

A Local Public Health Laboratory's Role and Surge Implications During a Long-term Shigellosis Outbreak

A. Singh¹, P. Biedrzycki², M. Khubbar¹, D. Griswold¹, J. Lokken¹, V. Kalve¹, B. Krause¹, A. Hagy², S. Gradus¹. City of Milwaukee Health Dept. ¹Division of Public Health Laboratories and ²Division of Disease Control and Environmental Health, Milwaukee,WI

Abstract

Objective: To describe the metrics, challenges, successes and lessons learned by a local public health laboratory during a prolonged surge of shigellosis within a community setting.

Study Design: A prolonged surge of 5 to 15-fold increase in shigella specimens per month from February 2007, peaking in June and July and not returning to baseline until May 2008, resulted in over 500 cases and over 400 laboratory isolates. Intense community messaging to media, laboratories, physicians, child care facilities and recreational water operators likely enhanced surge. By early summer laboratory and investigational workloads were beyond capacity resulting in delayed investigations, laboratory turn-around time, and significant stress among staff. Laboratory strategies to cope with the beyond-capacity surge included invoking a pre-arranged agreement with the state public health laboratory for assistance, additional cross training of staff, abbreviating work-up of stool cultures, limiting PFGE testing and allowing interns to assist in some areas.

Results: The laboratory played a key role in detecting resistant strains and outbreak patterns. A predominate PFGE pattern (81% of 393) with a rhamnose negative marker (99%) consisted of two minor subsets. Seven additional patterns among 39 (12%) isolates were detected. Strains were resistant to ampicillin (75%), SXT (66%) or both (54%) for all strains and outbreak strains were more resistant, 87% and 83% respectively. Surge interventions to support these activities provided mixed results.

Conclusions: Surge planning is critical and a variety of creative interventions are necessary to address such public health events that might exceed the threshold of expected capacity.

Scope

- 15 month-long "local" epidemic: March 2007 through May 2008
- 607 cases
- 461 isolates shigella
- Shigella cases per month
 - Pre-outbreak average = 10 cases/month
 - Outbreak average = 32 cases per month
- Antimicrobial resistant outbreak strain
 - Ampicillin = 87%
 - SXT = 83%

Description / Timeline

- March '07, increase in cases noted
- June-July '07, peak
- MD notifications of multi-drug resistant Shigella
- July '07, press release
- Nov - Dec '07, heavy case load continues (2nd peak)
- May '08, baseline returns to pre-March '07 levels
- foci of outbreaks: child care centers(>100) & family clusters (>250)
- many high risk patients:
 - childcare
 - healthcare
 - food establishments
 - schools

Introduction

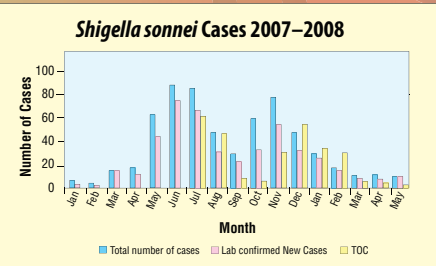
Shigella sonnei is the predominant serotype in U.S. community outbreaks of shigellosis. *S. sonnei*, a highly infectious agent, is transmitted by the fecal-oral route, spreads quickly and persists in daycare and preschool settings. Intervention of community outbreaks of shigellosis becomes a challenging task for public health management and demands considerable time, effort, and expense.

From March 2007 through March 2008 the Milwaukee Health Department (MHD) detected an increase in *Shigella sonnei* due to outbreaks in multiple child care facilities and family clusters.

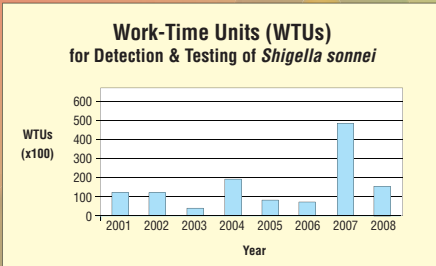
Intense community messaging to media, laboratories, physicians, child care facilities and recreational water operators may have enhanced awareness of the ongoing outbreak resulting in an increase in laboratory diagnosis and reporting of the disease.

The laboratory, although with surge workload well beyond its normal capacity, tracked the disease using markers and tools such as antibiotic resistance, rhamnose utilization and pulsed-field gel electrophoresis (PFGE). Outbreak related isolates were resistant to sulfamethoxazole-trimethoprim (SXT) (83%) and ampicillin (amp) (87%). Majority of these isolates lacked the capacity to ferment rhamnose (99%). PFGE subtyping resulted in two typical patterns differing by a band associated with this outbreak.

The large number and continued transmission of cases within the community placed an unusually heavy workload on both the laboratory staff and the case investigators. Changes and modifications in work flow were introduced to keep pace with the unexpected and prolonged surge.



