NORTH AMERICA WATER SLIDE INJURY SURVEY, 2021 UPDATE

Prepared for
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by

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Preface

This report presents the results of work done by the National Safety Council (NSC), under contract to the International Association of Amusement Parks and Attractions (IAAPA). It includes estimates by NSC for calendar years 2016 through 2021.

NORTH AMERICA WATER SLIDE INJURY SURVEY—2021

Introduction

Since 2016, the National Safety Council (NSC) has surveyed International Association of Amusement Parks and Attractions (IAAPA)-member parks in North America to collect and analyze water slide-related injuries occurring at water parks and other fixed-site amusement parks. The goal of the project is to develop annual injury and injury rate estimates of water slide-related injuries occurring in North American member parks. The survey included seasonal and year-round dedicated water parks, as well as fixed-site amusement parks that also have water slides.

2021 Results

A total of 208 North American member water parks and fixed-site amusement parks were invited to participate in the 2021 survey of water slide-related injuries. This sampling attempts to represent 100% of North American member parks with water slides. In addition to surveying all of the IAAPA park members listed as water parks, other member parks reporting to have one or more water slides were also included in the survey sampling. All facilities received an initial email at the end of the summer operating season (September 2021), and year-round operators received another follow-up at the end of the calendar year (December 2021). Non-respondents received monthly follow-up emails inviting their participation through June 2022. Water park operators were asked to report attendance, number of water slides, and water slide ridership, as well as the number of patron injuries. Because ridership is an important measure of exposure, water park operators were encouraged to provide an estimate of water slide ridership through exit surveys, sample counts, or other methods. Operators were also asked to provide a summary of their estimating procedures.

A total of 84 IAAPA-member parks responded to the survey. Participation in the survey has rebounded strongly from 2020 when only 47 member parks were able to provide some or all of the data requested because of disruptions caused by the COVID-19 pandemic. Of the 84 IAAPA-member parks providing data for 2021:

- 79 parks provided attendance-based data
- 58 parks provided ridership-based data
- and 53 parks provided both

Compared to 2020, participation increased 76% among parks providing attendance data and 32% among parks providing ridership data (see “Survey Response” and

"Methodology" in this report for more details). Overall, NSC estimates that approximately 40% of operating IAAPA-member parks with water slides in North America provided usable data for the 2021 estimate, an increase from 33% in 2020. Assuming that the size of the responding parks are representative of all member parks with water slides, the parks included in the current study represent 37% of the total estimated attendance and 28% of the total estimated number of rides on water slides taken at IAAPA-member parks in North America. Because the percentage of participating parks is moderate (below 50%), the injury estimates made from the sample data should be interpreted with caution.

Separate attendance-based and ridership-based analyses were performed. Not all facilities were able to report both attendance and ridership, and therefore there were differences in the selection of facilities used in each analysis. Table 1 presents the attendance and ridership-based estimates of water slide-related injuries for all member parks in North America. In 2021, the attendance-based injury estimate of 475 was 145 less than the ridership-based estimate of 620 injuries.

When comparing results across years, injury rates are a better indicator of change than the number of injuries. From year to year, both attendance and ridership varies. Because of the COVID-19 pandemic, average reported attendance among operating parks in 2020 decreased 82%, while average ridership decreased 73%. In 2021, average attendance rebounded 310% and ridership increased 221% from 2020 lows. However, average attendance is still down 23% and ridership is down 14% compared to 2019. Because of these industry disruptions caused by the COVID-19 pandemic in 2020, comparing 2020 to other years is not recommended. The following analysis focuses on the comparison to 2019 instead. Given the lower attendance and ridership reported in 2021, it is not surprising to see large decreases in the number of injuries. From 2019 to 2020, the attendance based injury estimate decreased 63% and the ridership based injury estimate decreased 54%. Using injury rates instead of injury counts helps to control for some of the variability in attendance and ridership. Compared to 2019, the 2021 attendance based rate decreased 40%, while the ridership rate decreased 37%. However, these changes should be interpreted with caution. The large decreases in reported attendance and ridership in 2021 compared to 2019 allow relatively small fluctuations in reported injuries to result in dramatic shifts in injury rates.

