



Hospital Personal Protective Equipment Planning Tool

Purpose: The Hospital Personal Protective Equipment (PPE) Planning Tool is designed to help hospitals determine approximate minimum PPE needs based on special pathogen category and a number of facility specific variables. Calculators are included for Ebola Virus Disease/Viral Hemorrhagic Fever (EVD/VHF) as well as special respiratory pathogens such as Middle East Respiratory Syndrome/Severe Acute Respiratory Syndrome (MERS/SARS), and for pandemic influenza. The tool does not provide information for less virulent pathogens. It is not intended as a clinical tool and should be used as a pre-incident planning tool and NOT during an outbreak.

The Hospital PPE Planning Tool is not proscriptive nor definitive. It is intended as a starting point for facility planners to estimate the minimum PPE that may be needed based upon the role the hospital has in the community (does the hospital provide screening only or screening and hospitalization) and adjusts for the number and types of personnel involved in patient management, length of shifts, duration of hospital stay or outbreak, and the types of PPE commonly used by the facility. The Hospital PPE Planning Tool is meant to be considered in conjunction with other planning tools, resources, information, and facility and community-wide preparedness efforts. This tool provides the minimum amounts of PPE used and additional will be required for training and to replace PPE that is contaminated, damaged, or otherwise rendered unusable in the course of patient care. It also does not consider that higher levels of PPE may be warranted in selected situations (such as during airway management). Therefore, based on the size of the facility and number of personnel, additional supplies will be needed.

The tool's outputs are based on the inputs in Section 1 of each page about staffing and types of PPE commonly used by the facility and the assumptions in Section 2 of each page about the types and amounts of PPE needed for the type of special pathogen and patient status. Users of the Hospital PPE Planning Tool should make adjustments to the assumptions when warranted based on their knowledge of their facility, community, and their level of preparedness. They should also understand that pre-incident assumptions may not hold true during an incident. Changes to the assumptions may dramatically affect the accuracy of the outputs in Section 3 of each page. The outputs of the tool may be used to discuss appropriate cache levels of PPE at the facility and coalition level and to discuss potential needs with vendors in advance of an incident to assure supply chain continuity.

Usage Notes: For an Excel version of this tool, copy and paste this link into your browser: <https://files.asprtracie.hhs.gov/documents/aspr-tracie-hospital-ppe-planning-tool.xlsx>. For questions, comments, or assistance with this spreadsheet, contact ASPR TRACIE at asprtracie.hhs.gov or 1-844-5-TRACIE (587-2243).

With which disease do you need assistance?

1. Ebola Virus Disease / Viral Hemorrhagic Fever (EVD/VHF)
 - a. Initial evaluation / stable patient
 - b. Hospitalized / unstable patient
2. Special Respiratory Pathogen (MERS/SARS/Novel Influenza)
 - a. Initial evaluation
 - b. Hospitalized patient(s)
3. Pandemic
 - a. Inpatient
 - b. ED

Acknowledgements: Portions of this tool are based on the Centers for Disease Control and Prevention (CDC) PPE Calculator (<https://www.cdc.gov/vhf/ebola/healthcare-us/ppe/calculator.html>), which was developed to assist healthcare facilities in estimating their PPE needs when managing a patient with Ebola virus disease. ASPR TRACIE expanded upon the CDC PPE Calculator and added additional variables and scenarios to provide healthcare facilities a broader tool.

Disclaimer: The predictions are highly dependent on assumptions (listed in Section 2 on each page) that can dramatically affect the outputs of the calculator. Users should understand the implications of the assumptions and the caveats. In some cases, though expert advice and review was the basis for the calculations, the calculations may not reflect actual clinical practices. This tool should not replace other planning and facility-specific considerations. The authors, HHS/ASPR, and ASPR TRACIE take no responsibility and bear no liability for any clinical care outcomes, provider injury/illness, or inaccuracies in or resulting from this calculator. The tool reflects current knowledge of existing scientific guidance and operational experience; users should be aware that the evidence base for the management of patients suspected or known to be infected with a special pathogen continues to evolve. All recommendations were current at the time of publication and vetted to the best of our ability.

Considerations for Stockpiling:

1. Because the role and capabilities of each hospital differ (e.g., a sample hospital might plan to transfer all potential EVD/VHF cases and is likely to transfer MERS for intensive care, but needs to plan for assessment care for these conditions as well as for pandemics) it is not possible to develop a unifying PPE cache recommendation. Hospital emergency management, infectious disease, infection prevention and control, and administration should work together to determine change out frequency of use per shift to help determine what is reasonable to stock at the facility. Please pay careful attention to CDC recommendations cited at the bottom of each page.

2. Healthcare coalitions should consider caches of PPE to be managed at the coalition/regional level, particularly to rapidly augment a frontline facility's PPE stocks for EVD/VHF suspect cases, but also to support hospitals caring for multiple MERS patients or other situations where there are disproportionate effects on coalition member hospitals. During a pandemic, this cache will not be as helpful as all facilities will have needs. The policies for request, allocation, and logistics of accessing and moving these caches is important if they are to succeed.

3. Federal stockpiles contain significant quantities of N95 respirators and other PPE that may be helpful in a situation where a single or few jurisdictions are affected. However, in a pandemic these stockpiles will be insufficient. Healthcare coalitions should work with their states to understand what is available and the process for activating and receiving the supplies as well as the timeline. Federal assets will take time to activate and mobilize, and once delivered will still require time to get to the bedside.

4. Though the filter media of N95 respirators does not substantially degrade, the flocking and elastic components can, and therefore careful planning should be done with suppliers and hospital administration to determine how large a cache is in the interest of the facility knowing that it is not a durable asset. After a manufacturer's listed "use by" dates, the manufacturer cannot guarantee that the product will perform as a newly produced item. Outdated masks and supplies must be kept separate from daily stock and clearly labeled 'for emergency use' if they are kept in caches for pandemics or epidemics. The same issues apply to gloves and other components of PPE caches. Rotation of stock is an excellent goal, though at the levels needed to be prepared for a pandemic is not possible at the hospital level. Agreements with suppliers may be able to be made that allow rotation at a regional level. Cached supplies should be stored within manufacturers' recommended storage conditions and checked at least yearly to assure they are safe and appropriate for use. Supplies should be used in the following order: first use PPE within the manufacturer's 'use by' dates, but the oldest first, then use the very recently expired supplies, then the oldest or longest expired. While all PPE must be inspected before use, expired PPE should have heightened inspection. Prior to using expired PPE, facilities should contact the manufacturer to discuss the conditions in which the supplies have been maintained and discuss potential issues.

5. Training PPE will be needed every year and is not accounted for in the estimates. Theft is also a significant concern. Accelerated consumption due to contamination, damage, early discarding by providers, and other causes on shift are also not included and as stated in the notes may require an adjustment. Depending on the role and size of the facility this may be in the range of 25%. There should be supervised/regulated dispensing of respirators during scarcity/pandemic situations.

