Shigellosis Outbreak Response at a Splash Pad in a Jurisdiction without Aquatic Codes

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Background Information

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Shigellosis

- *Shigella* spp. bacteria
- Symptoms include diarrhea, fever, stomach cramps
- Illness lasts 7 days
- Prevention
  - Wash hands
  - Avoid swallowing recreational water
  - Do not swim for two weeks after illness

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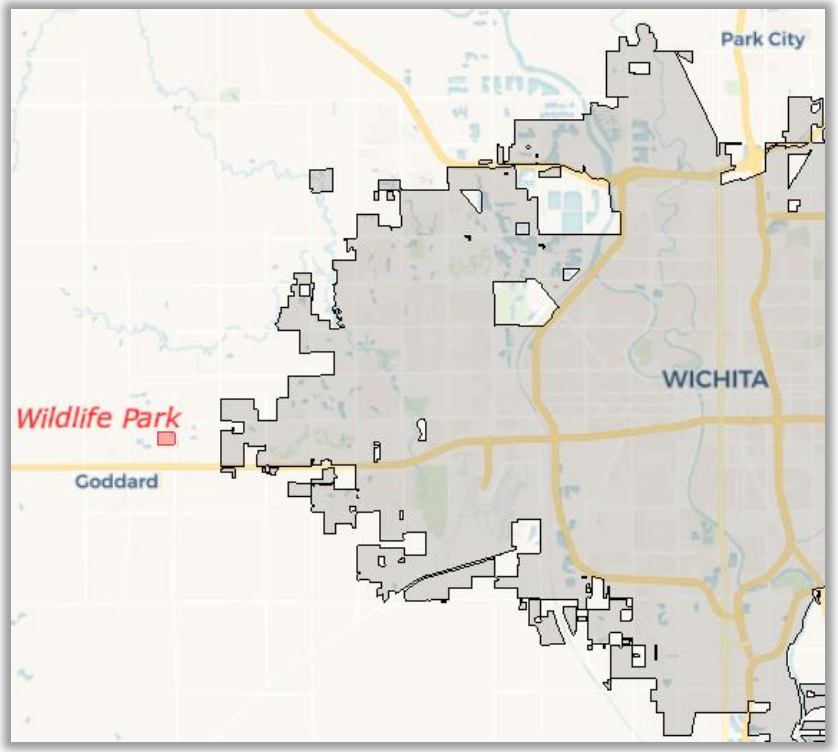
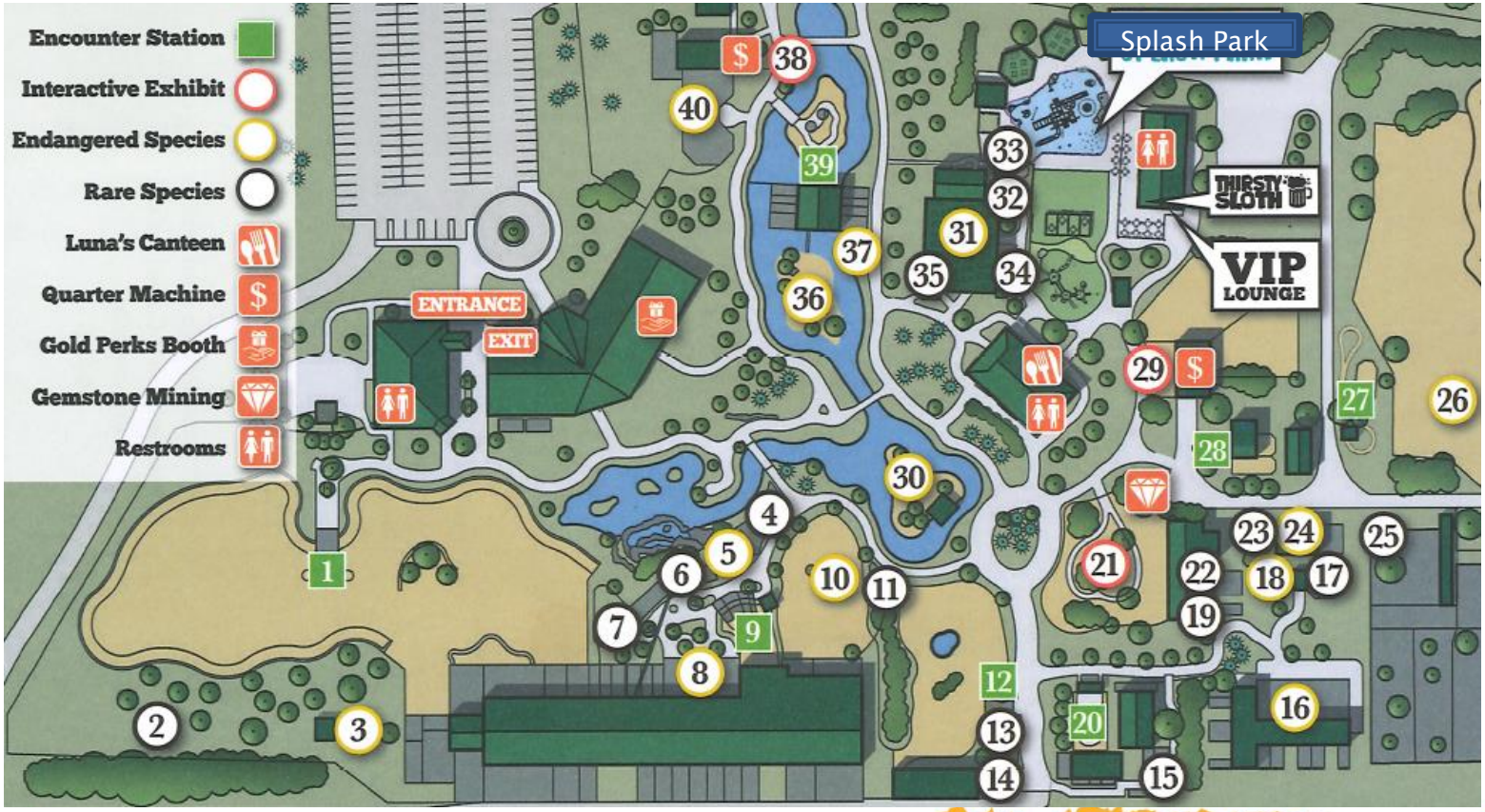
Wildlife Park Background

