

# Experimental Lake Erie Hypoxia Forecast Focus Group Study Results & Evaluation Surveys

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# Outline

Coproduction Research Approach

Focus group study

Evaluation surveys

Conclusion



# Coproduction Research Approach

**Involve intended users of the forecast in research design, implementation, and product dissemination to increase forecast usefulness and usability**

## **Coproduction Approach**

- Management Transition Advisory Group (MTAG)
- Annual Stakeholder Meetings
- Focus Group Study

# Methods: Focus Group Study

## Research Questions:

1. How are PWS who draw water from Central Lake Erie impacted by hypoxia?
2. What are their hypoxia forecast information needs?

## Study Metrics:

- **9** Focus Groups
- **10** Treatment Plants
- **32** Participants
- **>12 hrs** interview data



# Focus Group Results

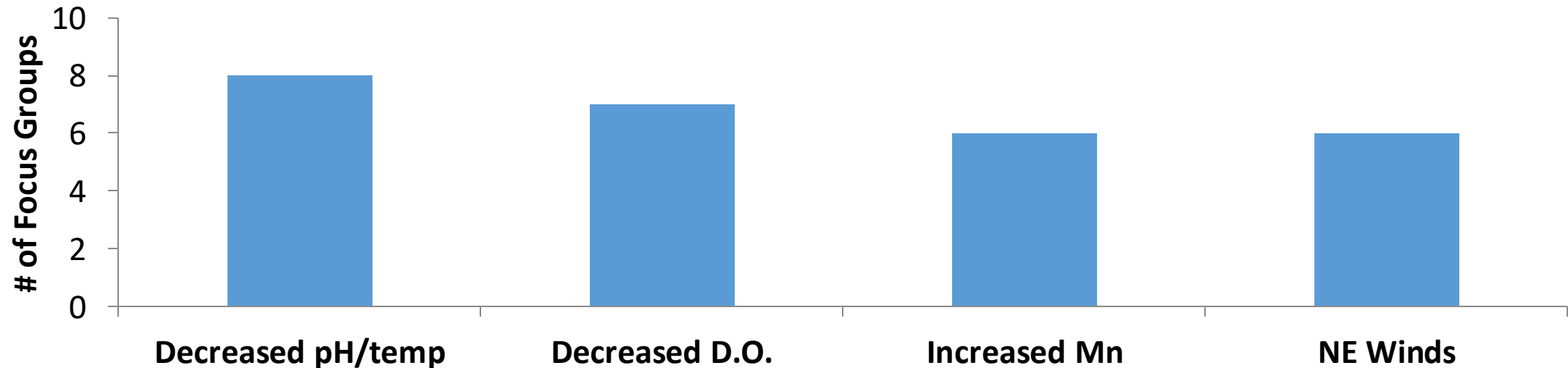
1. Occurrence of hypoxia at water treatment plants
2. Response of PWS to hypoxia
3. Potential financial impacts of hypoxia
4. Anticipated benefits of a hypoxia forecast
5. Recommendations for improvement of hypoxia forecast

# 1. Occurrences of hypoxia at water plants

## Knowledge/definitions of hypoxia differed among focus groups

- Strong associations with water quality changes and NE winds
- Most plants expressed concern for drops in pH (service pipe corrosion)
- Not every plant monitors D.O.
- More than half have experienced “yellow water” events

