Llywodraeth Cymru
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Technical Advisory Group

SARS-CoV-2 infection risks at indoor exercise facilities

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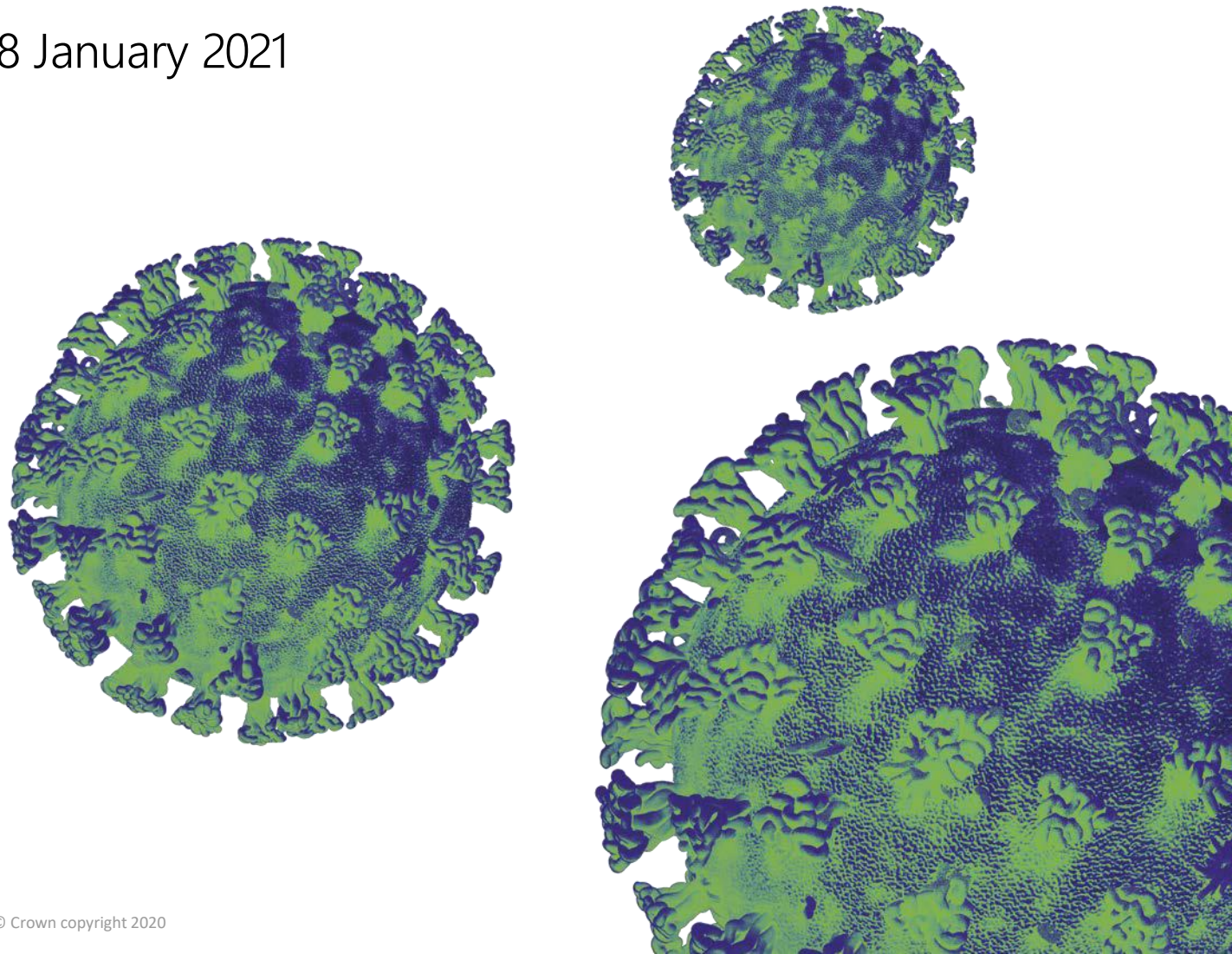

Technical Advisory Group - Environmental Science Subgroup

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8 January 2021

Scope: This document identifies the key risks associated with the use of indoor exercise facilities, defined here as gyms, leisure centres and dance or exercise classes, within the context of COVID-19 before outlining a range of mitigation options. This advice applies to indoor exercise facilities regardless of their ownership or management. Considerations regarding team sports, professional sports or aquatic facilities are outwith the scope of this current guidance. Saunas and steam rooms will also be considered separately.

