Original Investigation

Preventing Facial Pressure Injury for Health Care Providers Adhering to COVID-19 Personal Protective Equipment Requirements

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ABSTRACT

OBJECTIVE: To determine if a repurposed silicone-based dressing used underneath a N95 mask is a safe and beneficial option for facial skin injury prevention without compromising the mask's seal.

METHODS: Since February 21, 2020, staff in high risk areas such as the ED and ICU of King Hamad University Hospital have worn N95 masks when doing aerosol-generating procedures to protect against the novel coronavirus 2019. At that time, without education enablers or resources that could be directly translated into practice, the hospital's Pressure Injury Prevention Committee explored and created a stepwise process to protect the skin under these masks. This procedure was developed over time and tested to make sure that it did not interfere with the effectiveness of the N95 mask seal.

RESULTS: Skin protection was achieved by repurposing a readily available silicone border dressing cut into strips. This was tested on 10 volunteer staff members of various skin types and both sexes who became part of this evidence generation project. Oxygen saturation values taken before and after the 4-hour wear test confirmed that well-fitted facial protection did not compromise the mask seal, but rather improved it. An added advantage was increased comfort with less friction as self-reported by the staff. An educational enabler to prevent MDRPI from N95 mask wear was an important additional resource for the staff.

CONCLUSIONS: This creative and novel stepwise process of developing a safe skin protection method by which staff could apply a repurposed silicone border dressing beneath an N95 mask was largely effective and aided by the creation of the enabler.

KEYWORDS: coronavirus, COVID-19, enabler, facial injury, friction, medical device-related pressure injury, N95 mask, oxygen saturation, personal protective equipment, silicone dressing, skin

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INTRODUCTION

The global impact of the novel coronavirus 2019 (COVID-19) has had severe implications for frontline health care providers (HCPs). The safety of HCPs requires consistent and adequate use of personal protective equipment (PPE). In particular, the use of facial protective equipment against aerosolized transfer of COVID-19 droplets is a key recommendation worldwide.[1] It requires the use of a protective filtering respirator such as a N95 mask, eye protection such as glasses, fitted facial shields, and/or specially designed protective suits. Facilities have noted an attendant increase in medical device-related pressure injuries (MDRPI) among frontline HCP wearing facial PPE protection that requires risk mitigation. Guidelines are being rapidly developed all over the world to ensure that the best solution for each setting can be implemented.

The staff of the King Hamad University Hospital (KHUH) includes many ethnicities and various skin types. As in many other facilities, these HCPs have been wearing PPE with N95 masks in high risk areas since February 2020 as protection against COVID-19 (first confirmed case, February 21, 2020).[2] Early on, the Pressure Injury Prevention and Nursing Quality Committees of the KHUH agreed that PPE-related pressure and skin injury protection of all staff fell under their purview. Bundled pressure injury prevention interventions[3] such as the *INTACT SKIN* bundle are supported by the best evidence for patient pressure injury prevention; the use of these bundles is well documented in high-risk settings. Accordingly, the Nursing Quality Committee advised the Pressure Injury Prevention Committee to follow this approach in developing and testing a skin care bundle specifically

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applicable to the work environment of KHUH for those HCPs providing acute COVID-19 care.

A mnemonic-based approach[4] was used to enhance knowledge retention, with a one-word reminder of the importance of self-care: HELP. This mnemonic was designed to help HCPs remember the new rules and procedures that had been implemented in a very short time. This led to the creation of the HELP enabler, which emphasizes 10 evidence-based points to improve HCP prevention of facial mask injuries (Figure 1). The key message is to help yourself first, before helping others. Elements such as sufficient hydration[5] and nutrition[6] to support a 4-hour shift, emptying bladders before donning PPE,[7] keeping an eye on the amount of time spent in PPE,[1,3,8] good skin hygiene,[9] and the importance of mask leak tests[1] form the basis of this care bundle. Additional recommendations include using an acrylate lotion[10] or a protective dressing[11] for facial protection under PPE.

Because adhesives increase the risk of skin stripping and subsequent skin tear injuries,[12] the use of an atraumatic silicone dressing on the face also was proposed. The Pressure Injury Prevention Committee repurposed a readily available dressing for facial pressure injury prevention in the absence of existing evidence. However, the team had to establish that this use would not compromise the N95 seal efficacy and facial skin would remain intact under the dressing. Further, because this study had to address skin safety for all staff, skin type variation had to be taken into account; for this, researchers used the Fitzpatrick skin type classification.