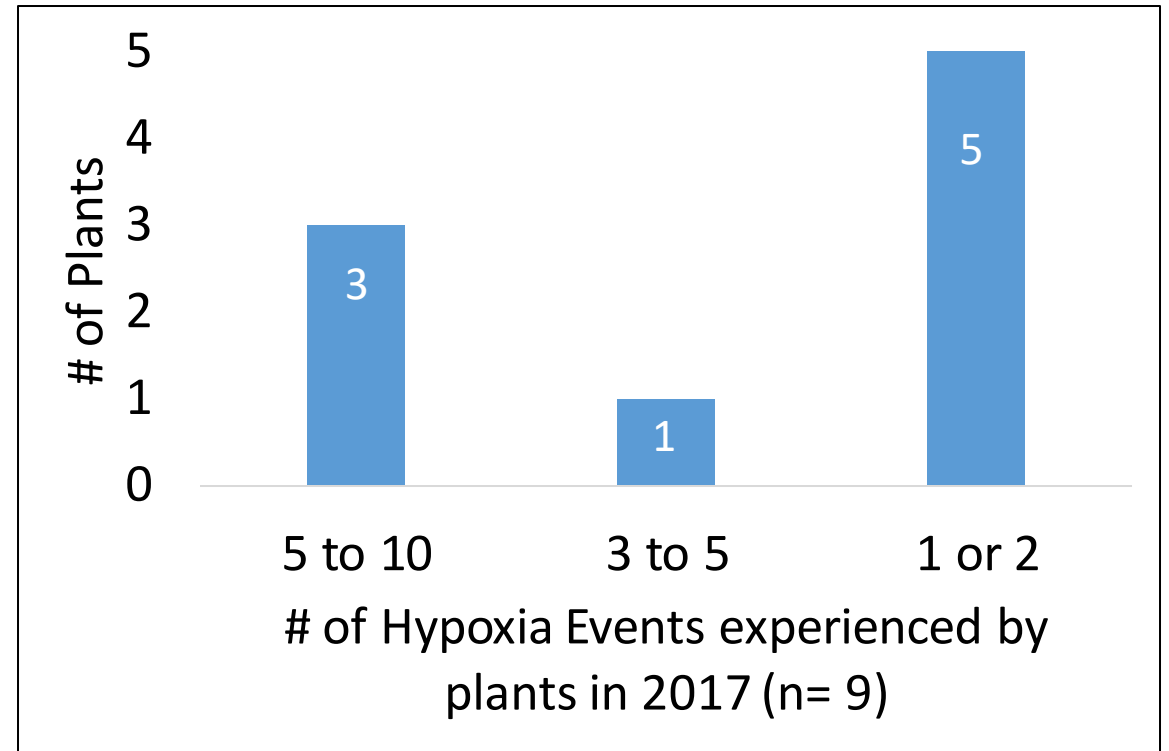
Indicators of Hypoxic Events Reported by Focus Groups (n=9)



# 1. Occurrences of Hypoxia at Water Plants

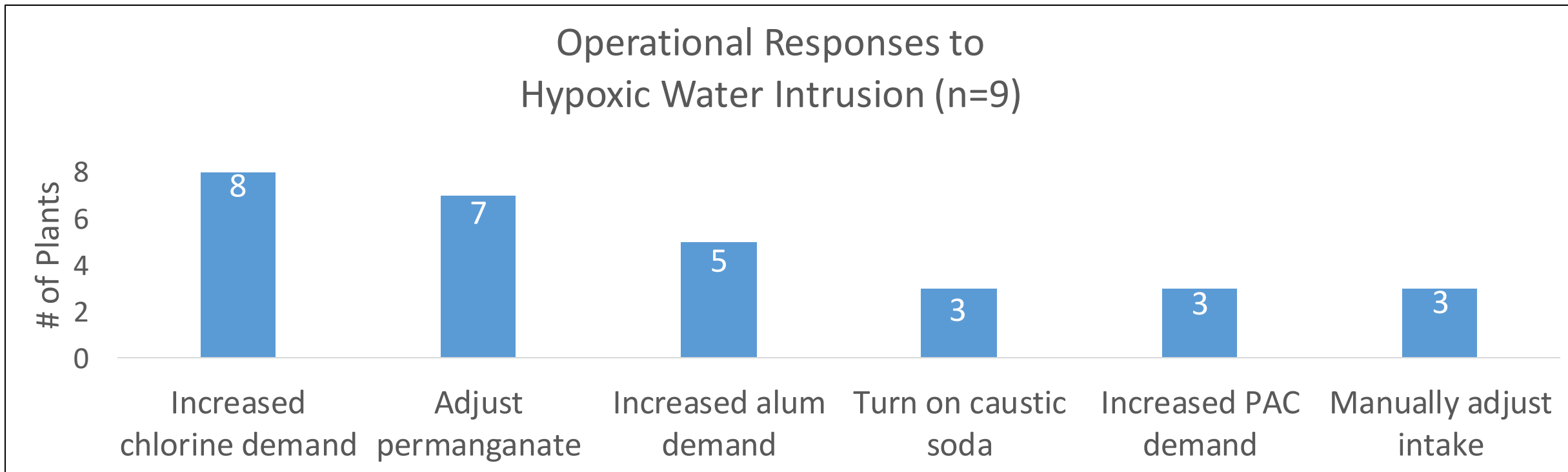
## Frequency of hypoxia events

- Every focus group reported experiencing at least 1 hypoxia-like event in 2017
  - Severe events occur more infrequently
  - 6(9) focus groups experienced severe
- Events lasted from a few hours to more than a week
- Most events occur from March - September
  - One reported event in January