There is a large amount of variability in the different activities gyms and indoor exercise classes/organisations provide and the spaces in which they provide them. It is recognised that not all gyms are the same and so this document will focus on general principles. It is also recognised that exercise has a major impact upon wellbeing, however this paper's scope solely focuses upon the environmental risks and mitigations.

Summary of Advice: We identify the high potential for superspreading events within indoor exercise facilities, contamination of surfaces and equipment, peripheral activity and workplace risks, and the impacts from reduced access to facilities. Chief among these is the risk of superspreading events. During periods of higher COVID-19 incidence, the risks posed by superspreading events are beyond acceptable levels. At lower levels of COVID-19 incidence, we propose that reduced occupancy combined with maximised ventilation represent important mitigations if these facilities were to remain open.

SAGE previously calculated with moderate confidence that gyms, leisure centres and fitness centres represented a low to moderate impact to transmission at a national level. It was estimated closing such facilities could reduce R_t up to 0.1 from their closure was estimated, although difficulty in estimating precisely changes in R_t was noted (UK SAGE).

1. **Potential for superspreading events**. (Direct risk)

   Risk: High **Confidence:** High

The transmission dynamics of COVID-19 are characterised by the propensity for clusters of infections to occur in certain conditions, in particular as superspreading events (SSE) where one or few infectors seed many infections (e.g. *Althouse et al 2020; Wong and Collins, 2020*). Reducing the likelihood of such SSE is therefore critical in mitigating the transmission of SARS-CoV-2 to manageable levels. Early in the pandemic, infected fitness instructors in South Korean gyms resulted in 12 SSE within a 24 day period, highlighting the risks posed by vigorous exercise in confined spaces (Jang et al 2020). A rapid review of reported superspreading events in an informal database (https://kmswinkels.medium.com/covid-19-superspreading-events-database-4c0a7aa2342b) comprising 2,007 events to the 27th of November 2020 identified 615 cases from 15 events (on average, 41 cases per event) associated with dance/fitness classes (9 events) or gym use (6 events). This is very likely an incomplete coverage of events but merely serves to illustrate the continued potential for SSE within indoor exercise facilities.

This is contrasted with a randomized controlled trial performed in Norway between May 25, 2020 and June 7, 2020 where the incidence of PCR-confirmed SARS-CoV-2 infection in 1,896 individuals permitted to use gyms with a control arm of 1,868 individuals was monitored (Helsingen et al 2020). Only one individual in the study returned a positive test due to a workplace infection. In the study region, a low incidence of 3.5-11 cases per 100,000 population was reported during the study. The insight afforded by this study is therefore limited to reinforcing the notion that transmission events within indoor exercise facilities are unlikely if the prevalence of the disease is low within the community. As the rates of SARS-CoV-2 transmission increase, so do the propensity for clusters of infection (e.g. Knight et al 2020). The risk of SSE within indoor exercise facilities is therefore primed by the overall prevalence of COVID-19 within a given community, indicating the requirement for control measures in facilities which are reflexive to risks within their communities.

To mitigate the probability of SSE within indoor exercise facilities, in addition to standard controls aimed at reducing fomite transmission (e.g. hand hygiene, high touch surface disinfection) or near-field infection risks (e.g. two metre social distancing) the utility of controls intended to reduce the probability of SSE are indicated. The first of these is to reduce the number of facility users sharing an indoor space at a given time to reduce the probability and impact of a transmission event by reducing the probability an infectious person is present and the number of exposed contacts. Maintaining a minimum of two metres distance in all directions is required, but this is also challenging as users may move rapidly around the indoor space for some activities. Activities should be planned to ensure that this minimum distance is always met. Spacing exercise stations or markings with three metre radii between users could provide an additional safety margin. Mitigating the risk from aerosol transmission merits detailed consideration as set out below.

