

# Michigan Journal of Public Health



*A Journal to promote public health practice, research and policy  
focusing on Michigan and the Great Lakes Region*

Volume 5

Issue #1

2011

(ISSN) 1937-2515

## **Mission Statement**

The mission of the Michigan Journal of Public Health is to promote public health practice, research and policy with specific focus on Michigan and the Great Lakes Region. We encourage contributions from the field of practice, original research, opinion and commentary. It is the expressed interest of this Journal to encourage dissemination from the field of public health practice.

## **Statement of Affiliation with the Michigan Public Health Association**

The Michigan Public Health Association (MPHA) is the organizing entity of the Michigan Journal of Public Health (MJPH) and is responsible for the publicizing and publication of the journal. The members of the Editorial Board are solicited from among public health practitioners and researchers, and approved by the Board of MPHA. MJPH Editorial Board members must also be members of MPHA and serve three year terms.

# **MJPH Editorial Board**

## **MEMBERS:**

**Stephen Borders**, PhD, MHA, School of Nonprofit and Public Administration, Grand Valley State University

**Talat Danish**, MD, MPH, Wayne County Department of Public Health

**Richard L. Douglass**, PhD, MPH, Program in Health Administration, School of Health Sciences, College of Health and Human Services, Eastern Michigan University

**Kieran Fogarty**, PhD, Interdisciplinary Health Science PhD Program, Western Michigan University

**Julie Gleason-Comstock**, PhD, MCHES, Department of Family Medicine & Public Health Sciences; Center for Urban Studies, Wayne State University

**Steven C. Gold**, MPH, Macomb County Department of Health & Community Services

**Theresa M. Green**, MBA, Berrien County Health Department

**Violanda Grigorescu**, MD, MSPH, Michigan Department of Community Health

**Kathleen Oberst**, PhD, RN, Institute for Health Care Studies, Michigan State University

**Laureen H. Smith**, PhD, RN, School of Nursing, Ohio State University

**Teresa Wehrwein**, PhD, RN, College of Nursing, Michigan State University

## **OFFICERS:**

MJPH Editor: **Julie Gleason-Comstock, PhD, MCHES**

MJPH Associate Editor: **Talat Danish, MD, MPH**

# Author Guidelines

## **STYLE:**

American Psychological Association (APA) current guidelines, 12 point font, Times New Roman double spaced, and 1" margin. We offer a variety of submission categories in order to welcome a varied audience within public health.

## **SUBMISSION CATEGORIES:**

**Research and Practice Articles** (up to 15 pages or 3500 excluding references, words in main text, a total of 4 standard digital photographs/tables/figures, and a structured abstract of 180 words) report the results of original quantitative or qualitative public health research. These may include, but are not limited to: evaluations/reports, demonstrations of innovative programs, best practice, exemplars/community-engaged scholarship, service learning, emerging problems, evidence-based practice and preliminary findings.

**Commentaries** (up to 10 pages or 2500 words in main text, 2 tables/figures, and an unstructured abstract of 120 words) include scholarly essays, critical analyses, and policy papers.

**Analytic Essays** (up to 15 pages or 3500 words excluding references, in main text, a total of 4 standard digital photographs/tables/figures, and an unstructured abstract of 120 words) provide a forum for critical analyses of public health issues from disciplines other than the biomedical sciences, including, but not limited to: the social sciences, human rights, and ethics.

**Briefs** (up to 4 pages or 500 words excluding references, in main text, 2 tables/figures, and an abstract of up to 80 words) provide preliminary or novel findings.

**Editorials** (may not exceed 1,200 words) are solicited based on recommendations from the Editorial Board, or members of MPHA. All recommendations require approval from the MJPH Editorial Board.

**Letters to MJPH** (must not exceed 400 words and contain no more than 10 references) are encouraged by our readers. Letters may include any public health topic.

**Notes from the Field** invites submissions of new or emerging issues, and underrepresented voices in community and public health. This category is designed to promote the exchange of ideas and practices amongst public health practitioners, thus, perspectives on new or effective community/field practices are encouraged. **Notes** is also intended to enhance sharing insights, issues, innovations and new approaches to our shared problems and are not subjected to the normal peer review process of practice and research articles, but may be sent for content review at the discretion of the editor. Authors should be aware that some information/data in Notes from the Field may require IRB and/or HIPAA documentation. Submit 750 words or less in a common electronic text format. No more than two graphics, including pictures, charts, graphs and tables. Using APA format, limit references to those essential for scholarship or further follow-up by readers. If the reference is not a book or an article, provide appropriate documentation. Authors may choose to include a list of resources in their submission.

In writing please follow these prompts:

**Title:** Write short, catchy titles that capture the reader's attention and highlight the uniqueness of the program.

**Overview:** In the first paragraph, give a brief overview of

- problem addressed;
- policy issues involved (local, state, federal, organizational);
- geographic location and the populations targeted;
- approach used to resolve the problem; and
- results obtained.

**Description:** Provide enough detailed information about the program/policy/issue to enable the reader to decide whether this effort could be replicated and what resources it would take to do so. Mention the history of the program/policy/issue and, if relevant, describe the key stages in program/policy/issue development, from acquisition of resources to current operational status. Interesting or unusual aspects of the program that merit a more detailed description, such as participant perspectives, staffing needs, volunteer training, special problems and solutions, or compelling situations may merit a more detailed description under a separate heading or as a sidebar box to the article.

**Discussion and Evaluation:** Summarize the evidence for the program/policy/issue's effectiveness. What has been most successful and most disappointing in your appraisal? What could have been done differently? What additional resources would have helped? Be explicit about funding sources and program/policy/issue costs.

**Next Steps:** Assess the viability/sustainability of the program and future challenges and opportunities. Comment on practical experiences and implications for other programs.

**Key Findings:** Use 3 or 4 bullets to highlight key outcomes and public health implications of the program. Write in lay terms easily understood by policy makers, the media, and readers outside of the field of public health.

## **MANUSCRIPT SUBMISSION PROCESS AND FORM:**

All authors must sign and submit via surface mail the MJPH submission form. The form is available at:

<http://www.mipha.org/PHJournal/MJPH%20MANUSCRIPT%20SUBMISSION%20FORM.pdf>

Please send an electronic pdf copy of the signed manuscript submission form with the actual electronic manuscript submission. Send only electronic submissions to:

Julie Gleason-Comstock, PhD, MCHES, Editor  
[jgleason@med.wayne.edu](mailto:jgleason@med.wayne.edu)

# Table of Contents

## EDITORIAL

---

- Promoting the Translational Relationship between Public Health Practice and Research **7**  
*Julie Gleason-Comstock, PhD, MCHES*

## RESEARCH AND PRACTICE

---

- Contact Investigation of Bus Travelers Exposed to Passenger with Contagious Tuberculosis **11**  
*Pavarti Pillai, MD, Andrea Saunders, MSc, Tiffany Bateman, RN, G. Allen Heimann, MD, Paul J. Edelson, MD, Curi Kim, MD*
- Norovirus Epidemiology and Duration of Shedding in Michigan, 2007-2008 **24**  
*Nodira Abdumailova, MD, PhD, David Dixon Dixon, PhD, Laura Mosher, MS, Patricia Somsel, DrPH, Anthony Muyombwe, PhD, Patricia Clark, MPH, Jeffrey Massey, Dr.PH, Brenda Brennan, MSPH, Paul Bartlett, DVH, PhD, MPH*
- Could Mid-Level Dental Providers Increase Access to Oral Healthcare in Michigan? **53**  
*H Luke Shaefer, PhD, Renee Tetrick, Elizabeth Phillips, PhD*

## SPECIAL SECTION

---

- Public Health Partnerships in Action: A Selection of Session Presentations from the 2011 Michigan Premier Public Health Conference **85**  
*Julie Gleason-Comstock, PhD, MCHES, Teresa Wehrwein, PhD, RN, NNRA-BC*
- WISEWOMAN Gardening Project **86**  
*Robin Roberts, MA, Vicki Lorraine, MS, Helen DeFlorio*
- Community Assessments: Successful Strategies in Working with Collaborating Competitors **88**  
*MaryKay VanDriemel, EdD, RN, FACHE and Cathy Raevsky*
- Public Health Action in Addressing the Michigan Medical Marihuana Law **90**  
*Maurice S. Reizen, MD, Amy Ann Moore*
- Controlling Hospital Admission through Prevention Education: The Role of Community Health Workers **92**  
*Mimi Rankin, Peter Sartorius, MS, Greg Cline, PhD*
- A Review of Infant Mortality in Wayne County, Michigan **96**  
*Gerry Polverento, Heidi Hilliard, MPH*

Editorial

**Promoting the Translational Relationship  
between Public Health Practice and Research**

Public health has always been about a translational relationship between research and practice. Imbedded in public health practice core functions of assessment, policy development and assurance is a relationship with systemic, evidence-based research. The assurance process, in particular, embraces the full continuum of innovative research to provide for insight and solutions for public health challenges (Turnock, 2009).

The inaugural 2006 *Michigan Journal of Public Health (MJPH)* and Editorial Board of Directors were recognized by the American Public Health Association (APHA) President and APHA Committee on Affiliates Award for its commitment to peer review and publication of the continuum of public health practice, research and policy. This issue provides examples of that ongoing commitment with local, statewide and national/international public health content focusing on the Great Lakes Region, inclusive of the Canadian international border.

- Conference proceedings from the 2011 Michigan Premier Public Health Conference illustrate the community gardening partnership of six Northern Michigan Counties with Michigan State Extension Service emphasizing social determinants of health and sustainable behavior change (Roberts, Lorraine & DeFlorio, 2011)
- A Michigan study of prevalent norovirus strains proposes current public health recommendations for home isolation following clinical recovery may need to be

lengthened (Abdumailova, Dixon, Mosher, Somsel, Muyombew, Clark, et al., 2011).

- Results from a contact investigation of active infectious tuberculosis across the United State-Canadian border suggest multiple barriers to assessing the degree of transmission risk to bus contacts (Pillai, Saunders, Bateman, Heimann, Edelson, Kim, 2011)

The *Journal* continues to look towards the future. Discussion of public health initiatives relevant to The Patient Protection and Affordable Care Act of 2010 were described in an article about the H1N1 Pandemic and use of Michigan Care Immunization Registry information technology (Gleason-Comstock, Davis, Dixon, Heimann, 2009) and continue to be explored in this edition's article on the potential for increasing access to health care through mid-level dental providers (Shaefer, Tetrick, Phillips, 2011).

The translational relationship between public health practice and research is a two-way street. Two icons of public health publication continue to provide guidance for the *MJPH*. *Public Health Reports*, a journal published by the U.S. Public Health Services in collaboration with the Association of Schools of Public Health, continues to address bridging the practice-research gap, suggesting the translation of research to practice has numerous barriers, but noting the importance of developing mechanisms for communication between research and practice (Scutfield, Lamberth, 2010). The APHA *American Journal of Public Health* recently emphasized the importance of a paradigm shift in health disparities research to translational, transformational and transdisciplinary

increasingly focused on community engagement (Dankwa-Mullan, Rhee, Stoff, Pholhaus, Sy, Stinson, et al., 2010.) *MJPH* will continue to work on the strengthening of translational relationships between public health practice and research through its Editorial Review Board membership, publishing of public health conference proceedings and a commitment to expansion of the Research and Practice section with the goal of being indexed in the National Library of Medicine's PubMed database.

Julie Gleason-Comstock, PhD, MCHES

Editor, *Michigan Journal of Public Health*

[jgleason@med.wayne.edu](mailto:jgleason@med.wayne.edu)

## References

- Dankwa-Mullan I, Rhee K, Stoff D, Pohlhaus J, Sy F, Stinson N, Ruffin J. (2010)  
Moving toward paradigm-shifting research in health disparities through  
translational, transformational, and transdisciplinary approaches. *Amer J Public  
Health, 100* (S1): S19- S24.
- Scutchfield FD, Lamberth C. (2010). Public health systems and services research:  
bridging the practice-research gap. *Public Health Reports 125*: 628-633.
- Turnock B. (2009). Public Health: What It is and How It Works. 4<sup>th</sup> Ed. Sudbury, MA:  
Jones and Bartlett Publishers. [www.jbpub.com](http://www.jbpub.com)

Research and Practice

**Contact Investigation of Bus Travelers  
Exposed to a Passenger with Contagious Tuberculosis**

Parvathy Pillai, MD  
Office of Health Practice, University of Michigan School of Public Health  
Ann Arbor, Michigan, USA

Andrea Saunders, MSc  
Tuberculosis Prevention and Control  
Public Health Agency of Canada  
Ottawa, Ontario, Canada

Tiffany Bateman, RN  
TB/Respiratory Unit, Infectious Diseases Branch  
Ontario Ministry of Health and Long-Term Care  
Toronto, Ontario, Canada

G. Allen Heimann, MD  
Windsor-Essex County Health Unit  
Windsor, Ontario, Canada

Paul J. Edelson, MD  
Division of Global Migration and Quarantine,  
Centers for Disease Control and Prevention  
Atlanta, Georgia, USA

Curi Kim, MD  
Division of Global Migration and Quarantine,  
Centers for Disease Control and Prevention  
Atlanta, Georgia, USA

### **Abstract**

Multiple barriers exist to conducting contact investigations for tuberculosis after bus travel, and the degree of transmission risk to bus contacts is uncertain. We describe a patient with active infectious tuberculosis and the contact investigation that took place following her 5 hour bus trip across the United States-Canadian border.

## **Introduction**

Although exposure to persons with active tuberculosis on a bus likely carries the risk of transmission, it is not clear how great a risk is involved and what circumstances may affect that risk (Edelson & Phipers, 2011). While guidelines have been published for investigation of tuberculosis exposures on airplanes (World Health Organization [WHO], 2008), there are no generally recognized guidelines for investigating exposures on buses.

We present a case of a patient with active infectious TB who traveled by bus across an international border and the subsequent contact investigation among bus passengers. This case also highlights the coordinated efforts required among public health and border security authorities when responding to an infectious traveler. Because this investigation comprised a public health response based on regulatory authority, it was exempted from human subjects review.

## Case Report

A woman living in the Chicago metropolitan area was hospitalized in 2008 with fever, cough, weight loss, and fatigue. Chest radiograph demonstrated extensive alveolar infiltrates bilaterally and at least one cavity. Sputum smears demonstrated 4+ (“many”) acid-fast bacilli (AFB) on microscopy and was positive for *Mycobacterium tuberculosis* by polymerase chain reaction (PCR). *M. tuberculosis* was culture confirmed, and the isolate was determined to be susceptible to all first-line anti-tuberculosis medications.

Upon hospital discharge, the patient began directly observed therapy (DOT) with the local health department. However, 12 days after initiating therapy, the patient defaulted from treatment. Over the next 6 days, multiple attempts were made to locate her, at which time a family member reported that she may have traveled out of the country.

The local health authorities notified the U.S. Centers for Disease Control and Prevention (CDC) Chicago Quarantine Station about the case, and the patient was added to the Do Not Board (DNB) list. The DNB list, managed by CDC and the U.S. Department of Homeland Security (DHS), is a public health tool which prevents individuals with infectious conditions that may constitute a serious public health threat from boarding commercial aircraft. A Lookout record was also placed for this patient. A Lookout record is a DHS tool that prompts a thorough review of an individual if he or she attempts to enter the United States through an international airport, seaport or land border port of entry. DHS Customs and Border Protection (CBP) would be alerted to her potential as a public health threat and notify CDC (CDC, 2008). Within DHS, CBP and Coast Guard

officers are required, pursuant to 42 U.S.C. § 268(b), to aid CDC “in the enforcement of quarantine rules and regulations.” CDC’s authority to detain individuals at ports of entry stem from the Public Service Act (42 U.S.C, §§ 264-272), Interstate Quarantine (42 CFR Part 70), and Foreign Quarantine (42 CFR Part 71), which authorize the Secretary of the Department of Health and Human Services to create and enforce regulations to prevent the introduction, transmission, and spread of communicable diseases from foreign countries into U.S. states and territories.