The Fitzpatrick skin type classification[13] was developed in the 1980s to measure the impact of sunburn injury on different skin types, and is deemed the criterion standard for skin type classification. The classification comprises six skin types ranging from light skin (type 1, which burns easily and never tans, and type 2, that usually burns and

Figure 1. HELP ENABLER

"Help yourself first, then help others!"

	Action	Rationale
H	Hydrate your body effectively in your off time (drink at least 2 L water/day)	Well-hydrated skin is more resistant to skin breakdown[5]
	Hygiene of your face and hands through cleansing and moisturizing in off time	Well-maintained skin has less risk for skin breakdown and irritation[9]
	Hours in personal protective equipment (PPE) accounted for (4 or 6 hours depending on work intensity)	Facial pressure is cumulative over time; less pressure, longer time/higher pressure, less time before skin breakdown[8, 11] Mask-induced hypoxia possible in HCPs[19, 20]
E	Eat a sufficiently nutritious diet in off time	Protein calorie malnutrition associated with increased risk of pressure injuries[6]
	Eat or drink **NOTHING** when in PPE	Shifts of 4 hours for nurses and 6 hours for doctors, nil per month in PPE, resulted in zero infection among staff[7]
	Empty your bladder before donning PPE	Zero bathroom breaks while in PPE also resulted in zero infections[7]
L	Lotion with acrylates applied on the nose, cheeks, forehead, and hands 10 minutes before donning PPE	Acrylate layer protects against interaction between skin and PPE facilitated by vapor and sweat moisture build-up[10]
	Leak test passed **every time** after application of N95 mask	Standard coronavirus precaution[1]
P	Protective atraumatic layer applied over the nose, on the cheeks, under the chin, and on the forehead and sides of the face **before** donning PPE.	Atraumatic dressings are a routine, evidence-based intervention for patient pressure injury protection[8,11,12]
	PPE applied in layers, with most rigid pieces applied over the softer layers	Layers add pressure but can be used to redistribute pressure to offload bony facial prominences[3,8]

tans slightly) to olive/medium brown skin (type 3, that initially burns and tans well, and type 4, that usually tans) and finally to dark brown and black skin (types 5 and 6).[13] In this study no HCP with type 1 (extremely light Caucasian skin) could be included because there are no nursing staff with that skin type at KHUH.

METHODS

This prospective observational cohort study was divided into five steps to establish the appropriateness, efficacy, and safety of each phase. It involved wear-time tests culminating in a final 4-hour crossover experiment. Developing the protocol and assembling key departments (nursing, infection control, quality assurance representatives, COVID-19 hospital committee) to discuss and approve the proposed skin protection protocol took time; this practice innovation began in March 2020 and was tested in the first 2 weeks of April 2020.

Institutional review board approval was received because the study involved human participants (Reference #20-334). Because N95 mask wear is mandatory for COVID-19 frontline care provider safety, any facial injuries sustained as a result were not deemed an ethical objection for this experiment. Essentially, facial injury was the real-life risk this study tried to mitigate. Participants signed an informed consent form to take part in the study and for all photos to be used in subsequent publication with no parts of faces obscured.

Phase 1. Ascertain how to repurpose an atraumatic silicone border dressing (Mepilex border sacrum, Mölnlycke, Norcross, Georgia) to cover bony facial prominences without compromising the N95 particulate respirator and surgical mask fit (3M type 1860, Minneapolis, Minnesota) using only one small dressing per day for the duration of a shift (this allows for the most stringent interpretation of infection control practice).

Phase 2. Fit eight participating staff members with various skin types who volunteered for this project with a protective dressing layer. Have infection control staff conduct a N95 fit test according to international best practice.

Phase 3. Continue the use of facial protection for 1 hour after the fit test and examine the condition of the facial skin thereafter.

Phase 4. Determine the efficacy and stability of the dressing underneath a fitted N95 mask after 3 hours and examine facial quality thereafter. (Only one participant was included in this phase.)

