Evaluating the Awareness of Medical Staff in Regards to the Environmental Effects of Single-use, Disposable Medical Gloves

University of Vermont Larner College of Medicine

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Nathaniel Moore, PA-C, MBA, FAWM
Medical Student

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Problem Identification

HAND HYGIENE

Handwashing is one of the most critical interventions a health care provider can do to decrease the spread of disease. Single-use gloves were invented to similarly help mitigate disease spread; however, in some instances, this replaced compliance with adequate hand sanitation methods. [3]

The “Gloves are off” campaign was initiated to encourage reduction of glove use for a better environmental impact and increased compliance of proper hand hygiene. [2]

QUANTITY

Single-use rubber gloves are widely distributed in medical institutions across the globe and continue to be the highest volume of disposable product. Over 300 million disposable gloves are used each year in the United States. [3]

Many forms of gloves exist including, but not limited to: butyl, latex, nitrile, neoprene, polyethylene, polyisoprene, polyurethane, polyvinyl alcohol, and polyvinyl chloride. [3]

COST

There is a tremendous financial expense associated with the purchasing and disposal of single-use gloves. The global medical waste management market size was estimated at 25.5 billion US dollars in 2020 with expected increases from the COVID-19 pandemic. [6]

Global demand for disposable gloves was over $6 billion in 2019. [5]

WASTE PRODUCTION AND ENVIRONMENTAL EFFECTS

US hospitals create, on average, 29 lbs of waste per hospital bed each day. This results in over 5 million tons of annual waste produced in a single hospital. [3]

Although these gloves can provide necessary barriers to potential contaminants, the lifecycle assessment of such a product yields harmful amounts of waste. Gloves are either disposed of in biohazard waste containers resulting in autoclaving, incineration, or chemical treatment or they accumulate in landfills resulting in further harm or spread of disease. [5]

The World Health Organization states that the disposal of untreated health care wastes in landfills can lead to the contamination of drinking, surface, and ground waters if those landfills are not properly constructed. [1]

There are both developed and developing countries that do not possess the infrastructure to properly dispose of waste; therefore, further efforts need to be increased to promote proper waste segregation and disposal. [1]

An example of a carcinogen in certain rubber gloves is diethylhexyl phthalate (DHEP), an additive in polyvinyl chloride (PVC) gloves that can be toxic in human development and testosterone production. [3]

Public Health Cost

The following data was collected during personal interviews in September 2022 at The University of Vermont Medical Center with the Environmental Services Manager, Inventory Controller of Supply Chain Services, and Equipment Manager of Emergency Medicine to report the monthly purchases of single-use, disposable gloves in the Emergency Department, Hinesburg Family Medicine Clinic, and Baird 6, a 38 bed inpatient hospital unit on the general surgery floor.

Quantity of gloves purchased per month

The University of Vermont Medical Center Emergency department

144,450

Hinesburg Family Medicine Clinic

9,000

Baird 6, a 38 bed inpatient unit at UVM Medical Center

17,500

×

Cost Per Glove

$0.08

=

Cost Per Month

University of Vermont Medical Center Emergency Department

$11,556.00

Hinesburg Family Medicine Clinic

$720.00

Baird 6, a 38 bed inpatient unit at UVM Medical Center

$1,400

In 2021, University of Vermont Medical Center produced **1,319 tons** of trash sent to a landfill in Coventry, VT and **628 tons** of recyclables.

Community Perspective

Multiple interviews were conducted with community members surrounding the lifecycle of single use, disposable gloves and potential sustainable solutions.

CRITICAL CARE PHYSICIAN

"Every time I walk away from a code and see all the waste, it seems like so much. Yet at the same time, I feel that we need all that equipment. I think we need scientific engineers to come up with a more sustainable solution."

FAMILY MEDICINE PHYSICIAN

"Perhaps there could be better education around when and if gloves should be used. This could reduce the amount of gloves reaching the landfills... COVID has also increased this number by a lot."