Approximately 2 weeks later, the Lookout record alerted CBP that the patient was entering Detroit, Michigan from Windsor, Ontario on a commercial bus that originated in Toronto, Ontario. CBP notified the CDC Detroit Quarantine Station whose staff advised CBP to detain the patient at the border, provide her with a face mask, isolate her, and collect contact information from other passengers. The patient was hospitalized under a local emergency isolation order. Multiple sputum smears were AFB positive (+1 to +3), which subsequently grew *M. tuberculosis* on culture.

The bus route from Toronto to Detroit lasted approximately 5 hours, and the patient was observed coughing during travel. She was one of 33 passengers to board the bus in Toronto. Two hours later, the bus stopped in London, Ontario for 30 minutes where nine additional passengers boarded the bus and no one disembarked. Approximately 2 hours later, the bus stopped in Windsor and 27 passengers exited. Aside from the patient and her three immediate family members, 13 travelers, including two bus drivers, were on board when the bus crossed the border from Windsor to Detroit. A contact investigation

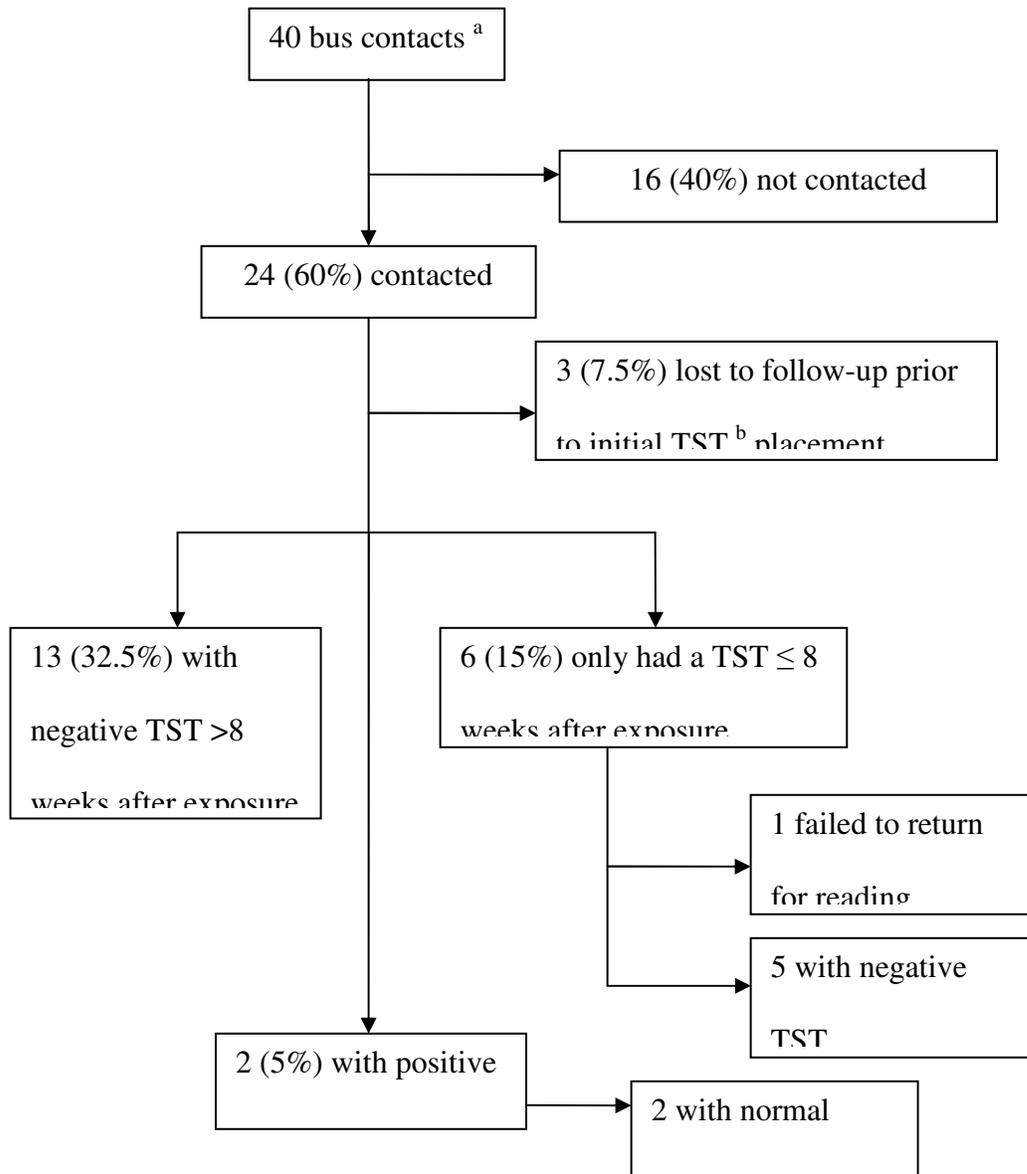
was initiated for the travelers still aboard the bus at the time of border crossing. As no locating information was available for the passengers who had exited the bus prior to the border crossing, the Ontario public health authorities issued a press release encouraging any passengers on this bus trip to seek medical care.

Of the 40 non-family member bus contacts, 24 were identified, including 13 contacts who crossed the border with the patient and 11 who responded to the Canadian press release (Figure 1). Most of these contacts were either Canadian or US citizens, and local public health agencies were informed about the passengers who resided in their jurisdictions; however, three contacts were neither US nor Canadian citizens and had returned to their home countries before they could be evaluated. Both US and Canadian contact investigation guidelines use a 5-mm cut-off size for interpreting a single tuberculin skin test (TST) result; if a negative TST result is obtained less than 8 weeks after exposure ended, a second TST should be placed no earlier than 8 weeks post-exposure (CDC, 2005; Tannenbaum, Yuan, and Wallington, 2007). Of the 21 individuals who were evaluated, 15 had complete evaluations: 13 had negative TST results at least 8 weeks after exposure and two had positive TST results (both had normal chest radiographs); one individual with a history of military service abroad had a 14 mm TST result at 6 weeks post-exposure and the other individual, who was born in a high-TB prevalence country, had a 15 mm TST result at 9 weeks. It is not known where these individuals sat on the bus in relation to the index case. Six individuals had incomplete evaluations: one person had a TST placed but did not return to have the test read and five had negative TST results within 8 weeks of exposure. Six individuals who tested negative at least 8 weeks

post-exposure were known to have boarded in Toronto, including two passengers seated within three rows of the index patient; data regarding origination of boarding is unknown for the remainder of the passengers.

**Figure 1**

*Investigation of travelers exposed to tuberculosis on a bus – United States and Canada, 2008*



*Note*

- a. Excludes 3 family members who also were on the bus and includes 2 bus drivers
- b. Tuberculin Skin Test
- c. One individual born in a high TB disease prevalence country ( $\geq 20$  cases/100,000 persons); the other with history of military service abroad (locations unknown)

## Discussion

Although likely transmission has been reported via a single bus or train trip exposure (Moore, Valway, Ihle, and Onorato, 1999), most published reports supporting the risk of TB transmission to other bus passengers have involved students who have had recurrent daily contact with the exposed individuals, often over a period of months (Neira-Munoz, Smith, Cockcroft, Basher, and Abubakar, 2008; Edelson & Phypers, 2011). In this case, exposure to an individual with infectious tuberculosis was for a single 5 ½-hour period on a commercial bus.

With fewer air exchanges per minute and no standard use of high-efficiency particulate air (HEPA) filters, the typical bus environment would likely be more conducive to transmission of respiratory pathogens than an airplane cabin (WHO, 2008; Huston, 2009). Unlike for airplanes, routine bus contact investigations are often not done. Bus travel typically does not involve assigned seating or retention of passenger manifests for more than 24 hours, which are both key tools in conducting airline contact investigations. With limited resources, bus investigations may be also regarded as a low priority compared to other TB control activities. Given these difficulties, the index patient should be determined to be highly infectious before a bus contact investigation is considered. This index patient had symptomatic, smear positive, cavitary TB, and two of her three immediate family members were found to have positive TST results in follow-up evaluation.

Utilizing the public health travel restriction tools facilitated this bus investigation by alerting CBP officials about the infectious traveler; CBP notified CDC quarantine staff of the situation before the passengers disembarked, which allowed CBP to obtain contact information at the port of entry. This underscores the value of the Lookout record and CDC-CBP cooperation in contact investigations.

Although 53% of the bus contacts began evaluation, the overall complete evaluation rate was only 38%, highlighting the difficulty in ensuring adequate follow-up, even with the collaboration of international, federal, state, and local health officials. This limited contact investigation did not identify probable transmission events. Only two bus contacts had positive TST results, which given other potential risk exposures could not be directly attributed to the recent bus travel.

Defining the risk of TB infection from bus exposures requires further study, especially considering the association of bus travel with low social economic status (SES) and the incidence of TB attributed to SES. Bus contact investigations under some circumstances appear feasible. Public health authorities should recognize the resources available to them to overcome some of the barriers to bus investigations while also emphasizing prevention. In general, travelers with communicable respiratory illness should be discouraged from boarding public conveyances.

### **Acknowledgements**

The authors gratefully acknowledge the following individuals for their assistance with the contact investigation (affiliations at time of investigation): Melinda Dixon, Vernard Green, City of Detroit Department of Health and Wellness Promotion; Shane Bies, Nancy Benavides, Oakland County Health Division; Candice Jemison, Wayne County Department of Public Health; Pamela Hackert, Ruta Sharangpani, University of Michigan School of Public Health; Peter Davidson, Michigan Department of Community Health; Demian Christiansen, Susan Marantz, Michael O. Vernon, Cook County Department of Public Health; Michael Lawson, East Tennessee Region, Tennessee Department of Health; Rose Marie Sales, Georgia Department of Human Resources; Frank Romano, Ohio Department of Health; Ann Hulvey, Marilyn Michaud, Public Health - Dayton & Montgomery County; Gabriel Palumbo, Nicole Cohen, Miguel Escobedo, Division of Global Migration, Centers for Disease Control & Prevention; Melanie Elms, Middlesex-London Health Unit; Elizabeth Rea, Toronto Public Health; Line Lauzon, Windsor-Essex County Health Unit; George Samuel, Ontario Ministry of Health and Long-Term Care.

### **Declaration of Conflict of Interest**

The authors report that they have no conflicts of interest.

### **Disclaimer**

The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the U.S. Centers for Disease Control and Prevention.

## References

- Centers for Disease Control and Prevention. (2008). Federal air travel restrictions for public health purposes-United States, June 2007-May 2008., *57*, 1009-1012.
- Centers for Disease Control and Prevention. (2005). Guidelines for the investigation of contacts of persons with infectious tuberculosis. *Morbidity and Mortality Weekly Report*, *54*, 1-37.
- Edelson P.J. & Phipers M. (2011). TB transmission on public transportation: a review of published studies and implications for contact tracing. *Travel Medicine and Infectious Disease*, *9(1)*, 27-31.
- Huston L. (2009). *Ultraviolet germicidal irradiation for transit buses (Final Report for Transit IDEA Project 53)*. Transportation Research Board. Retrieved July 22, 2009, from [http://www.trb.org/studies/idea/finalreports/transit/Transit53\\_Final\\_Report.pdf](http://www.trb.org/studies/idea/finalreports/transit/Transit53_Final_Report.pdf).
- Moore M., Valway S., Ihle W., & Onorato I. (1999). A train passenger with pulmonary tuberculosis: evidence of limited transmission during travel. *Clinical Infectious Disease*, *28*, 52-56.
- Neira-Munoz E., Smith J., Cockcroft P., Basher D., & Abubakar I. (2008). Extensive transmission of mycobacterium tuberculosis among children on a school bus. *Pediatric Infectious Disease Journal*, *27*, 836-837.
- Tannenbaum T., Yuan L., & Wallington T. (2007). Contact follow-up and outbreak management in tuberculosis control. In R. Long & E. Ellis (Eds.), *Canadian Tuberculosis Standards. 6<sup>th</sup> ed* (pp. 251-273). Ottawa: Tuberculosis Prevention and Control, Public Health Agency of Canada.

World Health Organization. (2008). *Tuberculosis and air travel - guidelines for prevention and control, 3<sup>rd</sup> ed* (WHO/HTM/TB/2008.399). Geneva, Switzerland: World Health Organization.

Research and Practice

**Norovirus Epidemiology and Duration of Shedding in Michigan, 2007-2008**

Nodira A. Abdujamilova, MD, PhD  
Michigan State University, College of Veterinary Medicine  
National Food Safety and Toxicology Center

David Dixon, PhD  
Michigan Department of Community Health  
Infectious Diseases Division, Bureau of Laboratories

Laura Mosher, MS  
Michigan Department of Community Health  
Infectious Diseases Division, Bureau of Laboratories

Patricia Somsel, DrPH  
Michigan Department of Community Health  
Infectious Diseases Division, Bureau of Laboratories

Anthony Muyombwe, PhD  
Michigan Department of Community Health  
Infectious Diseases Division, Bureau of Laboratories

Patricia A. Clark, MPH  
Michigan Department of Community Health  
Infectious Diseases Division, Bureau of Laboratories

Jeffrey Massey, DrPH  
Michigan Department of Community Health  
Infectious Diseases Division, Bureau of Laboratories

Brenda Brennan, MSPH  
Michigan Department of Community Health  
Infectious Diseases Division, Bureau of Laboratories

Paul C. Bartlett, DVM, PhD, MPH  
Michigan State University, College of Veterinary Medicine  
National Food Safety and Toxicology Center

## Abstract

**Background:** In the United States, an estimated 23 million cases of norovirus (NoV) are reported each year, and although mortality is low, the morbidity and economic impact are substantial.

**Methods:** RT-PCR and sequencing were used for identification of NoV genotypes obtained from outbreak and sporadic cases. RT Quant PCR was used to determine the viral load in fecal specimens. In order to rule out bacterial infection as the cause for acute gastroenteritis (AGE), bacterial culture for *Salmonella*, *E.coli O157*, *Shigella*, *Campylobacter* and *Clostridium difficile* was performed by standard laboratory procedures. The duration of NV shedding was investigated with longitudinal sampling in the sporadic cases and an evaluation of the association between viral load and days since clinical onset in the outbreak-associated cases.

**Results:** We describe the epidemiology and strain identification for NoV circulating in Michigan during 2007-8 in concurrent sporadic and outbreak-associated cases. In 2007-8, 138 norovirus outbreaks (3,437 cases) were reported to the MDCH. Among the 47 outbreak specimens sequenced, GI was identified in 14 (29.8%) and GII in 33 (70.2%). The predominant type was GII.4, found in 23 of the 33 (69.6%) GII specimens. The statistical analysis of outbreak-associated cases showed that neither NoV type nor number of days post-onset were associated with NoV log concentration. Among the sporadic cases, the repeated measures analysis of variance showed that NoV type (I or II)

was not associated with log titer ( $P = 0.90$ ), but that the number of weeks post-onset was statistically associated with declining log titer at  $p = 0.0005$ .

**Conclusion:** We found no predominant strain difference between concurrent sporadic and outbreak-associated cases. Prevalent strains of NoV were shed in high concentration for at least two weeks past disease onset, suggesting that current public health recommendations for 2-3 days home isolation following clinical recovery may need to be lengthened.

*Keywords:* public health, norovirus, epidemiology

## Background

Noroviruses (NoVs) are the leading cause of acute gastroenteritis (AGE) in adults, causing numerous outbreaks worldwide (Frankhauser et al, 2002; Siebenga et al, 2009; Patel et al, 2009). In the United States, an estimated 23 million cases of NoV occur annually. Although mortality is low, the morbidity and economic impact are substantial (Mead et al, 1999; Marks et al, 2003). Cases are most commonly attributed to contaminated food and/or drinking water, exposure to aerosolized feces or vomitus, direct or indirect oral contact with contaminated surfaces and direct fecal-oral transmission (Harrington et al, 2004).