Table 1. Attendance-Based vs. Ridership-Based Injury Estimates, 2016-2021

Year	Attendance-Based		Ridership-Based		Difference between Attendance-Based and Ridership-Based Injury Count
	Estimated Annual Number of Ride-Related Injuries	Injuries per Million Attendance	Estimated Annual Number of Ride-Related Injuries	Injuries per Million Patron-Rides	
2016	784	9.59	900	2.68	-116
2017	998	8.81	1,162	3.37	-164
2018	1,079	8.57	1,133	2.97	-54
2019	1,273	10.32	1,334	3.60	-61
2020*	367	19.2	371	4.31	-4
2021*	475	6.08	620	2.26	-145

Source: NSC estimates based on water slide injury survey.
* Because of the disruptions resulting from the pandemic, please use caution when comparing 2020 and 2021 results to previous years.

Confidence intervals were developed for the estimated 2021 water slide injury rates for parks in North America. The confidence intervals, along with exposure estimates, were then used to estimate the likely range of injuries experienced in 2021. The confidence intervals provided in Table 2 assume a Poisson distribution of the data instead of the normal bell-shaped curve often used in statistics. The Poisson distribution is commonly used in the medical and epidemiological fields to model events, particularly uncommon events like injuries and illnesses. Because of the increase in parks operating in 2021 compared to 2020, it is not surprising that significantly more injuries occurred in 2020. Because of the large swings in both attendance and ridership trends over the last three years, comparisons will focus on injury rates that help to control for the year-to-year changes in attendance and ridership. Comparing previous attendance rate estimates to the 2021 confidence intervals shows that the 2021 attendance-based injury rate estimate is significantly lower than in any previous year measured. Similarly, the ridership-based rate is also significantly lower compared to all previous years. As noted previously, because of the steep decline in average attendance and ridership compared to pre-pandemic norms, caution needs to be used when interpreting results. However, it is hoped that as attendance and ridership levels continue to recover to pre-pandemic norms, the improvements in injury rates will persist.

Table 2. 95% Confidence Intervals of Injury Rates and Counts Assuming a Poisson Distribution

	Attendance-Based Estimates		Ridership-Based Estimates	
	Injuries per Million Attendance	Injury Count	Injuries per Million Patron-Rides	Injury Count
Upper Confidence Limit	7.04	550	2.62	720
Estimated Value	6.08	475	2.26	620
Lower Confidence Limit	5.22	407	1.94	531

Figures 1 through 4 illustrate the longer-term injury and injury rate trends for both the attendance- and ridership-based estimates. Prior to 2020, both estimate procedures showed slight upward trends in both the number of injuries and injury rates. The addition of the 2020 and 2021 data results in a downward injury trend (illustrated by the downward sloping trend lines), while the slight upward injury rate trends are little changed.