ENVIRONMENTAL SERVICES MANAGER

"In order to have a more successful recycling program, we need more buy in from people. The primary focus [at UVMMC] is patient care, so we try to make it as easy as possible to recycle with educational signs above every waste station. There is not enough space in every patient room to have individualized recycling bins for every single-use product like gloves... We, here at UVMMC, all want to recycle and do more, but is difficult because we need to know the exact volumes of gloves being purchased and disposed of. I don't know the actual volumes. We also need more specific recycling outlets in place before we can have a successful program.

MEDICAL STUDENT

"Waste is a problem in all aspects of life and we can't just reuse soiled gloves in healthcare...Although, could you perhaps have more durable gloves that you could clean and then reuse? You also shouldn't be using gloves for things that are unnecessary. I used four pairs of gloves today in simulation and the model wasn't even a live patient!
There is no easy solution- reduce, reuse, recycle. You first must attend to your patient to save their life before you can even think about where your dirty gloves go- which is the problem. You also have to think about human safety before you just ship your dirty gloves anywhere. If you could come up with a solution to collect all gloves that are not a biohazard, that would be an ideal sustainable solution."

Methodology

SURVEY

A single page survey examined the awareness of health care workers to the use of single-use, disposable gloves in their practice. Questions included the quantity of gloves used daily, the knowledge of when to appropriately use medical gloves, the disposal method, and future efforts to make the lifecycle of single-use, disposable gloves more sustainable.

INTERVIEWS

Interviews were conducted with health care staff and environmental service workers to bring awareness of the utilization and disposal of single-use, disposable medical gloves and their subsequent environmental impacts.

DATA ACQUISITION

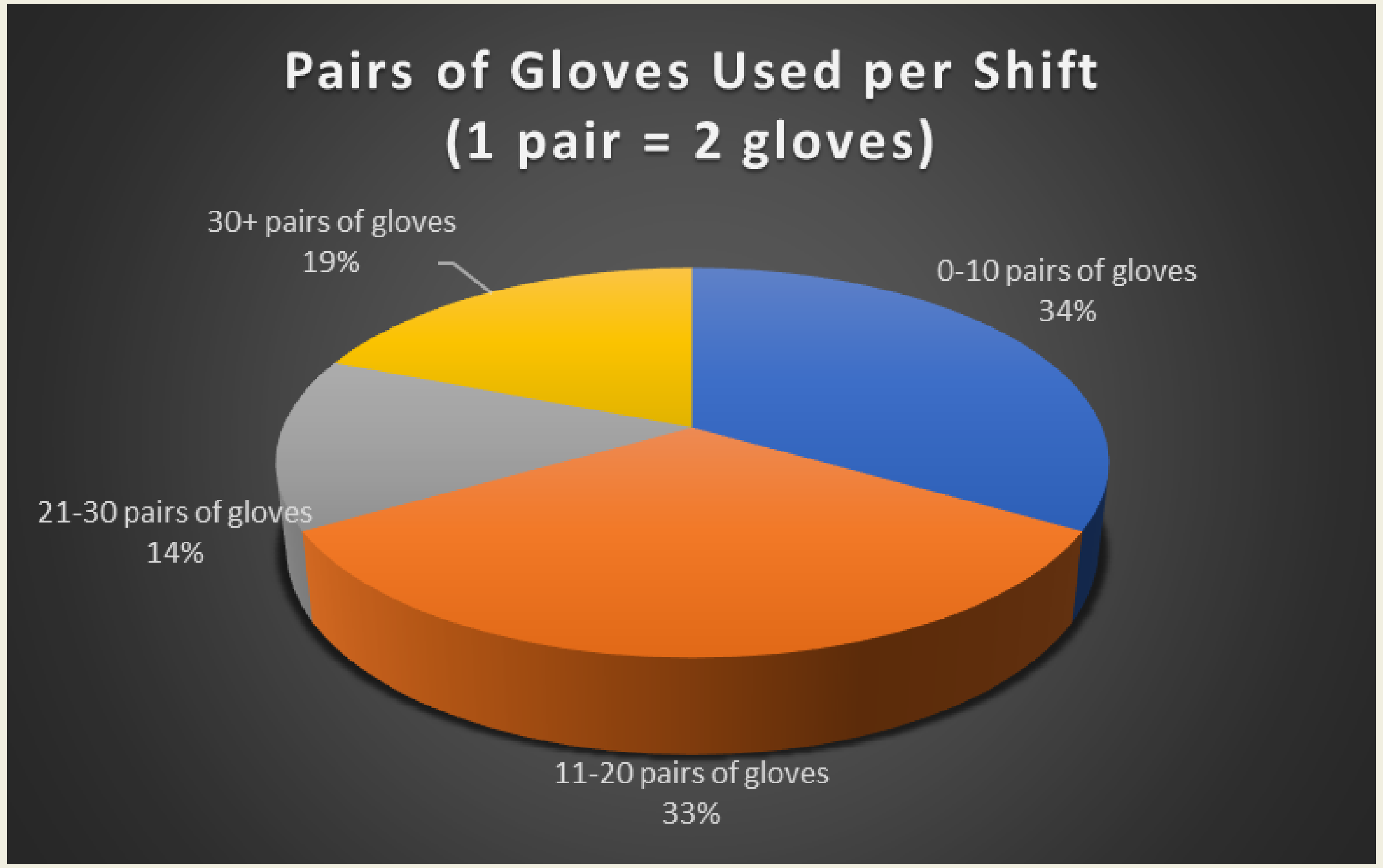
Acquired data from the University of Vermont Medical Center Inventory Controller for Supply Chain Services through observation of the September 2022 inventory reports.