Noroviruses are a group of non-cultivable, genetically diverse single-stranded RNA viruses belonging to the family *Caliciviridae*. They are classified into five genogroups based on the sequences of the RNA polymerase and capsid region of the genome. The genomes have three open reading frames (ORF). ORF1 encodes the nonstructural polyprotein, while ORF2 encodes the capsid protein and ORF3 encodes a putative minor structural protein (Symes et al, 2007). Genogroups I, II, and IV are associated with infections in humans. Currently, 32 genetic clusters have been identified (8 from GI; 19 from GII; 2 from GIII; 2 from GIV and one from GV), demonstrating a high degree of genomic diversity among NV (Ando, Noel & Frankhauser, 2000; Green et al, 2000; Wang et al, 2006; Martella et al, 2007).

In the U.S. approximately 50% of outbreak cases of waterborne and food-borne enteric diseases are due to NoV, but there is less information about sporadic cases of NoV

related AGE. (CDC, 2001, 2003; Monroe, 2005). Information regarding sporadic NoV is lacking due to the difficulty in obtaining fecal specimens from patients sufficiently early in the clinical course of their illness, and also because specimens for laboratory analysis are rarely obtained in the absence of an outbreak. In Michigan, the state health department laboratory normally only accepts clinical specimens for NoV diagnosis from outbreaks but not from sporadic cases.

It may be possible that different norovirus strains predominate among the sporadic NoV cases, and that patterns of disease progression and viral shedding may be very different among these sporadic cases compared with cases from recognized outbreaks.

Alternatively, sporadic NoV cases may result from low dose exposures to the same strains responsible for NoV outbreaks. Perhaps persons who have become ill by exposure to low doses of infectious particles may have a very different shedding pattern from individuals whose immune systems have been affected by massive doses of infectious particles as occurs in some outbreaks.

Most NoV outbreaks subside within 5-6 days, and the duration of symptoms in individuals is usually 48-72 hours (CDC, 2006). Health departments generally recommend that food handlers and health care providers stay at home for 2-3 days after clinical recovery. However, a recent report of an intentional NoV challenge showed that some people shed virus for as long as 2 or 3 weeks after clinical recovery, but it is unknown what percentage of naturally infected people will shed for these extended periods (Okhuysen et al, 1995; CDC, 2005; Atmar et al, 2008; Siebenga et al, 2008;

Kirkwood & Steitberg, 2008). Prolonged shedding of virus could increase the spread of NoV infection, thus it is possible that public health recommendations should be amended to increase the duration of home isolation of convalescing cases to reflect this prolonged shedding period.

Norovirus is one of the only enteric pathogen for which human challenge studies are ethically possible. While very helpful in elucidating NoV pathogenesis, these challenge studies were done with NoV from stored fecal specimens rather than from currently circulating strains. Challenge strains were derived from specimens collected before 1994 and from 1993-1996, respectively (Atmar et al, 2008; Phillips et al, 2009). Challenge studies may differ from naturally acquired infection in the challenge dose, method of transmission and the age and health status of the volunteers; challenge studies need to exclude volunteers with any underlying illnesses. It needs to be determined to what extent evidence of extended duration NoV shedding obtained from challenge studies can be generalized to naturally acquired infections.

Our objective in this study was to describe the epidemiology and strain identification for NoV circulating in Michigan during 2007-8 in concurrent sporadic and outbreak-associated NoV cases. We also sought to evaluate the duration of convalescent NoV shedding.

## Materials and Methods

**Outbreak Surveillance for NV in Michigan:** The policy of the Michigan Department of Community Health (MDCH) is to conduct outbreak-associated NoV testing on fecal specimens from no more than 6 people per outbreak. Specimens are routinely classified by PCR as negative or positive for viral RNA, and strains are typically classified only as GI or GII. In 2008, a descriptive epidemiologic analysis was conducted for each outbreak setting for which a sufficient number of specimens had been obtained. Forty-seven NoV-positive specimens from outbreak-associated cases were selected for sequencing and quantitative assessment. Selection of specimens was based on the availability of individual onset dates and a sufficient quantity of specimen available for further laboratory testing. Specimens came from 14 outbreaks in 12 Michigan counties during 2007-08. These 47 specimens were analyzed using the quantitative NoV PCR assay described below.

**Sporadic AGE Cases:** Fecal specimens were obtained from 18 volunteers with AGE whose symptoms were compatible with norovirus infection and who were not part of any recognizable outbreak. Volunteers included some university students, but most were referred to our study by participating local outpatient clinics who assisted us in distributing sampling supplies to persons they suspected of having NV infection. In addition to not being part of an outbreak of more than 2 associated cases, our sporadic cases were over 18 years of age, had no more than a low-grade fever, did not have bloody diarrhea, and did not suffer from recurring episodes of gastroenteritis. Onset fecal specimens were verified as negative for *Salmonella*, *E.coli O157*, *Shigella*,

*Campylobacter* and *Clostridium difficile* by standard MDCH laboratory procedures (MacFaddin, 1980; Bopp, Brenner & Fields, 2003; Nachamkin, 2003). Food service and health care workers were not included in this study because identification of a reportable enteric pathogen may have required them to be excluded from their workplace pending negative stool culture results. Study subjects were from local primary care clinics (2), community volunteers (15), and a nursing home (1). Stool specimens were requested at the onset of vomiting or diarrhea, 1 week after onset and 2 weeks after onset. Cases were paid an honorarium for participation, as approved by the IRB Committees at both MSU and MDCH.

The sporadic cases were screened to verify the absence of *Salmonella*, *Campylobacter*, *Clostridium difficile*, *Shigella*, and *E.coli O157*. The initial specimens were submitted in Cary-Blair transport media for bacterial culture. Stool samples were inoculated onto MacConkey (MAC), MacConkey Sorbitol, MacConkey Sorbitol with cefizime and tellurite (CT-SMAC), and Hektoen Enteric (HEK) plates and a tetrathionate enrichment broth and incubated aerobically at 35°C for 48 hrs. To demonstrate *Clostridium difficile*, an aliquot of stool was plated directly to a cycloserine cefoxitin fructose agar plate (CCFA) and incubated anaerobically. An additional aliquot was treated with ethanol for one hour at room temperature and then plated on an anaerobic blood agar plate. The plates were held for 96 hours before being discarded as negative. A *Campylobacter* blood agar plate was also inoculated and incubated microaerophilically at 42°C for 72 hrs. The tetrathionate broth was subcultured to a MAC and HEK after 24 hours incubation. All plates were read at 24-hour intervals, but held 48 hours before being reported as negative. Suspect organisms were identified using Gram's stain, colony morphology and

conventional biochemical tests (MacFaddin, 1980; Bopp, Brenner & Fields, 2003; Nachamkin, 2003).

### **RNA extraction, RT PCR, sequencing and RT Quant PCR.**

Stool specimens from both sporadic and outbreak-associated cases were suspended in sterile water (10 percent weight/volume). Specimens were centrifuged at 13000xg and the resulting supernatant was filtered through a 0.45 µM filter. NV RNA was extracted from 200 µl of the filtrate using QIAGEN QIAmp viral RNA mini kit (QIAGEN, Valencia, CA) according to the manufacturer's protocol. 5 µl of the eluted viral RNA suspension was used for RT PCR.

RT-PCR was performed using established primers and probes Cog 1F, Cog 1R, Ring 1A, Ring 1B, Cog 2F, Cog 2R and Ring 2 for region B as described previously (Kageyama et al, 2003).

Four primers that target the 3'-end of the RNA polymerase gene (region B) were used to detect strains of GI and GII genogroups. Primers, MON 432, MON 434 for detecting GI strains and MON 431, MON 433 for GII strains, yielding a 213 base pair amplicon (Anderson et al, 2001).

To analyze sequence information the biometrics applied MATH system was used. Sequences were blasted into a local database to provide similarities and dendrograms. The RT Quant PCR was performed using the Roche LightCycler 1.5 with 4.0 analysis software with the following modifications of the procedure described above: GI probes (Ring1a and Ring1b) were used at 400nm each and the volume of H<sub>2</sub>O in reaction mix was adjusted to allow for 5 µl of RNA (Trujillo et al, 2006). Standard curves for NV

quantification were generated using serial dilutions of GI and/or GII norovirus transcripts obtained from CDC and representing ORF1, 2 and 3 of the 3' region of G1.4 and GII.4 respectively.

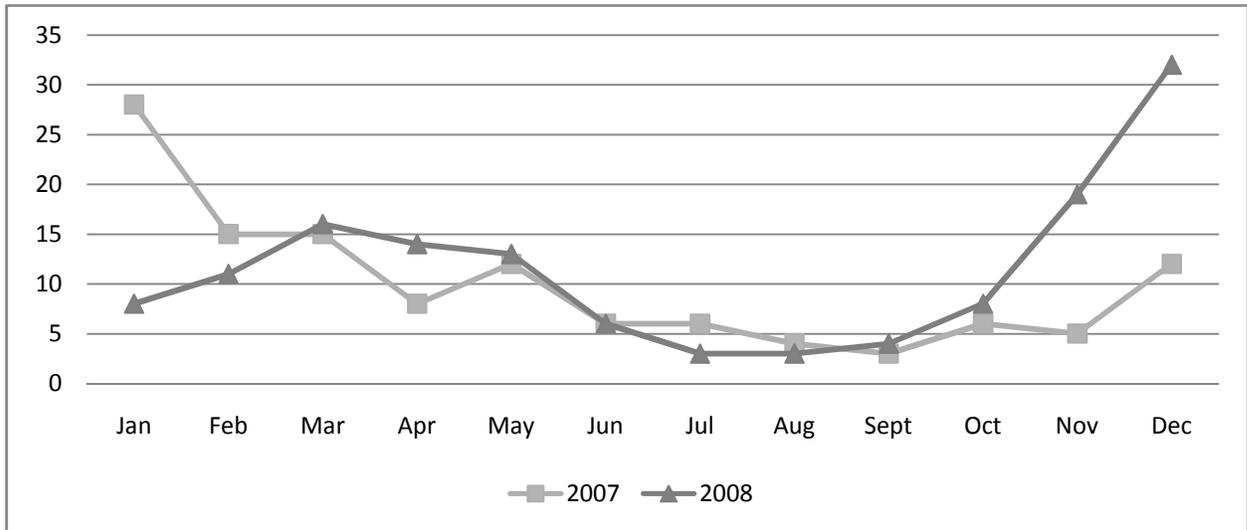
**Statistical analysis:** The outbreak-associated NoV concentrations were analyzed in a general linear model (SAS 9.1) with log concentration as the dependent variable and days post-onset and NoV group (I or II) as independent variables. The sporadic case data were analyzed as a mixed model with log titer as the repeated dependent variable and NoV type as the sole independent variable.

## Results

**Michigan NV Surveillance:** In 2008, 138 norovirus outbreaks (3,437 cases) were reported to the MDCH (Figure 1). Of these, 30 were confirmed by laboratory analysis of 2 or more collected specimens; 26 (87%) outbreaks were related to GII and 4 (13%) outbreaks were related to GI. The remaining 108 outbreaks were judged to have been NoV based on clinical and epidemiologic presentation. Most outbreaks (n=63) were associated with healthcare services, followed by restaurants (26), schools (25) and other settings (24).

**Figure 1**

*Reported Michigan Norovirus Outbreaks, 2007-2008*



**Outbreak-associated Cases:**

Among the 47 outbreak specimens sequenced, GI was identified in 14 (29.8%) and GII in 33 (70.2%) (Table1). The predominant type was GII.4, found in 23 of the 33 GII specimens (69.6%). The statistical analysis showed that neither NV type (I or II) nor days post-onset were associated with RNA log concentration, at  $p > 0.8$  in both instances.

**Table 1**

*Sequencing and Quantitative Assessment of Selected Michigan Norovirus Outbreak-associated Cases*

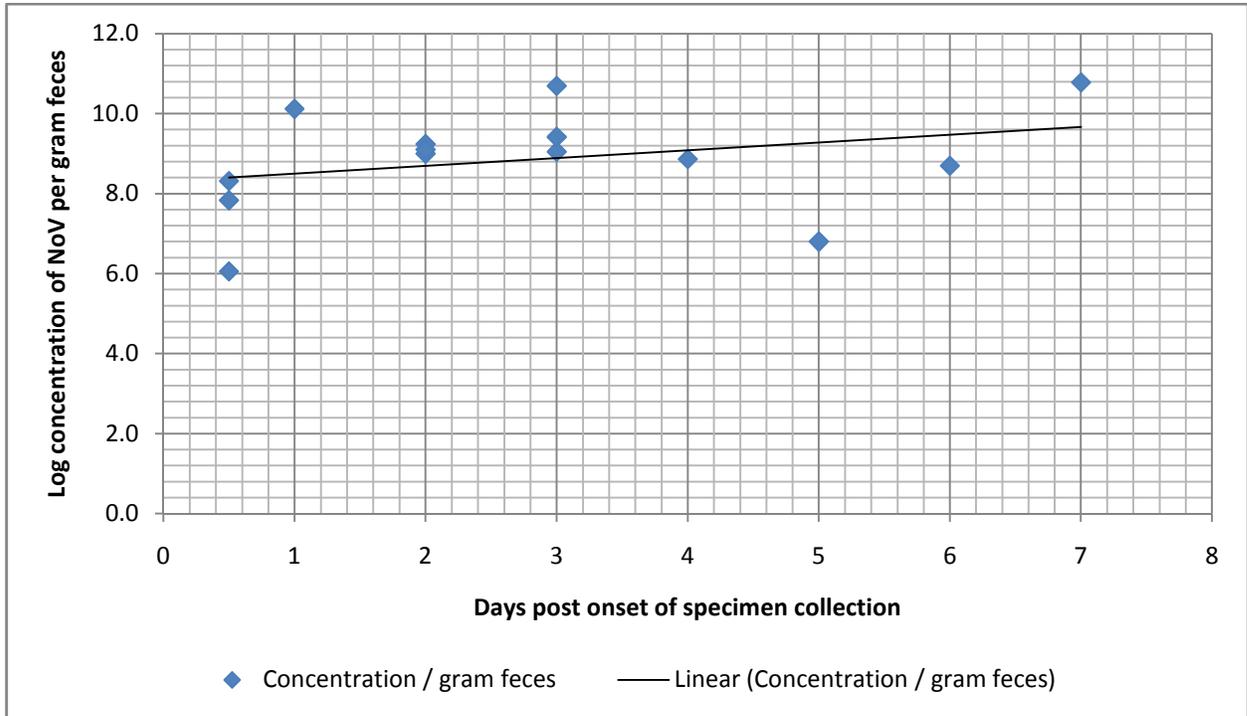
County	Date	Genotype	Specimen Number	Concentration / gram feces	Days Post Onset	Log Concentration / gram feces
Eaton	10/27/07	SaitamaT13-JPN_GI.2	O-1A	$2.07 \times 10^8$	0.5	8.3
			O-1B	$1.12 \times 10^9$	3	9.0
			O-1C	$1.72 \times 10^9$	2	9.2
			O-1D	$6.81 \times 10^7$	0.5	7.8
			O-1E	$1.14 \times 10^6$	0.5	6.1
			O-1F	$7.29 \times 10^8$	4	8.9
Berrien	11/13/07	Lit-USA94_GI.3 B	O-2A	$9.94 \times 10^8$	2	9.0
			O-2B	$6.02 \times 10^{10}$	7	10.8
			O-2C	$4.97 \times 10^8$	6	8.7
			O-2D	$2.61 \times 10^9$	3	9.4
			O-2E	$4.94 \times 10^{10}$	3	10.7
Jackson	12/13/07	SaitamaT13-JPN_GI.2	O-3A	$1.31 \times 10^{10}$	1	10.1
Calhoun	12/18/07	FMHill-USA_GII.4	O-4A	$9.76 \times 10^7$	4	8.0
			O-4B	$1.58 \times 10^8$	5	8.2
			O-4C	$1.14 \times 10^8$	4	8.1
Kalamazoo	12/20/07	Minerva2006 B (GII.4)	O-5A	$3.76 \times 10^8$	1	8.6
			O-5B	$3.17 \times 10^8$	2	8.5
			O-5C	$3.67 \times 10^{10}$	1	10.6
Genesee	12/21/07	SaitamaT13-JPN_GI.2	O-6A	$1.33 \times 10^9$	2	9.1
			O-6B	$6.27 \times 10^6$	5	6.8
Kent	1/11/08	FMHill-USA_GII.4	O-7A	$7.77 \times 10^8$	6	8.9
			O-7B	$1.83 \times 10^9$	6	9.3
			O-7C	$2.08 \times 10^9$	6	9.3
			O-7D	$4.70 \times 10^8$	5	8.7
Genesee	2/15/08	GN273-USA94_GII.7	O-8A	$2.70 \times 10^7$	1	7.4
			O-8B*	$1.53 \times 10^7$	3	7.2
			O-8C	$6.57 \times 10^8$	1	8.8
Mason	2/19/08	FMHill-USA_GII.4	O-9A	$1.84 \times 10^9$	5	9.3
			O-9B	$6.33 \times 10^{11}$	5	11.8
			O-9C	$2.33 \times 10^8$	1	8.4
			O-9D	$2.37 \times 10^8$	2	8.4