- TOC = Test of Cure samples sent to state lab
- Total cases = 607
- Lab confirmed cases = 461
- Baseline average/mo. = 10
- Outbreak average cases/mo. = 32
- Max. = 75, June 2007

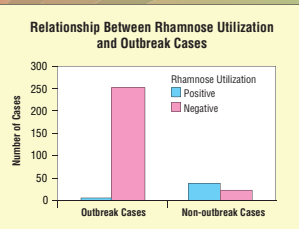


- Work-time units (WTUs) – a work load unit for minutes of analytical work for i) enteric culture, ii) Shigella identification, iii) PFGE and iv) susceptibility test

Shigella sonnei Strain Characterization

Rhamnose Utilization

Outbreak strains were "rhamnose negative"

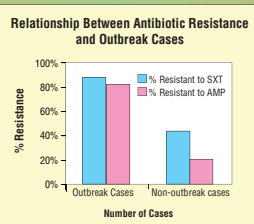


PFGE Strain	Rhamnose Not Utilized	"n" – Value
Outbreak	99%	259
Non-outbreak	35%	54

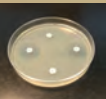
<15% referred *Shigella sonnei* to CDC 1974-2002 were rhamnose negative¹

Antibiogram

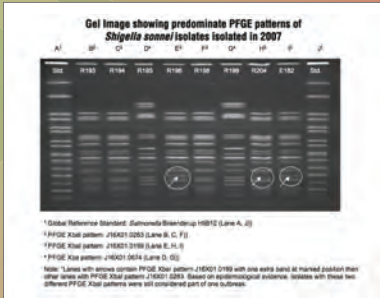
Outbreak strains were mostly "antibiotic resistant"



PFGE Strain	Resistant or Intermediate		"n" – Value
	SXT	Amp	
Outbreak	83%	87%	259
Non-outbreak	20%	44%	54



Pulse Field Gel Electrophoresis (PFGE) Activity



Lab confirmed outbreak-related cases of *Shigella sonnei*: 393

PFGE performed: 313

PFGE Confirmed Outbreak Cases XbaI patterns: n=254

- n=178: J16X01.0283
- n=76: J16X01.0199
- 97.57% similarity

Both PFGE patterns were *not* seen in 2006

Other significant PFGE XbaI patterns seen:

- J16X01.1467 (17 cases)
- J16X01.0917 (8 cases)
- J16X01.0674 (7 cases)

Epidemiological & Investigational Issues & Strategies

Child care centers >100 Family clusters >250

Most cases "high risk"

- Childcare-related
- School-related
- Food Handler
- Healthcare Worker

Average case takes more than a month to close (from diagnosis to TOC).

- May require multiple trips to home or other location for interviews and contact identification
- Follow-up of symptomatic contacts
- Time to track people

Interview case: disease questionnaire; assessment; teach case

- Symptomatic contacts: refer to primary care provider
- High risk cases require test of cure (most cases)
- Two negative specimens before returning to work
- Collaborate with physician

Childcare facilities

- On-site inspection
- Notification letter to contacts
- Identification of other symptomatic individuals
- Education with provider on hygiene measures
- Issues notice of exclusion of sick individuals

Schools

- On-site inspection if young children onsite
- Notification letter to contact
- Identification of other symptomatic individuals
- Education with provider on hygiene measures
- Issue notice of exclusion of sick individuals

Food handler

- Referral made to food inspectors
- Issue notice of exclusion of sick individuals

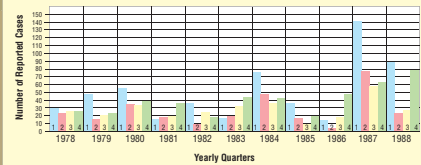
Healthcare worker

- Assess (via phone) if other illness within the facility
- Issue notice of exclusion of sick individuals

Other strategies

- Mass messaging via mail and telephone to licensed child care facilities
- Messaging to physicians: increase in cases and antibiotic resistance
- Press release to inform community about Shigella and prevention techniques
- Increase recreational water surveillance to assure adequate chlorination

Shigella Reported Cases - Milwaukee 1978-1988



Historical recognition: Milwaukee has periodic extensive shigellosis outbreaks, often with winter peaks.²

"In the developing countries, a combination of contact and waterborne spread can contribute to a prolonged, smoldering epidemic that lasts for months rather than weeks, until the population of susceptibles is exhausted."³

Summary and Conclusions

- Naturally occurring outbreaks like shigella that are of long duration represent a sustainability issue for lab, epi and environmental health that generally go well beyond typical emergency preparedness planning. This represents continued vulnerability for LPHAs in not being able to rapidly quench CD outbreaks and face relentless surging of assets (personnel, supplies, equipment) at the expense of other issues.
- LPHA response fatigue is always a threat during these types of events. Models for engaging other stakeholders in early response and mitigation is essential (private healthcare, daycares, schools, etc.)
- Rapid ID by lab to characterize strain and antibiotic sensitivity is critical and part of the new Health Security Intelligence models that are being advocated by the federal government. This information is critical for "epidemiologic situational awareness" as well and plays a prominent role in intervention decisions by epi and others.
- Shigella may not result in high mortality but the economic and social implications of long-term outbreaks are significant (lost work-time by parents, closures of daycares, cost for environmental disinfection, etc.)
- The shigella outbreak is an opportunity to hone the lab-epi interface and skill sets to create a "response memory" by department staff and should be mined for lessons learned by lab, epi and administration.
- Milwaukee and other cities (1,2) historically have long term shigellosis outbreaks and can anticipate and plan for future such outbreaks, often with winter peaks.

¹ MMWR. January 30, 2004. 53(03):60-63 Day care related outbreaks of rhamnose negative Shigella sonnei. Six States, June 2001–March 2003.

² Gradus, M.S. and H. D. Nichamin. 1989. Shigellosis winter trends in Milwaukee. Wisc. Med. Journal. April. Pp. 17-18.

³ Keusch & Bennis, Shigellosis, Chpt 32 in Bact. Inf. Humans. 1998.