INTERVENTIONS

Discussed the concept of problem identification and sustainable solutions surrounding medical waste with regards to single-use, disposable gloves with multiple members in the healthcare community.

Results

21 total responses



100%
of responders believe gloves are NOT disposed of in an environmentally friendly manner.

61.9%
of responders believe we use too many gloves in the medical field.

23.8%
of responders are not confident as to when to appropriately use gloves in the healthcare setting.

90.5%
of responders would be willing to support a more sustainable single -use, disposable glove even if it was more expensive.

66.7%
of responders reported recycling gloves and
33.3%
of responders reported reduction of use as the the best potential sustainable solution to single-use, disposable gloves.

Evaluation of effectiveness

This study was designed to bring awareness to the fact that single-use, disposable gloves are a significant contributor to medical waste. Multiple successful conversations were had surrounding alternative solutions for this wasteful product.

In conducting personal interviews, there appeared to be a communication gap between the supply chain and environmental services waste management with regard to the actual cost and volumes of incoming inventory and outgoing waste. The identification of such lack of communication could yield to future solutions.

To formally evaluate the effectiveness of this study, a follow-up survey should be given to participants in the future to see what, if any, changes are being made to their use or disposal of single-use, disposable gloves.

Limitations

The sample size of this study was small and only observed certain departments in the University of Vermont Medical Center. A larger scale study across multiple hospital networks comparing waste production and disposal methods would yield a greater data set to identify potential sustainable solutions.

Participants volunteered to be included in the study; therefore, a selection bias could be a confounding variable.

This research was conducted over a short time interval. If the longevity of the study was increased to include subject awareness of waste disposal over multiple years perhaps more sustainable strides would be identified as building blocks for future changes.

Recommendations for Future Projects

1 HOSPITAL WASTE

Look at specific interventions to decrease hospital waste.

2 BIODEGRADABLE PROCESS

Observe the actual biophysical properties of gloves in terms of their ability to biodegrade.

3 MARKET ANALYSIS

Analyze sustainable efforts of companies manufacturing novel products to disrupt the waste industry.

4 INNOVATIVE SOLUTIONS

Brainstorm circular systems to recycle and reuse single-use, disposable products.

5 OTHER INDUSTRIES

Observe the lifecycle of single-use, disposable gloves in non-medical industries. For example, the US food industry is thought to use over 30 billion disposable gloves per year. [4]

Where to go from here...

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