			O-9E	$7.53 \times 10^9$	4	9.9
			O-9F	$1.50 \times 10^8$	4	8.2
Genesee	3/7/08	SU1- JPN_GII.12	O-10A	$8.67 \times 10^9$	0.5	9.9
Menominee	3/19/08	FMHill- USA_GII.4	O-11A	$6.45 \times 10^8$	3	8.8
			O-11B	$1.71 \times 10^9$	3	9.2
Mecosta (DHD#10)	3/20/08	FMHill- USA_GII.4	O-12A	$6.69 \times 10^{10}$	1	10.8
			O-12B	$3.63 \times 10^9$	0.5	9.6
			O-12C	$3.19 \times 10^8$	1	8.5
Wayne	4/1/08	IDA- USA96_GII. 8B	O-13A	$5.33 \times 10^7$	8	7.7
			O-13B	$5.74 \times 10^8$	6	8.8
			O-13C	$5.46 \times 10^8$	6	8.7
			O-13D	$9.10 \times 10^7$	6	8.0
			O-13E	$3.98 \times 10^7$	7	7.6
			O-13F	$1.71 \times 10^8$	5	8.2
Western UP - Gogebic	5/15/08	FMHill- USA_GII.4	O-14A	$2.71 \times 10^8$	2	8.4
			O-14B	$1.49 \times 10^8$	4	8.2

\* Specimen did not sequence

**Figure 2**

*Concentration of Norovirus GI Particles per gram of Feces in Outbreak-associated Cases*



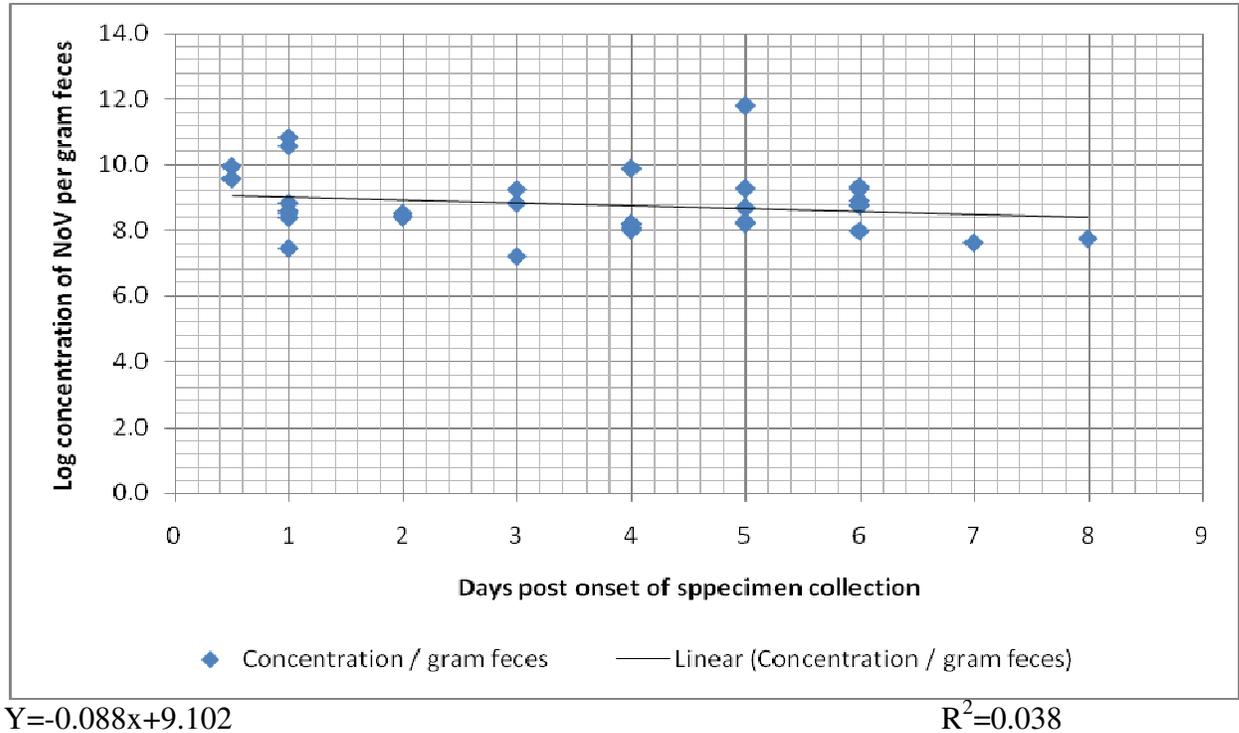
$Y=0.193x+8.306$

$R^2=0.091$

Convalescent shedding was observed in both GI and GII genotypes (Figures 2, 3). Our analysis of the outbreak-associated cases showed that viral shedding was detected in specimens collected as long as 8 days post-onset. The finding that days post-onset was not statistically associated with viral load means that we did not see any decrease in shedding in the days after disease onset. No information was available on duration of illness for these cases, but since NoV symptoms normally last 12-60 hours (CDC, 2001) it is likely that shedding continued several days past clinical recovery.

**Figure 3**

*Concentration of Norovirus GII particles per gram of Feces in Outbreak-associated Cases*



**Sporadic Cases:**

Culture results for *Salmonella*, *Shigella*, *Campylobacter*, *E.coli* O157, and *C.difficile* were negative for all sporadic cases. Ten of the 18 sporadic cases of AGE were positive for norovirus (Table 2). Specimens at onset were collected a mean of 1.2 days (range 0-3 days) after the first manifestation of diarrhea or vomiting. Norovirus GI were detected in 3/10 (30%) and GII sequences were detected in 7/10 (70%) of cases. Strain GII.4 was predominant, having been found in 4/7 (57%) of the GII cases. Duration of illness was a mean of 1.7 days (range 1 to 2) for the 7 cases where this information was available. The repeated measures analysis of variance showed that NoV type (I or II) was not associated

with RNA log titer (P=0.90) and that the number of weeks post onset of stool collection was statistically associated with declining RNA log titer at p=0.0005.

**Table 2**

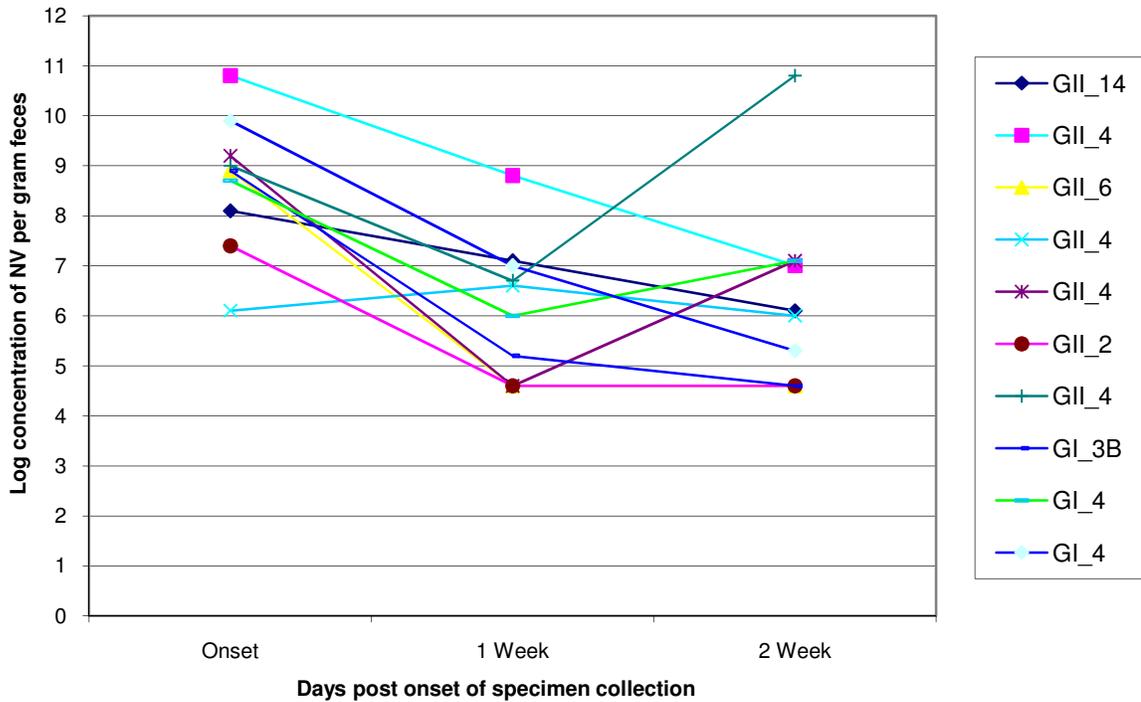
*Sequencing and Quantitative Assessment of Michigan Sporadic Norovirus Cases*

STUDY NUMBER	GENOTYPE	AGE	GENDER	ONSET	~ 1 WK POST ONSET*	~ 2 WK POST ONSET*
S-11	BerlinBA-DEU_GI.4	57	M	8.73 x 10 <sup>9</sup>	1.04 x 10 <sup>7</sup>	1.93 x 10 <sup>5</sup>
S-12	BerlinBA-DEU_GI.4	56	F	4.95 x 10 <sup>8</sup>	1.04 x 10 <sup>6</sup>	1.34 x 10 <sup>7</sup>
S-104	GII.14_0732OH_USA00	19	F	1.20 x 10 <sup>8</sup>	1.13 x 10 <sup>7</sup>	1.37 x 10 <sup>6</sup>
S-111	GII.4_FMHiill_USA	49	F	6.85x 10 <sup>10</sup>	5.99 x 10 <sup>8</sup>	1.12 x 10 <sup>7</sup>
S-112	GII.6_FLO_USA93	25	F	8.02 x 10 <sup>8</sup>	≤3.86 x 10 <sup>4</sup>	≤3.86 x 10 <sup>4</sup>
S-113	GII.4_FMHiill_USA	24	F	1.28 x 10 <sup>6</sup>	3.68 x 10 <sup>6</sup>	1.00 x 10 <sup>6</sup>
S-116	GI.3B-LR316_USA94	31	F	7.29 x 10 <sup>8</sup>	1.47 x 10 <sup>6</sup>	≤3.86 x 10 <sup>4</sup>
S-121	GII.4_FMHiill_USA	50	F	1.61 x 10 <sup>9</sup>	≤3.86 x 10 <sup>4</sup>	1.20 x 10 <sup>7</sup>
S-123	682_USA_GII.2	37	F	2.39 x 10 <sup>7</sup>	≤3.86 x 10 <sup>4</sup>	≤3.86 x 10 <sup>4</sup>
S-124	GII.4_FMHiill_USA	54	F	1.08 x 10 <sup>9</sup>	4.85 x 10 <sup>6</sup>	6.33 x 10 <sup>10</sup>

\*Concentration of NoV particles per gm feces at onset and 1 and 2 week post-onset. Specimens with concentrations listed as ≤3.86 x 10<sup>4</sup> did not amplify, and therefore this concentration is a minimum level of detection for the analysis and indicates that there were less than 64 transcripts (target sequences) for amplification in the 5 µl sample.

**Figure 4**

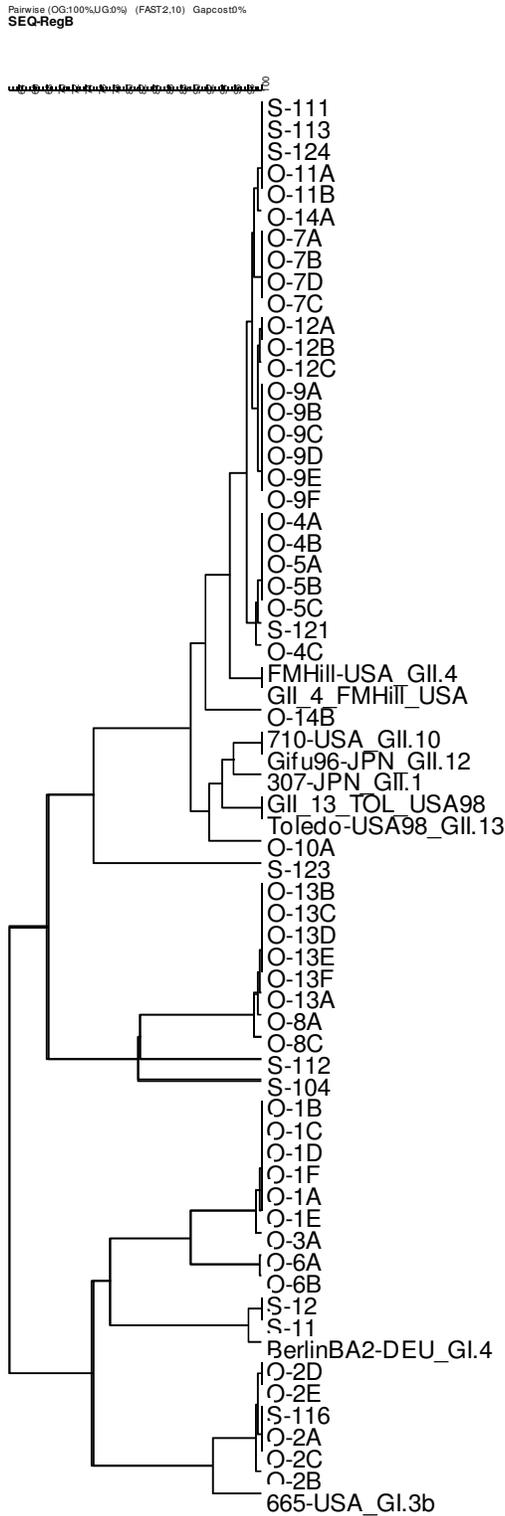
*Concentration of Norovirus RNA Versus the Number of Days Post Onset of Specimen Collection for 10 Michigan Sporadic Cases.*



The issue of shedding duration is better addressed in our longitudinal database of sporadic NoV cases where specimens were collected from each person at 0, 1 and 2 weeks post onset. A downward sloping trend was detected for all but one case, and no significant difference in slope was seen between GI and GII strains (Figure 4). While showing a statistically decreasing trend in viral load, titers of log 4 to 10 were still being shed after 2 weeks.

**Figure 5**

*Phylogenetic Tree of Sporadic (S) and Outbreak-associated Cases (O) Based on Similarity to CDC Reference Strains.*



We saw no distinctive strain differences between the sporadic and outbreak-associated NoV cases (Figure 5). Our findings agree with other reports that both GI and GII were circulating in Michigan and other U.S. states during 2008 (CDC, 2009).

## Discussion

### Duration of Shedding:

Our study of outbreak-associated and sporadic cases showed that viral shedding was observed in the specimens obtained up to 8 days post-onset and after 2 weeks, respectively. As such this finding is inconsistent with the theory that shedding rapidly subsides within a couple of days of disease onset.

Determining the duration of shedding is of paramount importance in establishing public health policy regarding the prevention of transmission from NoV convalescent carriers. Public health isolation precautions may need to be extended beyond 2-3 days post recovery given the reportedly small infectious dose of < 100 NoV particles, the high environmental stability, and the current information regarding the lengthy and high-titer NoV convalescent shedding of NoV (Kapikian, Estes & Chanock, 1996; LeBaron et al, 1990; CDC, 2003; Widdowson et al, 2005).

