Toxins Within Collections

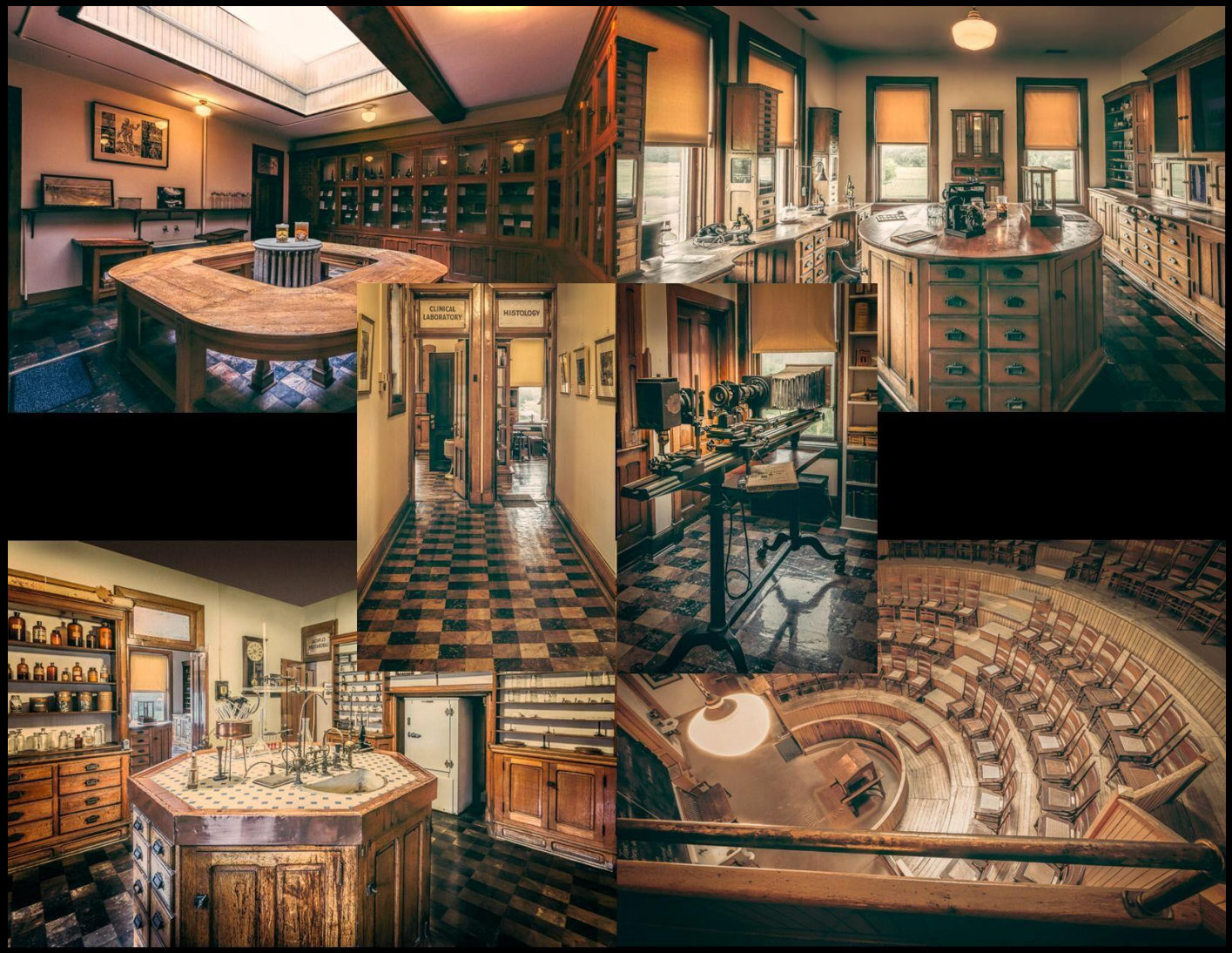
Jim Fuller, PharmD
MA Candidate Museum Studies
IUPUI
Indiana Medical History Museum
Intern

Sarah M. Halter, MA
Executive Director
Indiana Medical History Museum

Old Pathology Building

Indiana Medical History Museum | www.imhm.org | 317.635.7329

Challenges with the Collection



Challenges with the Collection

Research Question

How do Medical History Museums identify, assess, and mitigate toxins or poisons lurking in their collections?

