The Standard
Wednesday, February 5, 2020

A doctor works inside a hospital isolation ward in Wuhan. AFP

THERE'S AN IN AND OUT TO VIRAL OUTBREAKS

Fears over a much more serious coronavirus outbreak is the topmost concern in Hong Kong at this time. Let me try and help to explain some engineering theories behind effective systems that should mitigate possible risks.

Viruses are normally spread through aerosol droplets or sneezing. So, the most effective prevention is to stop the virus from spreading.

An engineering principle would be to screen the source of the viral spread through filters.

Experts believe viruses are mostly transmitted either through sneezing or through human physical contact with contaminated surfaces, like handrails on the MTR, walkways and escalators.

The aerosol gets diluted with distance and time, and the concentration should be diminished at least threefold in geometrical progression along any length of travel. In theory, one can therefore assume that the possibility of being infected across reasonable distances is extremely remote.

A sneeze can result in people on the receiving end being infected through its focusing of aerosol droplets in an area without too much reduction in strength, hence the general advice to wear masks in public, especially in congested areas like railway coaches, aircraft cabins, lifts, busy offices and shops.

The masks act as filters, ensuring viruses do not spread.

In hospitals, those infected are put in isolation wards, normally of the negative pressure type, to ensure that germs, viruses or bacteria are not let out.

Such wards normally include ventilation systems that draw air out at a rate larger than intake, the opposite of conventional air-conditioned spaces.

The extracted air, together with the recirculated air, passes through a filter, usually of the HEPA type, for maximum efficiency in filtration, with 12 air changes per hour ensuring fresh air.

Ultraviolet devices further help kill germs and bacteria. To ensure minimum air leakage, an ante room layout is normally fitted.

Anyone entering such wards must first enter the ante room to put on protective gear before access is allowed.

This double-room system with self-closing doors further ensures no direct flow of air out of the ward.

The design had been in use for some time and was further refined after SARS.

Other commonly used effective isolation systems are the installation of "P" or "U" traps in drains.

To ensure hygiene in plumbing systems, fresh water is filtered and treated with chlorine by the water supplies department, but as some tall buildings use pumped water tanks for upper floors, the tanks must be cleaned periodically.

To ensure bathroom hygiene, bath and floor drains have U-bends or P-traps whose design prevents insects and rodents from the outside with water blocks.

The fitting of such water traps is governed by the Buildings Ordinance, but users are key to their effective operation.

As such, the water column in the trap must be intact, but for new flats or in situations where floors are not frequently washed, dried-up columns can render the traps ineffective.

It is therefore vital to pour water into the drains periodically.

In the final analysis, personal hygiene is vital during this crisis, and isolating the sources of viruses, disinfection of all surfaces in public areas, and reducing unnecessary journeys will greatly help in halting the spread of this novel coronavirus and other harmful viruses and bacteria.

Veteran engineer Edmund Leung Kwong-ho casts an expert eye over Hong Kong's iconic infrastructure