Phase 5. Compare the difference in facial skin quality and metabolic oxygen saturation values (SpO_2) as determined by a fingertip applied pulse oximeter with and without facial protection applied in a 4-hour shift period on a normal working day among five participants. This test took place over 2 days in a work environment not actively caring for patients who were COVID-19 positive. Facial skin evaluation and SpO_2 values before and after removal of the mask were repeated.

RESULTS

Phase 1

During the study development period (March 2020), relevant guidelines on this topic were scarce. A process of creative problem solving was therefore followed to determine how facial skin injuries in health care providers in the authors' setting could be addressed in the most efficient and cost-effective manner. Because staff would have to remove the protective dressing at the end of each shift, it was clear that any product with aggressive adhesion would soon strip the outer layer of the skin[12] and that the additional pressure exerted by the N95 mask on the barrier would enhance adhesion. Pain on removal and skin injury over time would be likely.[12] Therefore, an atraumatic dressing was required.

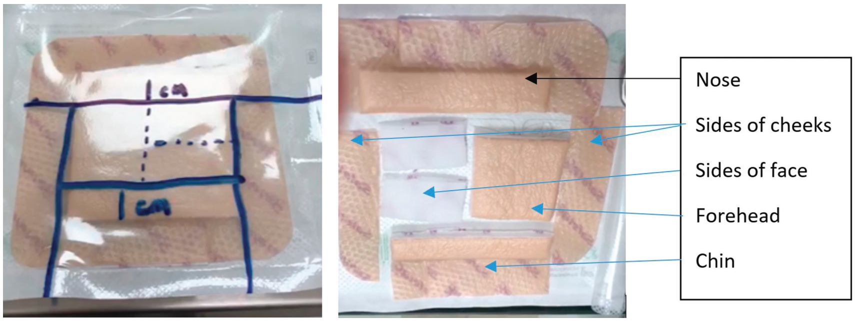
At the KHUH, an atraumatic silicone sacrum dressing is routinely used for pressure injury prevention of high-risk hospitalized patients[11] as part of the standard pressure injury prevention skin care bundle.[3] It is the only type of atraumatic silicone dressing available in the authors' setting; each dressing is similar in cost to a take-away coffee. The aim was to repurpose a single 10 x 10 dressing for frontline HCPs during each shift to provide facial protection and limit cost for the institution.

Figure 2 illustrates how the dressing was repurposed. The application technique includes the bridge of the nose, with the open edge of the dressing facing the nose tip and sides of the nose. Another piece is placed underneath the jaw with the open end facing forward on the chin edge, and other pieces are placed over the cheek bones. The Supplemental Table provides a step-by-step overview of dressing application.

Earlier testing revealed that the dressing edge could catch on to the N95 mask sponge and create an interlocking mechanism to position two offloading areas next to each other rather than on top of each other. This enhances the distribution of pressure over a larger area and prevents additional pressure on any given area by stacking multiple layers. The rationale was that if pressure was equally distributed over the nose with the interlocking fit of the N95 mask sponge on the dressing edge, the cheekbones were only in need of friction control (maintaining mask integrity without adding bulk). Further, this placement was successful even with some small facial hair stubble present on the cheeks and chins of male staff members; the dressing sat snugly despite being applied over chin hair, and removal was painless.

There was a square piece left for the forehead that could be used as pressure relief underneath protective eye shields or goggles resting on the forehead. Two additional small pieces remained to offset the pressure from

Figure 2. REPURPOSING THE DRESSING



the elastic band of the N95 mask touching the sides of the face close to the ears (Figure 3).