- Situation
- Background
- Assessment
- Recommendations

Situation

Medical History Museums (and all museums) with objects and artifacts made from natural products may have toxins, poisons, or hazardous compounds present in their collections.

Additionally, Medical History Museums may have fluid preserved specimens that may contain hazardous chemicals.

Background

- In order to protect from pests, from the 1800's to approx 1970, museums and collectors routinely treated their perishable artifacts with pesticides. [1]
- Among these, arsenic and mercury have significant human toxicity and leave significant quantities of residue on treated objects. [1]
- Especially objects made of or containing: Leather, Wood, Feathers, Vegetable matter, and other natural fibers. [1]
- Tissues may be preserved in a variety of chemicals including solvents, acids and alkalis, metals and their salts, and plastics. [2]
- "There are no safe organic solvents, only more or less toxic ones"[2] Catherine Hawks et al

1. Odegaard, Nancy, et al. 2005. Old Poisons, New Problems: A Museum Resource for Managing Contaminated Cultural Materials. Walnut Creek, CA : AltaMira Press, xxiv. 1-126.
2. Hawks, Catherine, et al, 2010. Health and Safety For Museum Professionals. New York, NY: Society for the Preservation of Natural History Collections.

How do Poisons Work?

A poison is a substance that can do harm if it enters the body.

The results can be immediate, injuring the organs, and/or cumulative, ultimately resulting in cancer or reproductive problems.

Even common substances, like water and salt, can be toxic if ingested in a high enough quantity.

Substances like arsenic are also poisonous, but a lesser dose is required to cause harmful effects.

Boyer, Leslie, Steven Seifert, Nancy Odegaard, Marilen Pool, and G Edward. 2005. "Understanding the Hazards: Toxicity and Safety." *In Old Poisons, New Problems: A Museum Resource for Managing Contaminated Cultural Materials,* 73. Nancy Odegaard and Alyce Sadongei eds.Walnut Creek, CA : AltaMira Press.

Poisonings

Entrance of a poison into the body depends on:

- **Form (solid, liquid, or gas)**
- **Chemical properties**
- **Availability (open container or spill)**
- **The person's activities (occupational, accidental, or suicidal)**
- **Body's built-in defenses (skin or stomach lining).**

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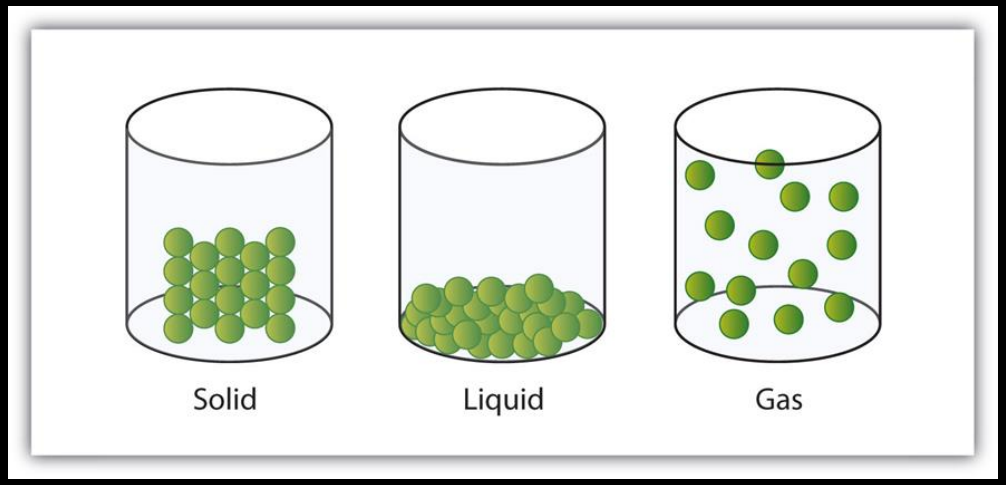

Photo credit: clipart-library.com

Pathways

The pathways for poisons to get into the body are referred to by toxicologists as:

- Ingestion (swallowing)
- Dermal exposure (skin contact)
- Inhalation (breathing)

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Photo credit: ICONFinder.com

clipartqueen.com

onlinewebfonts.com

Types of Poisonings

Once a poison has entered the body, poisoning may be:

- Acute
- Chronic
- Cancer/reproductive related

Boyer, Leslie, Steven Seifert, Nancy Odegaard, Marilen Pool, and G Edward. 2005. “Understanding the Hazards: Toxicity and Safety.” In *Old Poisons, New Problems: A Museum Resource for Managing Contaminated Cultural Materials*, 74. Nancy Odegaard and Alyce Sadongei eds.Walnut Creek, CA : AltaMira Press.

