Increasing ED Triage Efficiency During Mass Casualty HAZMAT Incidents
Final Report

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EXECUTIVE SUMMARY
The University of Michigan Health System (UMHS) is working to create a documented response process for a HAZMAT scenario. UMHS participated in an October 2012 drill called Operation Shared Burden, in which a simulated HAZMAT event occurred in Detroit, MI. Primarily, UMHS wants to improve the time it takes to don a HAZMAT suit. In order to reduce the time it currently takes to don a suit, the hospital has enlisted the help of an IOE 481 student team from the University of Michigan College of Engineering. The team has been tasked with improving the HAZMAT suit donning process, the HAZMAT material flow, the HAZMAT patient flow, and creating a system of visual cues for a HAZMAT incident. The team has collected data from interviews of disaster core members, surveys of the emergency department personnel, and observations of the donning and doffing of HAZMAT suits. Through observation and analysis, opportunities for improvement in the HAZMAT processes have become evident.

Background
In the aftermath of the October 2012 drill, University of Michigan Hospital System found that the processes of donning a HAZMAT suit, flow of incoming patients through the decontamination process, and containment of contaminated equipment needed improvements to keep the hospital safe and effective in a mass casualty HAZMAT situation. The team was assigned the following tasks:

Donning and doffing process
The following is a list of the tasks related to donning and doffing of the HAZMAT suits that the team confronted:

- Develop a process that enables a crew to don HAZMAT suits in less than 7 minutes. Develop visual cues, instructions, and mutual assistance to help standardize and accelerate the donning/doffing process.
- Determine the most efficient system for assisting others with donning the suits.
- Dedicate a space for the donning/doffing of the HAZMAT suits. If possible, incorporate the recommendation to the future architectural plan.
- Develop a rotation process that keeps track of the time a person spends in the HAZMAT suit.

Process flow
The following items are comprised of project tasks related to the patient and material flow:

- Organize and streamline the patient flow both inside and outside the facility.
- Develop a tagging system to distinguish decontaminated from contaminated people and equipment.
**Methods**

The team utilized interviews, surveys, time studies, and a literature search to obtain data for analysis. The interviews were conducted with key staff associated with the October drill. Seven in total were collected and analyzed, including results from nurses, technicians, doctors, and staff. Additionally, a four-question survey was sent to nurses and technicians in both the Adult Emergency Services (AES) and Pediatric Emergency Services (CES). The survey consisted of questions regarding boot size, HAZMAT experience, and shift time information. In total, 126 surveys were collected and analyzed.

Time studies were conducted using three donning methods. The studies were analyzed to determine the most efficient method for donning. In addition, the time studies were used to determine the largest wastes of the process. Lastly, a literature search was used to provide more detail on what occurred in the October 2012 HAZMAT drill. The literature search consisted of the after-action report, which contained key observations noted by participants in the drill (Wright, 2012).

**Findings and Conclusions**

After conducting the previous task, the team discovered the following findings and conclusions:

- The time studies determined that on average it took 11 minutes and 34 seconds per person to don the HAZMAT suits using solely the posters, 7 minutes and 22 seconds per person using a trainer working in series, and 5 minutes and 25 seconds per person using a trainer working in parallel. The team concluded that having a trainer working in parallel to assist the individual donners was the most efficient way to don. Helpers working in parallel assisted two donners at once; whereas helpers working in series assisted one donner at a time.
- According to the time studies, one of the largest inefficiencies in the donning process was selecting and putting on boots. The amount of time needed to select and don boots with a helper working in parallel was 65 seconds.
- During the October drill, there was no predetermined location for hospital personnel to don the suits. This created congestion in the surrounding hallways and confusion with the staff, leading to the conclusion that predetermined locations need to be specified for donning.
- The After Action report requested a rotation process to prevent overexertion of hospital staff. It was concluded that there was already a process in place to oversee the rotation.
- Through the literature search and interviews, it was determined that no definitive patient flow exists. The team has determined that a defined patient flow should be implemented.
• According to interviews and literature searches conducted by the team, it was found that contaminated patients and equipment entered the clean zone of the facility. A system needs to be implemented to prevent these occurrences.

**Recommendations**

After analyzing the findings and conclusions, the team would like to make the following recommendations:

• The team recommends the use of a trainer working in parallel to don up to four people simultaneously. The time studies found this technique to be the most efficient and practical method. Updated posters found in appendices 5-7 will decrease donning time.