## 2. Response to Hypoxia: Changes in Water Treatment

*“There have been **various theories about how we should treat hypoxic water**. One is cutting the permanganate off, the other is decreasing the pre-chlorine, increased carbon, increased alum....You’ve got to be careful oxidizing stuff, because you could cause other issues....But one thing we do for sure is turn off our permanganate.”*





## 2. Response to hypoxia: Changes in plant operations

- **Increased monitoring**

*“We run the raw water temperature and pH every two hours, so if they did see some kind of a drop, you would run it more frequently or keep a lid on it.”*

- **Communicate water quality changes to other operators, managers, & neighboring plants**

*“A lot of times...we talk among ourselves, same way as with other plants. We’ll call them and say, “what are you guys doing? What’s working well for you?” Sometimes the communication with other plants is helpful...because, it might take a plant down west of us a couple days to get to grips with what’s helping everything.”*

- **Quick and early treatment reduces negative impacts to water quality**

*“The sooner we catch any changes....You don’t have to make as big of an adjustment with your chemical treatment if you can stay on top of it.”*

### 3. Potential financial impacts

- Direct costs associated with hypoxic water treatment are minimal
- Indirect costs of severe events are likely more substantial.

*“I don’t think that there’s a great financial impact associated with hypoxia. There’s more of an aesthetic impact. Just like in Flint, there is nothing that you can do to get the confidence of the people back once you send them yellow water.”*

#### **Recent Developments:**

- At high levels manganese is a neurotoxin
- Transitioning to new Ohio EPA policy: regulating for health risks vs. aesthetic
  - New monitoring & water quality standards for manganese
  - >0.3 mg/L (precautionary advisory); > 1 mg/L (do not drink)

# 4. Anticipated Benefits of Hypoxia Forecast

- **Enables early treatment**

*“The biggest thing is making the operators aware that they may see [hypoxic water], to keep a close eye on it. The sooner we catch any changes, the smaller the corrections you have to make to your treatment.”*

- **Allows for preparation**

*“We would be better prepared. We could let the operators know that this could happen...maybe run some extra monitoring or pay more attention to current monitoring. If we know something is coming, we can check our chemicals to make sure that we’ve got enough in stock.”*



# 5. Recommendations for development of hypoxia forecast

- Provide forecast between 1-3 days in advance of event
- Include a written description of the forecast along with graphics
- Use different color scales to display D.O. and temperature forecasts
- Allow for viewing of past forecasts
- Limit the information, so that it's easier to digest
- Include pH, temperature, DO, and manganese
- Explain how the wind direction influences the hypoxia forecast
- Preference for intake specific forecasts\*

# Evaluating Project Success

## Measures of Success

- Increased knowledge
- Better prepared for hypoxic events
- Favorable review of the hypoxia forecast
- Favorable review of your involvement in this study



# Evaluation Survey

- Pre & post surveys conducted as written questionnaires
- 31 respondents
  - Sample size: 32 participants in 9 focus groups for plants that draw water from Lake Erie's Central Basin
  - Missing post-survey data from 1 respondent, pre-survey data of respondent omitted from analysis (n=31)



*This one-page survey will help us understand your thoughts. Your responses are voluntary and will be kept confidential. We appreciate your time and support!*

1. How much would you say you know about hypoxia and how it occurs in Lake Erie?

- Not heard of deal     Nothing at all     Some     Quite a lot     A great deal

2. How much would you say you know about how changes in wind, lake currents, and temperature affect the occurrence of hypoxia at water intakes near the shoreline?

- Not heard of deal     Nothing at all     Some     Quite a lot     A great deal

3. How much would you say you know about the impacts of hypoxia on public water systems?

- Not heard of deal     Nothing at all     Some     Quite a lot     A great deal

4. Would you like to increase your knowledge of how and when hypoxia affects Lake Erie water intakes?

- Definitely not     Probably     Maybe     Probably not     Definitely

5. To what degree has hypoxia impacted the operations of your plant?

- Strongly impacted     Somewhat     Neutral     Slightly     Not impacted at all

6. At your plant, how frequently do you talk about ways to respond to hypoxic water intrusion?

- Never     Occasionally     Sometimes     Often     Always

Participant ID: \_\_\_\_\_

# Survey Results

- Participant **knowledge increased** in 3 areas as a result of participation in focus groups: 1) General knowledge of hypoxia; 2) Knowledge of lake processes that create hypoxia, 3) Hypoxia's impact on plant operations
- Participant **intention to use the hypoxia forecast increased** after participation in the focus groups
- Participants have a **high desire to learn more about the impact of hypoxia** on drinking water treatment plants