- Privately owned 25-acre wildlife park just west of Wichita



Wildlife Park Background

- 400 animals, 40 exhibits-some interactive



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Wildlife Park Splash Pad

- 5,000 square feet
- Tipping buckets, water cannons, slides, waterfalls, fountain jets
- Built by the park
- Opened the previous summer

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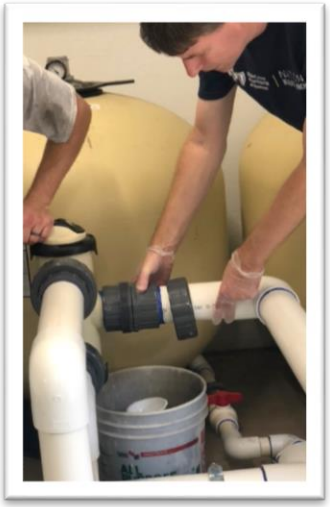
Outbreak Timeline

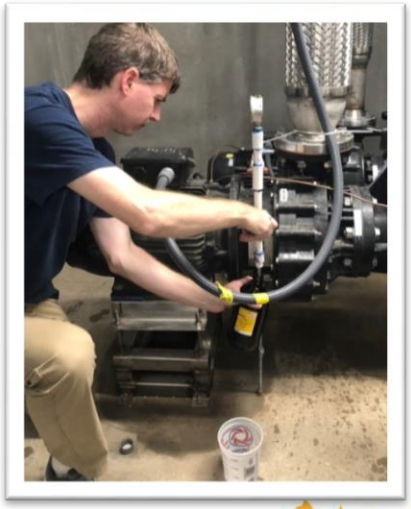
Outbreak Timeline

- Friday, June 18, 2021
  - 3 ill children interviewed through routine surveillance reported exposure to a splash pad inside a private wildlife park
    - Case 1: visited 6/11, only splash pad
      - PCR positive for *Shigella/EIEC* and STEC
    - Case 2: attended day camp 6/7-6/11, splash pad on 6/11
      - PCR positive for *Shigella/EIEC*
    - Case 3: interactive animal exhibits and splash pad on 6/11
      - Culture positive for *Shigella*
  - SCHD met with splash pad, which voluntarily closed