6. A few facilities in the United States use elastomeric half-face respirators with appropriate HEPA filters (usually P100 are included as these respirators are commonly used for industrial and painting applications). Though information about the use of these devices in the healthcare setting is limited, they are an attractive potential option and during a pandemic would rapidly pay for themselves. When the frequency of use of disposable respirators becomes high, the accumulated cost of their use during an incident may become equivalent to elastomeric facepieces. At this breakeven point, they may have particular relevance in intensive care environments, for instance. The elastomeric facepieces must be decontaminated after every use. These respirators should be inspected, maintained, and stored as per manufacturer recommendations. Some users may find the elastomeric respirators to be more irritating to the skin than filtering facepiece mask respirators though others may feel more comfortable with the seal of the elastomeric masks. Because the elastomeric masks are not in common healthcare use, their appearance will be unfamiliar and perhaps intimidating to patients and families.

7. Note that the assumptions for respirators in this tool do not include the increased requirements for simple fabric masks to be used by patients, family members, and those at low risk of exposure. Consumption of these masks will increase significantly and perhaps be as much as 5 times greater than usual use during a pandemic. Planners should consider the number of staff, patients, and loved ones who will require simple masks.

8. The calculations for pandemic assume that facilities will be operating under crisis standards of care, which may include the re-use of N95s. While re-use is not recommended, it is understood that it may be necessary under certain scenarios. Rather than focus only on quantities, planners should consider the risk profile of the facility under scenarios when re-use may be needed. This includes identifying which areas of the facility, care environments, and staff require a higher level of protection and recognizing that ASTM certified simple masks afford significant protection for healthcare workers not directly engaged in patient care. Manufacturer and CDC guidance on re-use should be sought and utilized when available.

9. Mask production is just-in-time - in some cases manufacturers have substantially different capacity to increase the production of certain respirators and not others. This may be worth discussing with your current vendor/manufacturer so that you can plan for the most likely models available during a pandemic/epidemic situation.

Ebola Virus Disease / Viral Hemorrhagic Fever Initial Evaluation / Stable Patient

Directions

Input your staff and PPE changes per 24 hours and what type of PPE you primarily use into the tan cells in Section 1. This should reflect the number of caregivers/personnel with the patient at one time. It is critical that the PPE changes per 24 hours reflect your facility staffing plan for how long personnel will be in the patient's room without a break/change in PPE. Section 2 shows the assumptions about the type and amount of PPE used per shift/change. Assumptions can be adjusted depending on your facility plan. Section 3 shows the calculations for your selected staff and duration of care. PPE calculations are minimums. PPE should always be changed earlier if it becomes soiled or contaminated or when masks become too moist and higher levels or changes of PPE may be required for airway interventions and other high risk procedures. The calculations do not account for these additional needs.

Section 1 Inputs

Do you primarily use disposable gowns or coveralls?	Coveralls								
Do you primarily use PAPR or N95 respirators for your providers?	N95	→	If PAPR, are shrouds reusable or disposable?	Reusable	→	How many filters are on the PAPR unit?	1		
Do you use elastomeric respirators?	No	→	If yes, what percentage of staff have elastomeric respirators?	0					

Staff	PPE changes/24 hours ²	PPE sets per day		Notes and assumptions - IMPORTANT - please read and change values if needed to be consistent with facility personnel plans.
Nurse with patient ³	1	6	6	→ Assume 4 hour shift with patient (then may rotate to support/other role) = 6 PPE changes/24 hours. (see notes below)
Doctor with patient	1	4	4	→ Assume 4 visits/day of 1-4 hours each. Optimally, time entry/exit to correspond with RN exits to minimize observer PPE use.
Trained Observer	1	6	6	→ Parallels RN rotation needs. If RNs or MDs are rotating in or out between shift changes must adjust observer PPE changes accordingly.
Environmental Services	1	2	2	→ Enter '0' staff if RN assumes these duties. Assume 2 visits/cleaning in 24 hours; if single visit, adjust PPE changes to '1'.
Lab Tech	1	2	2	→ Enter '0' staff if RN obtains labs. Assume 2 draws in 24 hours; may adjust PPE changes/24 hours to account for more or less frequent lab testing.
Other personnel	1	1	1	→ Includes family, spiritual care, biomedical, and other personnel required by hospital plan.
Total Team	6	21	21	

Total days (enter value 1-3)⁴ 3

SECTION 1 NOTES

- Facilities that use elastomeric respirators reduce their predicted N95 usage according to the percent of caregivers equipped. Providers should generally be issued their own elastomeric respirator. Facilities using these must assure appropriate donning, doffing, cleaning, and handling protocols as per OSHA respiratory protection standards including safe storage between shifts. Facilities should also have replacement particulate filter cartridges available in the event of contamination, splash exposure, etc.
- Calculations assume an RN shift of 4 hours in room with in-room sit down breaks not requiring PPE changes (likely rotating 4 hours with external support RN for total 8 hour shift). If breaks requiring PPE change are taken every 2 hours, adjust PPE changes/24 hours to 12 for nurses and trained observers (who should be assisting the entering RN with PPE, then donning PPE and assisting the exiting RN with doffing, then doffing themselves). This assures there is always a provider wearing PPE and ready to provide care.
- For a stable patient, only one RN should be required. If additional are required, adjust RN number upwards. During the rotation of staff, two person jobs can be accomplished if needed during a brief overlap period.
- Total days should be between 1 and 3 as by that point the patient should be ruled in/out and either transferred to another facility, moved to inpatient status for continued care, or taken off precautions.

Section 2 PPE Assumptions

Items in tan may be changed if needed based on PPE use assumptions by the facility. Note: if using PAPRs, assumptions about shroud/filter changes will dramatically affect calculations.

	ESTIMATED PPE Needed by Role per Shift ¹												
	All needed ²				Either Gowns OR Coveralls Needed ³		PAPRs or N95 Respirators Needed ³						
	Glove, long cuff	Glove, inner	Boot/shoe cover ⁴	Apron, disposable	Gown, disposable	Coverall	PAPR ⁵	PAPR Shroud	PAPR Battery	PAPR Filter ⁶	N95	Surgical Hood	Face Shield
Nurse	6	2	2	1	1	1	2	2	4	2	1	1	1
Doctor	2	2	2	1	1	1	1	1	1	1	1	1	1
Trained Observer	2	2	2	0	1	N/A	N/A	N/A	N/A	N/A	1	1	1
Environmental Services	2	2	2	1	1	1	1	1	1	1	1	1	1
Lab Tech	2	2	2	1	1	1	1	1	1	1	1	1	1
Other	2	2	2	0	1	0	0	0	0	0	1	1	1

SECTION 2 NOTES

- Quantity of product per shift may vary based on multiple factors including patient acuity, length of shifts, breaks, etc.
- Assumptions include two glove changes/shift of outer gloves by RN and no glove changes for other provider types due to shorter durations in the care environment. Impermeable apron is optional but should be strongly considered for 'wet' patients with bleeding, vomiting, or diarrhea.
- Either of these products may be used per CDC PPE guidance. Gowns and coveralls must be impermeable (e.g., surgical gowns, coated coveralls) not simply fluid resistant when used for 'wet' suspect patient care (e.g., vomiting, diarrhea, bleeding). OSHA advises impermeable be used for all suspect patients and state OSHA may have requirements that are stricter. Hospitals should be familiar with state OSHA standards.
- Boot/shoe covers must be knee high and impermeable if used with gown. Dedicated boots or waterproof booties may be used in conjunction with coveralls. Booties must be able to tolerate abrasion from the floors. Reusable boots must have a decontamination process defined and followed.
- Powered air purifying respirator (PAPR) blower units/systems may be reused post decontamination. Therefore, the quantity of PAPRs needed per shift and per day should be based on the number of persons that may be using a PAPR and the time needed to decontaminate and ensure that these products are ready for use. One PAPR will be needed for each staff member per shift who will be in direct contact with the patient. Facilities should consider having 1.5 to 2 shifts worth of PAPR blower units/systems on hand to account for changing of staff and decon time. Calculations reflect 2 PAPRs for RNs as they are unable to 'hand off' units when changing shifts. PAPR battery maintenance and assuring that enough charged batteries are always available is another key consideration when using PAPRs. Facility policy for decontamination of the units should be considered when determining needs.
- Follow the manufacturer's guidance to determine the need to replace/dispose of a filter during PAPR decontamination. Filters must have a HEPA component. Several manufacturers have added specific instructions for cleaning, disinfecting, and decontamination after use with a known or suspected Ebola patient. Estimate in the table assumes filter is being changed only when filtering capacity reached (airflow falls below minimums).

