A program of research in progress:

Understanding and minimizing occupational and environmental exposure to carcinogens

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My background

- BS in Community Health Education, Spanish language and literature concentration, CHES- University of Maryland
- MPH in Health Behavior and Health Education, Gillings School of Global Public Health, University of North Carolina at Chapel Hill (UNC)
- ABSN- UNC
- 13 years of clinical and administrative experience in inpatient hematology/oncology- UNC
- PhD with an oncology cohort- University of Utah
- Postdoc focused on interventions- UNC
- Assistant Professor- Duke University School of Nursing
Framework for my program of research

- Exposures
- Protective behavior
- Policy

Diagram showing the interconnection between Exposures, Protective behavior, and Policy.
Pesticide protective behaviors of Latino migrant and seasonal farmworkers

Aim 1: Compare and contrast observed and reported behaviors of Latino migrant and seasonal farmworkers to those mandated to be taught in EPA’s Worker Protection Standard

Aim 2: Identify Latino migrant and seasonal farmworkers’ perceived barriers and strategies to counter barriers to using the behaviors mandated to be taught in EPA’s Worker Protection Standard

Funded by: ACS Doctoral Degree Scholarship in Cancer Nursing, T32 Pre-doctoral Interdisciplinary Training in Cancer, Caregiving, & End-of-Life Care, Jonas Nurse Leader Scholarship, Frederick Lawson Scholarship (Utah)
## Findings: Observed vs. Self-Reported Behavior (Mandated)

<table>
<thead>
<tr>
<th>Behavior</th>
<th>All of the time</th>
<th>Some or most of the time</th>
<th>Never</th>
<th>Wilcoxon test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>Sometimes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td><strong>Clothing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wearing closed shoes * 3 type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>65</td>
<td>6</td>
<td>0</td>
<td>-0.378 (p=0.705)</td>
</tr>
<tr>
<td>Reported</td>
<td>66</td>
<td>5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Wearing socks **</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>11</td>
<td>0</td>
<td>2</td>
<td>0.000 (p=1.00)</td>
</tr>
<tr>
<td>Reported</td>
<td>70</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Wearing long sleeves</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>64</td>
<td>6</td>
<td>1</td>
<td>-2.197 (p=0.028)</td>
</tr>
<tr>
<td>Reported</td>
<td>69</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Wearing long pants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>70</td>
<td>1</td>
<td>0</td>
<td>-1.414 (p=0.157)</td>
</tr>
<tr>
<td>Reported</td>
<td>71</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Washing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washing hands before eating***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>7</td>
<td>0</td>
<td>34</td>
<td>-4.768 (p=0.000)</td>
</tr>
<tr>
<td>Reported</td>
<td>65</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Washing face before eating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>0</td>
<td>0</td>
<td>41</td>
<td>-4.542 (p=0.000)</td>
</tr>
<tr>
<td>Reported</td>
<td>46</td>
<td>15</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Washing hands before drinking****</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>0</td>
<td>7</td>
<td>62</td>
<td>-4.064 (p=0.000)</td>
</tr>
<tr>
<td>Reported</td>
<td>41</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Washing face before drinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>0</td>
<td>0</td>
<td>69</td>
<td>-1.896 (p=0.058)</td>
</tr>
<tr>
<td>Reported</td>
<td>31</td>
<td>18</td>
<td>22</td>
<td></td>
</tr>
</tbody>
</table>
For more information about this study...


Working with outreach workers and farmworkers to improve handwashing.
Development of a handwashing educational toolkit

Focus groups & web-based surveys with farmworker health outreach workers

Contains pesticide residue activities using fluorescent tracer
One-on-one and group discussion questions
Trainers’ guide in English and Spanish detailing the learning objectives, supplies needed, and step-by-step instructions


Funded by: North Carolina Farmworker Health Program
Next steps- toolkit evaluation

Community partner-led user satisfaction survey

Researcher-led measurement of pesticides on hands

Can we measure pesticides on farmworkers’ hands using hand wipes? Does washing hands decrease the amount of pesticides we measure?

Funded by: Southeast Center for Agricultural Health and Injury Prevention (CDC-NIOSH)
Participants wiped the whole hand with a sponge moistened in alcohol and then wiped each finger and the palm of the same hand with a second sponge.