Photo credit: wikimedia.org

Health Effects

When dealing with the issue of pesticide contaminated museum collections, adverse health effects are related to:

- Inherent toxicity of a substance
- The quantity and duration of exposure to it (a dose-response relationship)
- Individual susceptibility to its effects

Personal Protection Equipment (PPE): Individuals who use protective equipment in handling contaminated objects will be at very low exposures (and very low risk).

Boyer, Leslie, Steven Seifert, Nancy Odegaard, Marilen Pool, and G Edward. 2005. “Understanding the Hazards: Toxicity and Safety.” In *Old Poisons, New Problems: A Museum Resource for Managing Contaminated Cultural Materials*, 74-75. Nancy Odegaard and Alyce Sadongei eds.Walnut Creek, CA : AltaMira Press.

Arsenic and Mercury

Pesticides containing arsenic and mercury are of greatest concern.

- Use has been ubiquitous, for a long time, and generally in amounts that are capable of producing human toxicity
- The particular forms that were used are of high toxicity.
- Once applied, arsenic and mercury tend to remain on the treated object
- The degradation that does occur may only change the route of exposure and spectrum of toxicity
- The signs of toxicity, especially when exposure is to small amounts over time, can be subtle and difficult to diagnose.
- Both arsenic and mercury are elements so they are environmentally permanent and can contaminate air, soil, and groundwater.

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Arsenic

Arsenic is the toxic chemical used as a pesticide that is of the greatest concern.

The toxicity of arsenic is determined both by its chemical formulation and by the dose.
The toxicity levels for arsenic in general are:

- Acute toxicity by ingested dose:
  - 1 mg-10 g: toxic and fatal
  - 1-3 mg/kg ingested: potentially fatal

- Chronic (cumulative) toxicity by ingested dose:
  - 3-4 mg/day

Boyer, Leslie, Steven Seifert, Nancy Odegaard, Marilen Pool, and G Edward. 2005. “Understanding the Hazards: Toxicity and Safety.” In *Old Poisons, New Problems: A Museum Resource for Managing Contaminated Cultural Materials*, 75-76. Nancy Odegaard and Alyce Sadongei eds.Walnut Creek, CA : AltaMira Press.

Calculations!

Employee 150 lbs.

150 lbs x 0.4536 kg/lb = 68.04 kg

Recall 1 mg - 10 gm of Arsenic is potentially toxic dose

Poisoning dose 1-3 mg / kg x 68 kg = 68 - 204 mg

By comparison: Baby aspirin has 81 mg active Aspirin ingredient

Is this new information?

Arsenic in 50 A.D.

- Dioscorides, a Greek physician in the court of the Roman Emperor Nero, described arsenic as a poison in the first century.
- **Its ideal properties for sinister uses included its lack of color, odor or taste when mixed in food or drink**
- **Symptoms of arsenic poisoning were difficult to detect, since they could mimic food poisoning and other common disorders.**

https://sites.dartmouth.edu/toxmetal/arsenic/arsenic-a-murderous-history/ **accessed 10/15/19**

Arsenic and Old Lace in 1944

A drama critic learns on his wedding day that his beloved maiden aunts are homicidal maniacs, and that insanity runs in his family. (23 September 1944)

Photo credit:
https://www.imdb.com/title/tt0036613/mediaviewer/rm3694926080

Assessment

Methods:

- Literature review
- Created targeted survey questions with input from my museum mentor
- Created Survey Monkey on-line survey tool
- Distributed survey to:
  - Targeted museums as identified by my mentor
  - Museum-L Listserv
  - Other museums as identified by faculty
- Collated results and discussed with museum mentor
- Compiled related resources

Survey Respondents: 16 Responses

- States and Districts represented: 10
  - DC, IN, MD, MN, NJ, NM, OK, PA, UT, WA

- Types:
  - Medical Museums: 3
  - Governmental: 8
  - Colleges / Universities: 2
  - Private 501c3: 3

Question 1: Assess, identify, mitigate?