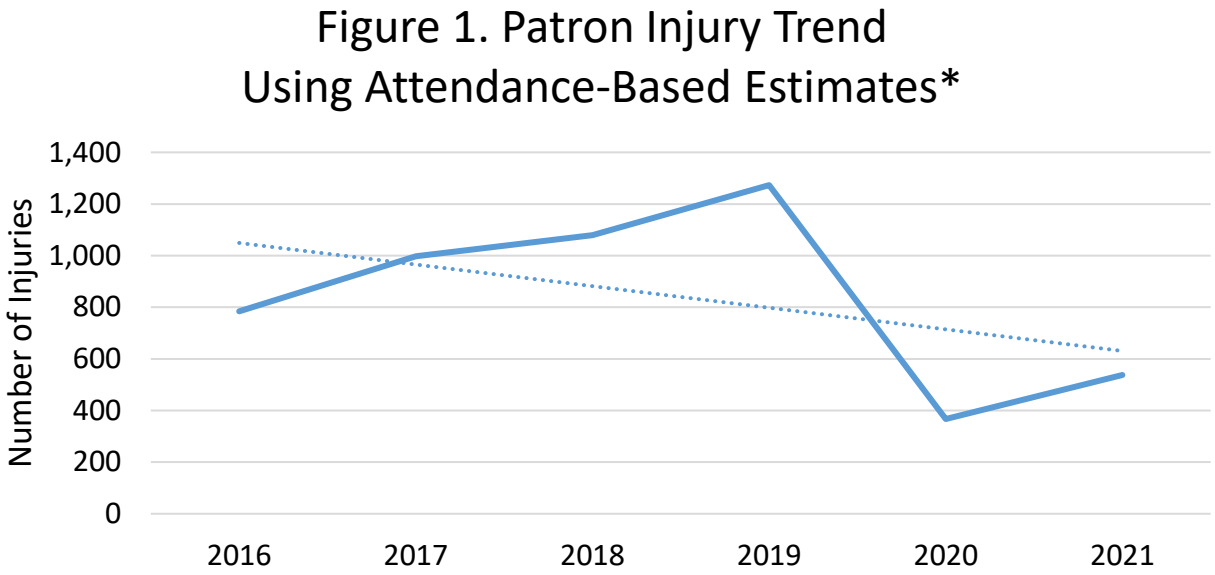


Figure 1 shows the long-term injury count trend as estimated using the attendance-based data. The downward sloping dashed trend line clearly indicates improvement. From 2016 to 2021, injuries have decreased 39% from 784 to 475 injuries.

Figure 2. Patron Injury Rate Trend Using Attendance-Based Estimates*

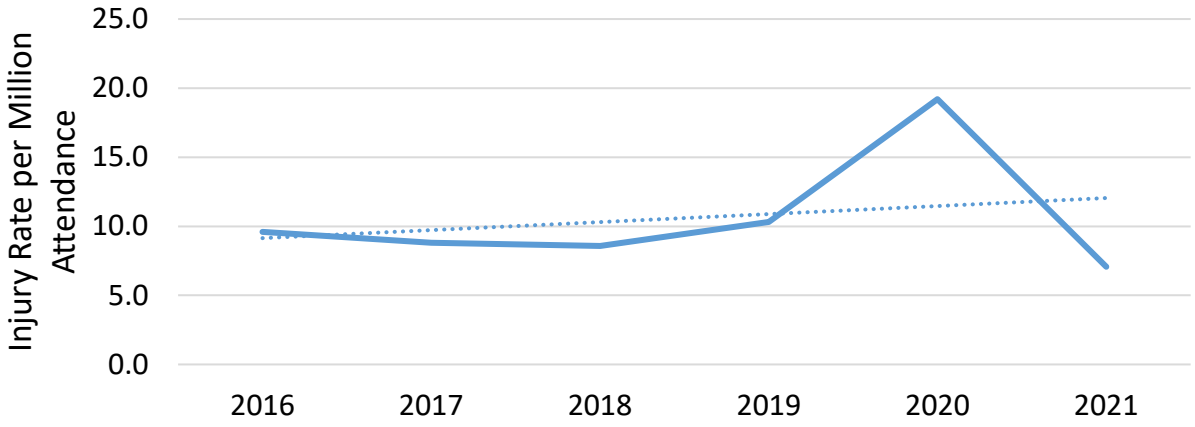


Figure 2 shows the long-term injury rate per million attendance trend. The upward sloping dashed trend line indicates an increase in the long term injury rate trend. Much of the increase is the result of an injury rate spike in 2020 that has since decreased in 2021. Comparing 2016 to 2021, the injury rate per million attendance has decreased 37%, from 9.59 to 6.08 injuries per million attendance.