• The carts should be stocked predominately with 7 and 11 gender-neutral sized boots to reduce the amount of searching time required to find an acceptable boot size. In addition, the fasteners on the boots should be unstrapped when not in use, to decrease the boot donning time.

• The space directly outside the HAZMAT room and the nearby ambulance entrance should be used to don the suits. The ambulance doors should be locked to maintain a barrier from the outside and create an alcove for donning of the suits. On the PEDs side, the team recommends that personnel donning HAZMAT suits use the hallway directly to the right of the ambulance entrance when entering.

• The gaps in the After Action report determine that there should be a dedicated staff member to take vitals and rotate the suited staff, according to the existing process.

• A HAZMAT patient flow map has been created by the team to construct a definitive process for first receivers. This patient flow map is located in Appendix 3 for the AES and Appendix 4 for the CES. There should be two dedicated staff members that will go to the parking lot immediately after notice of a mass casualty HAZMAT situation, and they will be in charge of setting up the visual markers for the parking lot (caution tape, signage, and pylons).

• Visual cues should be utilized to mark contaminated equipment. In order to do this, the team recommends having a designated leader duct tape the dirty equipment around the handles. This duct tape should be bright red in order to be easily distinguished from the clean equipment. Visual cues should also be utilized to distinguish between the clean and dirty patients. The existing green and red ponchos will be used to help distinguish between the two types of patients—red represents dirty patients and green represents clean patients.
INTRODUCTION
As the largest health care provider in southeast Michigan, the University of Michigan Health System (UMHS) has been tasked with being adequately prepared for a mass casualty HAZMAT scenario. UMHS performed a mass casualty drill called Operation Shared Burden in October 2012. The drill simulated a scenario where a dirty bomb was detonated in Detroit, MI. The adult and the pediatric emergency departments of UMHS were tasked with receiving and decontaminating the casualties involved in the incident. The drill exposed a set of problems and suggested that both emergency departments (EDs) could be better prepared for mass casualty HAZMAT incidents. Donning the HAZMAT suits took approximately 45 minutes, which did not meet the 7 minute standard established by Occupation Safety and Health Administration (OSHA).

The associate service chief at the UMHS department of emergency medicine asked the IOE 481 student team from the University of Michigan to investigate the HAZMAT process, specifically the donning and doffing of HAZMAT suits. This report shows the data collection, data analysis, findings, conclusions, and recommendations to the client.

BACKGROUND
The team reviewed the after-action report and obtained the following information. UMHS performed a mass casualty drill called Operation Shared Burden in October 2012. The drill simulated a scenario where a dirty bomb was detonated in Detroit, MI. As the largest health care provider in southeast Michigan, the adult and the pediatric ED’s of UMHS were tasked with decontaminating and receiving the casualties involved in the incident. The drill exposed a set of problems and proved that both ED’s were underprepared for mass casualty HAZMAT incidents.

Donning the HAZMAT suits took approximately 45 minutes, which did not meet the 7 minutes standard established by OSHA. ED employees were unfamiliar with the donning process due to the lack of training. Visual cues, instructions, and mutual assistance were nonexistent during the donning process. Personnel in the HAZMAT tent worked overtime due to the lack of a rotation process. There was no dedicated area for the donning/doffing of HAZMAT suits.

In the adult’s emergency services facility (AES), equipment and materials needed to deploy the decontamination tent were stored in a trailer, the inside of which was unorganized. In addition, the trailer was backed up in a parking stall, which made difficult to access. In the children’s emergency services facility (CES), equipment and materials needed to deploy the decontamination tent were stored on carts in the warehouse located in the basement, however other equipment and materials in the warehouse blocked the carts making it difficult to access. In addition, the warehouse was
only accessible to the maintenance staff. Nurses had to rely on maintenance staff to deploy the decontamination tent. Contaminated patients and equipment entered and contaminated the facility due to lack of visual cues to differentiate clean from dirty equipment. Wheelchairs and stretchers were in shortage during the HAZMAT triage process. Patients were re-triaged and miss-triaged after they entered the ED’s.

**Key Issues**
The following key issues drove the need for this project. The key issues are grouped into two groups, namely the donning process and the HAZMAT triage process.

**Donning Process:**
- According to the after-action report, donning the HAZMAT suits took 45 minutes, which did not meet the 7-minute standard established by OSHA. ED employees were unfamiliar with the donning process due to the lack of training.
- Visual cues, instructions, and mutual assistance were nonexistent during the donning process.
- There was no dedicated area for the donning/doffing process.