Section 3 Outputs

	Totals days:	3	PPE changes for total days	All needed				Either Gowns OR Coveralls Needed		PAPR/hood or N95 Respirators/splash protection							
				Glove, long cuff	Glove, inner	Boot/shoe cover	Apron, disposable, (optional for 'dry patient')	Gown, disposable	Coverall	PAPR	PAPR Shroud	PAPR Battery	PAPR Filter	N95	Surgical Hood	Face Shield	
			18	108	36	36	18	0	18	0	0	0	0	0	18	18	18
			12	24	24	24	12	0	12	0	0	0	0	0	12	12	12
			18	36	36	36	0	18	N/A	N/A	N/A	N/A	N/A	18	18	18	
			6	12	12	12	6	0	6	0	0	0	0	6	6	6	
			6	12	12	12	6	0	6	0	0	0	0	6	6	6	
			3	6	6	6	0	0	0	0	0	0	0	3	3	3	
Total PPE Needed for Total Days				198	126	126	42	18	42	0	0	0	0	63	63	63	

References

3M	Cleaning Reusable Respirators and Powered Air Purifying Respirator Assemblies The process for cleaning and disinfecting respirators is model-specific. This link provides cleaning and disinfection guidelines for commonly-used 3M respirators. Users should review the guidelines for the models of respirators used in their facilities.
ASPR TRACE	EMS Infectious Disease Playbook
CDC	For U.S. Healthcare Settings: Donning and Doffing Personal Protective Equipment (PPE) for Evaluating Persons Under Investigation (PUIs) for Ebola Who are Clinically Stable and Do Not Have Bleeding, Vomiting or Diarrhea Guidance on Personal Protective Equipment (PPE) To Be Used by Healthcare Workers during Management of Patient with Confirmed Ebola or Persons under Investigation (PUIs) for Ebola who are Clinically Unstable or Have Bleeding, Vomiting, or Diarrhea in U.S. Hospitals, Including Procedures for Donning and Doffing PPE
Halyard	10 Questions to Ask Before You Stockpile
NETEC	PPE 201: Critically Thinking about PPE
OSHA	PPE Selection Matrix for Occupational Exposure to Ebola Virus
The National Academies of Sciences, Engineering, and Medicine	Reusable Elastomeric Respirators in Health Care: Considerations for Routine and Surge Use

Ebola Virus Disease / Viral Hemorrhagic Fever Hospitalized / Unstable Patient

Directions

Input your staff and PPE changes per 24 hours and what type of PPE you primarily use into the tan cells in Section 1. This should reflect the number of caregivers/personnel with the patient at one time. It is critical that the PPE changes/24 hours reflect your facility staffing plan for how long personnel will be in the patient's room without a break/change in PPE. Section 2 shows the assumptions about the type and amount of PPE used per shift/change. Assumptions can be adjusted depending on the facility plans. Section 3 shows the calculations for your selected staff and duration of care. PPE calculations are minimums. PPE should always be changed earlier if it becomes soiled or contaminated or when masks become too moist and higher levels of changes of PPE may be required for airway interventions and other high risk procedures. The calculations do not account for these additional needs.

Section 1 Inputs

Do you primarily use disposable gowns or coveralls?	Gowns			
Do you primarily use PAPR or N95 respirators for your providers?	N95	→	If PAPR, are shrouds reusable or disposable?	Reusable → How many filters are on the PAPR unit? 1
Do you use elastomeric respirators?	No	→	If yes, what percentage of staff have elastomeric respirators?	0

Staff	PPE changes/24 hours ²	PPE sets per day		Notes and assumptions - IMPORTANT - please read and change values if needed to be consistent with facility personnel plans.
Nurse with patient ³	2	6	12	→ Assume 2 RN per 4 hour shift with patient (then rotate to support/other role) = 6 PPE changes/provider/24 hours. Both RNs may not be in room at all times. (see notes below)
Doctor with patient	1	4	4	→ Assume 4 visits/day of 1-4 hours each. Optimally, time entry/exit to correspond with RN exits to minimize observer PPE use.
Trained Observer	1	6	6	→ Parallels RN rotation needs - if RNs or MDs are rotating in or out between shift changes, must adjust observer PPE changes accordingly.
Environmental Services	0	2	0	→ Enter '0' staff if RN assumes these duties. Assume 2 visits/cleaning in 24 hours; if single visit, adjust PPE changes to '1'.
Lab Tech	0	2	0	→ Enter '0' staff if RN obtains labs. Assume 2 draws in 24 hours; may adjust PPE changes/24 hours to account for more or less frequent lab testing.
Other personnel	0	0	0	→ Includes family, spiritual care, biomedical, and other personnel required by hospital plan.
Total Team	4	20	22	

Total days (enter value default 7) * 7

SECTION 1 NOTES

- Facilities that use elastomeric respirators reduce their predicted N95 usage according to percent of caregivers equipped. Providers should generally be issued their own elastomeric respirator. Facilities using these must assure appropriate donning, doffing, cleaning, and handling protocols as per OSHA respiratory protection standards including safe storage between shifts. Facilities should also have replacement particulate filter cartridges available in the event of contamination, splash exposure, etc.
 - Calculations assume an RN shift of 4 hours in room with in-room sit down breaks not requiring PPE changes (likely rotating 4 hours with external support RN for total 8 hour shift). If breaks requiring PPE changes are taken every 2 hours, adjust PPE changes/24 hours to 12 for nurses and trained observers (who should be assisting the entering RN with PPE, then donning PPE and assisting the exiting RN with doffing, then doffing themselves). This assures there is always a provider wearing PPE and ready to provide care.
 - For a stable patient, only one RN may be required, but assumption for inpatient care is two nurses will be needed at least some times during the shift.
 - Total days are difficult to predict as patient course is highly variable. Default is 7 days but facility can adjust based on patient acuity/prior experience.
- If multiple patients, adjust staff numbers to number of personnel providing patient care in each room/isolation area (assume some may be in separate rooms and some cohorted). For example, physicians would not need to change PPE except gloves within the same room, but would have to make a full change to move between rooms.

Section 2 PPE Assumptions

Items in tan may be changed if needed based on PPE use assumptions by the facility. NOTE: If using PAPRs, assumptions about shroud/filter changes will dramatically affect calculations.