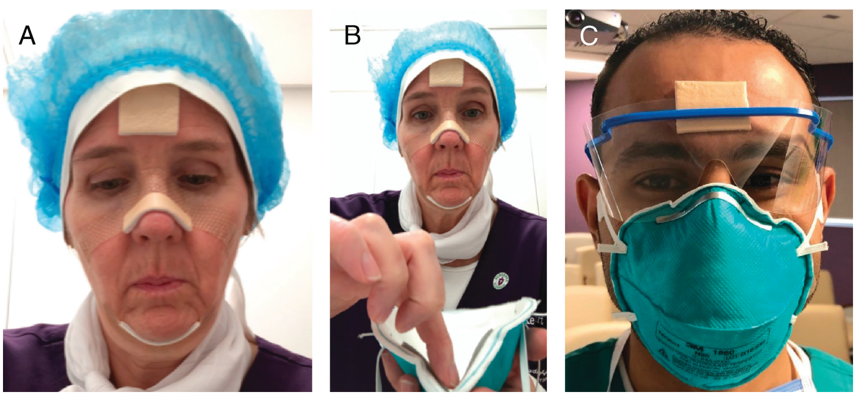
Phase 2

To ensure each person uses the correct N95 mask size, a standardized initial fit test in accordance with international guidelines is required. The KHUH Infection Control Team conducted the leak tests in late January and early February using the Hood method.[14,15] The method involves placing a see-through polymer hood with an applicator window in front of the face and a tight-fitting seal around the HCP's neck. To determine a participant's individual sensitivity, a distinct smell (denatonium benzoate) is serially sprayed into the hood to determine at what point (after how many sprays) a smell is observed. Next, the hood is removed, and the participant is instructed to rinse his/her mouth and wait 15 minutes. Then a N95 mask is donned and the procedure repeated. The mask fit is deemed effective when no smell is observed if half of the sprays required during the sensitivity test are applied. The infection control team documents each time a person passes the fit test (smell only observed after more than the threshold number of sprays). A person who fails the fit test is fitted with a different sized mask and the spray test is repeated until passing; however, it only needs to be completed once per person.[14]

Leak testing is the responsibility of each staff member and involves positioning the N95 mask on the head and fitting it around the nose by applying two fingers on either side of the nose and pressing the mask tight while breathing in. Next, hands are placed over the middle of the mask (without adjusting its position) and the staff member exhales sharply. If air escapes from the sides of the mask, the mask should be adjusted and all of the steps repeated until exhaled air exits only through the middle of the mask and no leaks occur on inhalation or exhalation. This process is repeated twice every single time an N95 mask is applied.[16] Where limited reuse of N95 masks is practiced, it is done in accordance with the KHUH infection control protocols governing mask functionality/cross-contamination prevention and not to exceed five uses per person.[17]

Eight volunteer staff members (four males and four females) with various Fitzpatrick skin types were included in this phase. Two work in the ED, two in ICU, one in a male surgical ward, and three in the wound care unit. All participants had previously passed the official N95 fit test. All staff previously wore N95 masks without skin

Figure 3. DRESSING APPLICATION AND PERSONAL PROTECTIVE EQUIPMENT FIT



protection. Participants applied the repurposed, separated atraumatic dressing segments on their own faces after an initial demonstration. The application took less than 5 minutes, inclusive of the time required to cut up the dressing. They then donned N95 masks and conducted manual leak tests.[16] All eight participants achieved the same mask positioning with the applied dressing beneath their mask as without.

Infection control then conducted another fit test. Staff all reported only a slight smell after 4 sprays, and this was consistent up to 6 sprays. Therefore, 95% blockage was achieved with this mask configuration. This outcome was certified by infection control as conforming to international standards—that is, all eight participants passed the fit test while using the atraumatic dressing.

Phase 3: Wear Comfort

Staff were instructed to maintain that exact PPE configuration for the next hour without repositioning or removal. Once the hour was over, they had to remove the mask and the facial dressing themselves, take a photograph of their face, and present it to the research team. All photos were time stamped to ensure masks were not removed before the period was completed.

Staff also had to report on this experience compared with their previous experience/original fit tests. There were no negative comments from the staff, despite application over hair in some men. In fact, some staff noticed that the nose dressing prevented mask movement they had previously experienced when looking up or down. This interlock also helped to minimize the perpendicular pressure of the N95 mask exerted on the nasal crest; all participants commented on improved nose comfort, as well as the absence of facial irritation caused by the direct contact of mask fibers to the cheeks. Comfort underneath the chin was also noted; itching and moisture vapor build-up appeared to be absent in this configuration. When asked if the dressing was worth the application time, the answer was a unanimous yes.

The immediate facial condition of all staff with protective dressings can be seen in Figure 4. Those with Fitzpatrick skin types 2 and 3 (lighter skin tone, n = 2) showed a bit of visible erythema over the bony cheek area. No marked erythema or pressure was visible on any of the other participants (n = 6). No erythema or pressure marks were visible on any staff member on the sides of their faces where the top applied elastic band of the N95 mask is placed.