**HAZMAT Triage Process:**
- Personnel in the HAZMAT tent worked overtime due to the lack of a rotation process.
- Contaminated people and equipment entered and contaminated the facility due to lack of visual cues to differentiate clean from dirty equipment. Wheelchairs and stretchers were in shortage during the HAZMAT triage process.
- Patients were re-triaged and miss-triaged after they entered the ED’s.

**Goals and Objectives**
The goal of this project was to decrease the time it takes to don a HAZMAT suit, and to develop a process flow for a mass casualty incident with a HAZMAT component. To achieve the goal, the team established the following objectives:

**Donning Process**
The following items are a list of the tasks related to donning and doffing of the HAZMAT suits that the team confronted:
- Develop a process that enables a crew to don HAZMAT suits in less than 7 minutes. Develop visual cues, instructions, and mutual assistance to help standardize and accelerate the donning/doffing process.
- Determine the most efficient system for assisting others with donning the suits.
- Dedicate a space for the donning/doffing of the HAZMAT suits. If possible, incorporate the recommendation to the future architectural plan.
• Develop a rotation process that keeps track of the time a person spends in the HAZMAT suit.

HAZMAT Triage Process
The following items are comprised of project tasks related to the patient and material flow:
• Organize and streamline the patient flow outside the facility.
• Develop a tagging system to distinguish decontaminated from contaminated people and equipment.

Project Scope
This project covered the HAZMAT response process from the activities in the ambulance bay to the activities at the triage process when patients get into the facilities. The analysis was done from the perspective of the patient receivers.

The following aspects were out of the scope of the project:
• Training and scheduling of staff
• Emergency communication system
• Activities after the patients are inside the facility

DATA COLLECTION AND ANALYSIS
To collect both qualitative and quantitative data, the team performed four methods of collection: a literature search, interviews, time studies, and survey.

Literature Search
The team conducted a literature search to gain knowledge about the October 2012 drill. Documentation regarding Operation Shared Burden was read and analyzed to gain insight into the current state. The after-action report was analyzed to give the team a better understanding of what happened during the drill, as well as the comments that were noted as hindrances in the HAZMAT donning process.

Interviews
The Associate Service Chief provided a list of personnel involved in the October drill to be interviewed. A set of questions, including both long-answer and multiple-choice questions, were developed and used during the interviews to guide the process and collect standardized data. The question set aimed to collect the ideas, comments, suggestions, and recommendations of the participants of the October drill. As suggested by the Associate Service Chief, the team completed seven interviews. The set of questions can be found in Appendix 1.
The interview results were treated as categorical data. Instead of performing numerical analysis, the team used qualitative lean principles to evaluate the comments and suggestions among the interviewed personnel.

**Time Studies: Donning Observation**

The team observed and video recorded eight people donning and doffing HAZMAT suits. The team adopted four approaches. First, a HAZMAT-trained nurse donned the suit with the assistance of another HAZMAT-trained technician. Second, three non-HAZMAT-trained nurses donned suits following instructions on posters. Third, two non-HAZMAT-trained nurses donned suits simultaneously following the instructions from a HAZMAT-trained nurse. Lastly, two non-HAZMAT-trained nurses donned suits one at a time following the instructions from a HAZMAT-trained tech. In addition, the team found that there were missing steps and other ways to improve the existing posters provided for donning, doffing, and checking the PAPR.

The team analyzed the recorded videos of the donning process and broke down the entire process into 13 elementary motions or activities. The list of the activities and their associated times are located in Appendix 8. The time each motion or activity takes were averaged and a standard deviation was calculated. A graph was constructed to highlight the most time consuming activities. The team utilized lean principles and ergonomic methodologies to reduce the amount of time it took to don the HAZMAT suit. This included grouping certain tasks to decrease complexity. This analysis of the time studies gave the team an understanding of what items can be reduced to decrease the overall donning time of the HAZMAT suits. The team concluded that the posters needed to be updated to save time and correctly don the HAZMAT suits.

**Surveys**

In addition to interviews, the team collected data through a survey on the boot size and disaster training of each employee in the adult and the pediatric emergency departments. The team used this data to optimize the stocking of the HAZMAT boots and obtain an understanding of the level of disaster training that employees currently possess. The team created a survey on the UMHS Qualtrics website and distributed to all nurses, paramedics, and related employees in both the adult and the pediatric ED. There were 126 nurses and technicians that responded to the survey out of the roughly 300 nurses and technicians in both AES and CES. The survey can be found in Appendix 2.