# Increased knowledge of hypoxia

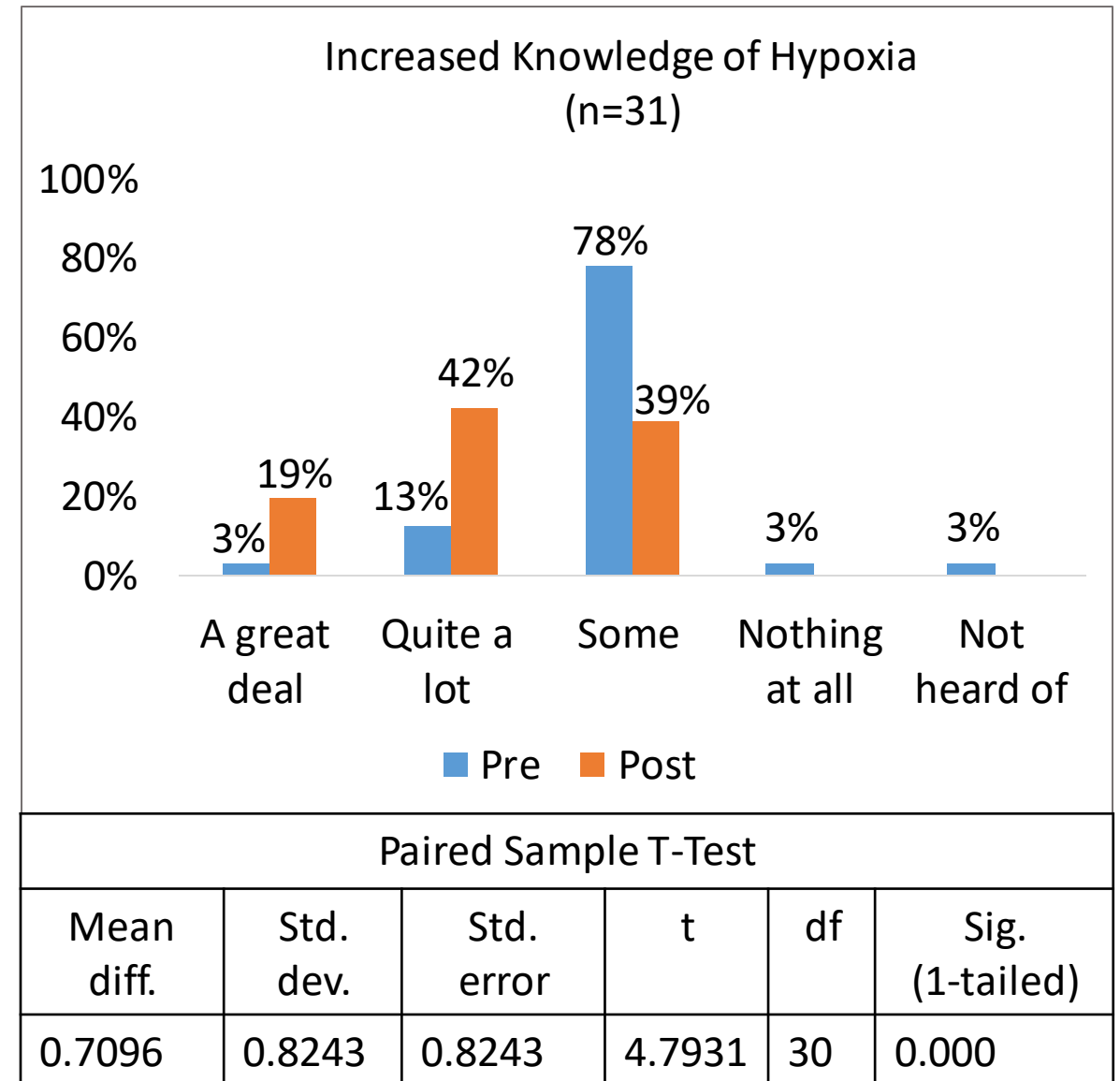
## Pre-Survey:

- Most participants said they knew “some” or nothing about hypoxia in Lake Erie (84%)
- Only a few said they knew a lot (16%)

## Post-Survey:

- Participants who said they knew a lot about hypoxia increased to 61%.