Phase 4

One staff member with Fitzpatrick type 2 skin was willing to test the mask without facial protection for 2 hours on a different day, before the leak tests were conducted. Researchers believed that this skin type would show visible injury most quickly. The next day, this participant wore the mask for 3 hours with facial protection applied. The results of this trial are depicted in Figure 5.

Mask wear without skin protection resulted in friction and chafing with erythema visible over and along the bony prominences of the cheekbones. A blanchable area was visible on the bridge of the nose after the 2-hour test. This finding is consistent with extant literature reporting that pressure injury can occur in as little as 2 hours.[8,11]

After testing with facial protection, slight erythema was again present over the bony prominences of the check bones with only a little redness on the left lateral side of the nose. However, these changes were much less noticeable than before, without additional friction or chafing areas present, signifying good mask fit with minimal movement during the 3-hour period. All erythema visibly diminished after 1 hour.

Phase 5

This experimental test took place over 2 consecutive days with five volunteer staff members (one male, four female) with skin types from fair to dark brown on the Fitzpatrick scale. Researchers theorized that skin damage or injury would be easier to observe in females, who have thinner skin than males.[18] If female skin was protected by the selected method, it could reasonably be assumed that males would be protected as well. Female nurses also outnumber male nurses in this setting and are therefore more likely to participate in direct care and require protection.

On the first day of this phase, the N95 mask was worn for 4 hours (no eating, drinking, or bathroom breaks allowed) with protection prepared and applied by each participant. Comfort was self-assessed by participants. At the end of the 4 hours, three participants felt that they could have continued for an hour or two more. Slight sweating was present, with indentations visible on all of the participants' faces. Only one (Fitzpatrick type 2) presented with slight erythema; the least damage was visible on the darkest skin.

Pulse oximetry saturation levels of each participant were also taken before and after the test. All participants lost between 1% and 3% SpO_2 in this test, with a mean loss of 2% metabolic SpO_2 (Table 1). This is in line with extant studies on N95 mask use that confirms overall oxygen intake is diminished during wear, even with a perfectly fitting mask.[19,20]

On the next day, the N95 mask was worn without any protection (Table 2). Each participant positioned their own mask and it was again worn for 4 hours without any eating, drinking, or bathroom breaks. All four female participants battled with discomfort; pruritus on the mask edges was noted after the first hour. All participants reported that they were relieved when the mask could be

Figure 4. **ALL FACES AFTER 1 HOUR OF MASK WEAR WITH FACIAL PROTECTION**

removed; none wished to continue wearing the mask for a longer time.

Less moisture build-up was visible compared with the day before, but skin indentations were present on all five faces. The lighter skin tones appeared to have more pressure-related impact than those with darker skin tones. All four females had various levels of skin erythema, with the fair skin most damaged of all. The participant with the darkest skin had the least visible damage; one small darkened area was visible that fully recovered in 1 hour. Of the female participants, three continued to have signs of indentation and erythema an hour after the test, with the fair-skinned participant least recovered compared with results from the day before.

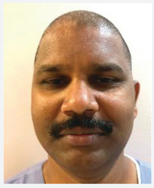
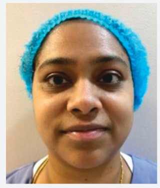
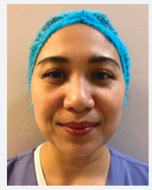
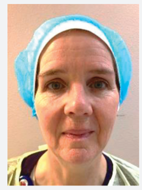
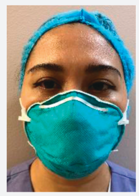
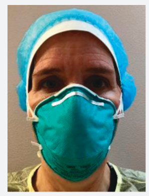
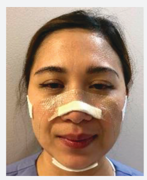
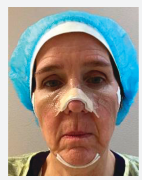
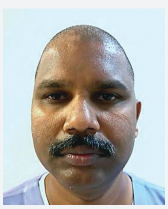
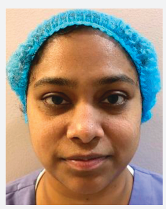
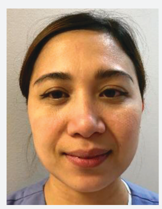
With regards to metabolic SpO_2 on the second day, three participants retained the exact same starting value, and one gained 1%. The remaining participant had a 2% SpO_2 loss. The mean loss was 0.2% metabolic SpO_2. Figure 6 depicts SpO_2 readings taken from the same participant before and after both 4-hour tests.