Figure 3. Patron Injury Trend Using Ridership-Based Estimates*

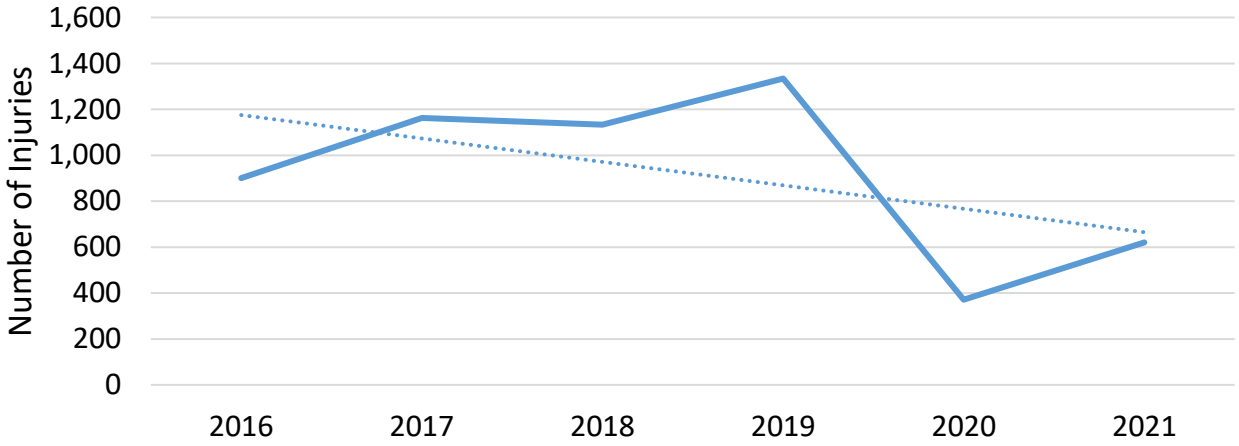


Figure 3 shows the long-term injury count trend as estimated using the ridership-based data. The downward sloping dashed trend line clearly indicates improvement. From 2016 to 2021 injuries have decreased 37%, from 900 to 620 injuries.

Figure 4. Patron Injury Rate Trend Using Ridership-Based Estimates*

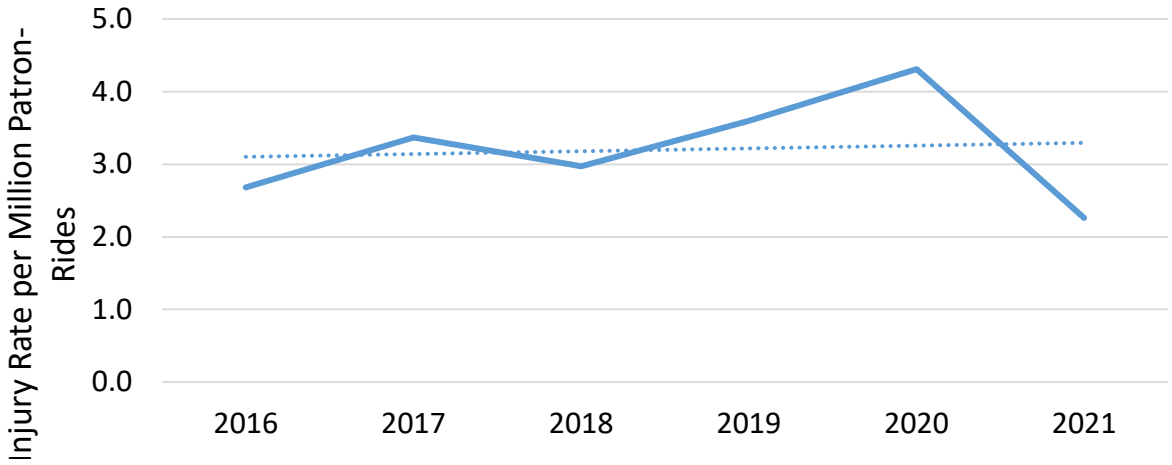


Figure 4 shows the long-term injury rate per million rides taken trend. The slight upward sloping trend line indicates a lack of consistent improvement. Comparing 2016 to 2021, the injury rate per million rides taken has decreased 16%, from 2.68 to 2.26 injuries per million rides taken. Another positive year of results will likely shift this trend line downward.

Ridership-based rates are a more appropriate measure of exposure to risk than attendance-based rates because injuries on water slides are the outcome of interest. Parks with similar attendance may have much different ridership numbers because of differences in the number and kinds of water slides provided. The results provided in Table 3 are based on the ridership analysis.

Table 3. Summary of Water Slide Injuries by Severity, North America, 2016-2021 (based on ridership)