Participant knowledge about hypoxia in Lake Erie increased significantly after participation in the focus group (paired  $t(30)=4.79$ ,  $p=0.00$ ).





# Increased knowledge of lake processes that create hypoxia

## Pre-Survey:

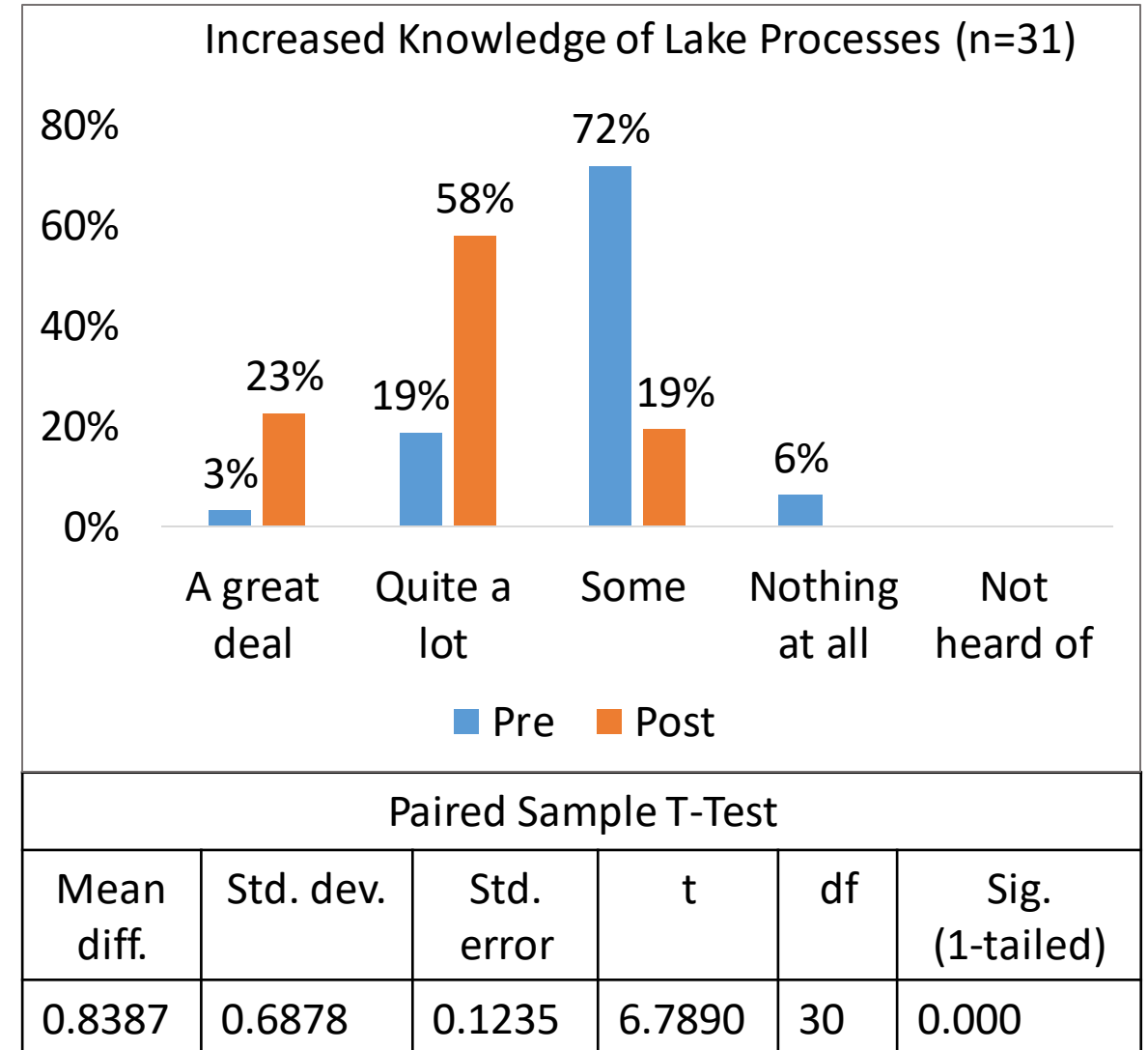
- Most participants said they knew “some” about Lake Erie’s physical processes (72%).
- Only 22% said they knew a lot

## Post-Survey:

- Participants who said they knew a lot about lake processes increased to 81%.

Participant knowledge about the lake processes that create hypoxia increased significantly after participation in the focus group (paired  $t(30)=6.78$ ,  $p=0.00$ ).