However, it has been suggested that some post infection detection may be non-infectious soluble viral antigen without public health significance (CDC,2001). Recent studies show that NoV genome can survive in water at 4<sup>0</sup>, 25<sup>0</sup> and -20<sup>0</sup>C for up to 2 months. Viral degradation was lower at 4<sup>0</sup> and -20<sup>0</sup>C compared to 25<sup>0</sup>C. Complete degradation of the genome was observed after 100 days (Ngazoa, Fliss & Jean, 2008). Infectivity studies are needed to determine how much of the shedding from a convalescent carrier is infectious, however, such studies are problematic for a disease agent without an established animal model.

Norovirus infection is somewhat unique among etiologies of food-borne disease in that the benign nature of the disease allows researchers to purposefully challenge human volunteers in order to study the disease syndrome. Only one NoV strain was used for each challenge study, but this may not have been the strain that was currently circulating among the human population. Persons made ill by naturally acquired infectious particles at low doses may have very different shedding patterns from individuals whose immune systems were overwhelmed by massive doses of infectious particles. Additionally, human volunteers for challenge studies cannot ethically include the very young, old and chronically ill (Atmar et al, 2008). Challenge volunteers, who are institutionalized for the duration of the challenge study, could have a very different standard of supportive care from self-treated cases occurring in the community. For all these reasons, field studies are still necessary for studying the epidemiology and ecology of sporadic and outbreak-associated NoV cases under natural conditions of exposure, transmission and host susceptibility.

The lowest infectious doses for norovirus are estimated to be 10 to 100 virus particles (FDA, 2007). Recent studies showed that the infectious dose depended on the genetics of the volunteers; 50 to 62% of the volunteers who had an epithelial binding gene (Se+), developed diarrhea when they were given doses from  $10^4$  to  $10^8$  viral particles and whereas volunteers who did not have the gene (S-) remained well with doses up to  $10^8$  viral particles (Lindesmith et al, 2003; Hutson et al, 2005). Also, the viral RNA load of

GII was found to be 100-fold higher than that of GI in fecal specimens of patients with norovirus-associated gastroenteritis (Chan et al, 2006).

In conclusion, we found no dramatic strain differences between sporadic and outbreak-associated cases of NoV. The prevalent strains of NoV in both the sporadic and outbreak-associated cases were shed in high concentration for at least two weeks past disease onset, suggesting that current public health recommendations regarding hygienic precautions for convalescent carriers may need to be re-evaluated.

### **Acknowledgements**

This project is funded entirely with federal funds from NIAID, NIH, Department of Health and Human Services, under Contract No. N01-AI-30058. This project was approved by Michigan State University's Biomedical and Health Institutional Review Board. We would like to acknowledge and thank Nancy Rentz for help in collection of the specimens and Dr. Julia Bell for help with preparing materials for the article.

## References

- Atmar RL, Opekun AR, Gilger MA, Estes MK, Crawford SE, Neill FH, Graham DY. (2008). Norwalk virus shedding after experimental human infection. *Emerg Infect Dis.* 2008;14(10):1553-7.
- Anderson AD, Garrett VD, Sobel J, Monroe SS, Fankhauser RL, Schwab KJ, Bresee JS, Mead PS, Higgins C, Campana J, Glass RI; Outbreak Investigation Team. (2001). Multistate outbreak of Norwalk-like virus gastroenteritis associated with a common caterer. *Am J Epidemiol.* 154(11):1013-1019.
- Ando T, Noel JS, and Fankhauser RL. (2000). Genetic classification of Norwalk-like viruses. *J. Infect. Dis.* 181:S336–S348.
- Bopp CA, Brenner FW, and Fields PI. *Escherichia, Shigella, and Salmonella.* In: Murray PR, Baron EJ, Jorgensen JH, et al. (2003). *Manual of Clinical Microbiology.* Ed 8. Washington, DC: ASM Press.
- Centers for Disease Control and Prevention. (2002). Norwalk-like Viruses: Public Health Consequences and Outbreak Management. *MMWR Vol 50.* 1-18. June 1, 2001
- Centers for Disease Control and Prevention. (2003). Norovirus Activity – United States, 2002. January 24. *MMWR 52(03):*41-45.
- Centers for Disease Control and Prevention. (2005). Norovirus Fact Sheet. Respiratory and Enteric Viruses Branch. Rotavirus.  
<http://www.cdc.gov/ncidod/dvrd/revb/gastro/norovirus-factsheet.htm>
- Centers for Disease Control and Prevention. (2006). Noroviruses and Food Handlers.  
<http://www.cdc.gov/ncidod/dvrd/revb/gastro/norovirus-foodhandlers.htm>

- Centers for Disease Control and Prevention. (2008). Norovirus Outbreaks on Three College Campuses - California, Michigan, and Wisconsin. October 09, 2009. MMWR 58(39); 1095-1100.
- Chan MC, Sung JJ, R. K. Lam RK, Chan PK, Lee NL, Lai RW, and Leung WK. (2006). Fecal viral load and norovirus-associated gastroenteritis. *Emerg. Infect. Dis.* 12:1278–1280.
- Frankhauser RL, Monroe SS, Noel JS, Humphrey CD, Bresee JS, Parashar UD, Ando T, and Glass RI. (2002). Epidemiologic and molecular trends of “Norwalk-like viruses” associated with outbreaks of gastroenteritis in the United States. *J. Infect. Dis.* 186:1-7.
- Green KY, Ando T, Balayan MS, Berke T, Clarke IN, Estes MK, Matson DO, Nakata S, Neill JD, Studdert MJ, and Thiel HJ. (2000). Taxonomy of the caliciviruses. *J. Infect. Dis.* 181(Suppl. 2):S322–330.
- Harrington PR, Vinjé J, Moe CL, and Baric RS. (2004). Norovirus Capture with Histo-Blood Group Antigens Reveals Novel Virus-Ligand Interactions. *J Virol.* 78(6): 3035–3045.
- Hutson AM, Airaud F, LePendu J, Estes MK, and Atmar RL. (2005). Norwalk virus infection associates with secretor status genotyped from sera. *J. Med. Virol.* 77:455.
- Kageyama T, Kojima S, Shinohara M, Uchida K, Fukushi S, Hoshino FB, Takeda N, Katayama K. (2003). Broadly reactive and highly sensitive assay for Norwalk-like viruses based on real-time quantitative reverse transcription-PCR. *J Clin Microbiol.* 41(4):1548-57.

- Kapikian AZ, Estes MK, Chanock RM. (1996). Norwalk group of viruses. In: Fields BN, Knipe DM, Howley PM, eds. *Fields virology*. 3<sup>rd</sup> ed. Philadelphia, PA: Lippincott-Raven, 783--810.
- Kirkwood CD, Streitberg R. (2008). Calicivirus shedding in children after recovery from diarrhoeal disease. *J Clin Virol*. 43(3):346-8.
- LeBaron CW, Furutan NP, Lew JF, et al. (1990). Viral agents of gastroenteritis: public health importance and outbreak management. *MMWR*. 39(RR-5):1--24.
- Lindesmith L, Moe C, S. Marionneau, Ruvoen N, Jiang X, Lindblad L, Stewart P, LePendu J, and Baric R. (2003). Human susceptibility and resistance to Norwalk virus infection. *Nat. Med*. 9:548–553.
- MacFaddin JF. (1980). *Biochemical tests for identification of medical bacteria*. 2nd ed. Williams & Wilkins, Baltimore, Md.
- Marks PJ, Vipond IB, Regan FM, Wedgwood K, Fey RE, and Caul EO. (2003). A school outbreak of Norwalk-like virus: evidence for airborne transmission. *Epidemiol. Infect*. 131:727–736.
- Martella V, Campolo M, Lorusso E, Cavicchio P, Camero M, Bellacicco AL, Decaro N, Elia G, Greco G, Corrente M, Desario C, Arista S, Banyai K, Koopmans M, Buonavoglia C. (2007). Norovirus in captive lion cub (*Panthera leo*). *Emerg Infect Dis*. 13(7):1071-1073.
- Mead PS, Slutsker L, Dietz V, McCaig LF, Bresee JS, Shapiro C, Griffin PM, and Tauxe RV. (1999). Food-related illness and death in the United States. *Emerg. Infect. Dis*. 5:607–625.
- Monroe S. CaliciNet / IDMEDS. (2005). Div of Viral and Rickettsial Diseases. CDC.

- Nachamkin I. *Campylobacter* and *Arcobacter*. (2003). In *Manual of Clinical Microbiology*, pp. 902–914. Edited by P. R. Murray, E. J. Baron, J. H. Jorgensen, M. A. Tenover & R. H. Tenover. Washington, DC: American Society for Microbiology.
- Ngazoa ES, Fliss I, Jean J. (2008). Quantitative study of persistence of human norovirus genome in water using TaqMan real-time RT-PCR. *J Appl Microbiol.* 104(3):707-15.
- Okhuysen PC, Jiang X, Ye L, Johnson PC, and Estes MK. (1995). Viral shedding and fecal IgA response after Norwalk Virus Infection. *J Infect Dis.* 171:566-9.
- Patel MM, Hall AJ, Vinjé J, Parashar UD. (2009). Noroviruses: a comprehensive review. *J Clin Virol.* 44:1-8.
- Phillips G, Lopman B, Tam CC, Iturriza-Gomara M, Brown D, Gray J. (2009). Diagnosing norovirus-associated infectious intestinal disease using viral load. *BMC Infect Dis.* 14;9:63.
- SAS 9.1. SAS Institute Inc., Cary, NC, USA.
- Siebenga JJ, Beersma MF, Vennema H, Van Biezen P, Hartwig NJ, Koopmans M. (2008). High prevalence of prolonged norovirus shedding and illness among hospitalized patients: a model for in vivo molecular evolution. *J Infect Dis.* 198(7):994-1001. Erratum in: *J Infect Dis.* 198(10):1575.
- Siebenga JJ, Vennema H, Zheng DP, Vinjé J, Lee BE, Pang XL, Ho EC, Lim W, Choudekar A, Broor S, Halperin T, Rasool NB, Hewitt J, Greening GE, Jin M, Duan ZJ, Lucero Y, O’Ryan M, Hoehne M, Schreier E, Ratcliff RM, White PA, Iritani N, Reuter G, Koopmans M. (2009). Norovirus illness is a global problem:

- emergence and spread of norovirus GII.4 variants, 2001-2007. *J Infect Dis.* 200(5):802-12.
- Symes SJ, Gunesekere IC, Marshall JA, Wright PJ. (2007). Norovirus mixed infection in an oyster-associated outbreak: an opportunity for recombination. *Arch. Virol.* 152(6):1075-86.
- Trujillo AA, McCaustland KA, Zheng DP, Hadley LA, Vaughn G, Adams SM, Ando T, Glass RI, Monroe SS. (2006). Use of TaqMan real-time reverse transcription-PCR for rapid detection, quantification, and typing of norovirus. *J Clin Microbiol.* 44(4):1405-12.
- U.S. Food and Drug Administration. (2007). Bad bug book. [http://vm.cfsan.fda.gov/\\_mow/intro.html](http://vm.cfsan.fda.gov/_mow/intro.html).
- Wang QH, Souza M, Funk JA, Zhang W, Saif LJ. (2006). Prevalence of noroviruses and sapoviruses in swine of various ages determined by reverse transcription-PCR and microwell hybridization assays. *J Clin Microbiol.* 44(6):2057-2062.
- Widdowson MA, Sulka A, Bulens SN, Beard RS, Chaves SS, Hammond R, Salehi ED, Swanson E, Totaro J, Woron R, Mead PS, Bresee JS, Monroe SS, Glass RI. (2005). Norovirus and foodborne disease, United States, 1991-2000. *Emerg Infect Dis.* 11(1):95-102.

Research and Practice

**Could a Mid-Level Dental Provider Increase  
Access to Oral Health Care in Michigan?**

H. Luke Shaefer, PhD  
Assistant Professor  
University of Michigan School of Social Work

Renee Tetrick  
MSW Student  
University of Michigan School of Social Work  
MPP Student  
University of Michigan Ford School of Public Policy

Elizabeth Phillips, PhD  
Research Associate  
University of Michigan School of Social Work

### **Abstract**

According to a 2000 Surgeon General's report, the United States faces an epidemic of unmet oral health needs, the result of both the high cost of care and geographic maldistribution of providers. This article assesses the extent of this unmet health care needs in Michigan, and examines one possible solution: the introduction of a mid-level dental provider (MDP) who could provide preventive and basic restorative care, under the supervision of a Michigan dentist. MDPs in various forms currently practice in over 50 countries including Canada and the U.K. The evidence suggests that a large and rigorous pilot of mid-level dental providers should be undertaken in Michigan, to inform policymakers about the structure's potential for improving access to oral health care for vulnerable populations in the state.

## **Introduction**

According to the Surgeon General's landmark report, *Oral Health in America*, "you cannot be healthy without oral health" (USDHHS, 2000). However, over one-third of American households report skipping dental care or dental examinations because of cost (Kaiser, 2009). Further, "profound and consequential" oral health disparities exist in this country (USDHSS, 2000). Both the high cost of care and the geographic mal-distribution of providers create barriers to care, and improving access is a vital step toward increasing the overall health of individuals, as well as society at large.

One potential solution to the problem of unmet oral health needs is the introduction of a mid-level dental provider (MDP). MDPs already provide basic preventive and basic restorative care in over 50 countries worldwide, in two U.S. states, and could do so in Michigan as well. This article examines the extent of unmet oral health care needs in Michigan, and makes the case that Michigan should consider creating a mid-level licensure that expands the scope of practice of dental hygienists to include basic restorative care such as fillings and simple extractions. Such a provider would work under the supervision of a Michigan dentist, who could be off-site. The evidence suggests that a rigorous pilot of mid-level dental providers should be undertaken, under the leadership of one or both of the dental schools in Michigan, to inform policymakers about the structure's potential for improving access to oral health care for vulnerable populations in Michigan.

## Why Oral Health Care Matters

Oral disease affects millions, disproportionately impacting those in poverty, the elderly, and children.<sup>1</sup> Tooth decay is the single most common chronic disease of childhood (USDHHS, 2000). Oral health problems in childhood are critical, because oral pain can negatively impact a child's learning, nutrition, and sleep. Moreover, lack of dental care in childhood can lead to long-term health problems and medical expenses, as oral diseases are progressive and cumulative (USDHHS, 2000), with the costs compounding over time. Many who cannot find or afford a dentist end up in hospital emergency rooms. A study of seven hospitals in the Twin City metropolitan area in Minnesota reportedly traced over 10,000 ER visits to toothaches, abscesses, and other untreated dental problems (Johnson, 2011). Yet, oral disease is largely preventable.

In *Oral Health in America*, the Surgeon General decried a “silent epidemic” of oral disease “affecting our most vulnerable citizens” and described the public health infrastructure for oral health as insufficient to meet the needs of disadvantaged groups (USDHSS, 2000). Unfortunately, despite widespread acknowledgement of the problem, little real progress has been made (Gehshan, 2008; Hilton and Lester, 2010). Nationally, utilization of dental services by children enrolled in public dental programs has increased somewhat, from 25% in 1999 to 38% in 2008 (Edelstein, 2010a). This improvement has been attributed to Medicaid/CHIP enhancements, and increased professional awareness. At the same time, since the Surgeon General's report, rates of oral disease have actually

---

<sup>1</sup> Much of the evidence on access to oral health care in Michigan was first reported by one of the authors of the current manuscript, Renee Tetrick, in (2011), “Addressing Unmet Oral Health Care Needs in Michigan with a Mid-level Dental Provider.” *Michigan Journal of Social Welfare*, 2(1), 85-97, and is revised and included in the current manuscript under MJSW's open-access copyright guidelines.

increased for young children, and economic and racial/ethnic disparities persist (Edelstein and Chinn, 2009).

### **Access to Oral Health Care in Michigan**

Children, in particular, face serious barriers to oral health care in Michigan. The 2005 Count Your Smiles (CYS) survey of Michigan third graders found that nearly one in ten had immediate dental care needs (pain, infection, swelling). According to parent reports, over one in eight had experienced a toothache in the past six months, and one in four had untreated dental disease. Nearly one in six lacked dental insurance, twice the rate lacking general health insurance (MDCH, 2006). Children without dental insurance had greater rates of dental disease, and much less access to care, than children with insurance. While overall 84% of Michigan's third graders had visited a dentist in the preceding year, roughly one in nine had been unable to obtain dental care.