Yes, we've assessed our collection

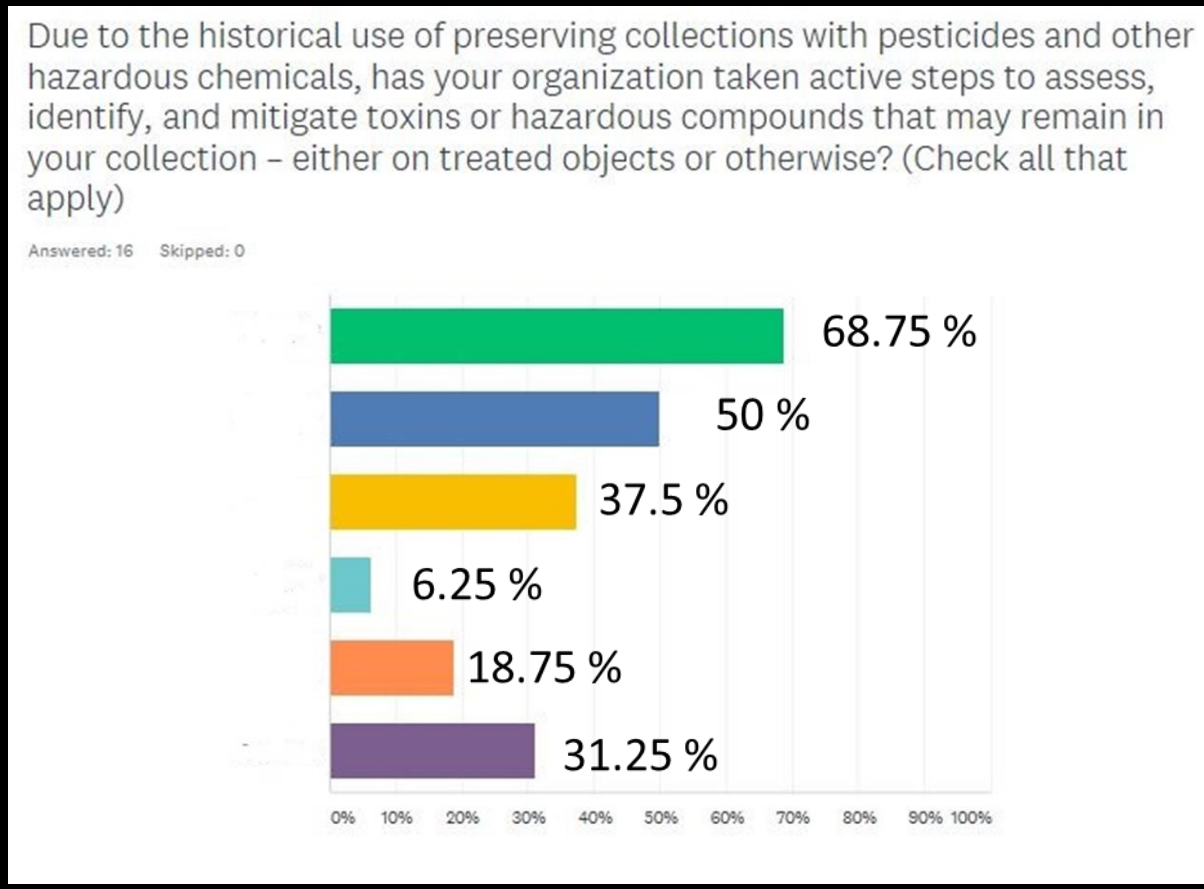
Yes, we've worked to identified hazardous compounds

Yes, we've worked to mitigated hazardous compounds

Yes, I'm willing to share developed materials

No, no assessment, identification or mitigation

No, Comments offered



Question 2: Active testing?