Outbreak Timeline

- Saturday, June 19, 2021
  - SCHD & KDHE inspect splash pad and collect water samples for CDC testing
  - Splash pad reopens without HD recommendation, but closes next day





Outbreak Timeline

- Sunday, June 20, 2021
  - First joint SCHD & KDHE news release with KDHE survey
    - Survey used for case finding
    - Provided way for public to provide information
      - Contact information
      - Visit dates
      - Illness dates
      - Diagnoses/lab results
  - SCHD begins receiving reports from public about illnesses


The Wichita Eagle

Diarrheal illnesses connected to Splash Park under investigation by KDHE, Sedgwick County

BY JASON TIDD

JUNE 20, 2021 07:20 PM,

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Outbreak Timeline

- Monday, June 21, 2021
  - SCHD conducts second inspection with Sedgwick County MABCD
- Friday, July 2, 2021
  - KDHE receives water sample results (*E. coli* in one pump & coliforms in 3 pumps)
- Thursday, July 8, 2021
  - SCHD, KDHE, & CDC meet to discuss inspection options, reopening requirements, & review SCHD-developed Model Aquatic Health Code (MAHC) reopening checklist

Outbreak Timeline

- Tuesday, July 13, 2021
  - WGS results received for two *Shigella flexneri* isolates
    - Exact match-zero base pair differences
- Wednesday, July 14, 2021
  - Second survey distributed via press release and emails
    - Added questions about animal exposures, splash pad behavior
    - Used for case control study

Outbreak Timeline

- Friday, July 16, 2021
  - SCHD, private pool inspector, & CDC (remote) inspect splash pad using reopening checklist
- Friday, July 23, 2021
  - SCHD Local Health Officer sends letter to facility stating they have met SCHD recommendations to reopen
- Final Update
  - 8 total shigellosis cases linked to outbreak
    - All reported visiting splash pad on June 11
  - Many other illnesses reported

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This seems like a "straightforward" outbreak…

…so what made it complicated?

Aquatic Codes & Environmental Health

- No aquatic codes in Sedgwick County
  - Cities may have aquatic codes/ordinances
    - Most for swimming pools and not splash pads
    - City with outbreak splash pad had no inspection requirements or regulations
- No environmental health program at SCHD
  - No certified pool/water inspectors on staff
  - No pre-developed inspection checklists or resources

Multiple Areas of Concern after Early Inspections

- System did not run 24 hours/day
- Did not have secondary disinfection system

- Reservoir not regularly deep cleaned
- No procedures for testing features other than slides

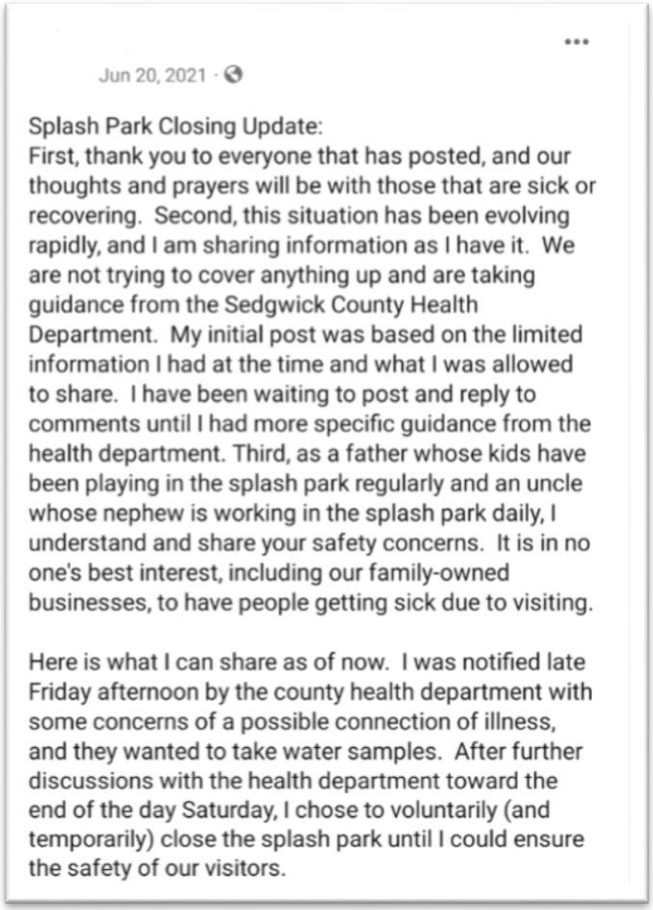
Multiple Areas of Concern after Early Inspections