The CYS also found that children living in the Upper Peninsula and northern Lower Peninsula (LP) have the highest rates of untreated decay. The rural southern LP has the highest rate of uninsured children, while the urban southern LP has the highest rates of children with immediate dental needs (17.4%). Toothache is most common among children in the city of Detroit. Difficulty obtaining dental care disproportionately affects Latino and African-American children, with nearly 10% of Latino children not having seen a dentist in three or more years.<sup>2</sup> Of course, cultural values and practices, such as baby-bottle use (including putting a child to bed with a bottle of juice, which can lead to

---

<sup>2</sup> While widely cited, the statistics from the CYS are subject to large sampling error, particularly with respect to sub-populations.

tooth decay), can also impact oral health. To the extent that current demographic trends continue and the widening income gap persists, we can expect these disparities to exacerbate over time (Edelstein, 2009).

Access to dental care is also a barrier for older adults, the disabled, and pregnant women. Data from the 2008 Behavioral Risk Factor Survey (BRFS) indicate that 25% of Michigan's older adults had not seen a dentist in over a year, despite need being great among this population (MDCH, 2010). Barriers such as affordability, lack of insurance (often lost upon retirement), institutional living and transportation in particular, are all contributing factors. Also, the elderly often take medications that can have oral side effects (USDHSS, 2000), and disproportionately suffer from oral cancer. If caught early, oral cancer is treatable. However in Michigan, only 40% of oral cancer cases are diagnosed when still localized, and African-Americans in Michigan are 1.5 times more likely to die from oral cancer than are non-African-Americans (MDCH, 2010).

Just as the elderly are more susceptible to certain conditions, pregnant women are at heightened risk. Though inconclusive as to causality, a correlation has been found between periodontal disease and preeclampsia (Buerlein, et al, 2010), and women with chronic oral infections may be more likely to give birth prematurely (USDHSS, 2000). What has been established is that mother-to-child transmission of bacteria (via saliva) is the primary means through which children first acquire dental caries (Buerlein, et al, 2010). Controlling oral disease in pregnant women thus has the potential to not only improve the oral health of women, but also of children. Unfortunately, many dentists are

uncomfortable treating pregnant women, and tend to delay treatment despite the fact that the benefits of providing dental care during pregnancy far outweigh any potential risks (California Dental Association, 2010). In addition, given that over 40% of births in Michigan are now covered by Medicaid (Casey, 2009), the on-again / off-again nature of adult dental coverage under Medicaid can only serve to increase vulnerability.

Individuals with developmental disabilities also have higher treatment needs than the general population. Studies indicate that this is due to difficulties accessing care, as well as to personal limitations with respect to oral hygiene (MDCH/MOHC, 2006).

According to the 2008 BRFSS, people with disabilities are less likely to have dental insurance than those without a disability (66% vs. 72%), and the disabled are more likely than the general population to have faced cost barriers to care during the past year (MDCH, 2010). Through the Donated Dental Program, the Michigan Dental Association works with the state Department of Community Health to identify dentists who will donate care to the elderly and disabled, however according to the MDCH website, wait lists are often two years or more.

In Michigan, like the U.S. generally, low-income individuals are disproportionately affected by oral disease. Those living below poverty are less likely to visit a dentist or have their teeth cleaned than are the more affluent. According to the 2008 BRFSS, nearly half of the state's adults with incomes less than \$20,000 had not visited a dentist in the prior year, while only 20% of those with household incomes between \$50,000 and \$75,000 had not. Likewise, those with less than a high school education were two times

less likely to have visited the dentist in the prior year than were all adults. And, while 16% of adults in Michigan over the age of 65 have lost all their teeth, 21% of Detroit's seniors have (MDCH, 2010). The fact that root canals are both expensive and generally not covered by emergency Medicaid may help explain the high rate of tooth extractions in Detroit.

### **Capacity, the Dental Workforce, and Geographic Distribution of Providers**

Current data suggest that Michigan's dental workforce is not large enough to meet the demand for oral health care in Michigan, as is true elsewhere elsewhere (MDCH, 2009a). Indeed, nationally, the dentist to population ratio is significantly below the physician to population ratio, and declining (Mertz and O'Neil, 2002). The majority of dentists practice in the suburbs, with few working in high-need rural or inner-city areas (Nash, 2009a). The high rate of debt among dental school graduates is often cited as a contributing factor in terms of practice location (USDHSS, 2000; Public Sector Consultants, 2010a). Nationally, only about 3% of dental school seniors plan to work in rural areas, and less than 3% ultimately plan to work in government service or community clinics (Okwuje, Anderson, and Valachovic, 2009). Some parts of the state have virtually no dentists; in 2007, twelve counties had fewer than five dentists, and one had not a single dentist at all (MDCH, 2010). In addition, whereas in the U.S. as a whole, 70% of all community-based health centers and local health departments have oral health components, in Michigan only 38% do (MDCH, 2010), and the state's community health centers often have lengthy wait lists (Public Sector Consultants, 2010a).

According to data from the 2010 MDCH Survey of Dentists, only half of the state's dentists plan to continue practicing more than ten years (Public Sector Consultants, 2011). At the same time, the state appears to have a surplus of dental hygienists.

According to the 2009 MDCH Survey of Dental Hygienists, 3% are employed in another field, 4% are actively looking for work, and 25% would like to work more hours. Of those looking for work, 86% reported difficulty finding a position (Public Sector Consultants, 2010b). A notable lack of racial/ethnic diversity in the dental workforce is also evident. In 2010, 87% of the state's dentists were white; only 3% were African-American and 1% were Latino (Public Sector Consultants, 2011). The high cost of dental education is no doubt a contributing factor to this disproportionate representation (USDHSS, 2003). To the extent that people are more comfortable with, and receptive to, receiving care and advice from somebody they feel they can relate to, this is problematic.

### **Lack of Insurance, Public Insurance, and Access to Care**

While noting that some communities even lacked enough dentists to care for privately insured patients, Michigan's 2010 Oral Health Plan report finds a serious shortage of dentists willing to care for uninsured and publicly insured populations in the state (MCDH, 2010). Insurance status is thus, not surprisingly, closely tied to dental access. In 2005, 92% of the state's privately insured children saw a dentist in the prior year, compared to 80% of the children with public insurance, and just 67% of children without insurance (MDCH, 2006). Similarly, the parents of over twice as many publicly insured children reported difficulty obtaining dental care for their children as did those with private insurance (13.2% vs. 5.6%).

Just over half of Michigan's dentists report seeing any children covered by Medicaid or MICHild (Public Sector Consultants, 2011). In Michigan's fee-for-service counties, the Michigan Oral Health Plan (MDCH, 2010) reports that in 2006 only 23% of dentists reported seeing children covered by Medicaid, and just 10% could be considered "critical access providers," the equivalent of seeing three or four children per week (Borchgrevink et al, 2008). Further, a total of nine counties did not have a single dentist that accepted Medicaid (MCDH, 2010). Due in part to the narrow definition of "medically necessary," adults enrolled in Medicaid have the most difficulty obtaining dental care. In 2010, 84% of Michigan's dentists stated that they did not see any adult Medicaid patients in a typical month, and only 19% reported seeing any adults on a sliding-scale basis (Public Sector Consultants, 2011).<sup>3</sup> The main explanation offered for non-participation in Medicaid is its low rate of reimbursement; administrative burden and patient behavior are also frequently cited (Public Sector Consultants, 2010a; Borchgrevink et al, 2008). Michigan is, in fact, well below the national average with respect to its fee-for-service Medicaid dental reimbursement rates (Borchgrevink et al, 2008).

### **Michigan's Current Goals and Strategies for Improving Oral Health and Access to Care**

In an attempt to improve access to care in the state, in 2000 Michigan placed Medicaid-eligible children from thirty-seven (primarily rural) counties into Healthy Kids Dental, administered by Delta Dental. Participating dentists are eligible to be reimbursed at

---

<sup>3</sup> It should be noted that the vast majority of the state's dentists do report doing some charity or volunteer work for which they receive no compensation. While generous, charity care is insufficient to meet the need.

Delta's usual rate. Expansions in 2006 and 2008 have brought the total number of covered counties to sixty-one, with Wayne County a notable exception. According to an analysis of the first several years of the program, the rate of utilization among children enrolled for any portion of the year went from 30% in 2001 to 37% in 2007, and for those enrolled for the entire year, from 49.0% to 55% (Eklund, 2008). And while participation among dentists certainly went up, there is some discrepancy as to how many are active participants. Edelstein (2010a) reports a 150% increase in enrollment due to the reforms, though notes that still less than a quarter of dentists are listed as Medicaid providers (time period undisclosed), while a 2009 Michigan Dental Association / Michigan Oral Health Coalition report states that 75% percent of the dentists in Healthy Kids Counties participate. A 2010 Survey of Dentists revealed, in any case, that while only 3% of the state's dentists said their practices were full, just 12% were accepting new fee-for-service Medicaid patients, and fewer than half were accepting new Healthy Kids Dental patients (Public Sector Consultants, 2011).

In a separate attempt to increase access to preventive care, Michigan passed Public Act 161 in 2005. PA 161 allows dental hygienists to treat (within their scope of practice) under-served populations in public or non-profit settings without the direct supervision of a dentist, through what is called a "waiver of assignment". That same year, the state also adopted its Oral Health Plan. In 2010 an updated report was issued; it recognizes collaboration among diverse stakeholders, but notes much work still to be done.

## **The Role of a Mid-Level Dental Provider**

One way that over 50 other countries, including Canada, the U.K, Australia, New Zealand and the Netherlands (for brief overviews of these and other countries' programs, see Nash and Nagel, 2005 or Nash et al, 2008), and now two U.S. states, address barriers to dental care is through a Mid-Level Dental Provider (MDP) model. MDPs, which are also called alternative providers or dental therapists,<sup>4</sup> fall in between dental hygienists and dentists, similar to nurse practitioners or physician assistants in the broader health field. MDP licensure allows non-dentists to provide routine and preventive care, under the supervision of a dentist, who in most models can be off-site. One of the hallmarks of the MDP model is that trainees are typically drawn from the communities they will serve (Hilton and Lester, 2010).

A number of states are considering MDP proposals, and the Kellogg Foundation has recently sponsored initiatives to develop curriculum and promote MDP programs in five states (Community Catalyst, 2010). Moreover, the 2010 Health Care Reform law not only mandates oral health benefits for children, but also authorizes demonstration programs to train and employ alternative dental providers as a means of increasing access for under-served communities. The American Dental Hygienists' Association has also advocated the creation of an Advanced Dental Hygiene Practitioner who would be able to perform many of the same clinical procedures as dental therapists. In fact, the combined hygienist/therapist model, which is typically achieved in three years of study, is becoming increasingly popular internationally (Nash, 2009b). It is worth noting that the

---

<sup>4</sup> MDPs were originally called dental nurses when New Zealand developed the first program in the 1920s to address widespread dental disease and a severe shortage of dentists. Notably, by the 1970s, well before water fluoridation, permanent tooth loss had been virtually eliminated in New Zealand (Friedman, 2011).

current U.S. dental hygiene curriculum covers many courses typically included in international therapist or combined hygienist/therapist programs, so existing dental hygienists could likely be trained to provide basic restorative care in an accelerated program (Nash, 2009a).

In Alaska, “Dental Health Aide Therapists” (DHATs) have been providing oral health care services in tribal villages under general supervision (which requires a dentist to provide consultation and advice through telecommunication, but does not require them to be physically accessible to the treatment site) since 2005. DHATs undertake two years of training post-high school, and provide a variety of services including simple extractions and restorations (fillings) that could previously be delivered only by a dentist. Minnesota passed MDP legislation in 2009. Unlike Alaska and most foreign programs, which typically require two to three years of training, in Minnesota dental therapists are required to have a Bachelor’s degree or more. In Minnesota, basic dental therapists will work under indirect supervision (in which a dentist is physically accessible to the treatment, if needed), while advanced dental therapists will have a somewhat expanded scope of practice, and will practice under general supervision. The type of supervision required is an important factor in determining the extent to which MDPs can provide care to populations in areas where there are few or no dentists.

### **MDPs Provide Safe, Quality Care**

Despite substantial evidence from both the U.S. and abroad indicating that MDPs provide safe and effective care that does not endanger patients, concerns have been raised,

primarily by American dental associations, that MDP licensure would create a two-tiered system that puts under-served and vulnerable populations at risk (APHA, 2006; Garcia et al, 2010). However, studies from Australia, Canada, and the U.K., as well as Alaska, many employing blind evaluations, find that MDPs provide high quality care, including both diagnosis and treatment equal to that provided by dentists. Similar findings were obtained by studies assessing several U.S. pilot programs undertaken in the 1960s and 1970s in which dental assistants or hygienists were trained in expanded functions. A key aspect of MDP education is to train providers to clearly know the limits of their scope of practice, and indeed it does not appear that they exceed their parameters of care (e.g. Fiset, 2005).

Moreover, MDPs provide this care in a cost-effective manner (e.g. Lewis, 1981; Riordan, 1997), and enjoy a wide degree of social acceptance and patient satisfaction (e.g. Wetterhall et al, 2010). Indeed, a recent study in the U.K. found patients attending therapists to have significantly higher rates of satisfaction than those attending appointments with dentists (Sun et al, 2010). Though often initially skeptical, once dentists understand the role therapists can play as part of the dental team, they typically develop a favorable attitude toward them (e.g. Gallagher and Wright, 2003; Fiset, 2005).

A recent GAO study included interviews with health officials in New Zealand, Australia, Canada and the U.K. and found “no reservations about the quality of care provided by dental therapists,” among any of them (GAO, 2010). Indeed as far back as the mid-1970s, a (positive) Canadian review of a dental therapist program in Saskatchewan

declared, “in light of these findings, which have been repeated so many times in the literature, one wonders whether the quality of dental [therapist] services is even an issue.” (Ambrose et al, 1976). Our own review of the existing literature has yet to uncover a single finding of low quality of care by MDPs.

Not all U.S. dentists oppose the MDP model. In a 2001 JADA editorial, Lawrence Meskin advocated a system of expanded duty auxiliaries as a cost-effective means of addressing dental access issues, and one that was preferable to increasing the number of dentists (Meskin, 2001). More recently Kenten Johnson, the Minnesota Dental Association’s “1999 outstanding new dentist,” strongly advocated in favor of that state’s new MDP program (Johnson, 2011). The American Public Health Association, and the American Association of Public Health Dentistry both also support MDPs (APHA, 2006; AAPHD, 2006).

One of the more recent countries to adopt the MDP model, the Netherlands added dental hygienist-therapists to their oral health care delivery system within the last decade based on the assumption that costs would be reduced and access to care improved (Nash et al, 2008). Though initially opposed by Dutch dentists, Dutch insurance, consumer and educational organizations came together to support this model (Friedman, 2011).

## **The Time is Right for MDPs in Michigan**

MDPs are one solution to lowering the cost of, and increasing access to, oral health care for underserved populations, especially children, people with disabilities, and the elderly. Due to fewer years of education, MDPs command lower fees than dentists for routine and preventive care. As a result, they would likely be more willing to participate in MIChild and Medicaid, as reimbursement would more fully cover costs associated with care. By law, the new Minnesota program requires that “at least 50 percent of a dental therapist’s practice must be invested in public health or clinics that see Medicaid patients” (Riggs, 2011). A recent study by the Pew Center on the States found that in addition to improving access to care, even dentists in private practice might benefit financially from employing dental therapists as they could increase their patient caseloads by delegating care to lower cost providers (Pew, 2010). A similar finding was obtained by Abramowitz and Berg (1973), and in a piece highlighting lessons for the U.S. from the Canadian experience, Quiñonez and Locker (2008) note, “the uptake of dental therapists into Canadian private practice is a clear indication that this provider is valuable in different service settings.”