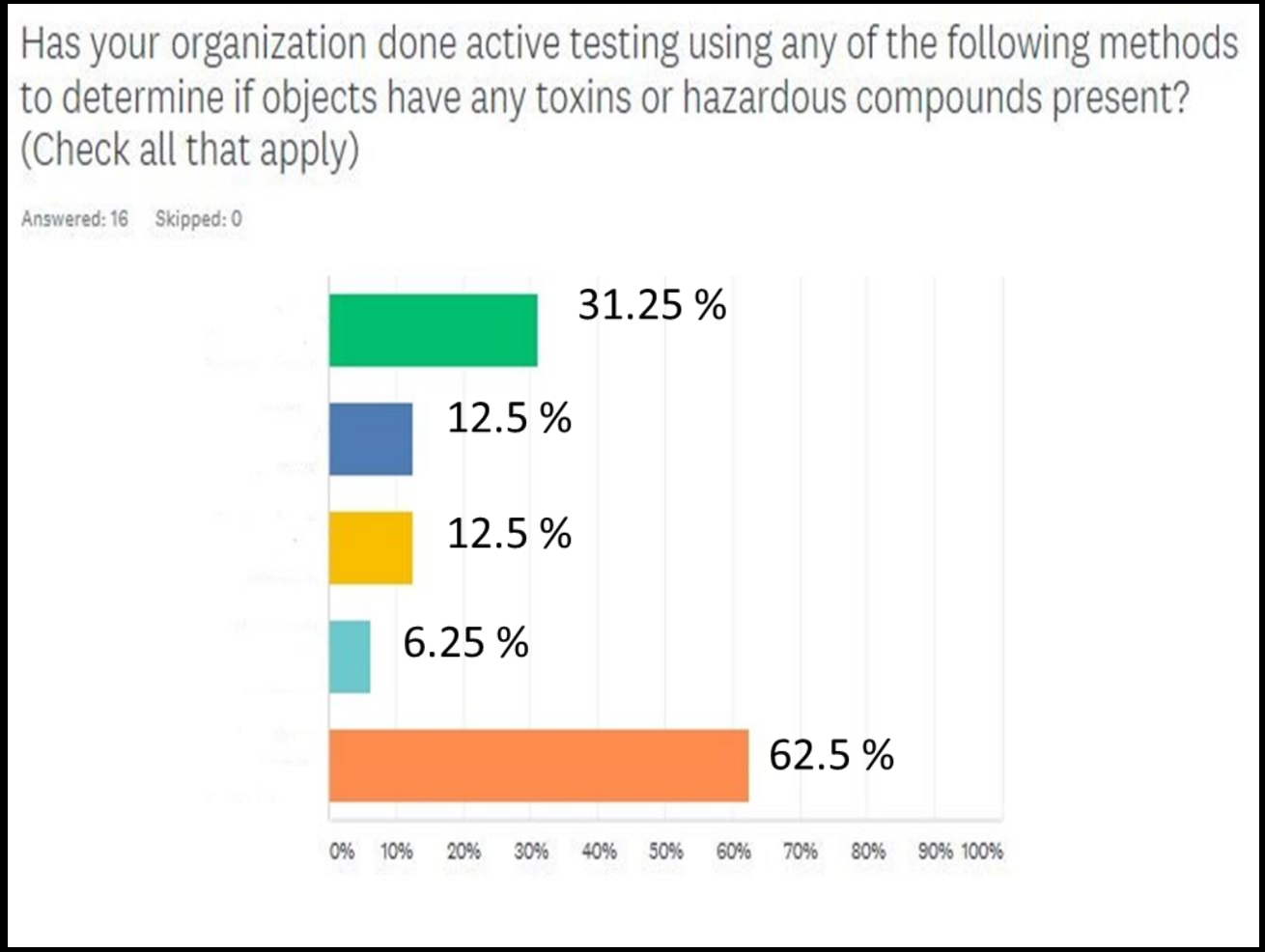
X-ray fluorescence (XRF)

Test Strips (please indicate brand)