- Checked total chlorine, not free
- Recorded ORP on log sheet, not choline level

DATE	PH LEVEL	CL LEVEL	TIME	CHECKED
6/6/21	7.4	749	4:00PM	RR
6/7/21	7.0	575	8:00AM	BS
6/7/21	7.3	739	12:00PM	BS
6/7/21	7.4	748	4:00PM	RR
6/8/21	7.5	750	8:00AM	NR
6/8/21	7.4	755	12:00PM	NR
6/8/21	7.3	721	4:00PM	NR, JP
6/9/21	7.1	402	8:00AM	BS, RR
6/9/21	7.3	739	12:00PM	NR
6/9/21	7.5	729	4:00PM	RR, NR
6/10/21	7.0	662	8:00AM	RR
6/10/21	7.4	753	12:00PM	RR
6/10/21	—	—	4:00PM	—
6/11/21	7.2	451	8:00AM	BS
6/11/21	7.6	748	12:00PM	RR

Splash Pad's Messaging

- Did not utilize SCHD-provided talking points
  - First put out misinformation stating filtration issues



Splash Pad Immediate Reopening

- Reopened after first inspection despite no changes being made to operations/system
- Did not tell SCHD about reopening until KDHE survey responses were received for day they were “closed”
- Stated had received approval from “Health Department” to reopen
  - Neither SCHD or KDHE had recommended reopening at that time

SCHD Workload

- Outbreak notification occurred Friday (6/18)
  - First inspection and news release over weekend
- Started receiving calls/emails from public Sunday
  - ~140 total calls/emails (most Sunday/Monday)
  - ~45 additional calls/emails for specimen testing
- PIO position vacant, so wrote news releases
- 5 onsite visits to splash pad
- 300+ staff hours worked
  - All while dealing with COVID and a hepatitis A outbreak

Outside Factors

- Unable to issue legal orders due to restriction of Health Officer authority by state legislation
- Pressure from splash pad about reopening
- Requests from internal and external legal counsel both during and after investigation

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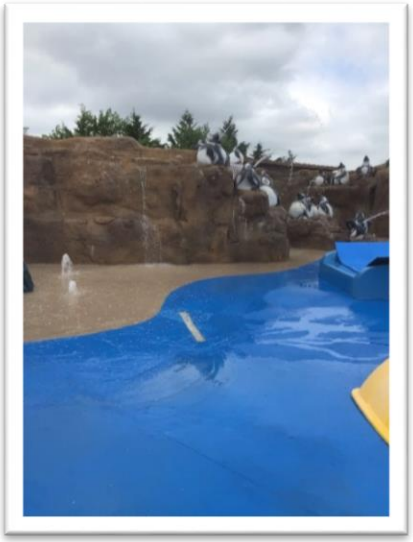
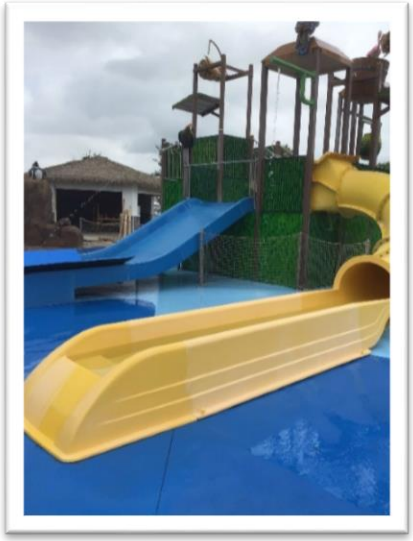
So….what went well?