Both sponges were placed in the same jar for storage and analysis.
Field work—Practical Challenges

- Difficulty wetting sponges with alcohol in high heat
- Contamination of sponges due to wind, dust
- Excessive amount of time required to prepare sponges in field
We are still learning what pesticides are on farmworkers’ hands.
Next steps

• Complete measurement of pesticides on hand wipe samples we have already collected

• Use hand wipe samples to measure differences in pesticide levels for farmworkers who have been trained using the toolkit and those who have not
A different path
How I became involved in this work

- Clinical Nurse IV in Oncology Clinical Practice Group
- Reviewed hospital policy regarding safe handling of hazardous drugs; worked to make changes
- Invitation to work on state policy NC HB644
- Legislation passed 2014
- Nursing representative to NCDOL for 1 year
- National Congressional briefing
- So many questions emerged!
Antineoplastic drug exposure

• **Acute effects**- skin rashes, allergic-type reactions, hair loss, nausea

• **Adverse reproductive outcomes**- congenital malformation, miscarriage, sub-fertility

• **Cancer risk**
Postdoctoral Fellowship Study

Exploratory, multi-method study utilizing observation, verbally-administered questionnaires, and interviews.

NAs are willing to participate in research

There is room for improvement in the PPE used by NAs when handling AD contaminated excreta (Observed use of double gloving, chemotherapy gowns, and face shields was low; use of plastic-backed pads when flushing excreta was high)

NAs have insights to improve training, education, and use of PPE in the workplace.


Funded by: T32 Postdoctoral Fellowship in Interventions to Prevent and Manage Chronic Illness, North Carolina Occupational Safety and Health Education Research Center Pilot Grant (CDC- NIOSH)
Examining surface contamination with antineoplastic drugs in inpatient oncology: a pilot study (1/18-12/18)

Aim 1: Describe inpatient oncology surfaces most contaminated with antineoplastic drugs
Aim 2: Characterize staff personal protective equipment (PPE) use and factors that influence its use


Funded by: DUSON CNR pilot
Study overview

Unit 1: Inpatient Medical Oncology
Unit 2: Inpatient Bone Marrow Transplant

Invited nursing staff to take a survey N=28

Sampled 2 rooms/unit where patients were receiving cyclophosphamide and/or etoposide (samples=34)

Sampled shared areas where PPE use was not expected, did these twice (samples= 36)

Samples per unit=70
Total= 140
Measures

Adapted version of “PPE Use and Predictive Factors Survey”

Two swabs
methanol/ acetonitrile/ water solution
wiped horizontally and vertically
average SA=180cm²

Analyzed by liquid chromatography-mass spectrometry
How many samples were detectable/quantifiable?

<table>
<thead>
<tr>
<th></th>
<th>Cyclophosphamide n=140</th>
<th></th>
<th>Etoposide n=139</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shared n=72</td>
<td>Room n=68</td>
<td>Overall</td>
<td>Shared n=72</td>
</tr>
<tr>
<td>ND</td>
<td>27%</td>
<td>15%</td>
<td>21%</td>
<td>72%</td>
</tr>
<tr>
<td>D</td>
<td>22%</td>
<td>13%</td>
<td>18%</td>
<td>18%</td>
</tr>
<tr>
<td>D&amp;Q</td>
<td>51%</td>
<td>72%</td>
<td>61%</td>
<td>10%</td>
</tr>
</tbody>
</table>
What were those levels?

<table>
<thead>
<tr>
<th>Level ng/cm²</th>
<th>Cyclophosphamide n=86</th>
<th>Etoposide n=42</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D&amp;Q</td>
<td>D&amp;Q</td>
</tr>
<tr>
<td>0 – 0.05</td>
<td>74%</td>
<td>81%</td>
</tr>
<tr>
<td>0.05-0.1</td>
<td>6%</td>
<td>12%</td>
</tr>
<tr>
<td>&gt;0.1</td>
<td>20%</td>
<td>7%</td>
</tr>
</tbody>
</table>
### Most contaminated areas in patient rooms

<table>
<thead>
<tr>
<th>Rank</th>
<th>Cyclophosphamide</th>
<th>Etoposide</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Toilet seat*</td>
<td>Toilet seat</td>
</tr>
<tr>
<td>#2</td>
<td>Remote control</td>
<td>Floor below IV pole</td>
</tr>
<tr>
<td>#3</td>
<td>Toilet seat</td>
<td>Toilet seat*</td>
</tr>
<tr>
<td>#4</td>
<td>IV pole</td>
<td>Floor below IV pole</td>
</tr>
<tr>
<td>#5</td>
<td>Doorknob to restroom</td>
<td>Doorknob to restroom</td>
</tr>
</tbody>
</table>