*This was the area of greatest knowledge gain (Mean diff.=0.8387).*



# Increased knowledge of hypoxia's impact on plants

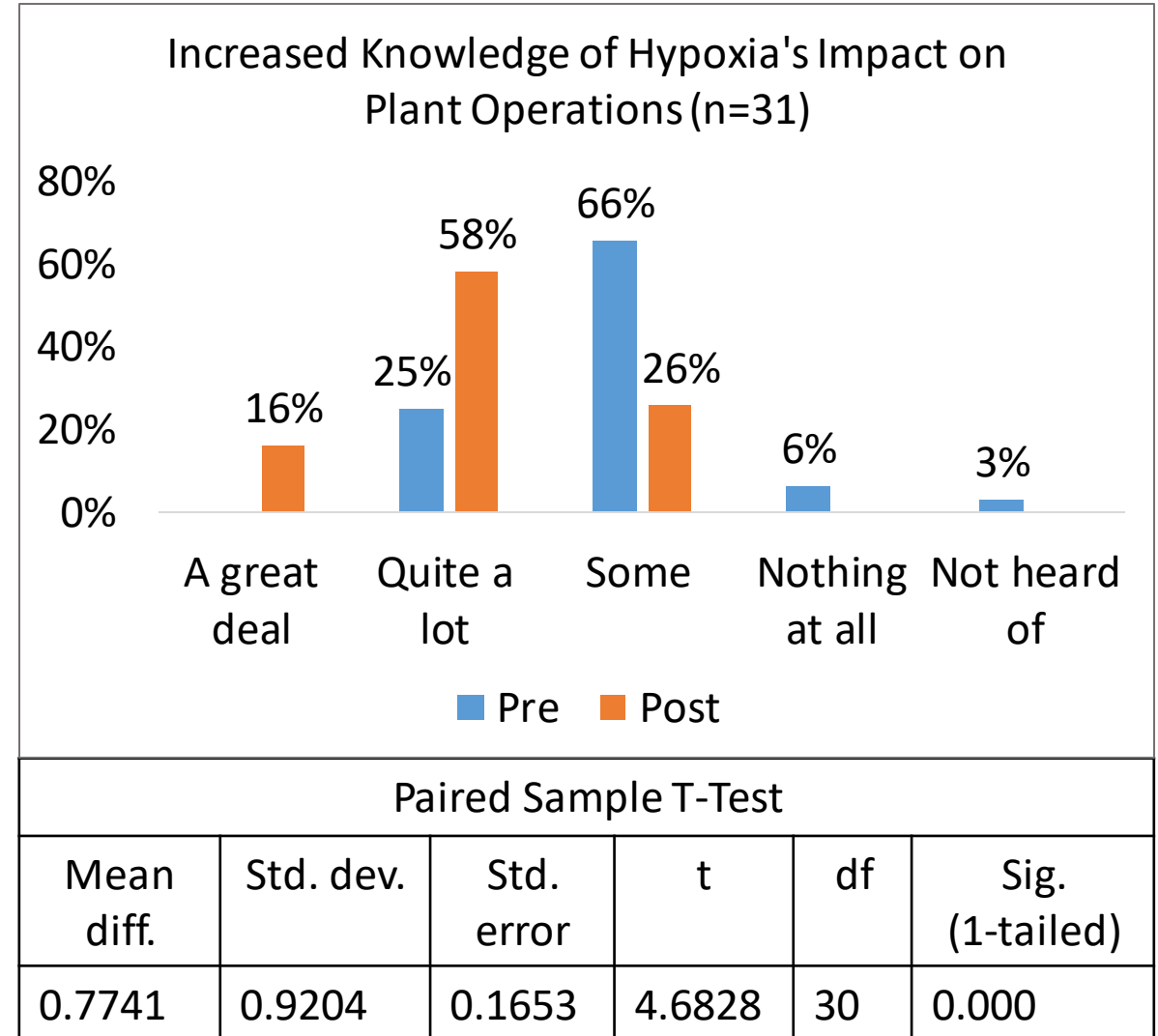
## Pre-Survey:

- Most participants said they knew “some” about the impact of hypoxia on water plants (66%).
- Only 25% said they knew a lot

## Post-Survey:

- Participants who said they knew a lot about the impact of hypoxia increased to 74%.