	ESTIMATED PPE Needed by Role per Shift ¹												
	All needed ²				Either Gowns OR Coveralls Needed ³		Either PAPRs. OR N95 Respirators Needed ³						
	Glove, ex cuff	Glove, Exam ⁴	Boot/shoe cover	Apron, Disposable	Gown, Disposable/Impermeable	Covera, impermeable	PAPR ⁵	PAPR Shroud	PAPR Battery	PAPR Filter ⁶	N95	Surgical Hood	Face Shield
Nurse	12	4	4	2	1	1	2	2	4	2	1	1	1
Doctor	2	2	2	1	1	1	1	1	1	1	1	1	1
Trained Observer	2	2	2	0	1	N/A	N/A	N/A	N/A	N/A	1	1	1
Environmental Services	2	2	2	1	1	1	1	1	1	1	1	1	1
Lab Tech	2	2	2	1	1	1	1	1	1	1	1	1	1
Other	2	2	2	0	1	0	0	1	0	0	1	1	1

SECTION 2 NOTES

- Quantity of product per shift may vary based on multiple factors including patient acuity, length of shifts, breaks, etc.
- Assumptions include two glove changes/shift of outer gloves by RN and no glove changes for other provider types due to shorter durations in the care environment. Aprons should be disposable and impermeable.
- Either of these products may be used per CDC PPE guidance. Gowns and coveralls must be impermeable (e.g., surgical gowns, coated coveralls) when used for 'wet' suspect patient care (e.g., vomiting, diarrhea, bleeding).
- Boot/shoe covers must be knee high and impermeable if used with gown. Dedicated boots or waterproof booties may be used in conjunction with coveralls. Booties must be able to tolerate abrasion resistance on the floors. Reusable boots must have a decontamination process defined and followed.
- Powered air purifying respirator (PAPR) blower units/systems may be reused post decontamination. Therefore, the quantity of PAPRs needed per shift and per day should be based on the number of persons that may be using a PAPR and the time needed to decontaminate and ensure that these products are ready for use. One PAPR will be needed for each staff member per shift who will be in direct contact with the patient. Facilities should consider having 1.5 to 2 shifts worth of PAPR blower units/systems on hand to account for changing of staff and decon time. Calculations reflect one PAPR per provider.
- Follow the manufacturer's guidance to determine the need to replace/dispose of a filter during PAPR decontamination. Several manufacturers have added specific instructions for cleaning, disinfecting, and decontamination after use with a known or suspected Ebola patient. Estimate in the table assumes filter is being changed only when filtering capacity reached (airflow falls below minimum).

Section 3 Outputs

Totals days:	7	Total staff for total days	All needed				Either Gowns OR Coveralls Needed		PAPR/hood OR N95 Respirators/splash protection							
			Glove, ex cuff	Glove, Exam	Boot/shoe cover	Apron, Disposable	Gown, Disposable/Impermeable	Covera, impermeable	PAPR	PAPR Shroud	PAPR Battery	PAPR Filter	N95	Surgical Hood	Face Shield	
		Nurse	84	1008	336	336	168	84	0	0	0	0	0	84	84	84
		Doctor	28	56	56	56	28	28	0	0	0	0	0	28	28	28
		Trained Observer	42	84	84	84	0	42	N/A	N/A	N/A	N/A	N/A	42	42	42
		Environmental Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Lab Tech	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total PPE needed for total days			1148	476	476	196	154	0	0	0	0	0	154	154	154	

References

3M	Cleaning Reusable Respirators and Powered Air Purifying Respirator Assemblies The process for cleaning and disinfecting respirators is model-specific. This link provides cleaning and disinfection guidelines for commonly-used 3M respirators. Users should review the guidelines for the models of respirators used in their facilities.
ASPR TRACIE	RMS Infectious Disease Playbook
CDC	For U.S. Healthcare Settings: Donning and Doffing Personal Protective Equipment (PPE) for Evaluating Persons Under Investigation (PUIs) for Ebola Who are Clinically Stable and Do Not Have Bleeding, Vomiting or Diarrhea Guidance on Personal Protective Equipment (PPE) To Be Used by Healthcare Workers during Management of Patient with Confirmed Ebola or Persons under Investigation (PUIs) for Ebola who are Clinically Unstable or Have Bleeding, Vomiting, or Diarrhea in U.S. Hospitals, Including Procedures for Donning and Doffing PPE
Halyard	10 Questions to Ask Before You Stockpile
NETEC	PPE 2014: Critically Thinking about PPE
OSHA	PPE Selection Matrix for Occupational Exposure to Ebola Virus
The National Academies of Sciences, Engineering, and Medicine	Reusable Elastomeric Respirators in Health Care: Considerations for Routine and Surge Use

Special Respiratory Pathogen (MERS/SARS/Novel Influenza) Initial Evaluation / Stable Patient

Directions

Input your staff and PPE changes per 24 hours and what type of PPE you primarily use into the tan cells in Section 1. This should reflect the number of caregivers/personnel with the patient at one time. It is critical that the PPE changes/24 hours reflect your facility staffing plan for how long personnel will be in the patient's room without a break/change in PPE. Section 2 shows the assumptions about the type and amount of PPE used per shift/change. Assumptions can be adjusted depending on the facility plans. Section 3 shows the calculations for your selected staff and duration of care. PPE calculations are minimums. PPE should always be changed earlier if it becomes soiled or contaminated or when masks become too moist and higher levels or changes of PPE may be required for airway interventions and other high risk procedures. The calculations do not account for these additional needs.

Section 1 Inputs

Do you primarily use PAPRs or N95s for your providers?	N95	→	If PAPR, are shrouds reusable or disposable?	Reusable	→	How many filters are on the PAPR unit?	1
Do you use elastomeric respirators?	No	→	If yes, what percentage of staff have elastomeric respirators?		→	0	

	Person/Shift	PPE changes/24 hours ²	Persons per day	Notes and assumptions - IMPORTANT - please read and change values if needed to be consistent with facility personnel plans.
Nurse with patient	1	6	6	→ Assume 1 RN per 4 hour shift with patient, then rotate to support role.
Doctor with patient	1	4	4	→ Assume 4 visits/day of 1-4 hours each.
Environmental Services	0	2	0	→ Enter '0' person/shift if RN assumes these duties. Assume 2 visits/cleaning in 24 hours; if single visit, adjust PPE changes to '1'.
Lab Tech	0	2	0	→ Enter '0' person/shift if RN obtains labs. Assume 2 draws in 24 hours; may adjust PPE changes/24 hours to account for more or less frequent lab testing.
Other personnel	0	0	0	→ Includes family, spiritual care, biomedical, and other personnel required by hospital plan.
Total Team	2	14	10	

Total days (enter value 1-3)³ **3**

SECTION 1 NOTES

- Facilities that use elastomeric respirators may reduce their predicted N95 usage according to percentage of caregivers equipped. Providers should generally be issued their own elastomeric respirator. Facilities using these must assure appropriate donning, doffing, cleaning, and handling protocols as per OSHA respiratory protection standards including safe storage between shifts. Facilities should also have replacement particulate filter cartridges available in the event of contamination, splash exposure, etc.
- Calculations assume an RN shift of 4 hours in room with in-room sit down breaks not requiring PPE changes (likely rotating 4 hours with external support RN for total 8 hour shift). If breaks are taken every 2 hours, adjust rotations to 12 for nurses. This assures there is always a provider wearing PPE and ready to provide care.
- Total days should reflect that by day three the patient should be ruled out or transferred to another facility or inpatient status.
- If multiple patients, adjust staff numbers to number providing patient care in each room/area (assume some may be in separate rooms and some cohorted). For example, physicians would not need to change PPE except gloves within the same room, but would have to make a full change to move between rooms.