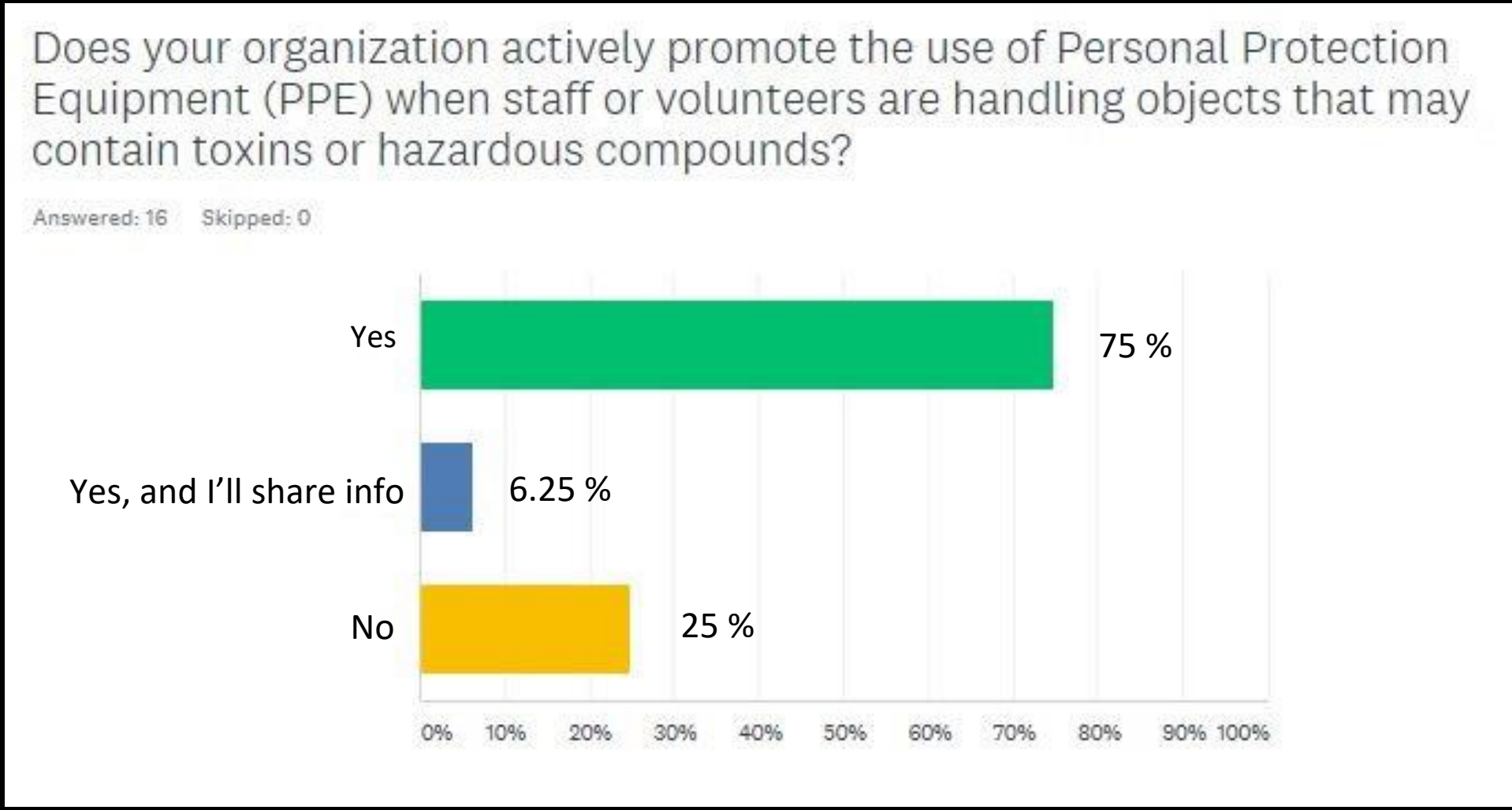
Other methods (please describe)