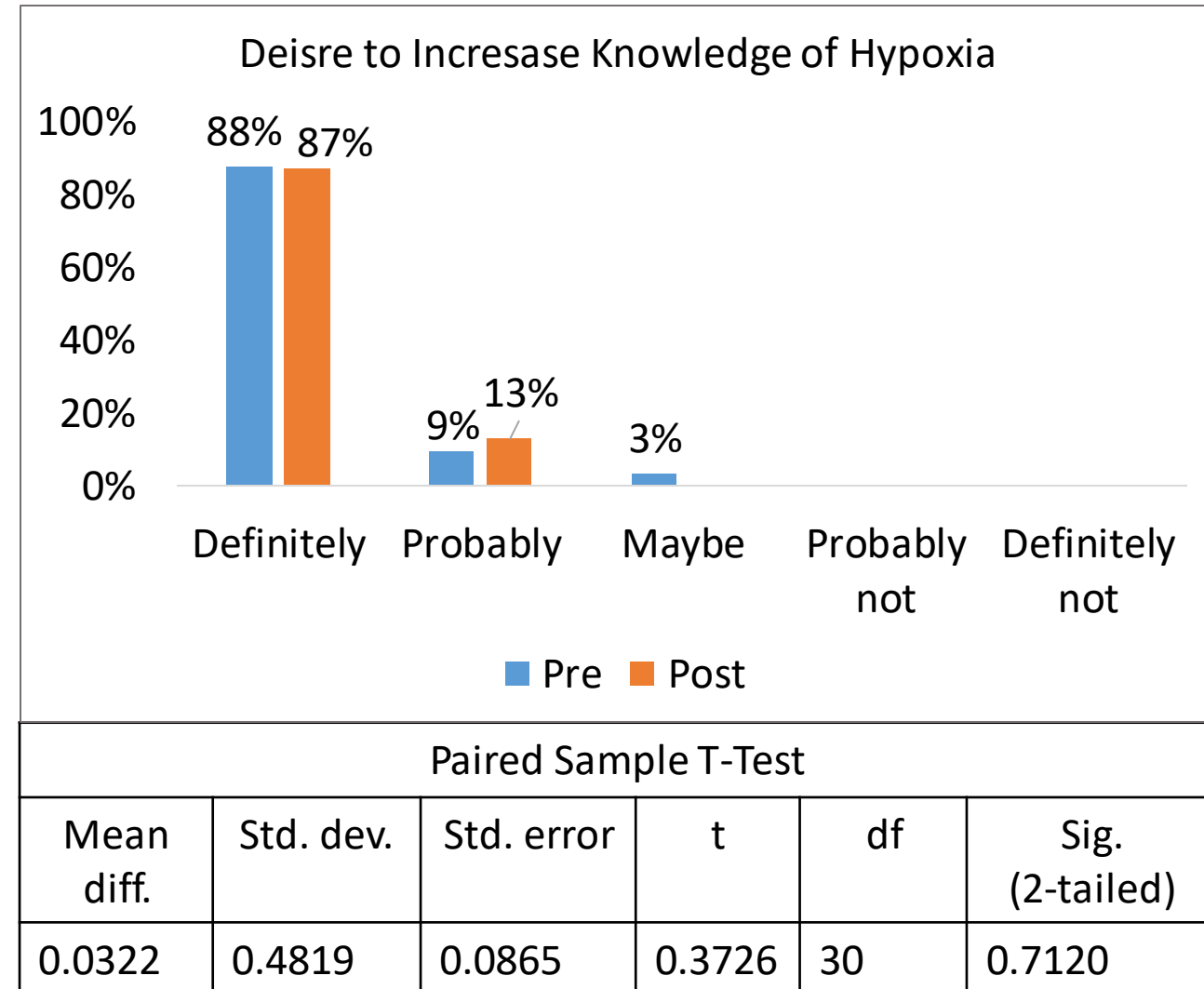
Participant knowledge about the impact of hypoxia on plant operations increased significantly after participation in the focus group (paired  $t(30)=4.68$ ,  $p=0.00$ ).



# High willingness to increase knowledge

- In both Pre and Post Surveys, the majority of participants indicated that they would like to learn more about the impact of hypoxia on treatment plants (Pre=88%, Post=87%).

Participant desire to learn more about the impact of hypoxia on water treatment plants did NOT significantly change after participation in the focus group (paired  $t(30)=0.37$ ,  $p=0.71$ ).