DISCUSSION

This article describes a holistic approach to facial skin injury prevention for HCPs to "HELP" staff to embrace a

Figure 5. **A, 2 HOURS OF MASK WEAR WITHOUT INTERFACING; B, 3 HOURS OF MASK WEAR WITH INTERFACING; C, 1 HOUR AFTER REMOVAL OF INTERFACING AND MASK (3 HOURS' WEAR)**

Table 1. 4-HOUR WEAR TIME TEST WITH FACIAL PROTECTION

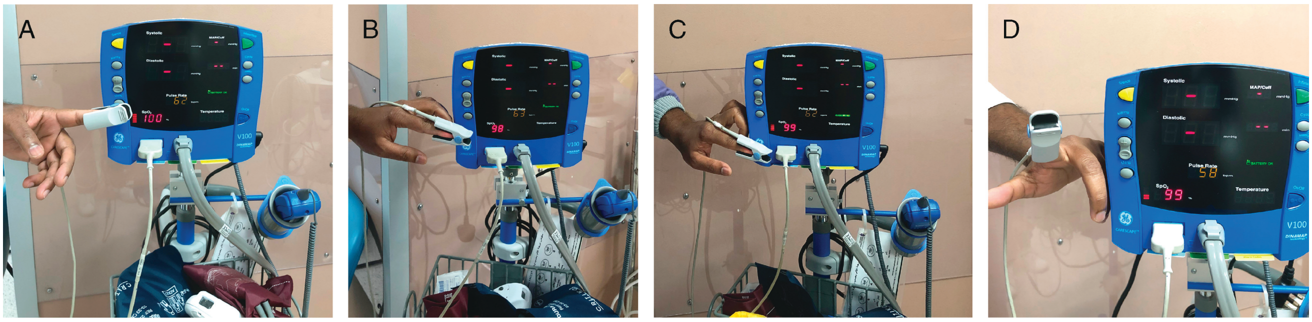
Fitzpatrick Skin Type	Type 6	Type 5	Type 4	Type 3	Type 2
Pretest facial condition					
Dressing applied					
Mask applied					
Pretest saturation	100%	100%	100%	100%	100%
Mask removed with dressing condition revealed					
Posttest saturation	98%	99%	97%	98%	98%
Posttest facial condition					

complete self-care approach while working in a high-risk COVID-19 setting. Facial protection was the cornerstone of this safety initiative.

Longer periods of PPE use (with each participant serving as their own control) produced a distinct difference between mask wear with and without protection, including improved facial condition and comfort without compromising mask seal. Three possible mechanisms of injury were identified in this experiment. The first was associated with direct high pressure causing skin indentations (ie, from mask edges, nose fitting device, and straps); the second a diffuse erythema in a linear pattern associated with lower pressure with or without friction (ie, mask edges moving). Both were more pronounced when no facial protection was present. The third was related to sweating: slight localized sweating underneath the mask was more

Figure 6. EXAMPLE OF PULSE OXIMETRY SATURATION READINGS

A, Before 4-hour wear time test with facial protection (100%); B, after 4-hour wear time test with facial protection (98%). C, Before 4-hour wear time test without facial protection (99%); D, after 4-hour wear time test without facial protection (99%).



pronounced when skin protection was used, attributable to the better integrity of the acquired seal. Associated moisture build-up from sweat is therefore a risk with this PPE configuration; accordingly, the use of a skin-protective acrylate[10] followed by meticulous facial care[9] is recommended for off-duty HCPs.

All participants cut up the dressing into segments with ease and could easily apply the dressing to their faces with the use of a mirror. After donning this protective layer, the integrity of the N95 mask was also easily established, with all staff passing both the leak and the fit tests.

