Development of a Transparent Medical Mask to Enhance (Healthcare Worker) HCW–Patient Communication

Problems/Challenges

Verbal communication is a complex cognitive function that goes beyond just hearing. The cognitive encoding of auditory signals is greatly enhanced by non-auditory cues which includes posture, limb gesturing, facial expression, and lip movements. Being able to see a speaker's face aids speech understanding, especially for communication vulnerable persons like those with hearing loss or language difficulties. Studies have found that the contribution of face and lip reading towards speech understanding is proportional to the degree of hearing loss, though persons with normal hearing also benefitted, especially where there is significant background noise.

The COVID-19 `new normal' currently mandates face masks be worn by healthcare workers (HCWs) and patients in all healthcare and community settings in many countries including Singapore. Inadvertently, the mask covers the lower half of the face, obscuring visual cues from lip movements and facial expressions. These masks can also attenuate the level of speech output and negatively impact speech understanding, particularly in noisy healthcare environments like clinic counters, the pharmacy, and in the Intensive Care Unit. In the community, noise levels may be even higher, especially in environments like hawker centres and markets.

Additionally, reduced facial visibility may compromise conveyance of emotions like concern, kindness and empathy, affecting the quality of therapeutic relationships HCWs can build with our patients.

Findings/Solutions

Notably, our survey of both staff and patients had both groups reporting that mandatory face mask-wearing compromised communication, understanding and emotional aspects of patient-HCW relationships. Many HCWs found it especially difficult to communicate effectively with communication vulnerable patients, who typically benefitted from visual cues or lip reading.

To overcome this issue, there needs to be a paradigm shift to disposable medical masks that feature a "transparent" window to allow clear visualisation of the mouth while maintaining existing Health Sciences Authority (HSA) safety standards. It is vital that this redesigned mask provide adequate respiratory protection against droplets, maintain bacterial filtration efficiency of ≥ 95% and fulfil all other safety and performance requirements. Importantly, the clear window must be fog-resistant whilst maintaining breathability.

Current Status/Future Plans

In collaboration with our engineering collaborator, RacerTech, we have already gone through multiple iterations of early prototypes. A Human Factor Engineering process will be incorporated to ensure that this mask meets end user needs i.e. be comfortable, durable, and acceptable. We have recently been awarded the Ng Teng Fong Innovation Grant to support this R&D process with the end point being a commercialisable, HSA-certified disposable medical mask that can be a viable alternative to the current default medical mask.

Concurrent collaborative efforts will be made to develop a reusable version for community use. We will also explore a version with clear window magnification as a novel countermeasure to enhance lip visibility whilst complying with safe distancing requirements. This enhanced visibility version will further aid communications, for e.g. for speech rehabilitation sessions, auditory-visual therapies, voice trainings, and communications with deaf persons. The recent inventions of high performance `transparent' filter fabrics hold exciting possibilities for a fully transparent mask in future.

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