Section 2 PPE Assumptions

Items in tan may be changed if needed based on PPE use assumptions by the facility. Note: if using PAPRs, assumptions about shroud/filter changes will dramatically affect calculations.

	EST MATED PPE Needed by Role per Shift ¹									
	All needed ²			PAPR/hood OR N95 Respirators/splash protection ³						
	Glove, long cuff	Shoe Cover (opt onal) ⁴	Gown, disposable fluid resistant ⁵	PAPR ⁶	PAPR Shroud	PAPR Battery	PAPR Filter ⁷	N95	Headcover (opt onal)	Face Shield
Nurse	6	2	1	2	2	4	2	1	1	1
Doctor	2	2	1	1	1	1	1	1	1	1
Environmental Services	2	2	1	1	1	1	1	1	1	1
Lab Tech	2	2	1	1	1	1	1	1	1	1
Other	0	0	0	1	1	1	1	0	0	0

SECTION 2 NOTES

- Quantity of product per shift may vary based on multiple factors including patient acuity, length of shifts, breaks, etc.
- Assumptions include two glove changes/shift of outer gloves by RN and no glove changes for other provider types due to shorter durations in the care environment.
- Either of these products may be used per CDC PPE guidance.
- Optional - Not included in CDC or WHO guidance, but included in OSHA guidance for MERS.
- CDC specifies "disposable" for MERS, "standard isolation" for SARS, and "clean" gown for avian influenza. OSHA states "fluid-resistant" gown. Because agents and recommendations are mixed, the facility should decide on an appropriate level of isolation gown in conjunction with their infection prevention practitioners. For simplicity, a disposable, fluid-resistant gown is likely preferred.
- Powered air purifying respirator (PAPR) blower units/systems may be reused post decontamination. Therefore, the quantity of PAPRs needed per shift and per day should be based on the number of persons that may be using a PAPR and the time needed to decontaminate and ensure that these products are ready for use. One PAPR will be needed for each staff member per shift who will be in direct contact with the patient. Facilities should consider having 1.5 to 2 shifts worth of PAPR blower units/systems on hand to account for changing of staff and decon time. Calculations reflect one PAPR per provider.
- Follow the manufacturer's guidance to determine the need to replace/dispose of a filter during PAPR decontamination. Several manufacturers have added specific instructions for cleaning, disinfecting, and decontamination.

Section 3 Outputs

Total days	Total staff for total days	All needed			Either PAPRs OR N95 Respirators Needed							
		Glove, long cuff	Shoe Cover (opt onal)	Gown, Disposable Fluid resistant	PAPR	PAPR Shroud	PAPR Battery	PAPR Filter	N95	Headcover (opt onal)	Face Shield	
3												
	Nurse	18	108	216	18	0	0	0	0	18	18	18
	Doctors	12	24	48	12	0	0	0	0	12	12	12
	Environmental Services	0	0	0	0	0	0	0	0	0	0	0
	Lab Tech	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0
Total PPE needed for total days		132	264	30	0	0	0	0	30	30	30	

References

3M	Cleaning Reusable Respirators and Powered Air Purifying Respirator Assemblies The process for cleaning and disinfecting respirators is model-specific. This link provides cleaning and disinfection guidelines for commonly-used 3M respirators. Users should review the guidelines for the models of respirators used in their facilities.
ASPR TRACIE	EMS Infectious Disease Playbook
CDC	Interim Infection Prevention and Control Recommendations for Hospitalized Patients with Middle East Respiratory Syndrome Coronavirus (MERS-CoV) Infection Control in Healthcare, Home, and Community Settings (Supplement 1 to Public Health Guidance for Community-Level Preparedness and Response to SARS) Interim Guidance for Infection Control Within Healthcare Settings When Caring for Confirmed Cases, Probable Cases, and Cases Under Investigation with Novel Influenza A Viruses Associated with Severe Disease
Halvard	10 Questions to Ask Before You Stockpile
OSHA	MERS Control and Prevention Avian Influenza Control and Prevention
The National Academies of Sciences, Engineering, and Medicine	Reusable Elastomeric Respirators in Health Care: Considerations for Routine and Surge Use
WHO	Infection Prevention and Control During Health Care for Probable or Confirmed Cases of Middle East Respiratory Syndrome Coronavirus (MERS-CoV) Infection

Special Respiratory Pathogen (MERS/SARS/Novel Influenza) Hospitalized Patient(s)

Directions

Input your staff and PPE changes per 24 hours and what type of PPE you primarily use into the tan cells in Section 1. This should reflect the number of caregivers/personnel with the patient at one time. It is critical that the PPE changes/24 hours reflect your facility staffing plan for how long personnel will be in the patient's room without a break/change in PPE. Section 2 shows the assumptions about the type and amount of PPE used per shift/change. PPE requirements depend on the number of staff, not the number of patients. For example, caring for two patients in the same room does not increase PPE requirements aside from a small increase in glove changes, providing care for patients in two rooms doubles the PPE requirements. Cohorting of patients is recommended to decrease the number of staff and therefore PPE needs when clinically possible. Assumptions can be adjusted depending on the facility plans. Section 3 shows the calculations for your selected staff and duration of care. PPE calculations are minimums. PPE should always be changed earlier if it becomes soiled or contaminated or when masks become too moist and higher levels or changes of PPE may be required for airway interventions and other high risk procedures. The calculations do not account for these additional needs.

Section 1 Inputs

Do you primarily use PAPRs or N95s for your providers?	N95	→	If PAPR, are shrouds reusable or disposable?	Disposable	→	How many filters are on the PAPR unit?	1
Do you use elastomeric respirators? ¹	No	→	If yes, what percentage of staff have elastomeric respirators?			0	

	Person/Shift	Shifts per day ²	Persons per day		Notes and assumptions - IMPORTANT - please read and change values if needed to be consistent with facility personnel plans.
Nurse with patient	1	6	6	→	Assume 1 RN per 4 hour shift with patient, then rotate to support role.
Doctor with patient	1	4	4	→	Assume 4 visits/day of 1-4 hours each.
Environmental Services	1	2	2	→	Enter '0' person/shift if RN assumes these duties. Assume 2 visits/cleaning in 24 hours; if single visit, adjust PPE changes to '1'.
Lab Tech	1	2	2	→	Enter '0' person/shift if RN obtains labs. Assume 2 draws in 24 hours; may adjust PPE changes/24 hours to account for more or less frequent lab testing.
Other personnel	1	1	1	→	Includes family, spiritual care, biomedical, and other personnel required by hospital plan.
Total Team	5	15	15		

Total days (enter value 1-20)³

SECTION 1 NOTES

- Facilities that use elastomeric respirators reduce their predicted N95 usage according to the percent of caregivers equipped. Providers should generally be issued their own elastomeric respirator. Facilities using these must assure appropriate donning, doffing, cleaning, and handling protocols as per OSHA respiratory protection standards including safe storage between shifts. Facilities should also have replacement particulate filter cartridges available in the event of contamination, splash exposure, etc.
- Calculations assume an RN shift of 4 hours in room with in-room sit down breaks not requiring PPE changes (likely rotating 4 hours with external support RN for total 8 hour shift). If breaks are taken every 2 hours and another provider cycles in adjust shifts per day to 12 for nurses. Assume there is always a provider wearing PPE and ready to provide care.
- Total days depend on how ill the patient is - average of 7 days assumed.
- If multiple patients, adjust staff numbers to **number providing patient care in each room/area** (assume some may be in separate rooms and some cohorted). For example, physicians would not need to change PPE except gloves within the same room, but would have to make a full change to move between rooms.