We are, and I'll share materials

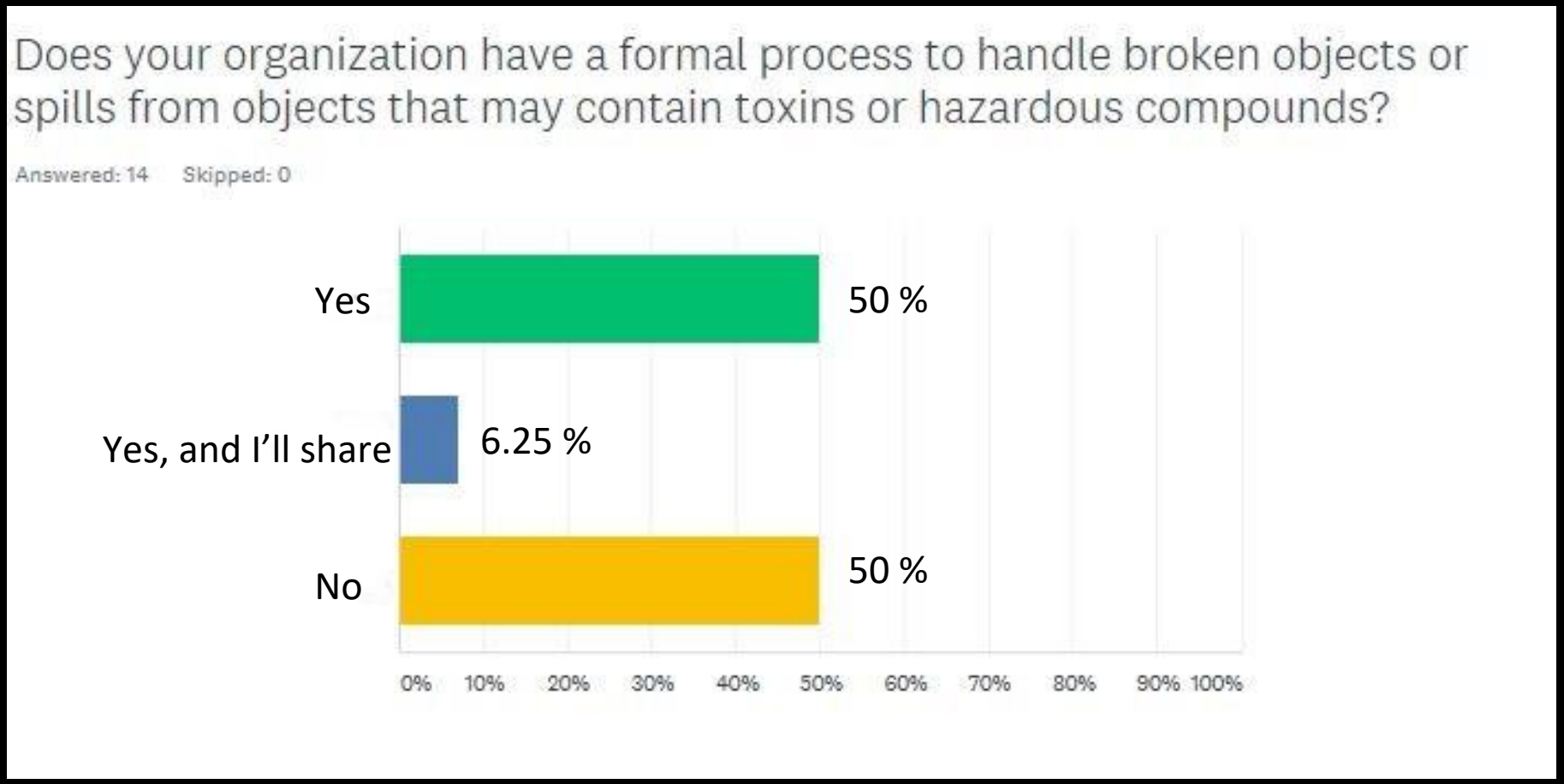
We have not done any active testing



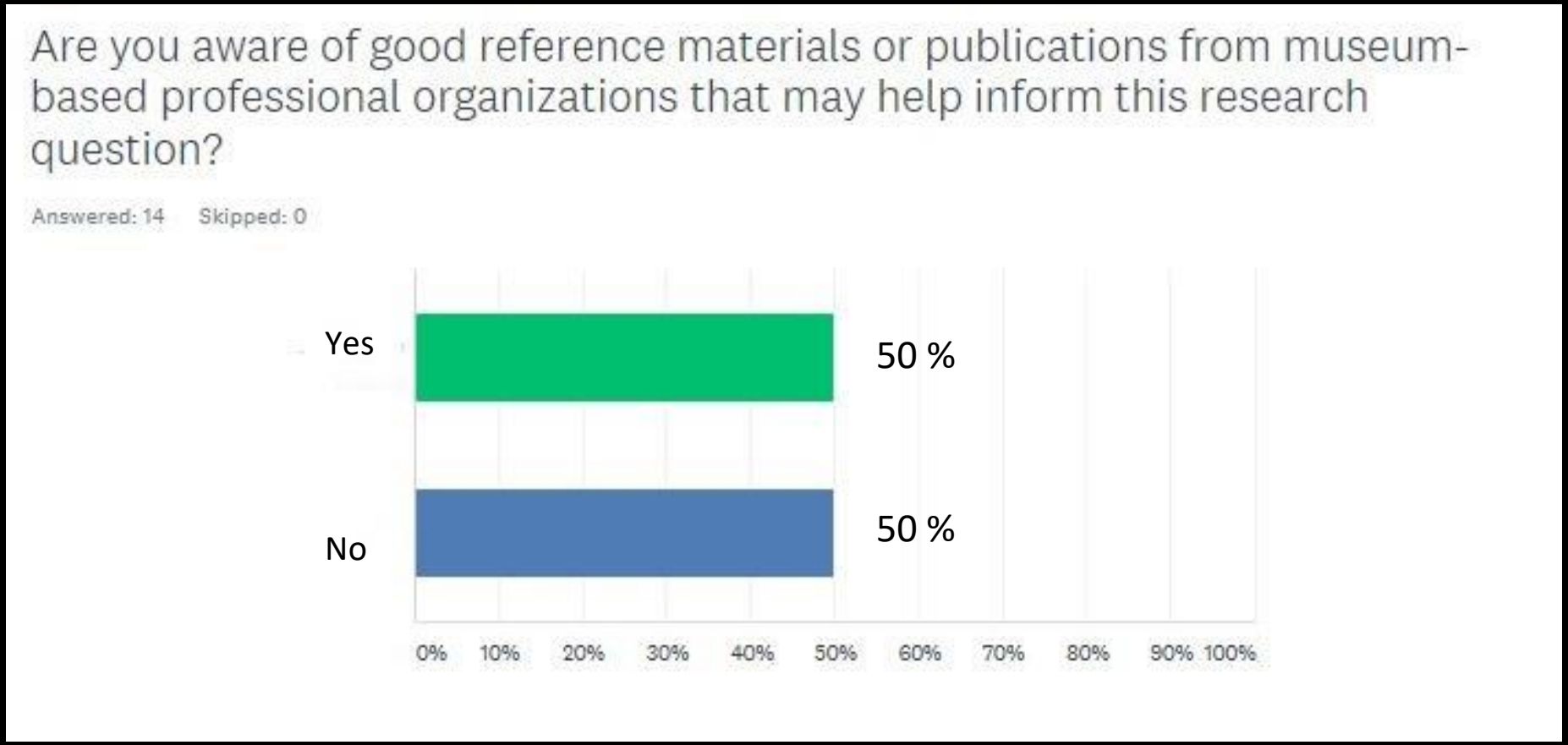
Question 3: Promote PPE?



Question 4: Handling of broken objects / spills?



Question 5: Good reference materials?



Key Findings:

- **68% have assessed but it was difficult for them to quantify what that meant when asked as follow-up.**
- **50% indicated they had worked to identify compounds but 62% indicated they had done no active testing.**
- **~ 20% have done no assessment, identification or testing.**
- **75% indicate they actively promote PPE but few have a formal policy or procedure when asked in follow-up.**
- **50% do not have a formal process for broken objects or spills**
- **50% are unaware of good references or materials**

Recommendations:

- **IMHM to implement Personal Protective Equipment (PPE) for staff and volunteers. (deliverable)**
- **IMHM should consider working with an external conservator to identify priorities and strategic plan. (draft grant proposal deliverable)**

Limitations of my study

- **Small sample size (may be able to increase with more time, recirculating survey, targeted requests to complete)**
- **Difficult to get engagement to complete survey**
- **Responses may be more aspirational than factual**
- **Museums may be reluctant to acknowledge that they are inadequately addressing toxins within their collections**

What We Learned

We are not alone.

We can work together.

We can learn from others.

What's Next?

Disaster planning

Policies and procedures

Questions?

Thank you!