The team performed statistical fitting to determine the distribution of the boot size of the employees at the two emergency departments. Then, the team optimized the stocking of the HAZMAT boots using a modified newsvendor problem technique. This analysis resulted in less clutter in the decontamination rooms and decreased donning time.
FINDINGS AND CONCLUSIONS
Through the methods conducted, the team compiled a list of findings and conclusions. These were important in determining the recommendations toward the project goal of developing a more efficient HAZMAT suit donning process and defining a triage process for the AES and CES.

Literature Search and Interviews:
Through the literature search and the interviews, the team found that the problems indicated in the key issues section of this paper had in fact occurred. This was done by reviewing the after-action report and interviewing key personnel close to the October drill.

Donning the HAZMAT suits took 45 minutes, which did not meet the 7 minutes standard established by OSHA. ED employees were unfamiliar with the donning process due to the lack of training. Visual cues, instructions, and mutual assistance were nonexistent during the donning process. Personnel in the HAZMAT tent worked overtime due to the lack of a rotation process. There was no dedicated area for the donning/doffing process.

In the adult’s emergency services facility (AES), equipment and materials needed to deploy the decontamination tent were stored in a trailer and were unorganized. In addition, the trailer was backed up in a parking stall, which made it difficult to access. In the children’s emergency services facility (CES), equipment and materials needed to deploy the decontamination tent were stored on carts in the warehouse located in the basement. Other equipment and materials in the warehouse blocked the carts. In addition, the warehouse was only accessible to the maintenance staff. Nurses had to rely on maintenance staff to deploy the decontamination tent. Contaminated patients and equipment entered and contaminated the facility due to lack of visual cues to distinguish them from decontaminated ones. Wheelchairs and stretchers were in shortage during the HAZMAT triage process. Patients were re-triaged and miss-triaged after they entered the ED’s.

The findings indicated that a future state process flow needed to be developed. This would define a process for both the AES and the CES.

Time Studies: Donning Observation
For the time studies on the donning process, the team divided the process into 13 fundamental activities. Figure 1 and Figure 2 show the times each activity took during the donning processes.
Figure 1: Time Study – donning with specialists helping:
*Putting on boots and checking PAPR were the most time-consuming activities*

Figure 2: Time Study – donning with posters only:
*Checking PAPR was the most time-consuming activity*
The team benchmarked the two approaches (specialists helping versus posters only) and found no significant difference in total donning time. However, the team identified the two most time-consuming activities, marked with arrows on the figures, namely putting on the boots and checking PAPR. Specifically, searching for the correct boot size and attaching the hose to the PAPR were the most time consuming sub-activities. Therefore, the team concluded that putting on the boots and checking the PAPR are the two most problematic activities in the donning process.

**Survey**

The team’s observation revealed that putting on the boots was time-consuming because finding the boots of the right size was difficult. Therefore, the team conducted a survey to understand the boot-size distributions in both ED’s. Figure 3 shows the distribution of the boot-size.

![Histogram of Boot Size](image)

Figure 3: Boot-size distribution for all respondents

*Showed a bi-modal pattern*

The figure shows a bi-modal pattern in the distribution. The team suspected that the bi-modal pattern was due to gender. The next figure (Figure 4) shows the boot-sizes by gender and confirmed the bi-modal pattern was indeed caused by gender. The two medians are seven and eleven for female and male respectively.
Figure 4: Boot-size distribution by gender
Median for female = 7 and median for male = 11

The team then evaluated the boot-size distribution by department, in order to see if the bi-modal pattern is consistent in both the AES and the CES. Figure 5 shows the distribution by department.

Figure 5: Boot-size distribution by department
*No difference between AES and CES*

As seen in the figure above, there is no significant difference between the distributions at the AES and the CES.
RECOMMENDATIONS

Donning Process
The following recommendations pertain to the HAZAT suit donning process:

- The team recommends the use of a specialist working in parallel to don up to four people simultaneously. The time studies found this technique to be the most efficient and practical method to reduce donning time to below 7 minutes. Updated posters found in appendices 5-7 will decrease donning time.
- The team suggests that the carts be stocked predominately with size 7 and 11 boots. This will reduce the amount of searching time required to find an acceptable boot size. In addition, the fasteners on the boots should be unstrapped, to decrease the boot donning time.
- The team recommends using both the space directly outside the AES HAZMAT room and the nearby ambulance entrance. The ambulance doors should be locked to maintain a barrier from the outside and create an alcove for donning of the suits. On the PEDs side, the team recommends that people donning HAZMAT suits use the hallway directly to the right of the ambulance entrance when walking into the building.
- There should be a dedicated staff member to take vitals and rotate the suited staff, according to the existing process.