Section 2 PPE Assumptions

Items in tan may be changed if needed based on PPE use assumptions by the facility. NOTE: if using PAPRs, assumptions about shroud/filter changes will dramatically affect calculations.

	ESTIMATED PPE Needed by Role per Shift ¹												
	All needed			PAPR/hood			or				N95 Respirator/splash protection ²		
	Glove, long cuff	Shoe cover (optional) ³	Gown ⁴	PAPR ⁵	PAPR Shroud	PAPR Battery	PAPR Filter ⁶	N95	Headcover (optional) ⁷	Face Shield			
Nurse	12	4	2	2	2	4	2	1	1	1			
Doctor	2	2	1	1	1	1	1	1	1	1			
Environmental Services	4	2	1	1	1	1	1	1	1	1			
Lab Tech	4	2	1	1	1	1	1	1	1	1			
Other	4	2	1	1	1	1	1	1	1	1			

SECTION 2 NOTES

- Quantity of product per shift may vary based on multiple factors including patient acuity, length of shifts, breaks, etc.
- Either of these products may be used per CDC PPE guidance. Use of PAPR may be preferred during aerosol-generating procedures.
- Optional - Not included in CDC or WHO guidance, but included in OSHA guidance for MERS.
- CDC specifies "disposable" for MERS, "standard isolation" for SARS, and "clean" gown for avian influenza. OSHA states "fluid-resistant" gown. Because agents and recommendations are mixed, the facility should decide on an appropriate level of isolation gown in conjunction with their infection prevention practitioners. For simplicity, a disposable, fluid-resistant gown is likely preferred.
- Powered air purifying respirator (PAPR) blower units/systems may be reused post decontamination. Therefore, the quantity of PAPRs needed per shift and per day should be based on the number of persons that may be using a PAPR and the time needed to decontaminate and ensure that these products are ready for use. One PAPR will be needed for each staff member per shift who will be in direct contact with the patient. Facilities should consider having 1.5 to 2 shifts worth of PAPR blower units/systems on hand to account for changing of staff and decon time.
- Follow the manufacturer's guidance to determine the need to replace/discard of a filter during PAPR decontamination. Several manufacturers have added specific instructions for cleaning, disinfecting, and decontamination. Estimate in the table assumes filter is being changed only when filtering capacity reached.
- Not included in CDC or WHO guidance, but included in OSHA guidance.

Section 3 Outputs

Totals days:	7	Total staff for total days	All needed			Either PAPRs OR N95 Respirators Needed						
			Glove, long cuff	Shoe Cover (opt. omal)	Gown	PAPR	PAPR Shroud	PAPR Battery	PAPR Filter	N95	Headcover (opt one)	Face Shield
Nurse		42	504	168	84	0	0	0	0	42	42	42
Doctor		28	56	56	28	0	0	0	0	28	28	28
Environmental Services		14	56	28	14	0	0	0	0	14	14	14
Lab Tech		14	56	28	14	0	0	0	0	14	14	14
Other		7	28	14	7	0	0	0	0	7	7	7
Total PPE needed for total days			700	294	147	0	0	0	0	105	105	105

References

3M	Cleaning Reusable Respirators and Powered Air Purifying Respirator Assemblies The process for cleaning and disinfecting respirators is model-specific. This link provides cleaning and disinfection guidelines for commonly-used 3M respirators. Users should review the guidelines for the models of respirators used in their facilities.
ASPR TRACIE	EMS Infectious Disease Playbook
CDC	Interim Infection Prevention and Control Recommendations for Hospitalized Patients with Middle East Respiratory Syndrome Coronavirus (MERS-CoV) Infection Control in Healthcare, Home, and Community Settings (Supplement I to Public Health Guidance for Community-Level Preparedness and Response to SARS)
Halyard	Interim Guidance for Infection Control Within Healthcare Settings When Caring for Confirmed Cases, Probable Cases, and Cases Under Investigation with Novel Influenza A Viruses Associated with Severe Disease 10 Questions to Ask Before You Stockpile
OSHA	MERS Control and Prevention Avian Influenza Control and Prevention
The National Academies of Sciences, Engineering, and Medicine	Reusable Elastomeric Respirators in Health Care: Considerations for Routine and Surge Use
WHO	Infection Prevention and Control During Health Care for Probable or Confirmed Cases of Middle East Respiratory Syndrome Coronavirus (MERS-CoV) Infection

Pandemic Influenza Inpatient

Directions

This section assumes that staff will be wearing PPE for the entire shift on ALL inpatient units. If patients are cohorted to infectious units you may enter the number of staff for those units, but this is likely to be possible only early in the pandemic and not during a majority of the weeks. This assumes that N95 masks will be used and re-used during the shift.¹ PPE calculations are minimums. PPE should always be changed earlier if it becomes soiled or contaminated or when masks become too moist and higher levels or changes of PPE may be required for airway interventions and other high risk procedures. The calculations do not account for these additional needs nor for theft from stock which may be a significant issue. Hospitals will need to plan on a modifier (**perhaps 25%**) to compensate for these losses. Section 2 shows the assumptions about the type and amount of PPE used per shift/change. PPE requirements depend on the number of staff, not the number of patients. Section 3 shows the calculations for your selected staff and duration of the pandemic.

NOTES

1. Re-use of N95 respirators is not advised by manufacturers nor by CDC or other expert groups. Though CDC recommends using a mask for each patient encounter, there may be no alternative to re-use during a pandemic if shortages preclude recommended infection prevention practices. Providers could each use 20-40 masks/shift, depending on their responsibilities and how often they enter patient rooms. Most institutions plan on assigning a tray for each provider so that the N95 can be removed and set on its front, then picked up by the straps again to re-apply. Hand hygiene is critical. The masks must be disposed of if they become contaminated, are worn during procedures likely to generate significant aerosols, are damaged, etc. as outlined in CDC guidance at: <https://www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html>. A faceshield or surgical mask may be worn over the N95 to prevent surface contamination.