The most crucial safety consideration for frontline providers during the pandemic lies in the order of PPE removal; it must be doffed in the exact reverse order it was donned.[1] Bathroom and eating breaks cannot be factored into shifts because the proper reverse removal of layers of PPE takes more time than application to prevent contamination and risk to others in the facility.[1,7] All body PPE must be removed first, followed by a thorough handwashing,[21] after which the N95 masks are removed by touching only the elastic bands,[1] and the handwashing procedure is repeated before the facial protective dressings can be removed. Essentially, staff can greatly increase the risk for COVID-19 self-contamination if they touch their faces before all contaminated PPE is safely removed.[1]

This stringent PPE process requires heightened staff awareness of this vital safety precaution, reinforcing the HELP enabler's focus on adequate nutrition and hydration in off duty times and recommendations to limit excessive amounts of fluids immediately before a shift. Given these self-care strategies, a 4-hour fasting period is feasible. The key is to plan and shift nutrition and hydration activities to directly after and/or no less than an hour before a shift. Staff with medical conditions who cannot adhere to a 4-hour fasting or bathroom break-free shift should be deemed at high risk for contagion not only to themselves, but also others using the same facilities.

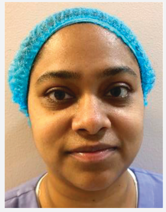
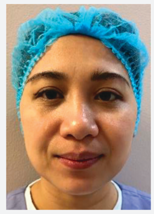
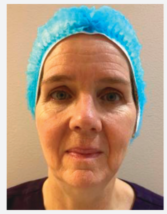
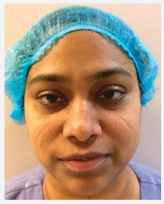
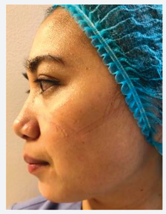
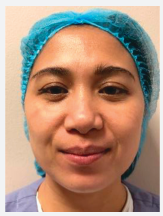
At least one facility has already trialed this approach with success. For each 4-hour shift of frontline staff in full PPE in Wuhan, China,[7] touching masks, eating, drinking, and bathroom breaks were prohibited. This simple process ensured zero staff contracted COVID-19.[7] Their experience provided the rationale for the 4-hour wear test conducted in this study.

A different cross-sectional study[22] (N = 4,306) from China on facial injuries sustained by HCPs when using PPE also identified this 4-hour cut-off time. Researchers found a statistically significant difference in the number of injuries sustained if HCPs exceeded this time frame in PPE.[22] Skin protection under masks is therefore a necessity because shift lengths can be unpredictable based on PPE supplies[23] but also because facial injuries have been noted in shorter shift periods[22] and within 2 hours in this study.

It is of vital importance that hours of PPE wear (regardless of facial protection applied) be documented[3] to prevent prolonged exposure, excessive moisture build-up, and skin breakdown. Based on the experience of aggressive frontline COVID-19 care in Wuhan,[7,22] it is recommended that each 8-hour shift be divided between two teams where one team does the work requiring N95 mask wear (in the dirty/infected area) while the rest works in the clean area. After 4 hours inside without eating, drinking, or a bathroom break in full PPE, the two teams switch. This prevents exhaustion, mask hypoxia,[19] and protects the skin of HCPs[7,22] with minimal impact on staffing.

The most interesting finding of this study was the drop in participant SpO_2 values by 2% on average when using the protective dressing underneath the N95 mask. This corresponds with tight-fitting mask wear studies conducted during flu outbreaks.[19,20] It is possible that the protective dressing increases the mask's seal stability while mitigating pressure-related skin damage. Critically, extended periods of N95 mask wear may be related to mask-induced hypoxia in HCPs;[19,20] hypoxia is an established major risk factor for pressure-related skin breakdown.[3] Mitigation of this concern can be achieved by the split-shift approach previously described.[7,22]

Table 2. **4-HOUR WEAR TIME TEST WITHOUT FACIAL PROTECTION**

Fitzpatrick Skin Type	Type 6	Type 5	Type 4	Type 3	Type 2
Pretest facial condition					
Pretest oxygen saturation	99%	100%	98%	99%	98%
Posttest oxygen saturation	99%	100%	98%	97%	99%
Posttest facial condition, front					
Posttest facial condition, lateral					
Posttest facial condition, 1 hour after removal					

The reduced SpO_2 finding was not the case with N95 mask use alone. This may indicate that despite passing the fit and leak tests, the discomfort from mask wear results in participants occasionally moving their faces to relieve pressure and facial irritation, which could result in small leaks. The participant with type 2 skin most likely had a leak present during the test where the protective layer was not applied that was sustained during the test by mouth, chin, and facial movements. This participant had a 1% increase in SpO_2 and the most pronounced skin damage present after the test.