HAZMAT Triage Process
The items below include the recommendations pertaining to the triage process:

- A HAZMAT patient flow map has been created to construct a definitive process for first receivers. This patient flow map is located in Appendix 3 for the AES and Appendix 4 for the CES. There should be two dedicated staff members that will go to the parking lot immediately after notice of a mass casualty HAZMAT situation, and they will be in charge of setting up the visual markers for the parking lot (caution tape, signage, pylons).
- Visual cues should be utilized to mark the dirty equipment. In order to do this, the team recommends having a designated leader to duct tape the dirty equipment around the handles. This duct tape should be bright red.
- Visual cues should also be utilized to distinguish between the clean and dirty patients. The existing green and red ponchos will be used to help distinguish between the two—red represents dirty and green represents clean.
EXPECTED IMPACT
Recommendations will result in the following:

- Standardized HAZMAT donning and doffing process, along with updated assisting posters, so that donning can be performed in less than 7 minutes.
- Sorted suit carts that will reduce donning time and increase donning clarity.
- A predetermined location for donning and doffing to take place.
- The prevention of personnel in the HAZMAT suits working overtime due to the installment of a rotation process.
- A tagging system for contaminated equipment and people.
- Organization of the triage system by streamlining the patient flow.
REFERENCES
APPENDIX 1: Interview Questions

Long-Answer Questions:

1. What was your role in the drill? What were your responsibilities?

2. What was good and what was bad in the drill?

3. What was the bottleneck of the HAZMAT triage process?

4. How many people should be suited up during the process? What are their jobs and responsibilities?

5. Could there be any improvements in the tagging process?

6. If you put on a suit, what happened? What could be made better? Should everyone have a to-go kit?

Multiple Choice Questions:

1. How many wheelchairs are required for the dirty cycle (outside decontamination tent and decontamination room)?
   A) 5 to 10; B) 10 to 20; C) 20 to 30; D) as much as possible

2. How many wheelchairs are required for the clean cycle (inside ED)?
   A) 5 to 10; B) 10 to 20; C) 20 to 30; D) as much as possible

3. How many stretchers are required for the dirty cycle (outside decontamination tent and decontamination room)?
4. How many stretchers are required for the clean cycle (inside ED)?
A) 5 to 10; B) 10 to 20; C) 20 to 30; D) as much as possible

5. Do you think it would be easier to don the HAZMAT suit with assistance from your colleagues?
A) Yes, much easier; B) Yes, a little bit easier; C) Indifferent; D) No, it will make things worse.
APPENDIX 2: Survey Questions

1. Do you work in the AED or PED?

2. What is your shoe size? (All sizes need to be in Men’s sizing, please subtract 2 for Women’s)

3. Have you received HAZMAT training before?
   • If you have, what is your level of experience?

4. What is the start time and end time of your shift?
   • If none of the above, please indicate your shift times.
APPENDIX 3: AES HAZMAT Triage

AES Decontamination Zones

Breakdown of Staff: (S=Security NT=Nurse/Tech)
ED Triage: 1S/2NT
Yellow and Green: 1NT
Decon Tent: 4NT
Cold Zone: 1S
HAZMAT Room: 2NT

Contaminated Parking

Contaminated Ambulance Turn Around

DECON TENT

GREEN Ambulatory

BLACK Expectant

RED Non-ambulatory

Patient Awaiting Admission

DECON TENT

YELLOW Ambulatory

Valet

Waiting Area (All Colors)
APPENDIX 4: CES HAZMAT Triage

CES Decontamination Zones

Breakdown of Staff: (S=Security NT=Nurse/Tech)
- ED Triage: 1S/2NT
- Yellow and Green: 1NT
- Decon Tent: 4NT
- Cold Zone: 1S
- HAZMAT Room: 2NT
- Non-Contaminated Entrance: 1S
APPENDIX 5: Updated PAPR Poster

PAPR DIRECTIONS
Powered Air Purifying Respirator

Be sure to inspect all parts of the assigned equipment. If inspection reveals damage to any component: DO NOT USE. Remove from service and notify the ED contact (Dave Navigo). Using a damaged PAPR may cause serious injury.