2. **Infection through aerosol transmission** (Direct Risk)

Risk: High **Confidence:** High

It is highly likely that the potential for SSE is driven by the colocation of individuals undergoing intense physical activity. The quanta emission rates of SARS-CoV-2 from infected individuals are markedly elevated due to physical activity resulting in increased rate and depth of exhalation (e.g. Buonanno et al 2020). The importance of ventilation as a means of reducing long-range COVID-19 transmission risks in diverse settings is already emphasized with high confidence (SAGE-EMG, 2020). Where appropriate, exercise in well-ventilated outdoor shelters or outdoor activities should substitute indoor activities. Recognizing the importance of ventilation provides further impetus for reducing occupancy of an indoor exercise facility to aid the utility of existing ventilation. However the paramount importance of maximising the air change rate to dilute emitted SARS-CoV-2 particles as efficiently as possible is stressed. A potential mitigation is the provision of 100% fresh air rather than the recirculation of air within or between indoor spaces, and a rate of 20 litres per second per person is recommended in line with UK Government advice (https://www.gov.uk/guidance/working-safely-during-coronavirus-covid-19/providers-of-grassroots-sport-and-gym-leisure-facilities). It should be noted this advice pre-dates the recognition of the “new variant” of SARS-CoV-2 (VOC-202012/01, lineage B.1.1.7) and advice from a paper written by UK SAGE EMG, SPI-B and the Transmission Group (2020) notes all values from previous EMG papers on ventilation should be increased, potentially by a factor of 1.5-1.7 to account for the increased transmissibility of the variant. Adjusting occupancy may help reduce the risk when combined with improving ventilation as required with a minimum of 100 square feet (9.3 square metres) of net useable indoor space per person. Shorter duration sessions, for example 40 minute sessions or classes with 20 minute changeover periods where the space is unoccupied could help reduce risks in two ways, firstly by reducing the time of exposure to infected persons, and secondly by permitting “airing times” or “fallow periods” during changeovers. These periods help by continuing the dilution of released virus particles in the absence of additional source(s) from infected person(s). In addition, this fallow time provide ample time for effective disinfection of surfaces. The evidence that a 20 minute fallow period within every hour helps prevent longer term accumulation of aerosols is derived from modelling scenarios using classrooms (Melikov et al 2020) rather than indoor exercise facilities, thus is presented as a conservative estimate. Carbon dioxide monitoring may prove expedient for monitoring the dilution of indoor air with fresh air to reduce the rebreathed fraction of the exercise space (Andrade et al 2018).

3. **Infection by direct contact with contaminated surfaces and equipment shared between users** (Direct risk)

   Risk: High **Confidence:** High

Indoor exercise facilities typically offer access to a wide range of shared equipment (e.g. exercise machines, bikes, weights, mats, climbing surfaces) which may become heavily contaminated by respiratory secretions from infected users (e.g. Mukherjee et al 2014). SARS-CoV-2 is likely to remain viable when deposited on such surfaces for enough time for secretions from an infected user to contaminate subsequent users (Van Doremalen et al 2020). The importance of regular and effective hand hygiene is stressed but the need for effective disinfection of equipment between each user represents a primary control. The selection of effective disinfectants must bear in mind efficacy against SARS-CoV-2 and other potential infectious agents but also their safety for use by members of the general public.

4. **Indoor exercise facilities as workplaces and peripheral activities** (direct risk)

   Risk: Medium/High. **Confidence:** High.

While risks to and from facility users during exercise have been emphasized above, it should be recalled that indoor exercise facilities are also places of work and also include other activities which may pose risk (e.g. locker and shower facilities, cafes, administrative offices, viewing galleries). These factors may compound the risks of SARS-CoV-2 transmission posed within indoor exercise facilities. Workplace specific guidance should be rigorously adhered to and owners should conduct full COVID-secure workplace risk assessments (https://gov.wales/your-responsibilities-employer-coronavirus).

Considering the SSEs described in South Korea (Jang et al 2020) where infected instructors perpetuated the transmission of SARS-CoV-2 across multiple classes, the potential for instructors to link different classes and thereby multiply the dimensions of infection clusters should be noted. Instructors often provide loud verbal directions to class members, further amplifying the risks posed by an infected instructor due to the elevated rate of emissions from loud speech (Asadi et al 2019; Buonanno et al 2020). This may be mitigated by stringent infection prevention measures on the part of instructors and staff. These should include the use of face coverings where possible (Shaw et al 2020), the reduction or elimination of music to reduce background noise as well as the use of individual-issued microphone headsets, and the cohorting of instructors with dedicated classes where possible.

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