# Increased intention to use the hypoxia forecast

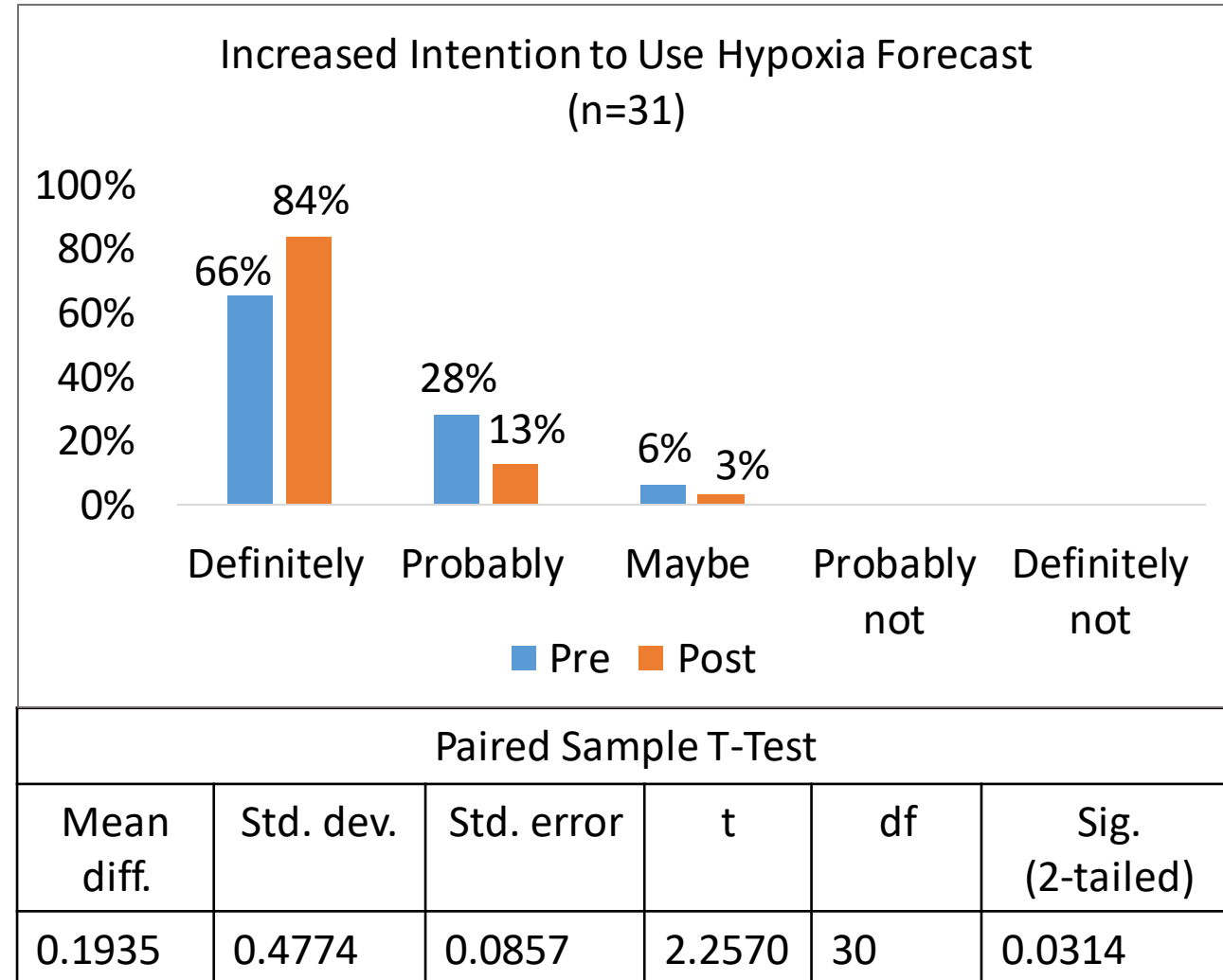
## Pre-Survey:

- 66% of participants said they would definitely use the hypoxia forecast
- 34% said they would “probably” or “maybe” use it

## Post-Survey:

- 84% of participants said they would definitely use the hypoxia forecast

Participant intention to use the hypoxia forecast increased significantly after participation in the focus group (paired  $t(30)=2.25$ ,  $p=0.03$ ).



# Conclusion

- Survey and focus group data represent short-term results (yr 2 of 4)
- To gather longer-term results, focus groups and survey will be repeated two years after the original data collection period.
- Measures of success
  - Increased knowledge
  - Better prepared for hypoxic events
  - Favorable review of the hypoxia forecast
  - Favorable review of your involvement in this study

# Thank you!

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