Assembly
1. Remove three respirator cartridges from original packaging.
2. Remove plug and unscrew cap from all three of the respirator cartridges. Plug must be removed or air will not flow.
3. Attach three cartridges to the blower unit, turning until cartridges are hand tight. Over tightening the cartridges may damage the PAPR.
4. It is necessary to conduct an air flow test as part of the assembly process. This step tests the PAPR to ensure enough air will be drawn through the PAPR to adequately protect the user.
   - Insert air flow test tube (containing ball) firmly into the hose that is connected to PAPR.

- If hose is not already connected to PAPR, attach breathing hose to the blower unit, secure in place by tightening the clamp located at the bottom of the breathing hose.
- Connect the battery pack to the blower unit and turn the battery to the on position. The ball should float towards the center or higher end of the test tube to indicate adequate airflow.

5. Remove air flow test tube and attach breathing tube to the hood. KEEP PAPR RUNNING WHEN DONNING HOOD.

University of Michigan Health System
APPENDIX 6: Updated Donning Poster

**DONNING**
*(LEVEL “C” PPE)*

**Remove all jewelry, belts, and items in your pockets before beginning! Have Decon Unit Leader check your vitals.**

1. Complete inspection of PAPR or SAR.

2. Put on inner nitrile gloves.

3. Put on chemical protective suit and tuck in suit hood (only zipping up to waist).

4. Put on Chemical resistant boots.

5. Attach PAPR or SAR to shielded hood and turn airflow on.

6. Put on outer gloves. You can put on another layer of nitrile gloves for increased dexterity over these if you choose.

7. Zip up the protective suit

8. Blouse sleeves of suit over outer gloves and boots

9. Tape boots, gloves, and zipper of suit, creating tabs like the picture below.

10. Belt on PAPR or SAR. **KEEP** the PAPR/SAR running.

11. Put on hood carefully tucking inner shroud into the chemical protective suit before zipping up.

12. Make sure identification is placed on hood exterior identifying employee’s name and start time in warm zone.

13. Decontamination Unit leader performs final inspection before you leave.
APPENDIX 7: Updated Doffing Poster

DOFFING
(Level “C” PPE)

1. Wash outer gloves thoroughly.

2. While still wearing PPE, wash yourself starting at the head and ending at the bottom of your boots (your partner will need to wash your back).

3. Step into bag and remove all duct tape from your outer gloves and boots and place in bag.

4. Remove outer gloves (two pairs if you have the extra nitrile layer) and place them in bag.

5. Remove hood by grabbing top of head, bending forward at the waist, and pulling off in one smooth movement, while being careful to avoid contact ( detach PAPR or SAR from waist and place in designated area).

6. Unzip chemical suit and remove arms from sleeves. Do not touch the inside of your suit.

7. Begin to roll the suit from the inside out and away from your body (only touching the inside of the suit with your inner gloves).

8. Step out of rubber boots and suit, and into the cold zone.

9. Remove inner gloves by removing the first glove, and then pinching the second glove and rolling it down your hand without making contact with the exterior of the glove (place gloves with rest of suit in bag).

10. Complete additional steps such as showering when needed.

## APPENDIX 8: Elementary Activities for Donning

<table>
<thead>
<tr>
<th>Activity</th>
<th>Donner Time (sec)</th>
<th>Helper Time (sec)</th>
<th>Donner Time (sec)</th>
<th>Helper Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taping Hands</td>
<td>0</td>
<td>50</td>
<td>0</td>
<td>29</td>
</tr>
<tr>
<td>Taping Legs</td>
<td>0</td>
<td>59</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>Taping Zipper</td>
<td>0</td>
<td>24</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Putting on Boots</td>
<td>40</td>
<td>180</td>
<td>26</td>
<td>0</td>
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<tr>
<td>Checking PAPR</td>
<td>55</td>
<td>0</td>
<td>244</td>
<td>163</td>
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<tr>
<td>Tucking in Hood</td>
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<tr>
<td>Fastening PAPR</td>
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<td>19</td>
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<tr>
<td>Putting on Inner Gloves</td>
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<td>19</td>
</tr>
<tr>
<td>Putting on Outer Gloves</td>
<td>16</td>
<td>0</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Putting legs in PPE and bringing up to waist</td>
<td>15</td>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Putting arms in PPE</td>
<td>9</td>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Zipping PPE</td>
<td>36</td>
<td>0</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td>Prep Time (taking off shoes, putting up hair, etc.)</td>
<td>7</td>
<td>58</td>
<td>45</td>
<td>0</td>
</tr>
<tr>
<td>Prep Time (taking off shoes, putting up hair, etc.)</td>
<td>200</td>
<td>450</td>
<td>429</td>
<td>276</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>650</strong></td>
<td><strong>705</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>