Splash Pad Followed Immediate Recommendations

- Increase free chlorine from 1.5 ppm to 3 ppm



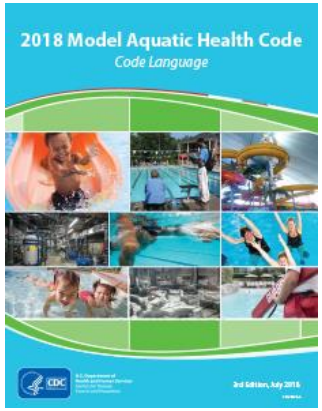


- Test 3 times/day in filtration system, standing water, and features

- Run pumps and disinfection system 24 hours/day

Model Aquatic Health Code (MAHC)

- SCHD utilized CDC's MAHC and expertise for guidance on splash pads
- Identified items related to splash pads and created 28 item just-in-time reopening checklist
  - Included references to MAHC and expected standards
  - Incorporated direct recommendations from CDC experts



https://www.cdc.gov/mahc/index.html

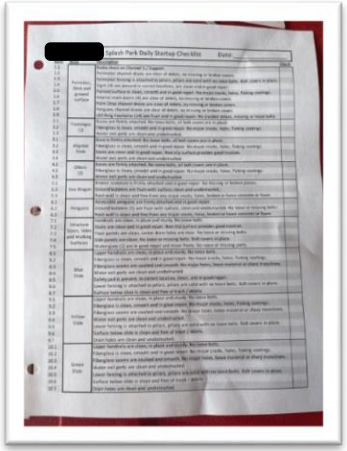
Reopening Checklist Example

Category	#	ITEM	STANDARD	INSPECTION DATE	DATE COMPLETED	COMPLETED	NOTES / RESULT
Hire	1	Hire independent aquatic design/engineering company to review design plan and confirm construction is compliant with the plan. The company will perform an on-site visit and perform a gap analysis to assess existing facility and procedures and what is needed to meet MAHC.	• After review of plans and on-site visit, company submits report to Tanganyika and SCHD. Two parts to the report: 1. Does the Splash Park design match the construction of the facility? This is due before re-opening. 2. Gap analysis of what is needed to meet MAHC. This is due 30 days from re-opening date.				Firm completed on-site inspection on 7/6/21. Report(s) are in progress.
Log	2	After new controller is installed, manually test pH, free chlorine, total chlorine, and total alkalinity and also calculate combined chlorine (total chlorine - free chlorine), from pump room, reservoir, and features in the venue.	Free chlorine: 2-5ppm, max of 10 ppm Combined chlorine (total – free) is <0.4 ppm pH: 7.2 - 7.8 Alkalinity 60-180 ORP: 600-900	7/21/21	7/21/21	√	Independent pool operator will test on 7/22.
Calc	3	Calculate Theoretical Peak Occupancy (TPO) *(MAHC 4.1.2.3.5.3)*	TPO = Aquatic Venue Surface Area/Density Factor Note: Density Factor for Interactive Water Play Aquatic Venues= 10ft² (0.9 m²) per bather on surface	7/16/21	7/16/21	√	This was calculated to be 495 people based on the system.
SOP Log	4	Establish and implement occupancy monitoring procedure to prevent overcrowding. Use TPO for overcrowding threshold.	Procedure added to SOP.	7/16/21	7/16/21	√	Have position of "splash guard" who will now roam the splash park and use counters to track number of occupants. Recommended to do: Staff sign procedure and training log. Record excursions on maintenance log.
Calc Log	5	Calculate flow rate/turnover time *(MAHC 4.7.1.10)*	No greater than 0.5 hours. If not aquatic design/engineering firm can train. 4.7.1.10.2A The TURNOVER TIME shall be calculated based on the total volume of water divided by the flow rate through the filtration process.	7/16/21	7/16/21	√	350 gallons/minute filtration rate. Turnover time is 20 minutes when heavily loaded. Backwashing is done as needed when the PSI shows 10 over the normal starting range.

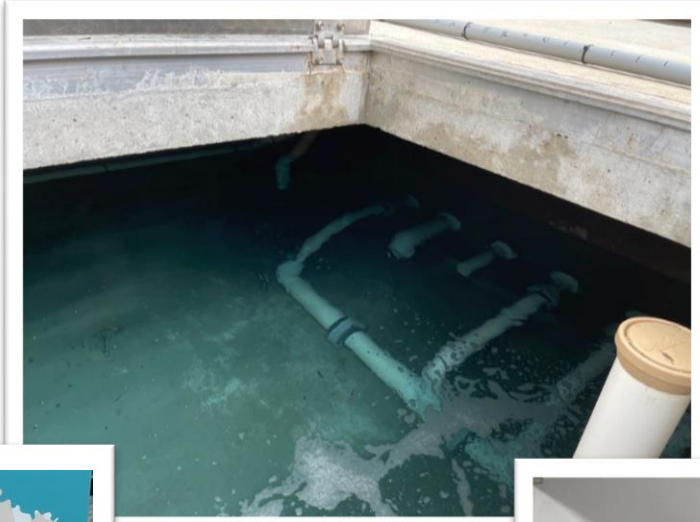
Creative Final Inspection

- CDC participated remotely via Zoom
  - Utilized to talk with splash park staff and conduct inspection
- Partnered with private pool inspector for onsite expertise
  - Conducted water testing for chlorine & pH
- Reviewed improvements made from reopening checklist
- Recommendation from CDC and pool inspector to allow reopening once documentation provided