Section 1 Inputs

Please assure cells in Section 1 reflect your surge staffing and not daily staffing

What is the total number of MDs at your hospital? ¹	50		
What is the total number of RNs at your hospital? ¹	40		
Do you plan to reuse (launder) gowns? ²	No		
Does your staff use elastomeric respirators? ³	No	→	What percentage of inpatient care staff have elastomeric respirators? 0

Roles	Person/Shift	Shifts per day	Persons per day	Notes and assumptions - IMPORTANT - please read and change values if needed to be consistent with facility personnel plans.
Floor Nurses	20	2	40	→ RNs required to staff all floor, monitored, and step down beds including surge beds at usual staffing ratios.
ICU Nurses	10	2	20	→ RNs required to staff all ICU beds including surge beds at usual ratios.
Doctors	6	2	12	→ Include inpatient admitting physicians and consulting physicians (and trainees/residents).
Healthcare Assistants	15	2	30	→ All healthcare assistants (does not include clerical and other non-clinical staff).
Environmental Services	4	2	8	
Lab Tech	4	2	8	→ All lab personnel collecting patient samples at bedside.
Respiratory Therapy	2	2	4	→ Respiratory therapists providing bedside care.
Radiology	2	2	4	→ Radiology techs with direct exposure to patients.
ECG Tech	1	2	2	→ ECG techs with direct exposure to patients.
Other ⁴	2	2	4	→ Includes spiritual care, biomedical, and other medical/surgical personnel as required.
Total Team	66		132	

Projection 1 Total days (42 168) ⁵	84
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SECTION 1 NOTES

- Eye protection is reusable and estimated 2 per provider during a pandemic calculated off total providers (RN/physician/APP). Full face flexible faceshields are preferred to reduce contamination of the mask but are far less durable. If a hospital plans to use these, they should consider restricting use to certain environments (e.g., ICU) where the risk and exposure may be highest or to situations likely to generate aerosols. If using faceshields, may need to assume 1/shift and plan stock from the grid in Section 3. Policies and education for appropriate cleaning of the faceshields and goggles are critical to prevent them from acting as fomites.
- Laundered gowns assumes a 72 hour cycle time (that is, gowns/24 hours required x3 is supply required).
- Facilities that use elastomeric respirators reduce their predicted N95 usage according to the percentage of caregivers equipped. Providers should generally be issued their own elastomeric respirator. Facilities using these must assure appropriate donning, doffing, cleaning, and handling protocols as per OSHA respiratory protection standards including safe storage between shifts. Facilities should also have replacement particulate filter cartridges available in the event of contamination, splash exposure, etc.
- As the pandemic progresses, crisis care strategies such as conservation of gloves and gowns (for body fluid contact only) and re-use of N95 masks for additional time periods, may have to be implemented based on available resources and prioritization of need for protection.
- Duration of a pandemic wave is assumed to be 12 weeks (84 days). This may be adjusted from 6 weeks (42 days) up to 24 weeks (168 days). Contingency and crisis staffing patterns may affect these calculations, e.g., for 8 hour shifts rather than 12, change shifts per day to 3 rather than 2.

Section 2 PPE Assumptions

Items in tan may be changed by the hospital to account for their pandemic plans

ESTIMATED PPE Needed by Role per Shift ¹				
	Gloves	Shoe cover	Gown ²	N95
Floor Nurse	8	2	2	1
ICU Nurse	12	2	2	1
Doctors	12	2	2	1
Healthcare Assistant	8	2	2	1
Env Services	16	4	4	1

Lab Tech	12	2	2	1
Respiratory Therapy	8	2	2	1
Radiology	8	2	2	1
ECG Tech	8	2	2	1
Other	2	2	1	1

SECTION 2 NOTES

1. Calculations assume the provider uses the same N95 for the whole shift (e.g., has designated location to doff/don mask). Note that this is a crisis standards of care situation and appropriate only if adequate masks are not available to follow usual infection prevention guidelines. If providers wear N95 only to their next break, change masks required to 3-4 depending on the number of breaks/shift. PPE consumption may be higher early in the pandemic when cohorting is not performed and providers must make multiple PPE changes during a shift. Calculations do NOT account for simple masks for patients and family members nor for any PPE for ancillary staff (nutrition services, pharmacy, etc.) to prevent transmission. Some personnel (e.g., outpatient pharmacy, physical therapy) may need to wear at least some PPE some of the time. Assumes all staff will be caring for cohorted patients and floor nurses and HCA, RT, radiology, and ECG techs change gloves 4 times to take breaks or for glove contamination or damage (otherwise use alcohol-based hand hygiene products). Physicians, ICU nurses, and lab change gloves 6 times/shift and environmental services change 8 times/shift. Use of PAPR and other re-usable (e.g., elastomeric) respirators will decrease N95 use. Use of more than 1 N95/shift will increase use dramatically.

2. CDC specifies "clean" gowns. Facilities should determine what type of gown will be used, including clean isolation gowns vs. disposable fluid-resistant, etc.

Section 3 Outputs

Total Eye Protection: ¹	180
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Totals days:	84	PPE changes for total days	Gloves	Shoe cover	Gown	N95
Floor Nurse		3360	26880	6720	6720	3360
ICU Nurse		1680	20160	3360	3360	1680
Doctors		1008	12096	2016	2016	1008
Healthcare Assistant		2520	20160	5040	5040	2520
Environmental Services		672	10752	2688	2688	672
Lab Tech		672	8064	1344	1344	672
Respiratory Therapy		336	2688	672	672	336
Radiology		336	2688	672	672	336
ECG Tech		168	1344	336	336	168
Other		336	672	672	336	336
Total PPE needed for total days			105504	23520	23184	11088

SECTION 3 NOTES

1. Reusable eye protection must be decontaminated per manufacturer recommendations. Face shields and other disposable eye protection may be used but will require large quantities. Full face flexible faceshields are preferred to reduce contamination of the mask but are far less durable. If a hospital plans to use these, they should consider restricting use to certain environments (e.g., ICU) where the risk and exposure may be highest or to situations likely to generate aerosols. If using faceshields, may need to assume 1/shift and plan stock from the grid in Section 3. Policies and education for appropriate cleaning of the faceshields and goggles are critical to prevent them from acting as fomites.

Contingency and crisis plans may reduce the need for PPE but further increase provider risk - for example, glove and gown use could be restricted to higher risk exposure patient encounters or limited to certain job classes depending on the availability of PPE and the relative risk of exposure.

References

CDC	Interim Guidance for Infection Control Within Healthcare Settings When Caring for Confirmed Cases, Probable Cases, and Cases Under Investigation with Novel Influenza A Viruses, Associated with Severe Disease
	Recommended Guidance for Extended Use and Limited Reuse of N95 Filtering Facepiece Respirators in Healthcare Settings
Halyard	10 Questions to Ask Before You Stockpile
OSHA	Pandemic Influenza Preparedness and Response Guidance for Healthcare Workers and Healthcare Employers
The National Academies of Sciences, Engineering, and Medicine	Reusable Elastomeric Respirators in Health Care: Considerations for Routine and Surge Use
WHO	Infection Prevention and Control During Health Care for Confirmed, Probably, or Suspected Cases of Pandemic (H1N1) 2009 Virus Infection and Influenza-Like Illnesses

Pandemic Influenza Emergency Department

Directions

Enter your staff for the ED into Section 1 tan cells. This section assumes that staff will be wearing PPE each shift throughout the ED. Early in the pandemic PPE may be used for specific patient encounters but this will not be possible during the majority of the weeks. This assumes that N95 masks will be used and re-used during the shift.¹ PPE calculations are minimums. PPE should always be changed earlier if it becomes soiled or contaminated or when masks become too moist and higher levels or changes of PPE may be required for airway interventions and other high risk procedures. The calculations do not account for these additional needs nor for theft from stock which may be a significant issue. Hospitals will need to plan on a modifier (**perhaps 25%**) to compensate for these losses. Section 2 shows the assumptions about the type and amount of PPE used per shift/change. PPE requirements depend on the number of staff, not the number of patients. ED providers will have higher turnover of gloves and gowns compared to inpatient units. Section 3 shows the calculations for your selected staff and duration of the pandemic.

