The City of Milwaukee Health Department (MHD) conducts water quality monitoring on several local public beaches on a seasonal basis (June-August) for purposes of assessing health risk to patrons contact with potentially contaminated surface water. This information is important and used by the MHD in decision making specifically related to the necessity of posting daily public water quality advisories at each site. These advisories alert patrons to the elevated bacteria levels in the water posing a potential health risk. During 2012, the MHD developed a partnership with the University of Wisconsin – Milwaukee Zilber School of Public Health (ZSPH) to more comprehensively assess water quality at each City public beach including monitoring of Escherichia coli levels, impact of rainfall and algal presence, significance of varied in water quality and determination of triclocarban concentrations. Sub-daily E. coli samples were obtained to better understand variance in public exposure as a function of time of day. The data collected as a result of this partnership suggest that non-point pollution sources from storm water run-off and sewer cross connections may contribute to adverse environmental beach water quality conditions. Documented fluctuation of bacteria levels in the water posing a potential health risk. During 2012, the MHD developed a partnership with the ZSPH to sample four to six times per week throughout the beach season for E. coli testing, a standard marker for pathogenic microorganisms in surface waters.

Zilber School of Public Health (ZSPH) Beach Research

Triclocarban and E. coli Levels in Beach Water (2012)

A positive correlation between Triclocarban and E. coli levels suggests that wastewater influences beach water quality. Triclocarban is present in personal care products.

Sub-Daily Variations in E. coli Levels (2012)

Sub-daily testing for E. coli showed the possibility of dramatic shifts in water quality over a 24-hour period. Beach water sampling by the Milwaukee Health Department has historically been done in the morning.

Enhancement of Predictive Modeling (2013)

E. coli data was used along with meteorological, hydrological, and sanitary survey data in refining Nowcast, a water quality predictive model developed at the Wisconsin Department of Natural Resources.

Advantages of Collaboration

Public Health Risk Assessment

MHD was able to better protect the beach-going public as a result of this collaboration. ZSPH gained access to a large number of E. coli data sets to expand its research efforts. This research will further enhance modeling and analytical approaches to beach risk assessment.

Capacity Building

Previously MHD only had the staffing and resources to sample some beaches once a week. Beginning in 2012, ZSPH sampled all beaches four to six times per week, providing more timely E. coli data for advisory decisions.

Enhanced Capabilities

ZSPH researchers compiled more detailed sanitary survey data, which was used to refine a Nowcast predictive model. Analysis for Triclocarban, a wastewater marker, was also conducted by ZSPH and informed MHD’s understanding of beach water quality.

Workforce Development

MHD staff and ZSPH students gained experience in interpretation and presentation of data, statistical methods, and analytical techniques. MHD lab added qPCR methods to its array of analytical services.

Special Events Support

The USA Triathlon Age-Group Nationals were held in Milwaukee this past summer. MHD, with the capability of ZSPH for off shore sampling, was able to compile E. coli data along the proposed swim route, validating E. coli beach water quality basis.

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- Background photos (credit: https://myopqislipto/bkmpukboqekk/lngqum).jpg

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Future Trends for the MHD Program

Water quality predictive modeling is an important line of research. The Nowcast model could be enhanced by sub-daily or even streaming data from a Sonde device, measuring the most important parameters such as wind speed and direction, wave height, etc. Retrospective analysis of a growing volume of historical data may also lead to improved forecasting.

Clearer epidemiologic understanding of the impacts of poor beach water quality is needed to validate, inform, and allocate surveillance efforts. This will ultimately improve characterization of risk at public beaches.

Sub-daily variations in E. coli levels at an order of magnitude or more underscore the challenges of accurate and timely beach advisories. Quantitative determinations of E. coli or other reliable marker species, with quicker turnaround times, would be an important breakthrough.

Triclocarban occurs in a variety of personal care products, and when found in surface water it indicates wastewater infiltration. Peaks of Triclocarban co-occurring with peaks in E. coli may suggest that the E. coli originates from wastewater. The presence of Triclocarban may be useful in predicting beach water quality and offer the advantage of a quicker analytical turnaround time.