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The Biomonitoring of Great Lakes Populations Program

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Background

Over the past century, careless practices have resulted in contamination of the Great Lakes ecosystem, the world's largest fresh surface water system. Over 30 million people live on the U.S. side of the Great Lakes basin, which spans eight states. Local, state, and federal agencies in the U.S. and Canada have passed environmental laws aimed at reducing the levels of pollution. Legacy pollutants banned or phased out of commerce decades ago in sediment, ongoing industrial and municipal discharges, agricultural runoff, leachate from disposal sites, contaminated groundwater, and atmospheric deposition, however, continue to pose environmental and public health concerns. The U.S. and Canada have identified 43 environmentally degraded surface water systems called areas of concern (AOCs) (U.S. Environmental Protection Agency, 2017).

Since 2009, Congress has appropriated funds to the U.S. Environmental Protection Agency (U.S. EPA) for the Great Lakes Restoration Initiative (GLRI) to accelerate efforts to protect and restore the Great Lakes ecosystem (www.glri.us). In conjunction with other federal agencies, U.S. EPA developed GLRI action plans to remediate Great Lakes environmental problems and prevent associated human health issues. Under the auspices of GLRI, the Agency for Toxic Substances and Disease Registry (ATSDR) began the Biomonitoring of Great Lakes Populations (BGLP) program in 2010.

BGLP Program Overview

The BGLP program consists of a series of cross-sectional studies carried out collaboratively with state health departments (Figure 1). The primary program objectives are: 1) to assess body burdens of persistent toxic substances in people at high risk of exposure to contaminants in the Great Lakes ecosystem, and 2) to use biomonitoring data to inform health officials and help guide public health actions throughout the restoration process. Urban communities living in or near AOCs and indigenous communities that live off the land in the Great Lakes basin are at risk of potentially high exposure to contaminated air, water, and soil through eating locally caught fish, aquatic plants, and wildlife (Christensen et al., 2016; Fitzgerald et al., 2004; Knobeloch, Turyk, Schrank, & Anderson, 2009; Turyk et al., 2006).

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The first BGLP program (BGLP-I) was initiated in 2010 and was completed in September 2015 through cooperative agreements with state health departments in Michigan, Minnesota, and New York. The three state programs targeted four adult susceptible populations (i.e., shoreline anglers, sport anglers, American Indians, and Burmese immigrants) residing in seven AOCs.

The Michigan Department of Health and Human Services biomonitoring project targeted shoreline anglers, defined as urban Michigan residents who fish from the riverbank and regularly consume their catch from the Detroit River or Saginaw River/Bay AOCs. While these AOCs are contaminated with mercury, metals, polychlorinated biphenyls (PCBs), dioxins, and furans, the areas are important resources for urban anglers, many of whom are low income and fish for sustenance, as well as recreation (Kalkirtz, Martinez, & Teague, 2008).

The Minnesota Department of Health partnered with the Fond du Lac (FDL) Band of Lake Superior Chippewa to conduct a population-based biomonitoring study of American Indians affiliated with FDL and other tribes who lived in proximity to the St. Louis River AOC. The FDL community might experience greater exposure to contaminants as consumers of traditional foods from local aquatic environments, such as fish and waterfowl.

The New York State Department of Health program targeted two susceptible adult populations that were sampled, recruited, and enrolled independently. The first target population was licensed anglers living in proximity to AOCs near the Upper Niagara River and Buffalo River who eat locally caught fish. The second population of interest was refugees and immigrants from Burma and their descendants who lived in the city of Buffalo and ate fish caught in the area. Due to economic and cultural factors, recent Southeast Asian refugee populations tend to engage in subsistence fishing and consume high levels of locally caught fish (Schantz et al., 2010).

To ensure statistically valid sampling strategies and harmonization of data collection, ATSDR provided oversight, scientific guidance, and technical support for all aspects of the program. ATSDR worked collaboratively with the state programs to develop a core set of questionnaire domains, which included demographic information, residential history, housing characteristics, job history, lifestyle factors, dietary intake, recreational activities, smoking history, fish consumption patterns with a focus on fish species and locally caught fish, and reproductive history in women. The biomonitoring questionnaires for each state program were tailored to fit local concerns and designed to assist in the interpretation of contaminant levels in the target subpopulation. State programs were required to assess a core set of pollutants including metals, PCBs, and banned pesticides. Some chemicals of emerging concern that are found in the Great Lakes, such as polyfluoroalkyl substances and bisphenol A, were measured in state-specific studies.

Study Accomplishments

To our knowledge, the BGLP program is the most comprehensive biomonitoring program to evaluate susceptible populations' exposure to a wide range of environmental contaminants in

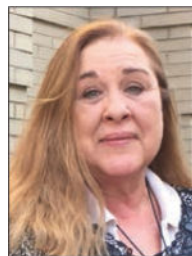
the Great Lakes region (Table 1). With 1,431 participants to date, a diversity of susceptible populations in 7 different AOCs, 14 required analytes measured in all participants, and over 50 optional analytes measured in state-specific studies and participants, the BGLP-I state programs completed data collection and preliminary analysis as of September 2015. Study participants received personal result packages along with chemical-specific fact sheets that explained sources of exposure and ways to reduce exposure, and eat safe fish advisory brochures. The state program staff worked closely with community partners within each study population to create culturally relevant educational messages. State programs also conducted educational outreach through various venues at community events and stakeholder meetings. Comprehensive analysis of the study data is in progress.