In Saskatchewan, where dental therapists may work independently, they are now well accepted by dentists, suggesting that the two can be colleagues rather than competitors (Friedman, 2011). Saskatchewan actually provides an interesting and informative case study. Before dental therapists began working in school clinics in 1974, children there had poor dental health and low service use, due largely to geographic and economic inaccessibility. Though widely regarded as successful, the school-based public program was eliminated in 1987 due primarily to pressure from dentists. Since then there has been

both a notable decline in utilization, and an increase in untreated caries among children (Quiñonez and Locker, 2008). While some of the existing therapists moved to other public settings, others moved to private practice. There is currently just one training program for dental therapists in Canada, at First Nations University in Prince Albert, and outside of Saskatchewan, Canadian dental therapists work primarily on First Nations reserves.

An additional, and perhaps equally important benefit of MDPs, is that they are likely to be more easily recruited from under-served populations. Indeed, a recent survey of dental school seniors reports that 46% of African-American, and 34% of Latino students state that service to vulnerable and low-income populations is “very important” to them; only 16% of white dental school seniors make this claim (Okwuje et al, 2009).

California’s experience with Registered Dental Hygienists in Alternative Practice (RDHAP) is also illustrative. There, RDHAPs are authorized to practice their profession independently (with a “dentist of record” for referral, consultation and emergencies) in under-served settings. Compared to all registered hygienists, RDHAPs are more likely to be from under-represented minorities (21.2% vs. 8.5%) and to be able to converse in a language other than English (Mertz and Glassman, 2011). Indeed, it appears that the RDHAP program attracts those with a stronger commitment to improving access to care for the under-served. Increasing the ethnic and racial diversity of the dental workforce should thus reduce barriers to care by both increasing cultural credibility, and increasing the likelihood that such therapists will set up practice in under-served areas. Moreover,

to the extent patient behavior (missed appointments, poor habits) is a common complaint of dentists working with under-served populations, MDPs from within the community would seem uniquely qualified to address some of these issues. Evidence from Alaska and Canada highlight these points (Wetterhall et al, 2010; Lewis, 1981).

Edelstein (2010b) reports that, according American Dental Association survey data, the majority of procedures currently delivered exclusively by dentists could safely be delegated to properly trained MDPs. This would allow dentists, who have considerable knowledge of complex oral problems, to devote more of their time to advanced procedures – an optimal and efficient use of the limited number of professionals with such skills. In addition, at a time when Michigan has been hard hit by unemployment and the realities of the twenty-first century economy, MDP licensure would create a new class of professional jobs for the state. The need for oral health care in Michigan, as across the U.S., is high, and MDPs provide a solution that should be given serious consideration. MDP licensure will increase access to care for under-served populations, lower the cost of care, and create jobs.

What type of mid-level provider should Michigan consider? The trend internationally is a combined dental hygienist-dental therapist (referred to for the remainder of this article as a DH/DT), and this would also be the best option for Michigan. This new provider would work under the supervision of a Michigan-licensed dentist, who could be off-site. The DH/DT would be trained to provide advanced preventive care and basic restorative care including fillings and simple extractions. More advanced procedures would remain

restricted to dentists. The main practice settings of DH/DT providers might include Federally Qualified Health Centers (FQHCs), Tribal Lands, schools or community centers with Head Start programs or programs for needy seniors, or private practice settings in areas of the state with the most significant provider shortages. Using new technologies like those employed in the Alaska DHAT program, the supervising dentist would approve all treatment plans—no irreversible procedures would be conducted without prior approval by the supervising dentist.

The DH/DT model is the right one for Michigan for several reasons. First, because oral disease is almost entirely preventable, expanding access to advanced preventive care should be a key priority for improving access. It seems more cost-effective to train one provider who could provide both advanced preventive care and basic restorative care, rather than segmenting these roles. It also seems more likely that one combined DH/DT provider would relocate to a remote part of the state, relative to the probability that a hygienist and a therapist would jointly relocate to such an area. For this reason, the DH/DT model—while it requires somewhat more education—may be the most cost-effective way of getting underserved populations the care they need.

Second, Michigan currently has a large supply of unemployed and under-employed dental hygienists. Given the overlap in competencies of these two types of providers, registered dental hygienists could be trained in a relatively short period (12-18 months) to provide basic restorative care. Indeed, training practicing dental hygienists is likely the fastest way to train providers and get them into the practice environment. Finally, a

combined provider would require less “disruptive change” within the current care delivery system than would the introduction of a totally new type of provider. Instead of creating an entirely new class of providers, the DH/DT would add competencies—many of which overlap what is currently taught in dental hygiene curriculums—to an existing provider. Existing systems could be adapted rather than requiring entirely new systems. Because it builds on pre-existing structures, the combined DH/DT model would benefit from having more institutional support from within the oral health community than would a new class of provider, which might be seen as a threat to both dentists and dental hygienists.

While there is considerable evidence regarding the quality of care provided by mid-level dental providers, an area in need of further research is the extent to which (or perhaps in what forms) the introduction of such providers into the US system would lead to increased access to oral health care. There is no guarantee that the introduction of a mid-level provider would improve access to care in Michigan. There may be unique characteristics about the US system (and Michigan in particular) that might lead to these types of providers being ineffective in expanding access. In this way, it may be as much a matter of how a mid-level provider is structured and implemented, rather than whether one is implemented. For example, it is likely that the training of the new provider would need to focus on culturally competent care delivery, and specialize in serving vulnerable groups.

Numerous stakeholders have stressed the need for more empirical evidence on the impact

that these types of providers would have on access, and the implications they would have for the broader provider community. It would be ideal for such evidence to come from within Michigan, as there are always concerns about whether successful programs in other states can be replicated in new settings. Indeed, a pilot such as the one described below could provide critical information regarding the specific characteristics of the new mid-level structure that would have the greatest effect on access to care for vulnerable populations, and whether this impact merits such a major change to the way dental care is delivered in Michigan.

We recommend a 7-year pilot study, the primary goal of which would be to assess the impact of introducing DH/DT providers in Michigan on access to oral health care.

Michigan's two schools of dentistry (at the University of Michigan and the University of Detroit Mercy) are well positioned to conduct this type of research, given the flexibility dental educational institutions are allowed within the practice act. Either or both of them could conduct the pilot we describe below without a change to the practice act. This research might be undertaken in collaboration with social work or public health researchers, who could provide information on best practices for reaching and serving vulnerable populations.

During each of the first 3 to 4 years of the pilot, 8 to 10 registered dental hygienists with prior practice experience would begin a program that trains them in basic restorative care in a 12 to 18-month program at one or both of the schools of dentistry. These experimental DH/DT student-providers would then practice as part of the pilot project for

3 years, first in clinics within one or both of the Schools and Dentistry, and then off-site in practice settings that would be most likely to reach vulnerable populations. As previously described, these might include FQHCs, Tribal Lands, schools or other government or non-profit settings (i.e. Head Start programs), or in private practice settings in areas of the state with the most significant shortages of providers. Throughout their participation in the study, the experimental DH/DTs would be under the supervision of dentists on the faculty at one or both of the Schools of Dentistry. Because the DH/DT providers who participated in the study might not be able to practice as DTs in Michigan following completion of the study, their time would have to be funded throughout the training and practice periods. This means private or public funds must be raised to pay for the training program and compensate the participating trainees. However, there are numerous sources that could be drawn upon for this purpose.

The experimental DH/DT providers would be assessed on a variety of outcomes including quality of care (although the evidence is strong already that these types of providers provide safe and competent care), and, more importantly, impact on access to care. As much as possible a randomized experimental design should be used to assess these impacts. While the principal investigators of the study should have final say on all aspects of the study, an advisory council of stakeholders (such as the Michigan Dental Association, the Michigan Dental Hygienists' Association, the Michigan Department of Community Health, and others) should be convened to recommend outcomes and track the progress of the research.

Problems in oral health account for considerable uncompensated emergency room care, and are associated with conditions such as diabetes, stroke, heart disease, and serious problems for newborns (USDHSS, 2000). By improving access to care and providing prevention and treatment of oral disease, MDPs could help Michigan residents become healthier, and, as a result, both residents and the state would save in overall health costs – an important consideration in a time of tight budgets.

Though falling short of explicitly recommending MDPs, the 2003 National Call to Action to Promote Oral Health did list as Action Step 4, “Increase Oral Health Workforce Diversity, Capacity and Flexibility” and recommends as part of Action Step 2 (Overcome Barriers by Replicating Effective Programs and Efforts), specific strategies to “explore policy changes that can improve provider participation in public health insurance programs and enhance patient access to care;” “ensure an adequate number and distribution of culturally competent providers to meet the needs of individuals and groups, particularly in health-care shortage areas;” and “make optimal use of oral health and other health care providers in improving access to oral health care.” In fact, efforts to supplement the U.S. dental workforce with MDPs are already underway. Congress and the U.S. Department of Health and Human Services have mandated studies (Edelstein, 2010b), Health Care Reform authorized pilot programs, and foundations are funding demonstrations. Michigan would do well to be at the forefront of this important movement.

### **Acknowledgements**

This research has been generously supported by a grant from the Nokomis Foundation.

### **Disclaimer**

The views expressed are those of the authors and should not be construed as representing the Nokomis Foundation or the University of Michigan.

## References

- Abramowitz, Joseph, and Lawrence E. Berg (1973). "A Four-Year Study of the Utilization of Dental Assistants with Expanded Functions," *Journal of the American Dental Association* 87:623-635.
- Ambrose, E.R., A.B. Hurd and W.J. Simpson (1976). *A Quality Evaluation of Specific Dental Services Provided by the Saskatchewan Dental Plan: Final Report* (unpublished report).
- American Public Health Association (APHA) (2006). "Support for the Alaska Dental Health Aide Therapist and Other Innovative Programs for Underserved Populations," Policy Number 20064. Retrieved from: [www.apha.org/advocacy/policy/policysearch/default.htm?id=1328](http://www.apha.org/advocacy/policy/policysearch/default.htm?id=1328).
- American Association of Public Health Dentistry (AAPHD) (2006). Letter from Robert J. Wyeant to John McCain. Retrieved from: <http://www.aaphd.org/default.asp?Page=mccain.htm>
- The Annie E. Casey Foundation (Casey) (2009). KIDS COUNT Data Center, [datacenter.kidscount.org](http://datacenter.kidscount.org) (retrieved March 17, 2011).
- Bolin, Kenneth Anthony (2008). "Assessment of Treatment Provided by Dental Health Aide Therapists in Alaska: a pilot study," *Journal of the American Dental Association* 139: 1530-1539.
- Borchgrevink, Alison, Andrew Snyder, and Shelly Gehshan (2008). "The Effects of Medicaid Reimbursement Rates on Access to Dental Care," *National Academy for State Health Policy*. Retrieved from: [www.nashp.org/Files/CHCF\\_dental\\_rates.pdf](http://www.nashp.org/Files/CHCF_dental_rates.pdf).
- Buerlein, Jessie, Hillary Peabody and Kathryn Satoro (2010). "Improving Access to

Perinatal Oral Health Care: Strategies and Considerations for Health Plans: Issue Brief” NIMCH Foundation, Children’s Dental Health Project. Retrieved from:  
<http://www.nihcm.org/pdf/NIHCM-OralHealth-Final.pdf>

Caleche, Hanny et al (2009). “The Capacity of Dental Therapists to Provide Direct Restorative Care to Adults,” *Australia and New Zealand Journal of Public Health* 33 (5): 424-429.

California Dental Association (2010). “Oral Health During Pregnancy and Early Childhood: Evidence-Based Guidelines for Health Professionals,” *CDA Journal*, 38 (6): 391-403. Retrieved from:  
<http://www.cdafoundation.org/library/docs/journal0610.pdf>

Community Catalyst (2010). “W. K. Kellogg Foundation Supports Community-led Efforts in Five States to Increase Oral Health Care Access by Adding Dental Therapists to the Dental Team,” 12/17/2010 press release. Retrieved from:  
[www.communitycatalyst.org/press\\_releases?id=0145](http://www.communitycatalyst.org/press_releases?id=0145).

Edelstein, Burton L. (2010a). “The Dental Safety Net, its Workforce, and Policy Recommendations for its Enhancement,” *Journal of Public Health Dentistry* 70: S32-39.

Edelstein, Burton L. (2010b). “Training New Dental Health Providers in the U.S.: Executive Summary” (Prepared for the W.K. Kellogg Foundation, December 2009; updated June 2010). Retrieved from:  
<http://www.cdhp.org/system/files/Executive%20Summary%20-%20Training%20New%20Dental%20Health%20Providers%20Edelstein%20Revised%202010.pdf>

- Edelstein, Burton L. and Courtney H. Chinn (2009). "Update on Disparities in Oral Health and Access to Dental Care for America's Children," *Academic Pediatrics* 9 (6) 414-419.
- Eklund, Stephen A. (2008). "Michigan's Medicaid Healthy Kids Dental Program" power point presentation dated April 28, 2008. Retrieved from:  
<http://www.medicaidental.org/Docs/2008/Eklund.pdf>
- Fiset, Louis (2005). "A Report on Quality Assessment of Primary Care Provided by Dental Therapists to Alaska Natives" (unpublished report).
- Friedman, Jay W. (2011). "The International Dental Therapist: History and Current Status," *California Dental Association Journal* 39 (1): 23-29.
- GAO (2010). *Oral Health: Efforts Under Way to Improve Children's Access to Dental Services, but Sustained Attention Needed to Address Ongoing Concerns*, GAO-11-96.
- Gallagher, J.L. and D.A. Wright (2003). "General Dental Practitioners' Knowledge of and Attitudes Towards the Employment of Dental Therapists in General Practice," *British Dental Journal* 194 (11): 37-41.
- Garcia, Raul, Ronald Inge, Linda Niessen, and Dominick DePaola (2010). "Envisioning Success: the Future of the Oral Health Care Delivery System in the United States," *Journal of Public Health Dentistry*, 70: S58-65.
- Gehshan, Shelly (2008). "Foundations' Role in Improving Oral Health: Nothing to Smile About." *Health Affairs* 27(1): 281-287.
- Hammons, Paul E., and Homer J. Jamison (1968). "New Duties for Dental Auxiliaries – The Alabama Experience," *American Journal of Public Health* 58 (5): 882-886.

- Hammons, P.E., H.C. Jamison, and L.L. Wilson (1971). "Quality of Service Provided by Dental Therapists in an Experimental Program at the University of Alabama," *Journal of the American Dental Association* 82: 1060-1066.
- Hilton, I.V. and A.M. Lester (2010). "Oral Health Disparities and the Workforce: a Framework to Guide Innovation," *Journal of Public Health Dentistry* 70: S15-23.
- Johnson, Kenton M. (2011). "Dentists Can Help Address the Access Problem," *Dentaltown.com* February 2011: 18-20. Retrieved from: [http://www.pewcenteronthestates.org/uploadedFiles/wwwpewcenteronthestatesorg/Initiatives/Childrens\\_Dental\\_Health/dental\\_column.pdf](http://www.pewcenteronthestates.org/uploadedFiles/wwwpewcenteronthestatesorg/Initiatives/Childrens_Dental_Health/dental_column.pdf)
- Jones, D.E., D.E. Gibbons, and J.F. Doughty (1981). "The Worth of a Therapist," *British Dental Journal* 151(4): 127-128.
- Kaiser Family Foundation (Kaiser) (2009). "Kaiser Health Tracking Poll, February 2009." Retrieved from: <http://www.kff.org/kaiserpolls/upload/7866.pdf>.
- Lewis, D.W. (1981). Performance of the Saskatchewan Health Dental Plan, 1974-1980 (unpublished report).
- Lobene, Ralph R. (1979). *The Forsyth Experiment: An Alternative System for Dental Care*. Harvard University Press.
- Mertz, Elizabeth and Paul Glassman (2011). "Alternative Practice Dental Hygiene in California: Past, Present, and Future," *California Dental Association Journal* 39 (1): 37-46.
- Mertz, Elizabeth and Edward O'Neil (2002). "The Growing Challenge of Providing Oral Health Care Services to All Americans," *Health Affairs* 21 (5): 65-77.

Meskin, Lawrence H. (2001). "Back to the Future," *Journal of the American Dental Association* 132: 421-422.