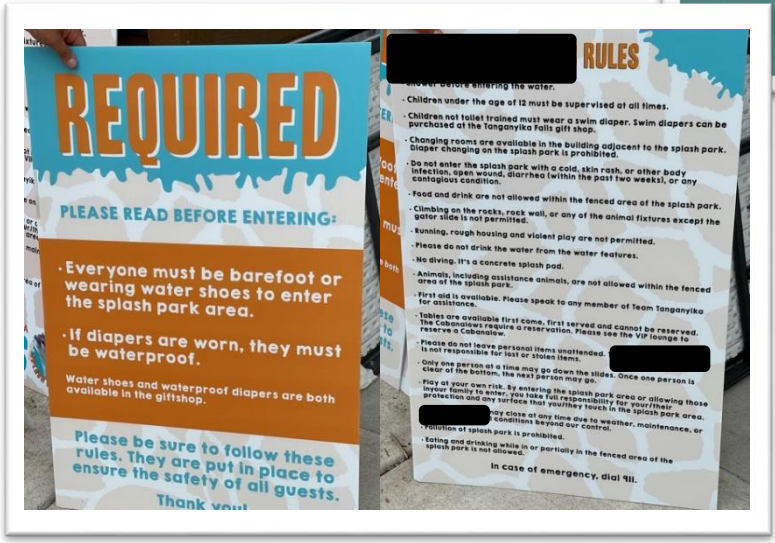
Additional Improvements



Updated opening checklist & testing protocols



Established regular reservoir cleaning procedure



New signage based on MAHC

Installed secondary disinfection system and run system 24 hrs./day

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SCHD Preparedness

- Quickly adapted previously created talking points
- Employed COVID-19 hotline number for public questions
- Utilized trained staff to handle public questions, assist with surveys, and support specimen collection

