Supplemental Table 1. Healthcare Worker, Patient, and Environmental Sites Sampled.

|  |  |  |
| --- | --- | --- |
| Healthcare Workera | Patientb | Environmentb |
| Right and left handc | Anterior nares (MRSA only) | Urine bag exterior |
| Clothes over abdomen | Throat | Stool bag exterior |
| Right and left sleeve (or  forearm) below elbow | Tracheostomy site | Door handle inside the room |
| Ring | Axillae | Glove box |
| Bracelet | Antecubital fossae | Sinke |
| Watch | Hands | Computer tableComputer keyboardComputer mousef |
| Stethoscope | Inguinal area | Ventilator control knob |
| Tie | Perianal area | Infusion pump control panel |
| Pager | Ankles and/or area covered by sequential compression devices | Overbed table |
| HCW personal cell phone |  | Call button |
| Mobile phone for hospital use |  | Blood pressure cuff |
| Tablet device |  | Bed linen |
| Sign-out paper |  | Bed rail |
| Gownd |  | Telephone receiver |
| Each glove |  | Vital sign monitor control knob  |
|  |  | Toilet handle |

aEach site was cultured immediately **before and after** a patient encounter.

bEach site was cultured immediately **before** a patient encounter.

C Hand and glove were swabbed at the dorsum of each finger three times and the palm of each hand two times with a twirling motion of the swab with a single swab for both hands or both gloves. 10

dGowns were swabbed at each forearm twice and then a “W” along the beltline, all with a single swab and performed with a twirling motion.10

eThe entire sink bowl was swabbed whereas a single area of the sink rim was sampled by RODAC plate.

fFor keyboard and mouse, swabs were used to sample both of them; a single area of the ledge above the keyboard was sampled by RODAC plate.

Supplemental Table 2. A donning and doffing checklist for glove and gown removal based on the guidance document published by the Centers for Disease Control and Prevention.19

|  |  |
| --- | --- |
| **Donning** |  |
| Don gown? |  NO YES |
| Did the gown fully cover torso from base of neck to knees, arms to end of wrists?  |  NO YES |
| Did the gown fully cover to wrap around the back? |  NO YES |
| Fasten the gown in back of neck? |  NO YES |
| Fasten the gown at the waist? |  NO YES |
| Tie strings in a bow (i.e., not a double knot)? |  NO YES |
| Don gloves? |  NO YES |
| Hand hygiene performed prior to donning gloves? |  NO YES |
| Did the gloves extend to cover wrist of isolation gown? |  NO YES |
| **Doffing**  |  |
| ***Glove removal*** |  |
| Which glove was removed first? |  Right Left |
| Method 1: Gloves and gown removed SEPARATELY? |  NO YES |
| If yes, which was removed first? |  Gloves Gown |
|  *If yes,* using gloved hand, grasp palm area of the other gloved hand and peel off  first glove? |  NO YES |
|  *If yes,* hold removed glove in gloved hand? |  NO YES |
|  *If yes,* slide fingers of ungloved hand under remaining glove at wrist and peel off  second glove over first glove? |  NO YES |
| Method 2: Gloves and gown removed TOGETHER? |  NO YES |
|  *If yes*, gloves peeled off at the same time, only touching inside of the gloves and gown with bare hands? |  NO YES |
| If hands were contaminated during glove removal, immediately wash their hands or use an alcohol based hand sanitizer? |  NO YES |
| ***Gown removal*** |  |
| Slowly unfasten gown ties? |  NO YES |
|  *If yes,* with  |  Gloved hands Bare hands |
|  *If yes,* sleeves contact body when reaching for ties? |  NO YES |
| Grasp gown in front and pull away from the body so that ties break touching outside of gown? |  NO YES |
|  *If yes*, with |  Gloved hands Bare hands |
| Peel gown away from neck and shoulder touching inside of gown with bare hands |  NO YES |
| Turn gown inside out? |  NO YES |
| Fold or roll into a bundle? |  NO YES |
| If hands were contaminated during gown removal, immediately wash their hands or use an alcohol based hand sanitizer? |  NO YES |
| ***Hand hygiene and others*** |  |
| Discard PPE in designated container with red bag liner? |  NO YES |
| Touch face or any exposed skin area while doffing PPE? |  NO YES |
| Wash their hands or use an alcohol-based hand sanitizer immediately after removing all PPE? |  NO YES |

