2. Public Health Impacts

This section builds on the "Impacts of HABs on Public Health" section of HARRNESS (page 57), discussing the following research topics and needs (Fig. 8).

Public Health Impacts – Research Topics and Needs

2.1 Developing Diagnostic Tools
Research Need: Conduct assessments of public health professionals, public service groups, and other sectors that respond to HAB poisonings, and utilize their feedback, to develop tools for clinical diagnostic support and transition them to operation.

2.2 Improving Surveillance
Research Need: Improve surveillance of human exposure and disease.

2.3 Developing Epidemiological Methods
Research Need: Develop new, cost effective epidemiological methods appropriate to HAB issues that will enhance capacity to develop primary public health and prevention activities.

2.4 Identifying Susceptible Populations
Research Need: Identify susceptible populations based on characteristics such as physiological traits, behavioral factors, socioeconomic status, and cultural practices.

Figure 8. Public Health Impacts - Research Topics and Needs

2.1 Developing Diagnostic Tools

Research Need: Conduct assessments of public health professionals, public service groups, and other sectors that respond to HAB poisonings, and utilize their feedback, to develop tools for clinical diagnostic support and transition them to operation.

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HARRNESS Recommendation: "Develop tools for clinical diagnostic support" (HARRNESS, 57).

In their report to Congress providing recommendations for a new and comprehensive national ocean policy, *An Ocean Blueprint for the 21st Century* (2004), the US Commission on Ocean Policy recognizes the need to "support the development of improved methods for monitoring and identifying pathogens and chemical toxins in ocean and coastal waters and organisms." Such methods are to include "new tools for measuring human and environmental health indicators in the marine environment" and "models and strategies for predicting and mitigating harmful algal blooms." In the same year, this critical need was echoed by the passing of the Oceans and Human Health Act (OHH Act), which establishes a national research program to improve understanding of the role of the oceans in human health.

Building on *Ocean Blueprint* and the OHH Act, HARRNESS recognizes that "there are no readily available tools or methods for diagnosing HAB-related illness in humans or animals. Thus, accurate diagnosis, treatment, and prognosis are impossible" (HARRNESS 2005, 57). Consequently, documented cases of HAB-related poisonings likely represent only a small portion of those that actually occur. To improve diagnosis and reporting, and thereby understand and reduce impacts of HABs on human health, HARRNESS recommends the development of tools for clinical diagnostic sup-

port. For example, a diagnostic decision-support software program could be made available to public health professionals and regularly updated to incorporate new information on HAB-related illnesses. Alternatively, a diagnostic keycard would enhance ease of use and maximize access by a diversity of responders. Similarly, a simple informational card summarizing HAB-related illnesses and symptoms might facilitate recognition and appropriate response by high-risk groups such as recreational fishermen, beach goers, and public service groups such as lifeguards, hotel operators, and coastal resource managers. Another critical need is for development of assays for biological effects of these toxins. These assays could be in the form of biological markers of exposure (i.e., toxin concentrations in urine, blood, or other biological specimens) or of effect (e.g., changes in a clinical blood parameter that is specific to a particular toxin). Laboratory assays that confirm exposure would enhance correct diagnosis and the ability to prevent further illnesses. Finally, we cannot improve HAB-related illness diagnosis until there is some consensus on case definitions. Using what we know about the symptoms associated with exposures to HAB-related toxins to identify what would likely be the clinical presentations of people with HAB-related illnesses would provide physicians with a basis for accurate diagnoses.

Like any product, developing, prototyping, and evaluating tools to connect HAB science to diagnostic decisions requires a good understanding of and collaboration with their potential users. Important considerations include user preferences (e.g., media type), knowledge (e.g., familiarity with vectors and symptoms of HAB illness), and perceptions (e.g., of the seriousness of HAB illnesses) as well as the environment in which the tool will be used (e.g., hospital laboratory, private medical office, or in the field). For example, if it turns out that public health professionals have relatively little understanding of exposure pathways – e.g., consumption of contaminated food or water, or inhalation of aerosolized toxins – then a diagnostic tool developed for their use must convey this information in order to facilitate diagnosis, reporting, and treatment of HAB-related poisonings. Similarly, if medical professionals in a HAB-affected locality view HAB-related illnesses as minimally serious, effective diagnosis and treatment could be aided by integrating or pairing a diagnostic tool with communications emphasizing potentially severe symptoms such as liver failure where high concentrations of cyanobacterial toxins contaminate drinking water.