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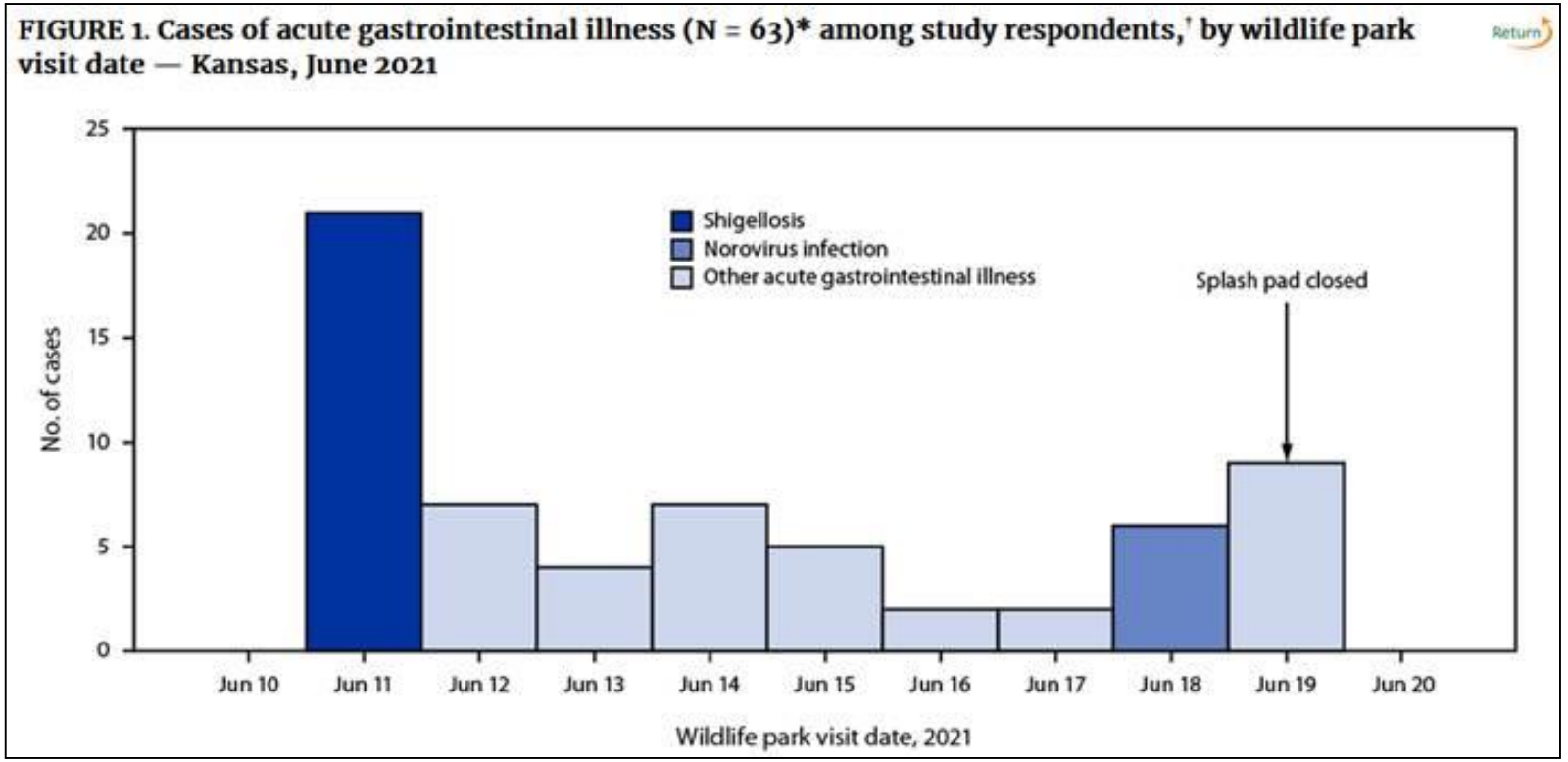
What else did we find?