Ongoing and Future Studies

With additional GLRI funding, ATSDR funded a cooperative agreement program (BGLP-II) in 2014 with the New York State Department of Health. This program recently completed data collection on two adult populations living in Syracuse, New York, who eat fish from Onondaga Lake—immigrants from Burmese and Bhutan and urban low-income minority anglers. Most recently, ATSDR established the BGLP-III program in 2015 and funded a cooperative agreement program with the Wisconsin Department of Health Services. The BGLP-III program proposes to target two adult susceptible populations who fish and eat their catch from the Milwaukee Estuary AOC—licensed anglers living in proximity to the Milwaukee Estuary AOC and Burmese refugees who are known to eat a substantial amount of fish from this area.

In conclusion, ATSDR's BGLP programs will collectively evaluate human exposure to a wide range of legacy and emerging contaminants in susceptible populations residing near nine Great Lakes areas of contamination (Figure 2). The biomonitoring results generated from this program will help guide public health actions to reduce and prevent harmful chemical exposure in Great Lakes populations with increased exposure risk.

Biographies



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Editor's Note

As part of our continuing effort to highlight innovative approaches to improving the health and environment of communities, the *Journal* is pleased to publish a bimonthly column from the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is a federal public health agency of the U.S. Department of Health and Human Services (HHS) and shares a common office of the Director with the National Center for Environmental Health (NCEH) at the Centers for Disease Control and Prevention (CDC). ATSDR serves the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances.

The purpose of this column is to inform readers of ATSDR's activities and initiatives to better understand the relationship between exposure to hazardous substances in the environment and their impact on human health and how to protect public health. We believe that the column will provide a valuable resource to our readership by helping to make known the considerable resources and expertise that ATSDR has available to assist communities, states, and others to assure good environmental health practice for all is served.

The conclusions of this column are those of the author(s) and do not necessarily represent the views of ATSDR, CDC, or HHS.

Wendy Wattigney is a biostatistician at ATSDR and served as the project lead for the Biomonitoring of Great Lakes Populations (BGLP) programs I and II. Zheng Li is a lead environmental health scientist and team lead at ATSDR, and serves as the project lead for the BGLP-III. As chief of the Environmental Epidemiology Branch in the Division of Toxicology and Human Health Sciences at ATSDR, Angela Ragin-Wilson manages several programs and projects including the Great Lakes Biomonitoring Program and Navajo Prospective Birth Cohort Study.



FIGURE 1.
Biomonitoring of Great Lakes Populations (BGLP) Program Timeline

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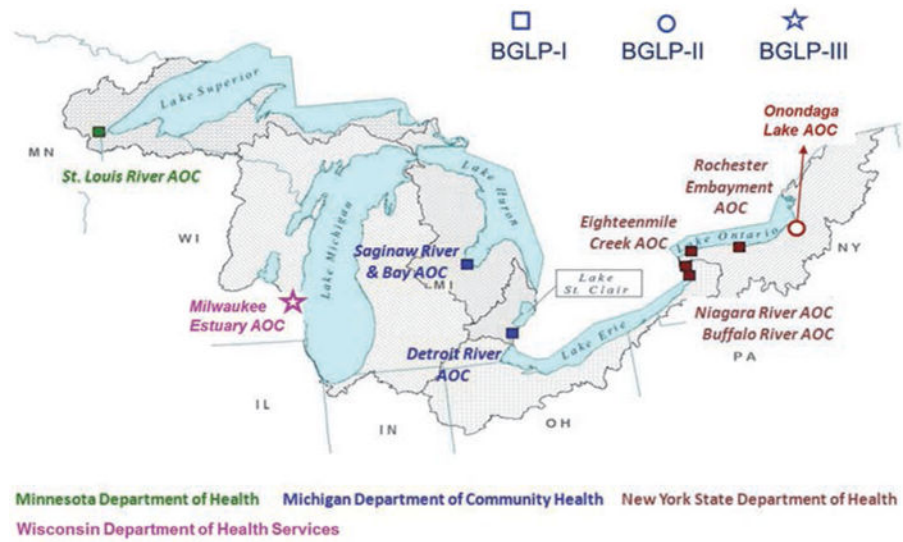


FIGURE 2.
Biomonitoring of Great Lakes Populations (BGLP) Program: Cooperative Agreement Partners and Areas of Concern

TABLE 1

Biomonitoring of Great Lakes Populations (BGLP) Program: Study Populations and Areas

State	Target Subpopulation	Area of Contamination	# of Participants
Michigan, BGLP-I	Shoreline anglers	Detroit River Saginaw River/Bay	287 38
Minnesota, BGLP-I	American Indian community	St. Louis River	491
New York, BGLP-I	Burma immigrant community Licensed anglers	Buffalo River Niagara River Eighteen Mile Creek Rochester Embayment	206 409
New York, BGLP-II	Burma and Bhutan immigrant community Shoreline anglers	Onondaga Lake	311 89
Wisconsin, BGLP-III	Licensed anglers Burma immigrant community	Milwaukee Estuary	400 (estimated) 100 (estimated)

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