Health, Safety and Wellbeing
Fact Sheet

August 2021

Coronavirus/Covid 19 – transmission risks

THE **occupational risk** of contracting or passing on – *transmitting* - the coronavirus is continuous from leaving home to getting home.

By April 2021, the UK Health and Safety Executive (HSE) had acknowledged that airborne transmission of the virus had, earlier in the pandemic, been underestimated.

Mechanics of transmission

By April 2021, **three main ways** of passing on the virus – and its variants - had been established and acknowledged by the HSE:

§ aerosols and small droplets
§ larger droplets and secretions
§ surface contamination

The chance that someone would become infected when exposed to the coronavirus also depends on individual susceptibility and how much virus each person needs to absorb to become infected.

Particles carrying or containing the virus can enter the body in three ways:

§ Being directly inhaled
§ Directly through mucus membranes surrounding the eyes and in the notes and
§ From hands touching eyes and noses

Generally, maintaining a distance of two metres between people – wearing masks – in a shared, indoor, environment greatly reduces transmission risks.

However, the distance that aerosols and small droplets can travel depends on the power with which they are exhaled.

Close-range transmission routes are complex, because so many factors are involved.

The closer people are to one another, the greater the risk.

Airflow is one of the most significant factors and transmission. Another is activity.

The amount of virus that can be produced and carried on aerosols and other droplets from an infectious person's mouth can vary by a magnitude of 10, according to what they are doing. Less is produced and travels shorter distances if someone is speaking quietly than if they are singing, shouting or "projecting their voice".

The size of aerosols and other droplets can range from 1 micron to 10 microns and the amounts can range from 100 to 100,000 "copies" of the virus per cubic metre. (A micron is a 1,000th of a millimetre.)

Aerosols and droplets can only be found in air that has been exhaled by an infectious person and, generally, disappear within an hour.

The human body can inhale particles (of anything) up to 100 microns in size.

Close range transmission is difficult to prevent and difficult to measure.

Also, the airflow inside buildings can very quickly spread aerosols and droplets in several different directions, including going round or over transparent screens (carried upwards by the heat of a person's breath) so masks remain essential.

Transmission occurs in any setting

Risk factors make some settings more or less dangerous, so transmission associated with a particular setting is not always what it seems. Also, it can occur during work time, but not always in the immediate place of work.

Invisible factors

Ventilation is crucial – and "traditional" standards for offices – of changing all the air 2.5 times an hour – may not be adequate to prevent coronavirus transmission.

However, because aerosols and droplets are rapidly diluted in the air, transmission risks are less in large spaces.

Time is important too. Anecdotal evidence suggests that risks also vary according to how long someone is in a particular space. Fewer people have been infected in supermarkets and buying coffee because they are in those places for shorter periods of time than they are in offices. Therefore the exposure times – and transmission risks – are less.

Individual traits are factors too. The risks from an infectious person who spits as they talk are greater than from someone who doesn't, for example, so wearing appropriate masks properly and for no longer than the recommended periods of time is essential in such circumstances.

Risk assessments

Risk assessments should therefore consider:

§ **Proximity:** Risk increases with shorter distance and face-to-face
§ **Enclosure:** Risk is greater indoors and increases with poor ventilation
§ **Duration:** The risk increases the longer you are close to an infectious person
§ **Activity:** Activities such as singing, speaking loudly and aerobic activity increase breathing rate and viral emission
§ **Crowding:** More people present, the greater the chance of an infector (infectious person) being present
§ **Environmental conditions:** The virus survives in the cool, dry and dark
§ **Symptoms**: Asymptomatic transmission means it is hard to detect infectious people; they may not have coughs or fevers

Evidence of transmission

The relative importance of different transmission routes was still (in March 2021) unclear.

§ Studies show air and surface transmission are both possible.

§ Outbreaks and contract tracing data show transmission risks are greatest when people are close together.

§ With frequent, careful handwashing and regular cleaning of places of work, infection risks from "random" surfaces are minimised.

§ *Super-spreading* can happen and is likely to be airborne transmission, but how often this happens was (by March 2021) still unclear.

§ Little evidence had been found for outdoor transmission, even in crowds or when people were close together.

Respiratory aerosols

The coronavirus as a size of about 100nm but contained with respiratory fluids; it is not "naked"

Generation rate depends on the person and activity: Coughing and sneezing emit more virus than breathing and talking

The volume of virus is greater in larger particles while small particles contain more viruses

Evaporation depends on the composition of the fluids and the micro-organisms within them …

Environmental detection

Laboratory studies have confirmed that the virus can survive on indoor surfaces and in air and that many factors influence the rate of decay and, therefore, the transmission risks.

Exposure to particles

Infection most often occurs from **aerosols** carrying particles smaller than five microns or from **droplets** larger than five microns.

§ Larger particles can stay suspended in the air for longer.

§ Particles up to 100 microns can be inhaled.

§ Surface/facial contamination can be any size

§ The human eye cannot see anything smaller than 40 microns.

§ Transmission risks vary according to exposure "routes".

Aerosol exposure

Scientists and engineers have used models to estimate concentration of virus needed in air together with ventilation rates to try to quantify transmission risks.

They have considered factors such as how strongly and quickly people breath, how far apart people are and whether ventilation systems include filters (and how often they are cleaned or changed).

The ratio of the how much air a room or building contains and how often the air is (completely) changed is crucial.

The relative concentration of virus is eight times greater in among 20 people in 300 cubic metre space than among 160 people in an 8,750 cubic metre space.

Therefore, risks vary according to:
§ the virulence of the virus variant
§ duration of exposure
§ ventilation
§ size of the space
§ aerosol emission and vocalisation

What about hands?

How well hands transfer the virus to the eyes and nose depend on several factors too:
§ The quantity of micro-organisms on the surfaces touched;
§ How often surfaces are touched;
§ The effectiveness of the transfer;
§ The size of the area touched to pick up the virus;
§ How often someone touches their face;
§ How efficiently the virus gets through mucous membranes;
§ The size of the area touched to deposit the virus;
§ How often and well both hands and surfaces are cleaned, and
§ The rate at which the virus decays on surfaces and hands.

Based on online presentations during an online event organised by the Institute of Civil Engineers, with HSE attendance, on March 16, 2021.

Links checked April 2021. The information is the best available at this time.