Survey Results

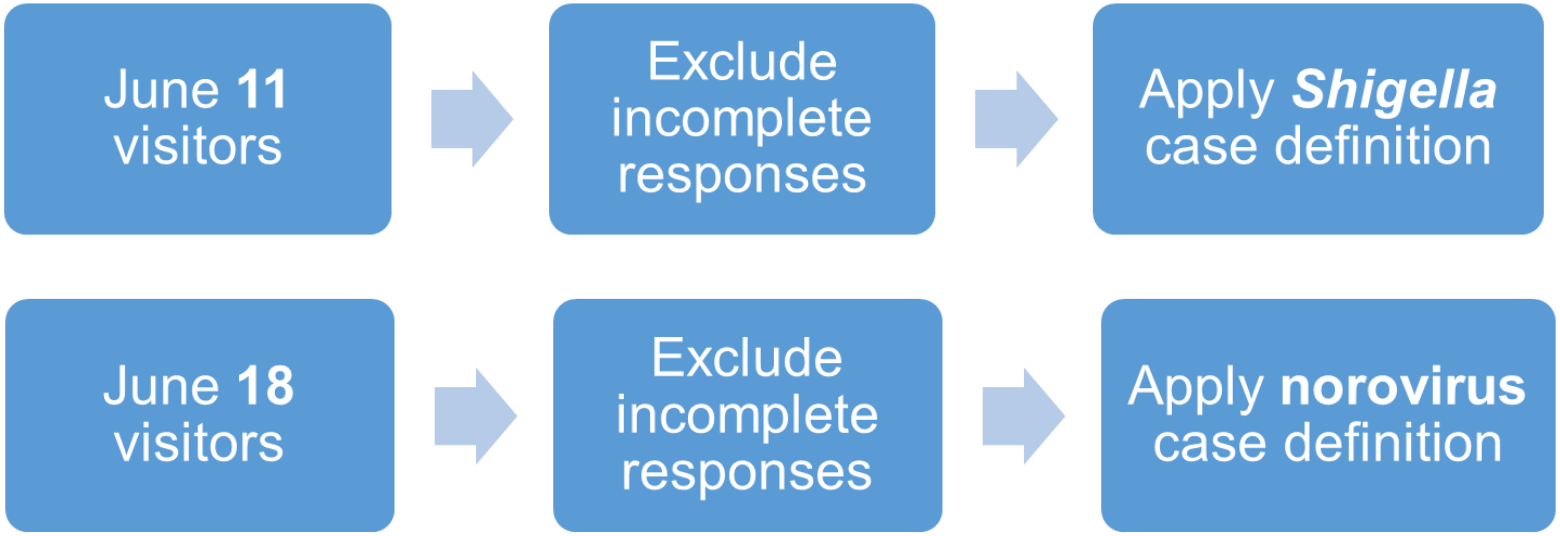


https://www.cdc.gov/mmwr/volumes/71/wr/mm7131a1.htm

Norovirus

- 2 lab-confirmed norovirus genogroup II cases identified after initial survey
- 3 survey respondents diagnosed with norovirus
- All reported visiting the splash pad on 6/18

Case Control Analyses



- *Shigella* case definition: diarrhea 12-73 hours after visiting June 11
- Norovirus case definition: vomiting or diarrhea 12-56 hours after visiting June 18

Case Control Analyses

Potential Exposures to Shigella on June 11	Ill (N = 21)	Not ill (N = 43)	OR (bivariate)	95% CI	p-value
Entered splash pad	21/21 (100%)	35/43 (81%)	10.3	1.2–1,356	0.032
Got splash pad water in the mouth	13/15 (87%)	7/19 (37%)	9.0	2.0–56.4	0.003

Potential Exposures to Norovirus on June 18	Ill (N = 6)	Not ill (N = 19)	OR (bivariate)	95% CI	p-value
Entered splash pad	6/6 (100.0%)	13/19 (68%)	6.3	0.6–863.0	0.149
Got splash pad water in the mouth	6/6 (100.0%)	5/12 (42%)	17.7	1.5–2,501.5	0.018

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Summary

Summary: Inspections

- SCHD successfully coordinated inspections and reopening without having an environmental health program
- Pre-develop a reopening checklist and inspection resources prior to an outbreak occurring
- You may have to think outside the box for inspections (ex. remote inspector)

Summary: MAHC

- Utilize CDC's MAHC for inspections and training
- Make sure your local pool and splash pad operators read it/know the recommendations
  - Should be used for recirculating and non-recirculating splash pads
- Ensures following guidance based on latest science and best practices
- https://www.cdc.gov/mahc/index.html

Summary: Analyses

- 2 outbreaks associated with the splash pad
- Each caused by pathogens readily inactivated by free chlorine
- Getting splash pad water in the mouth was significantly associated with illness

Limitations: Analyses

- Daily overall wildlife park and splash pad patron counts not available
- Case and survey respondent counts small and analyzing by wildlife park entry date further limited power
- Wording of one response choice to question asking if respondents entered splash pad might not have been clear and might misrepresent respondents' exposure to splash pad water
- Small samples can over-represent rare events, leading to bias
- Time elapsed after splash pad visit until survey response could lead to recall bias

More Information?

Outbreaks of Acute Gastrointestinal Illness Associated with a Splash Pad in a Wildlife Park — Kansas, June 2021

Weekly / August 5, 2022 / 71(31);981–987

Samaria K. Aluko, MPH[1,2]*; Syed S. Ishrati, MD[3]*; David C. Walker, MS[1]; Mia C. Mattioli, PhD[1]; Amy M. Kahler, MS[1]; Kayla L. Vanden Esschert, MPH[1]; Kaylee Hervey, MPH[4]; Justin Rokisky Jr., MPH[2,5]; Mary E. Wikswo, MPH[6]; Joseph P. Laco, MSEH[5]; Sonalli Kurlekar, MPH[4]; Adrienne Byrne, MS[4]; Noelle-Angelique Molinari, PhD[1]; Michelle E. Gleason, MPH[1]; Christine Steward, MPH[4]; Michele C. Hlavsa, MPH[1]; Daniel Neises, MPH[3] (View author affiliations)

- *MMWR* article published August 5, 2022
  - https://www.cdc.gov/mmwr/volumes/71/wr/mm7131a1.htm

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  - Farah Ahmed
  - Sheri Tubach
  - Purity Kaboe
- CDC
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  - Michele Hlavsa
  - Mia Mattoli
  - Joseph Laco
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  - Justin Rokisky Jr
  - Michelle Gleason
  - Mary Wikswo
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  - David Walker
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