Michigan Dental Association and Michigan Oral Health Coalition (MDA/MOHC) (2009). "Improve Children's Oral Health by Expanding Healthy Kids Dental"

Michigan Department of Community Health (MDCH) (2006). *Count Your Smiles 2005-2006*. Retrieved from:

[http://www.michigan.gov/documents/Basic\\_Screening\\_Survey\\_updated\\_3-16-06\\_164625\\_7.pdf](http://www.michigan.gov/documents/Basic_Screening_Survey_updated_3-16-06_164625_7.pdf)

Michigan Department of Community Health and Michigan Oral Health Coalition (MDCH/MOHC) (2006). *Michigan Oral Health Plan*. Retrieved from:

[http://www.michigan.gov/documents/oral\\_health\\_work\\_plan\\_final\\_color\\_140634\\_7.pdf](http://www.michigan.gov/documents/oral_health_work_plan_final_color_140634_7.pdf)

Michigan Department of Community Health, Oral Health Program (MDCH) (2009).

*Addressing Dental Workforce in the State of Michigan*. Retrieved from:

<http://www.mohc.org/files/Addressing%20Dental%20Workforce-JM.pdf>

Michigan Department of Community Health, Oral Health Program (MDCH) (2010).

*Michigan Oral Health Plan*. Retrieved from:

[http://www.michigan.gov/documents/mdch/Michigan\\_State\\_Oral\\_Health\\_Plan\\_FINAL\\_2\\_326169\\_7.pdf](http://www.michigan.gov/documents/mdch/Michigan_State_Oral_Health_Plan_FINAL_2_326169_7.pdf)

Nash, David A. (2009a). "Adding Dental Therapists to the Health Care Team to Improve Access to Oral Health Care for Children," *Academic Pediatrics* 9 (6): 446-451.

- Nash, David A. (2009b). "Expanding Dental Hygiene to Include Dental Therapy: Improving Access to Care for Children." *The Journal of Dental Hygiene* 83(1), 36-44.
- Nash, David A. et al (2008). "Dental Therapists: a Global Perspective," *International Dental Journal* 58: 61-70.
- Nash, David A., and Ron J. Nagel (2005). "Confronting Oral Health Disparities Among American Indian/Alaska Native Children: The Pediatric Oral Health Therapist," *American Journal of Public Health* 95 (8): 1325-1329.
- Nuffield Foundation (1993). *Education and Training of Personnel Auxiliary to Dentistry*, London: Nuffield Foundation.
- Okwuje, Ifie, Eugene Anderson, and Richard W. Valachovic (2009). "Annual ADEA Survey of Dental School Seniors: 2008 Graduating Class," *Journal of Dental Education* 73 (8): 1009-1032.
- Pew Center on the States (2010). "It Takes a Team: How New Dental Providers Can Benefit Patients and Practices." Retrieved from:  
[http://www.pewcenteronthestates.org/uploadedFiles/Pew\\_It\\_Takes\\_a\\_Team.pdf](http://www.pewcenteronthestates.org/uploadedFiles/Pew_It_Takes_a_Team.pdf).
- Public Sector Consultants, Inc (2010a). "A United Voice for Oral Health: Final Report and Recommendations from the Michigan Access to Oral Health Care Work Group."
- Public Sector Consultants Inc. (2010b). "MDCH Survey of Dental Hygienists: Survey Findings 2009." Retrieved from:  
[http://www.michigan.gov/documents/healthcareworkforcecenter/2009DentalHygienisSurveyReport\\_310255\\_7.pdf](http://www.michigan.gov/documents/healthcareworkforcecenter/2009DentalHygienisSurveyReport_310255_7.pdf)

- Public Sector Consultants Inc. (2011). "MDCH Survey of Dentists: Survey Findings 2010." Retrieved from:  
[http://www.michigan.gov/documents/healthcareworkforcecenter/2010SurveyOfDentistsReport\\_348742\\_7.pdf](http://www.michigan.gov/documents/healthcareworkforcecenter/2010SurveyOfDentistsReport_348742_7.pdf)
- Quiñonez, Carlos R., and David Locker (2008). "On the Pediatric Oral Health Therapist: Lessons from Canada," *Journal of Public Health Dentistry* 68 (1): 53-56.
- Riggs, S. (2011). *Oral Health and Prevention: Rebranding the Profession*. Focus group white paper for the Institute for Oral Health. Retrieved from:  
<http://www.iohwa.org/2011fg/IOH-Jan2011-Focus-Group-Whitepaper-partial-Riggs.pdf>
- Riordan, P.J. (1997). "Can Organised Dental Care for Children be Both Good and Cheap?" *Community Dentistry and Oral Epidemiology* 25: 119-125.
- Sun, N., G. Burnside, and R. Harris (2010). "Patient Satisfaction with Care by Dental Therapists," *British Dental Journal* 208, online article number E9.
- U.S. Department of Health and Human Services (USDHHS) (2000). *Oral Health in America: A Report of the Surgeon General*. Rockville, MD: U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health.
- U.S. Department of Health and Human Services (USDHHS) (2003). *National Call to Action to Promote Oral Health*. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental and Craniofacial Research. NIH Publication No. 03-5303.

Wetterhall, Scott, James D. Bader, Barri B. Burrus, Jessica Y. Lee, and Daniel A.

Shugars (2010). Evaluation of the Dental Health Aide Therapist Workforce Model  
in Alaska: Final Report, Research Triangle, NC: RTI International.

Special Section

**Public Health Partnerships in Action: A Selection of Session Presentations from the 2011 Michigan Public Health Conference**

Julie Gleason-Comstock, PhD, MCHES

Teresa Wehrwein, PhD, RN, NNEA-BC

The 2011 Michigan Premier Public Health Conference (MPPHC) was held October 13-14<sup>th</sup> in Grand Rapids Michigan. Papers were selected for presentation at the MPPHC through a peer review process. The Michigan Public Health Association is one of the “Partners in Planning” for Michigan’s annual public health conference, along with the Michigan Association for Local Public Health, Michigan Association of Counties, Michigan Public Health Institute, Michigan State University, Michigan Departments of Agriculture and Rural Development, Department of Community Health and Department of Environmental Quality, Great Lakes Chapter Society for Public Health Education, University of Michigan School of Public Health and Michigan State Medical Society.

Paper session presenters were invited to submit their conference abstract for publication in the *Michigan Journal of Public Health*. Authors from five presentations subsequently submitted their abstracts for publication. The *MJPH* tradition of providing broader dissemination of conference presentations began in 2010 with the publication of posters from the 2009 Conference. Paper session abstracts from the 2011 Conference published in this edition of the *Journal* embrace a span of public health education, community assessment, epidemiology and policy, reflective of the Conference’s goal to “celebrate the contributions of public health in Michigan’s communities”

([www.events.mipha.org/mpphc](http://www.events.mipha.org/mpphc)).

## **WISEWOMAN Gardening Project**

Robin Roberts, MA

Vicki Lorraine, MS

Helen DeFlorio

The WISEWOMAN Gardening Project, a three year partnership between Michigan WISEWOMAN and Michigan State University extension, provides economically-challenged woman with the skills and resources to increase healthy behaviors and earn additional income through gardening.

A gardening curriculum and manual were developed incorporated nutrition education, gardening basics growing and produce for market, and selling at a farmer's market. The project emphasizes the Social Determinants of Health and their role in sustainable behavior change. In 2010, twenty-five women in six Northern Michigan countries participated.

The WISEWOMAN Gardening Project provides participants opportunities to:

- Increase physical activity
- Increase consumption of fresh fruit, vegetables
- Enhance nutrition knowledge, allowing them to convey the health benefits of their products to customers
- Supplement their income in order to purchase other healthy eating options
- Develop new gardening and income-generating skills

At the community level, the Gardening Project focuses on prevention by:

- Expanding access and availability of fresh produce
- Developing new outlets for fresh produce
- Increasing customer knowledge of the health benefits of fresh fruits and vegetables
- Emphasizing the social determinants of health
- Enhancing partnerships

## **Community Health Assessments: Successful Strategies in Working with Collaborating Competitors**

Cathy Raevsky

Mary Kay Van Drie, EdD, RN, FACHE

The passage of the Patient Protection and Affordable Care Act (PPACA) in May of 2010 included new requirements for health systems that dovetailed with new requirements for Health Departments seeking National Public Health accreditation. One of these requirements was conducting a community health assessment. This created a perfect opportunity for Hospitals to engage in a partnership with Local Public Health Departments.

The Kent County Health Department (KCHD) and Value Health Partners (VHP), an incorporated, strategic alliance among eight Michigan health systems covering 61 Michigan counties, 27 Hospitals and over 230 facilities, decided to pilot a community health assessment project in Kent County that could then be replicated throughout the VHP system. This would eliminate a hodgepodge of different processes and data elements and compare them in an apples to apples fashion. The Health Department would serve Mary's Hospital, Metropolitan Hospital, Mary Free Bed and Pine Rest. The Health Department's challenge was to:

- Facilitate without taking charge
- Connect the dots for participants
- Balance both content and process
- Build individual and group capacity

The five Hospital systems struggled through their different agendas and institutional concerns that came into play at various times throughout the process, but always concluded that the value of the collaborative process transcended all the other concerns and was the most value-added part of the process.

## **Public Health Action in Addressing the Michigan Medical Marihuana Law**

Maurice S. Reizen, MD

Amy Ann Moore

In November 2008 a ballot initiative passed which provided for the medicinal use of marihuana for some Michigan residents. Since that time, several consequences have emerged in local communities with a variety of responses from both Townships and Cites. Michigan communities have come to three decisions regarding the Michigan Medical Marihuana Law:

1. Allow open exchange, growing and distribution of marihuana within the parameters of the law,
2. Observe federal drug law which prohibits all marihuana use, or
3. A combination of these two views.

The most public discussions on the Michigan Medical Marihuana law relate to zoning and growing marihuana for medicinal use. However, a large gap exists across Michigan as to how the Michigan Marihuana law affects public health. We will explore what is really happening to Michigan communities as it relates to views and attitudes about marihuana use, community norms surrounding use, public safety, school impact, illegal drug use, drug availability, multi-unit housing and family and community drug education.

This program will provide a brief overview of zoning and the resources that currently exist for cities and townships. However the bulk of the program will provide details about

the actual Michigan Medical Marihuana Law, marihuana use in public and multi-unit housing, medicinal use of Marihuana, the consequences of the Law on Drug addiction and use, School and law enforcement consequences, recommended changes to the Michigan Medical Marihuana Law, discussion on the Michigan Medical Marihuana Law.

## **Controlling Hospital Admission through Prevention Education: The Role of Community Health Workers**

MiMi Rankin

Peter Sartorius, MS

Greg Cline, PhD

A steady increase in cases of Type-II diabetes has been a growing concern across Michigan communities for some time. Based on Michigan BRFSS data and population data, an estimated 12.2% of adults had some type of diabetes in 2007 (with roughly 90% having Type-II). (BRFSS, 2007) In 2010, the state estimated the per-person cost of diagnosed diabetes at \$9,975 totaling \$7 billion statewide. The state attributed another \$1 billion in outlays for undiagnosed diabetes. (The Facts, 2010) This costly trend is the product of an array of environmental, social, and political factors, and as such, the complexities of the issue cannot be curtailed or overlooked. Among other factors, it is the diversity in the historical and ethnic backgrounds of at-risk communities that poses a substantial challenge for healthcare providers. From an ethnicity perspective, Black non-Hispanics, Hispanics, and American Indians experience the highest rates of diabetes. As representative members of their communities, Community Health Workers (CHW) present an opportunity to bridge the communication gap that frequently exists between providers and patients. CHW programs have been supported by various groups, such as the American Association of Diabetes Educators, for their effectiveness in educating people with and at risk for diabetes and advancing self-management of the disease. (AADE, 2009)

Between 2007 and 2009, the Trinity Health *Call to Care* initiative funded the Muskegon Community Health Project (MCHP) to test a Community Health Worker outreach and education model for low-income, at-risk diabetics within the Muskegon community. The project reached out to 138 participants to provide education on the management of Type-II diabetes through in-home visits as well as primary care office sessions. After testing the effects of several program components against Hemoglobin A1c (HgbA1c) counts in participants, we concluded that the MCHP appeared to have been effective and should be replicated in other at-risk communities.

To test the effectiveness of MCHP, we examined the effect of months in the program, home visits, and of office visits on HgbA1c levels of the participants. Through bivariate and multivariate testing and analysis, we were able to determine whether each program component had an effect on HgbA1c; we also were able to detect when the component seemed to start being effective and when it stopped being so; furthermore, we used measures of association to assess the strength and direction of relationships established between program components and HgbA1c levels. Our findings were able to determine the effect of each of the three aspects of the MCHP.

Testing revealed that months in the program had a positive affect (drop in HgbA1c) as soon as a participant was enrolled for at least six months, and ceased to have a detectable effect after the 19<sup>th</sup> month of enrollment. Similarly, we began seeing drops in HgbA1c levels as soon as a participant had been visited at home at least twice and we ceased to detect an effect after the 10<sup>th</sup> home visit. Number of office visits had a random

relationship of unknown strength and direction of effect on HgbA1c levels. During the course of linear regression analysis, we determined that the number of months and number of home visits pointed to the same relationship, as months in the program created an opportunity to have more home visits. Subsequently, we were able to attribute a .45 drop in HgbA1c levels for each home visit; this indicates that the model is responsible for approximately 20% of the recorded changes in participants' HgbA1c levels.

It should be noted that no data were included to describe exactly what took place during each home and office visit, therefore, the effect of intensity of these visits was not a measurable factor. We also did not know when home visits occurred in conjunction with office visits, which could have greatly affected the power of such visits. Also noteworthy is the fact that home visits focused entirely on disease management; conversely, office visits could have been scheduled for another reason while still including a session on diabetes self-management (this scenario could potentially reduce the effect of the training encounter, but these findings should not be interpreted as evidence that CHW interfaces within the primary care setting are ineffective).

As the data showed, home visits by CHWs for diabetes self-management education were clearly effective in lowering HgbA1c levels of low income, at-risk persons diagnosed with Type-II diabetes. The positive impact of MCHP was clear and similar programs should be attempted in other at-risk Michigan communities. Going forward, cost-effectiveness analyzes would provide further insight into the viability of the CHW model and its hopes for sustainability in our communities.

## References

American Association of Diabetes Educators. (2009). Community Health Workers in Diabetes Management and Prevention. *The Diabetes Educator*, 35(3), 48s-51s.

DOI:10.1177/0145721709339140

Diabetes in Michigan 2010 – The facts. (2010). Retrieved from

[http://www.michigan.gov/documents/mdch/Diabetes\\_in\\_Michigan2010\\_331597\\_7.pdf](http://www.michigan.gov/documents/mdch/Diabetes_in_Michigan2010_331597_7.pdf)

Michigan Behavioral Risk Factor Surveillance System. Michigan Department of Community Health, Chronic Disease Epidemiology Section, 2005-2007.

## **A Review of Infant Mortality in Wayne County, Michigan**

Gerry Polverento

Heidi Hilliard, MPH

Governor Rick Snyder has listed as one of his “Dashboard Items” the reduction of infant mortality in Michigan as one of the measures of success for his administration.

According to the Division for Vital Records and Health Statistics (VRHS) at the Michigan Department of Community Health, 881 infant deaths occurred for 117,309 births in 2009, which represents an infant mortality (IM) rate of 7.5. Wayne County experiences 250 of those 881 infant deaths for their 24,226 births, which represents an IM rate of 10.1. These numbers are part of an upward trend in IM from previous years in both Michigan and Wayne County, and are significantly above the national average of 6.3 for 2009.

Using data from the Wayne County Medical Examiner Office, as well as the VRHS and Michigan Child Death Review (CDR), this presentation will use time series analysis to illustrate the IM trend in Wayne County and Michigan since 2001, including changes in the various causes and manners of death for infants over this time. Additionally, this presentation illustrate how and where targeted public health initiatives may result in the biggest impact in reversing the IM trend in Michigan, thereby achieving Governor Rick Snyder’s goal.

Finally, a discussion will take place of what initiative are already occurring locally and state with, with the goal of reducing these numbers, and some of the significant challenges these initiatives face which contribute to the elusiveness of meeting these goals.