Validation of three decontamination methods for respirators used in South Africa to address stock shortages during the COVID-19 Pandemic

Tanusha Singh [1,2,3], Zibusiso Masuku[4], Tobias van Reenen[5], Daniel Glazer[5], Thabang Duba[1], Onnicah Matuka[1], Lufuno Muleba[1], Zethembiso Ngcobo[1], Edith Ratshikhopha[1], Zubaydah Kirsten[1], Keertan Dheda[6], Lynelle Mottay[6], David Rangongo[1], Dikeledi Singo[1], Lebogang Ntlailane[1], Tebogo Nthoke[1], Jeanneth Manganyi[1]

[1] National Institute for Occupational Health (NIOH), National Health Laboratory Services (NHLS), Johannesburg, South Africa
[2] Department of Clinical Microbiology and Infectious Diseases, School of Pathology, University of Witwatersrand, Johannesburg, South Africa
[3] Depart of Environmental Health, University of Johannesburg, South Africa
[4] The National Institute for Communicable Diseases (NICD), National Health Laboratory Services (NHLS), Johannesburg, South Africa
[5] Council for Scientific and Industrial Research, Built environment, Pretoria, South Africa
[6] Centre for Lung Infection and Immunity, University of Cape Town, Cape Town, South Africa

Correspondence:Tanushas@nioh.ac.za

Introduction: Filtering face piece respirators (FFRs) are designed to meet the filtration efficiency requirements and are used to provide respiratory protection to users in various settings. With the global shortage of FFRs the need for reuse of equipment may be life saving.

Aim: This study aims to investigate the impact of three decontamination methods on the performance criteria of seven commonly used FFRs in South Africa and determine the feasibility of applying the technology for decontamination of FFRs for reuse in the country.

Methods: This was an experimental study conducted in Gauteng. Seven types of FFRs (3M N95, V-flex N95, Kimberly Clarke, Makrite 9500 N95, KN95, 3M FFP2 and Greenline FFP2) were selected and subjected to each of the three decontamination methods namely, ultraviolet germicidal irradiation (UVGI), vaporous hydrogen peroxide (VHP) and moist heat sterilisation. The performance criteria include fit testing, filtration testing and visual inspection. Fit testing was done on volunteers (n= 19) who gave consent for 30 cycles for each FFR after the decontamination process. Filtration testing of 144 FFRs was done after decontamination according to SANS 50149.

Results and discussion

Nine participants (47%) has been through 30 decontamination cycles with VHP. Three participants reached 30 cycles with 3M N95 and V-flex. Only one participant completed 30 cycles for Kimberly Clarke, 3M FFP2 and green line FFP2. All participants failed fit testing with KN95 on the first day and only one passed Makrite N95 for VHP method. UVGI decontamination has gone through 30 cycles with 8 of 18 participants (44%) completing the cycle. All FFRs referred for filtration testing passed the test.

Conclusion

The preliminary findings show that VHP and UVGI does not appear to effect fit testing as nine of 19 participants for VHP and eight of 18 participants completed 30 cycles for UVGI. Instead, the donning and doffing of FFRs may be a contributory factory to fit failure.