Building on the HARRNESS recommendation to develop diagnostic tools, the research objectives below emphasize the need to build bridges between users and producers of such tools to ensure their effective design and delivery. Research on the preferences, knowledge, perceptions, use-environments, and other characteristics of potential users such as public health professionals and public service groups (called "user assessment") is critical to develop tools that are specific for the exposures of concern and promote accurate diagnosis and effective treatment. Focus groups involving potential users are also critical to test prototypes, and education is needed to transition tools to operation in clinical and community settings.

Effective design and delivery of diagnostic tools requires research on user characteristics, focus groups to test prototypes, and education to transition tools to operation.

Research Objectives

1. *Identify categories of public health professionals, public service groups, resource managers, and other sectors that are integral to responding to, reporting cases of, diagnosing, and treating HAB-related poisonings.*
2. *Assess preferences, knowledge, perceptions, and other characteristics of these user communities that may influence product design.*
3. *Define the scope and sequence of information to be produced by diagnostic tools and determine effective methods for risk communication given cultural, educational and socioeconomic diversity of coastal areas and user groups.*
4. *Incorporate feedback from user communities on product prototypes to maximize support in efficiently and effectively responding to, reporting cases of, diagnosing, and treating HAB-related poisonings.*
5. *Utilize educational and outreach programming to facilitate effective transfer of diagnostic tools for use in clinical, beach-side, household and other settings.*
6. *Evaluate effectiveness of clinical diagnostic tools through surveys to obtain user feedback.*

These objectives outline a step-by-step process for tool development and delivery that includes learning about local medical institutions, tourism operators, and other groups that provide care for individuals experiencing symptoms, assessing characteristics of such responders to inform the development of prototypes utilizing up-to-date information on toxins and their effects, testing prototypes by incorporating user feedback, and facilitating the use of products in various settings through educational programming.

Example Project

Assessing the Needs of Medical Health Professionals for Tools to Support Diagnosis of HAB Illnesses

Description: Following Objectives (1) and (2) above, the overarching goal of this project is to identify informational, technological, and other needs of public health professionals to ensure that tools developed are maximally effective in promoting accurate diagnosis and effective treatment. Subsequent funding and continued work would be necessary to develop prototypes, test them by incorporating feedback from the public health community, facilitate their use through educational programming, and evaluate their effectiveness for facilitating diagnosis, reporting and treatment of HAB-related illnesses.

Methods:

- Surveys, semi-structured interviews with key informants, and focus groups to assess the preferences, knowledge, and perceptions – as well as HAB diagnostic needs and ease-of-use information about various diagnostic schemes – of groups of public health professionals that may differ with respect to these characteristics, e.g., emergency responders, community health clinicians, private physicians, hospital administrators, beach managers, life guards, and emergency medical technicians.

- Interpretation of survey, interview, and focus group results to identify needs of public health professionals for diagnostic tools to facilitate accurate diagnosis and effective treatment of HAB-related illnesses – including HAB information (e.g., methods of exposure and types of toxins), medical information (symptoms characteristic of various illnesses), and technological requirements (e.g., preferred media or format such as a diagnostic tree).

Outcomes:

- Identification of informational and technological needs for tools to assist public health professionals in diagnosing HAB-related illnesses.

Challenges: Engaging public health professionals in survey response and focus groups.

Timeline: Approximately one year. Phase One – project planning, survey development, focus group planning. Phase Two – survey, interview, and focus group implementation, data analysis.

Expertise Needed:

- HAB Toxicologist
- Epidemiologist
- Sociologist

While the technical challenges of a Harmful Algal Bloom Information System (HABIS) are significant, equally challenging is the need to understand stakeholder needs and requirements in order to ensure that data are captured in the most efficient and accurate manner possible.

Estimated Cost: $50,000 - $75,000, including part-time salary of $25,000 for principal investigator; graduate student stipend of $12,000; travel and other expenses associated with focus groups, surveys, and interviews; and supplies.

Potential Partners: Centers for Disease Control and Prevention, state and local health departments, local chapters of American Red Cross, lung health organizations, marine laboratories, and medical schools.