l results in a 4-log reduction of COVID-19 (0.17 mg/l free chlorine minutes during 4.41, at pH 7.0 and 5°C).

During the meeting there was consensus that approach b) is a safe approach, but not everyone agreed with approach a).

After the meeting I made some graphs, because we need to translate the Ct values to something an average pool operator can understand. As Michelle pointed out, the level of education among pool operators is low. It is expected that this goes for a vast majority of the pool operators worldwide. I ended up with, what I call, HOCl-bars (pronunciation as hockl-bars sounds nice)[2]. Similar to isobars, the HOCl-bars represent equal levels of HOCl. The level of HOCl is mainly determined by the level of free chlorine and acidity (pH), and to a lower degree also pool water temperature. Within the Ct value, besides HOCl, time is also important so I made two graphs, one for an inactivation in 60 seconds and one for an inactivation in 30 seconds, see below graphs.



[2] If a name for these graphs already exists, then we better use that name and forget HOCl-bars

I started making these graphs for the Dutch pool operators, so chlorine and pH ranges are based on Dutch legislation, but can be changed easily.

An important factor for the effectivity of the disinfection is the presence of cyanuric acid. The graphs are made for the absence of cyanuric acid (current situation in most Dutch pools). I made the same graphs in the presence of cyanuric acid, but then they become completely red as soon as cyanuric acid reaches 13 mg/l (or 6.5 mg/l with inactivation in 30 seconds).

The problem in some countries represented in this meeting is that regulated pool water quality parameters not always allow to increase the free chlorine level and/or reduce the acidity to a desired level.

4. Disinfection of the coronavirus on surfaces in swimming pool buildings

As transmission of COVID-19 through the air is more important, the disinfection of surfaces becomes less important. It is suggested to handle surfaces similar as hands. So wash them with soap, leave to soak for 20 sec. and rinse of with water. The use of high concentrations of chlorine, H_2O_2 or ethanol are not needed in swimming pools when symptomatic swimmers and pool staff stay at home. It is more likely that these high concentrations of disinfectants can cause harm to swimmers or staff or damage to surfaces or materials.

Some surfaces are not easy to disinfect, such as foam equipment or canvas inflatables. It is suggested to avoid the usage of this equipment and to use only if necessary, so not for recreational use. If used, drying after usage is the best you can do in practice.

5. Exposure to Coronavirus during swimming

Although it was suggested that transmission of COVID-19 through the air is more important than transmission by infected surfaces, this has not been published yet. It is not clear how the scientific

community will respond to this new publication. For the time being, physical distancing remains very important, also during swimming. As suggested by Regina, physical distancing is a better term then social distancing.

Besides dilution and disinfection, as a respiratory virus, the infectious dose differs depending on the transmission route. For inhaled respiratory droplets, the infectious dose is lowest, and for swallowing pool water (containing COVID-19) the infectious dose is much higher. Nevertheless, it is suggested to reduce the formation of aerosols from pool water. These aerosols can be released from whirlpools, water slides, and other recreational elements. As John and Susanne also indicated, economic pressure to re-open recreational facilities is high. It is therefore suggested that recreational elements can only be used with proper inactivation of COVID-19 in the pool water (preferably in 30 seconds)[3], combined with proper ventilation (explained in more detail in next topic).

In order to reduce both release and exposure, Austria is planning to use a minimum of 6 m^2 of water surface for each swimmer. In the Netherlands the recommended water surface per visitor depends on the type of activity. When swimmers are moving (like lane swimming), more distance is needed (10-12 m^2/swimmer) compared to when swimmers remain more or less in the same position (9 m^2/swimmer). The Dutch guideline leaves room for pool operators to fine-tune their local guidelines, depending on the local situation.

6. Air conditioning and circulation

Some publications suggest that VOCID-19 in aerosols and on surfaces might survive during several days. Good ventilation during the opening hours is therefore important to reduce aerosols. During the meeting, a top-down air circulation was suggested to be favourable, although the behaviour of the aerosols in the pool hall it is not clear. It is suggested to avoid recirculation of pool air and have as much fresh air intake as technically possible. Be aware that software updates can be needed in order to run the new COVID-19 settings in the air conditioning and ventilating system. During the summer time, when outside temperature is not very low, maximum fresh air intake is not a problem for most pools. But when outside temperatures start dropping, this will more and more become a technical problem. The main problem lies in the heating capacity of a pool building, during winter this heating capacity could be unavailable, depending on design parameters. We still have during summer to come up with possible solutions for the winter time.

7. Vulnerable visitors / swimmers

All agree that vulnerable swimmers should not go swimming during the VOVID-19 pandemic. Pool owners/operators should inform vulnerable swimmers about the risks. In the end it is up to the swimmers themselves to make the decision whether to swim or not.

8. Pool related topics (floating tanks, natural pools)

In natural pools there is no disinfection. Although the dilution can be high, COVID-19 is not inactivated during natural treatment. Austria suggested to reduce the maximum allowed number of

[3] HOCl-bars can be used for this

swimmers so there is 25 m^2 water surface for each swimmer. Several experts suggest not to open the natural pools during the COVID-19 pandemic.

Floating tanks have a very high salt-concentration. For bacteria, the high osmotic pressure is a hostile environment in which many will not survive. But COVID-19 might be able to survive high salt-levels. For floating tanks, disinfection therefor is also important. In the USA, a secondary disinfection is required in these systems.

9. Summary and closure

It was very fruitful to discuss different aspects of COVID-19 and swimming pool with a group of pool experts. For future topics this can be good way to have (frequent) meetings among pool experts worldwide. Please contact the group of experts if new topics arise.

10. Next meeting

The next meeting will be a conference, mainly on COVID-19 protocols. The conference will be held in the afternoon (Italian time) on Monday 22nd of June, 2020. If you want to give a short presentation about your countries COVID-19 swimming pool protocol, please contact with Vincenzo Romano-Spica. Invitations to join this conference will be send later.

References

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