Supplementary Table 3. Healthcare worker contamination or acquisition of target multidrug organism by errors in personal protective equipment donning and doffing.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Contamination/AcquisitionError Type | Not contaminatedn (%) | Contaminatedn (%) |  |  |
| Odds ratio (95% CI) | *P value* |
| Contamination |  |  |  |  |
|  Any HCW site contamination | 80 | 45 |  |  |
|  Multiple doffing errors | 30 (37.5) | 17 (37.8) | 1.01 (0.48-2.15) | .975 |
|  Donning gown error  | 68 (85.0) | 38 (84.4) | 0.96 (0.35-2.64) | .934 |
|  Donning gloves error  | 9 (11.4) | 7 (15.6) | 1.43 (0.49-4.15) | .506 |
|  Doffed gloves first | 16 (20.5) | 9 (20.0) | 0.97 (0.39-2.42) | .946 |
|  Hand contamination | 121 | 4 |  |  |
|  Multiple doffing errors | 45 (37.2) | 2 (50.0) | 1.69 (0.23-12.41) | .631 |
|  Donning gown error  | 103 (85.1) | 3 (75.0) | 0.52 (0.05-5.32) | .487 |
|  Donning gloves error  | 16 (13.3) | 0 | Not applicable | 1.000 |
|  **Doffed gloves first** | 22 (18.5) | 3 (75.0) | 13.23 (1.31-133.26) | **.026** |
|  HCW clothes contamination | 121 | 4 |  |  |
|  **Multiple doffing errors** | 41 (35.0) | 6 (75.0) | 5.56 (1.07-28.80) | .**052** |
|  Donning gown error  | 99 (84.6) | 7 (87.5) | 1.27 (0.15-10.98) | 1.000 |
|  Donning gloves error  | 15 (12.9) | 1 (12.5) | 0.96 (0.11-8.38) | 1.000 |
|  Doffed gloves first | 24 (20.9) | 1 (12.5) | 0.54 (0.06-4.62) | 1.000 |
|  HCW equipment contamination | 119 | 6 |  |  |
|  Multiple doffing errors | 46 (38.7) | 1 (16.7) | 0.32 (0.04-2.80) | .408 |
|  Donning gown error  | 102 (85.7) | 4 (66.7) | 0.33 (0.06-1.96) | .226 |
|  Donning gloves error  | 15 (12.7) | 1 (16.7) | 1.37 (0.15-12.57) | .572 |
|  Doffed gloves first | 25 (21.4) | 0  | Not applicable | .345 |
|  HCW PPE contamination | 87 | 38 |  |  |
|  Multiple doffing errors | 33 (37.9) | 14 (36.8) | 0.95 (0.43-2.10) | .908 |
|  Donning gown error  | 73 (83.9) | 33 (86.8) | 1.27 (0.42-3.81) | .674 |
|  Donning gloves error  | 9 (10.5) | 7 (18.4) | 1.93 (0.66-5.64) | .251 |
|  Doffed gloves first | 16 (18.8) | 9 (23.7) | 1.34 (0.53-3.37) | .536 |
|  Any non-PPE HCW contamination | 108 | 17 |  |  |
|  Multiple doffing errors | 39 (36.1) | 8 (47.1) | 1.57 (0.56-4.41) | .386 |
|  Donning gown error  | 93 (86.1) | 13 (76.5) | 0.52 (0.15-1.82) | .291 |
|  Donning gloves error  | 14 (13.1) | 2 (11.8) | 0.89 (0.18-4.29) | 1.000 |
|  Doffed gloves first | 21 (19.8) | 4 (23.5) | 1.25 (0.37-4.21) | .748 |
| Acquisition |  |  |  |  |
|  Any HCW site acquisition | 82 | 43 |  |  |
|  Multiple doffing errors | 32 (39.0) | 15 (34.9) | 0.84 (0.39-1.80) | .650 |
|  Donning gown error  | 69 (84.1) | 37 (86.0) | 1.16 (0.41-3.31) | .779 |
|  Donning gloves error  | 9 (11.1) | 7 (16.3) | 1.56 (0.54-4.52) | .414 |
|  Doffed gloves first | 16 (20.0) | 9 (20.9) | 1.06 (0.42-2.65) | .903 |
|  Hand acquisition  | 121 | 4 |  |  |
|  Multiple doffing errors | 45 (37.2) | 2 (50.0) | 1.69 (0.23-12.41) | .631 |
|  Donning gown error  | 103 (85.1) | 3 (75.0) | 0.52 (0.05-5.32) | .487 |
|  Donning gloves error  | 16 (13.3) | 0  | Not applicable | 1.000 |
|  **Doffed gloves first** | **22 (18.5)** | **3 (75.0)** | **13.23 (1.31-133.26)** | **.026** |
|  HCW clothes acquisition  | 121 | 4 |  |  |
|  Multiple doffing errors | 45 (37.2) | 2 (50.0) | 1.69 (0.23-12.41) | .631 |
|  Donning gown error  | 102 (84.3) | 4 (100.0) |  | 1.000 |
|  Donning gloves error  | 15 (12.5) | 1 (25.0) | 2.33 (0.23-23.91) | .429 |
|  Doffed gloves first | 24 (20.2) | 1 (25.0) | 1.32 (0.13-13.25) | 1.000 |
|  HCW equipment acquisition  | 120 | 5 |  |  |
|  Multiple doffing errors | 47 (39.2) | 0  | Not applicable | .156 |
|  Donning gown error  | 103 (85.8) | 3 (60.0) | 0.25 (0.04-1.59) | .166 |
|  Donning gloves error  | 15 (12.6) | 1 (20.0) | 1.73 (0.18-16.56) | .505 |
|  Doffed gloves first | 25 (21.2) | 0  | Not applicable | .582 |
|  HCW PPE acquisition  | 87 | 38 |  |  |
|  Multiple doffing errors | 33 (37.9) | 14 (36.8) | 0.95 (0.43-2.10) | .908 |
|  Donning gown error  | 73 (83.9) | 33 (86.8) | 1.27 (0.42-3.81) | .674 |
|  Donning gloves error  | 9 (10.5) | 7 (18.4) | 1.93 (0.66-5.64) | .251 |
|  Doffed gloves first | 16 (18.8) | 9 (23.7) | 1.34 (0.53-3.37) | .536 |
| Any non-PPE HCW acquisition  | 112 | 13 |  |  |
|  Multiple doffing errors | 43 (38.4) | 4 (30.8) | 0.71 (0.21-2.46) | .765 |
|  Donning gown error  | 96 (85.7) | 10 (76.9) | 0.56 (0.14-2.24) | .417 |
|  Donning gloves error  | 14 (12.6) | 2 (15.4) | 1.26 (0.25-6.29) | .675 |
|  Doffed gloves first | 21 (19.1) | 4 (30.8) | 1.88 (0.53-6.71) | .299 |

HCW; healthcare worker. PPE; personal protective equipment. CI; confidence interval.