*same toilet in same room*
Most contaminated areas in shared areas

<table>
<thead>
<tr>
<th>Rank</th>
<th>Cyclophosphamide</th>
<th>Etoposide</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Floor near common desk</td>
<td>Floor in front of pharmaceutical waste bin</td>
</tr>
<tr>
<td>#2</td>
<td>Floor near entry staff locker room**</td>
<td>Med fridge handle</td>
</tr>
<tr>
<td>#3</td>
<td>Floor in front of pharmaceutical waste bin</td>
<td>Common phone</td>
</tr>
<tr>
<td>#4</td>
<td>Floor near entry to break room</td>
<td>Floor in personnel lounge/bathroom</td>
</tr>
<tr>
<td>#5</td>
<td>Floor near entry staff locker room**</td>
<td>Floor near entry to break room</td>
</tr>
</tbody>
</table>

** same location, 2 different days
Aim 2: Describe PPE use

- Administration
- Chemotherapy Waste Disposal
- Handling Excreta
Exploratory: Is PPE use related to these predictive factors?

- Workplace safety climate is the only factor moderately associated with PPE use ($r=0.46$, $p\leq 0.05$)

- There were no relationships on Unit 1

- PPE use was significantly positively related to self-efficacy ($0.59$, $p\leq 0.05$) and workplace safety climate ($0.82$, $p\leq 0.05$) on Unit 2
Some interesting findings

• Levels of contamination on toilet seats; implications for patient and family education

• No CSTD in use; some respondents reported use during administration

• Workplace safety climate matters

• In 1/3 of the patient administration surfaces tested in which the patient received only one drug of interest, the other drug was found (17/51); implications for cleaning.
U.S. Pharmacopeia (USP) General Chapter <800> enforceable 12/1/19

Information about “standards for safe handling of hazardous drugs to minimize the risk of exposure to healthcare personnel, patients and the environment”

–Population
Standards are for “all healthcare personnel who receive, prepare, administer, transport or otherwise come in contact with hazardous drugs ….”
What’s in USP <800>?

– Personnel and practices
– Receiving/storage
– Compounding environment
– Compounding processes/procedures
– Spills/cleaning/disposal
– Medication administration and protective equipment
More USP <800> recommendations

• Baseline and routine surface wipe sampling as a measure of containment*
• Preparing for costs, anticipating resources
• Medical surveillance
• Alternative duty
• Hazardous drug working group/ HD compliance officer
NIOSH R21 (resubmission) USP <800> focus

• What impact does extent of implementation of USP <800> have on surface contamination?

• **Aim 1.** Identify USP <800> practices associated with the lowest extent of surface contamination.

• **Aim 2.** Identify workplace safety climate and activity-specific PPE use practices associated with the lowest extent of surface contamination.
One impact of COVID-19

• ONS published interim guidelines for PPE use related to supply challenges during COVID-19

• Did these guidelines and/or public awareness of PPE use change contamination levels in the two oncology units?

• Re-sampling all 140 inpatient surfaces, second survey of staff (application NC OSHERC)

• Data to inform intervention focused on PPE
Duke Cancer Institute Pilot 2021-2022

Examining occupational exposure risks and the efficacy of toilet seat covers and routine discharge cleaning in minimizing antineoplastic drug contamination
Specific Aims of DCI Pilot:

1. Test whether plastic backed pads over the toilet while flushing (experimental condition) are more efficacious than regular flushing (control condition) in minimizing AD contamination on toilet seats and on other bathroom surfaces.

2. Explore and test the efficacy of the current discharge cleaning method and agents to remove AD contamination from toilet seats and other bathroom surfaces.
Using Silicone Wristbands to Assess Nurses' Exposure to Antineoplastic Drugs: A Feasibility Study

1) Is wearing a silicone wristband acceptable to nurses?
2) Can silicone bands detect four antineoplastic drugs [ADs] to which the nurses were exposed?
Translation of Research to Practice

ONS/HOPA Joint Position statement safe handling of hazardous drugs:

Q&A: https://www.ons.org/sites/default/files/2020-03/ONS_HOPA_ToiletFlushing.pdf

Safe Handling Chapter in Chemotherapy and Immunotherapy Guidelines and recommendations for Practice, 2nd Edition

Co-Editor 4th Edition Safe Handling of Hazardous Drugs text for ONS
Questions

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