NOTES

1. Re-use of N95 respirators is not advised by manufacturers nor by CDC or other expert groups. Though CDC recommends using a mask for each patient encounter, there may be no alternative to re-use during a pandemic if shortages preclude recommended infection prevention practices. Providers could each use 20-40 masks/shift, depending on their responsibilities and how often they enter patient rooms. Most institutions plan on assigning a tray for each provider so that the N95 can be removed and set on its front, then picked up by the straps again to re-apply. Hand hygiene is critical. The masks must be disposed of if they become contaminated, are worn during procedures likely to generate significant aerosols, are damaged, etc. as outlined in CDC guidance at: <https://www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html>. A faceshield or surgical mask may be worn over the N95 to prevent surface contamination.

Section 1 Inputs

Please assure cells in section 1 reflect your surge staffing

What is the total number of MD/APPs on your ED staff roster? ¹	10
What is the total number of RNs on your ED staff roster? ¹	20
Do you plan to reuse (launder) gowns? ²	Yes
Does your staff use elastomeric respirators? ³	No
→	What percentage of inpatient care staff have elastomeric respirators?
	0

	Person/Shift	Shifts per day	Persons per day	Notes and assumptions - IMPORTANT - please read and change values if needed to be consistent with facility personnel plans.
ED Nurses	12	2	24	→ RNs required to staff ED at surge levels per shift (may include urgent care/acute clinic staff)
ED Physicians/Advanced Practice Providers	8	2	16	→ MD/APP required to staff ED at surge levels per shift (may include urgent care/acute clinic staff also in addition to trainees)
Healthcare Assistant	10	2	20	→ All healthcare assistants (does not include clerical and other non-clinical staff)
Environmental Services	2	2	4	→ Assigned to the ED
Lab Tech	2	2	4	→ All lab personnel collecting patient samples at bedside in the ED
Respiratory Therapy	2	2	4	→ Respiratory therapists providing ED care
Radiology	2	2	4	→ ED radiology techs
Other ⁴	4	2	8	→ Includes spiritual care, biomedical, and other medical/surgical personnel as required.
Total Team	42	16	84	

Projection 1 Total days (42-168) ⁵	84
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SECTION 1 NOTES

- Eye protection is reusable and estimated 2 per provider during a pandemic calculated off total providers (RN/physician/APP). Full face flexible faceshields are preferred to reduce contamination of the mask but are far less durable. If a hospital plans to use these, they should consider restricting use to certain environments (e.g., resuscitation area) where the risk and exposure may be highest or to situations likely to generate aerosols. If using faceshields, may need to assume 1/shift and plan stock from the grid in Section 3. Policies and education for appropriate cleaning of the faceshields and goggles are critical to prevent them from acting as fomites.
- Laundered gowns assumes a 72 hour cycle time (that is, gowns/24 hours required x3 is supply required).
- Facilities that use elastomeric respirators may reduce their predicted N95 usage according to percentage of caregivers equipped. Providers should generally be issued their own elastomeric respirator. Facilities using these must assure appropriate donning, doffing, cleaning, and handling protocols as per OSHA respiratory protection standards including safe storage between shifts. Facilities should also have replacement particulate filter cartridges available in the event of contamination, splash exposure, etc.
- As the pandemic progresses, crisis care strategies such as conservation of gloves and gowns (for body fluid contact only) and re-use of N95 masks for additional time periods, may have to be implemented based on available resources and prioritization of need for protection.
- Duration of a pandemic wave is assumed to be 12 weeks (84 days). This may be adjusted from 6 weeks (42 days) up to 24 weeks (168 days). Contingency and crisis staffing patterns may affect these calculations, e.g., for 8 hour shifts rather than 12, change shifts per day to 3 rather than 2.

Section 2 PPE Assumptions

Items in tan may be changed by the hospital to account for their pandemic plans

	ESTIMATED PPE Needed by Role per Shift ¹			
	Gloves	Shoe cover (optional)	Gown Impervious	N95
Nurses	24	4	4	1
Doctor	24	4	4	1
Healthcare Assistant	12	4	2	1

Env Services	12	4	4	1
Lab Tech	8	2	4	1
Respiratory Therapy	6	2	2	1
Radiology	6	2	2	1
Other	4	2	1	1

SECTION 2 NOTES

1. Calculations assume provider uses same N95 for whole shift (e.g., has designated location to doff/don mask). Note that this is a crisis standards of care situation and appropriate only if adequate masks are not available to follow usual infection prevention guidelines. If providers wear N95 only to their next break, change masks required to 3-4 depending on the number of breaks/shift. PPE consumption may be higher early in the pandemic when suspect cases are managed individually and providers must make multiple PPE changes during a shift. Calculations do NOT account for simple masks for patients and family members nor for any PPE for ancillary staff (nutrition services, pharmacy, etc.) to prevent transmission. Some personnel (e.g., outpatient pharmacy, physical therapy) may need to wear at least some PPE some of the time. Assumes ED staff will have higher glove use due to procedures/body fluid exposures as well as to take breaks or for glove damage (otherwise use alcohol-based hand hygiene products). Use of PAPR and other re-usable (e.g., elastomeric) respirators will decrease N95 use. Use of more than 1 N95/shift will increase use dramatically.

Section 3 Outputs

Total Eye Protection: ¹	60
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Total Days	84		PPE changes for total days	Gloves	Boot/ shoe cover	Gown Impervious	N95
		Nurses	2016	48384	8064	288	2016
		Doctor	1344	32256	5376	192	1344
		Healthcare Assistant	1680	20160	6720	120	1680
		Env Services	336	4032	1344	48	336
		Lab Tech	336	2688	672	48	336
		Respiratory Therapy	336	2016	672	24	336
		Radiology	336	2016	672	24	336
		Other	672	2688	1344	24	672
Total PPE needed for total days				114240	24864	768	7056

SECTION 3 NOTES

1. Reusable eye protection must be decontaminated per manufacturer recommendations. Face shields and other disposable eye protection may be used but will require large quantities. Full face flexible faceshields are preferred to reduce contamination of the mask but are far less durable. If a hospital plans to use these, they should consider restricting use to certain environments (e.g., resuscitation area) where the risk and exposure may be highest or to situations likely to generate aerosols. If using faceshields, may need to assume 1/shift and plan stock from the grid in Section 3. Policies and education for appropriate cleaning of the faceshields and goggles are critical to prevent them from acting as fomites.

Contingency and crisis plans may reduce the need for PPE items - for example, if gloves and gowns are worn only for body fluid exposures or limited to certain job classes depending on the availability of PPE and the relative risk of exposure.

References

CDC	Interim Guidance for Infection Control Within Healthcare Settings When Caring for Confirmed Cases, Probable Cases, and Cases Under Investigation with Novel Influenza A Viruses Associated with Severe Disease
Halyard	Recommended Guidance for Extended Use and Limited Reuse of N95 Filtering Facepiece Respirators in Healthcare Settings
Halyard	10 Questions to Ask Before You Stockpile
OSHA	Pandemic Influenza Preparedness and Response Guidance for Healthcare Workers and Healthcare Employers
The National Academies of Sciences, Engineering, and Medicine	Reusable Elastomeric Respirators in Health Care: Considerations for Routine and Surge Use
WHO	Illnesses