Mask discomfort may therefore add to the iatrogenic risk of contracting COVID-19 infection. The same risk applies to staff with any facial injury resulting in a skin breach, because pain may compromise proper N95 mask seal. Adding repeated pressure to an existing facial injury has the potential to exacerbate minor injuries and lead to deeper dermal injuries; this is why patients are carefully positioned to displace pressure to other body parts once a stage 1 pressure injury is present.[3]

Limitations

This small sample was recruited to serve in a pilot project to determine if the application of a facial protective layer could mitigate facial injury risk among N95 mask wearers. More research using different border dressings would be beneficial to expand the evidence base on this topic and give providers more options.

The staff at KHUH is also mainly of West and East Asian descent, hence the lack of a nurse with a Fitzpatrick skin type 1. This is a major limitation because this skin type is usually the most sensitive to injury and skin insults. Further, although the Fitzpatrick scale is the criterion standard for sun-related skin damage, it may not fully predict pressure and shear damage on skin because deeper injuries may not be immediately visible. Further testing in institutions that have HCPs with Fitzpatrick type 1 skin is warranted.

Further work is also needed on N95 mask wear and the impact of reduced SpO_2 on fatigue, headache, and concentration to determine the optimal safety balance between skin risk, metabolic stress, and personal protection.

CONCLUSIONS

Early on in the COVID-19 health crisis, the need to protect the skin of HCPs was prioritized at the KHUH. At that time, there were no educational resources available to guide practice. (Some enablers have since been released, beginning in April 2020.[24,25]) The creative stepwise process of skin protection described in this article was developed with readily available products and participants who volunteered to help develop a safe solution for skin injury prevention.

At roughly the same cost as a daily take-away coffee, a repurposed atraumatic silicone border dressing can support skin health underneath a tight-fitting mask. By cutting it into segments and carefully applying it without creases over the nose, cheekbones, and sides of the face, HCPs can achieve pressure redistribution and facial skin protection. This method does not appear to interfere with N95 mask integrity and in fact may provide additional leak protection by securing the mask more firmly in position, ultimately protecting against accidental viral transfer to the face.[1] Accordingly, these authors recommend that HCPs add an atraumatic silicone border dressing as a safe and beneficial option to protect facial skin under PPE.

However, no dressing by itself (regardless of testing) can provide complete care of facial skin underneath N95 masks. It is critical that HCPs implement a comprehensive skin care approach. Frontline staff who "HELP" themselves by taking responsibility for their own skin care, who are well prepared, well rested, fed, and hydrated can more safely take care of others.

It is the authors' hope that this creative evidence-based clinical facial protection solution and HELP enabler will be of assistance to their global colleagues in the fight against COVID-19. ●

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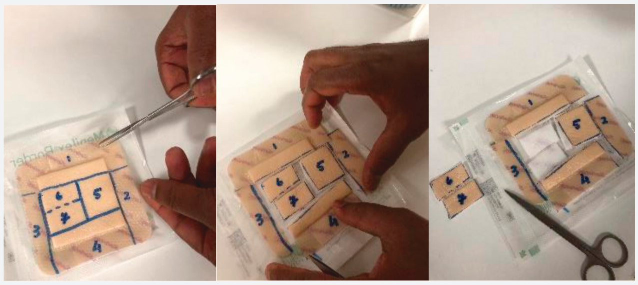
Supplemental Table. **APPLICATION OF THE PROTECTIVE DRESSING**

Step 1: Hand preparation	Handwashing according to correct technique, 40 to 60 seconds
Step 2: Prepare dressing by cutting it in required segments 1-7	
Step 3: Apply dressing segments in this order: 1) On the nose 2, 3) Sides of face 4) Under chin	
Step 4: Apply the rest of the dressing on areas in need of added relief: 5) Forehead (thicker or thinner as needed) 6, 7) Sides of ears	
Step 5: Apply N95 mask and other protective equipment over dressing	
Step 6: Removal	Handwashing for 40 to 60 seconds Remove the mask using elastics only and discard properly Wash hands again, 40 to 60 seconds Remove all protective dressings in reverse order (7 through 1) Wash hands and face and apply moisturizer on both Follow the HELP enabler for total self- and skincare

Face model: Jaison Matthai, RN, hyperbaric oxygen therapy specialist, Wound Care Unit, King Hamad University Hospital. Reprinted with permission.