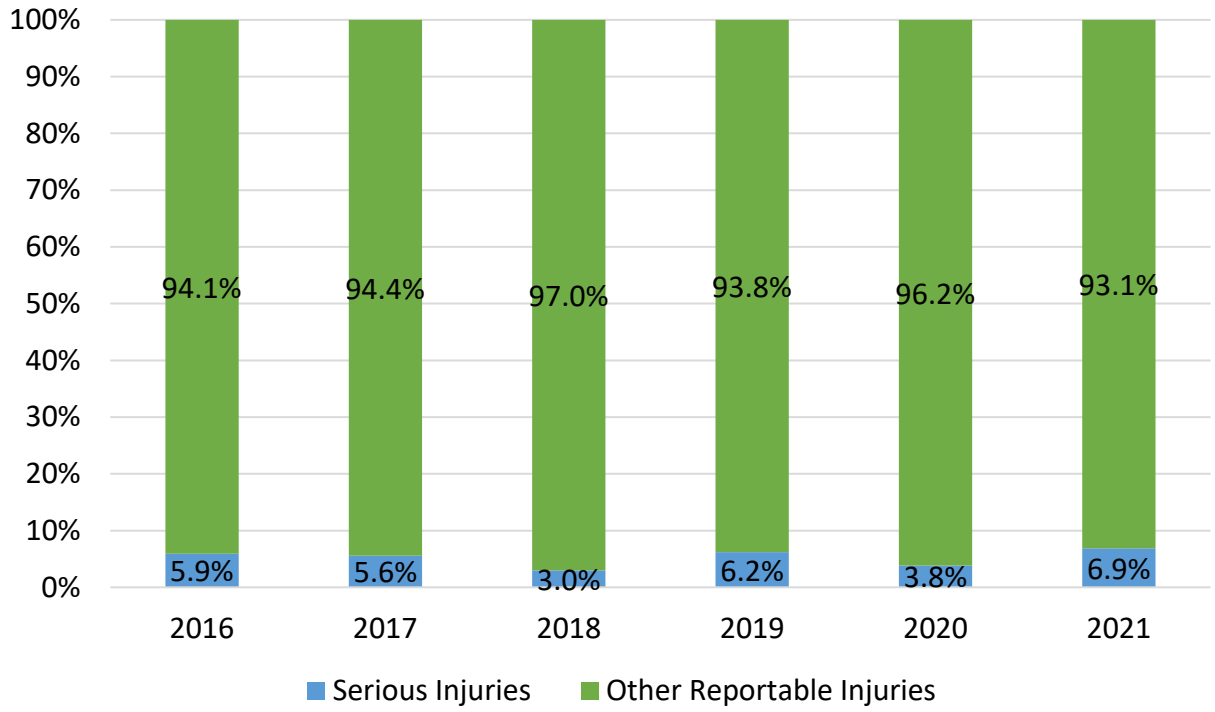
		Injuries by Severity		
Year	Characteristic	Total	Serious Injuries	Other Reportable Injuries
2016	Estimated Number of Injuries	900	53	846
	Percent	100.0%	5.9%	94.1%
	Injuries per Million Patron-Rides	2.68	0.16	2.52
2017	Estimated Number of Injuries	1,162	65	1,097
	Percent	100.0%	5.6%	94.4%
	Injuries per Million Patron-Rides	3.37	0.19	3.19
2018	Estimated Number of Injuries	1,133	34	1,098
	Percent	100.0%	3.0%	97.0%
	Injuries per Million Patron-Rides	2.97	0.09	2.88
2019	Estimated Number of Injuries	1,334	83	1,251
	Percent	100.0%	6.2%	93.8%
	Injuries per Million Patron-Rides	3.61	0.23	3.38
2020*	Estimated Number of Injuries	371	14	357
	Percent	100.0%	3.8%	96.2%
	Injuries per Million Patron-Rides	4.31	0.17	4.14
2021*	Estimated Number of Injuries	620	43	577
	Percent	100.0%	6.9%	93.1%
	Injuries per Million Patron-Rides	2.26	0.16	2.10

Source: NSC estimates based on water slide injury survey. Note: Totals may not equal sum of parts due to rounding.

* Because of the disruptions resulting from the pandemic, please use caution when comparing 2020 and 2021 results to previous years.

As shown in Figure 5, about 6.9% of the injuries in 2021 were reported to be "serious," meaning an injury resulting in immediate admission and hospitalization in excess of 24 hours for purposes other than medical observation. The percent of reported serious injuries in 2021 increased from 3.8% in 2020.The remaining 93.1% were reportable injuries that were other than serious incidents that involved medical treatment beyond ordinary first aid.

Figure 5. Proportion of Injuries by Severity



Source: NSC estimates based on water slide-related injury survey.

Survey Response

Of the approximately 208 IAAPA-member parks in North America with water slides, 84 IAAPA-member parks responded with data, of which: 79 parks provided attendance-based data; 58 parks provided ridership-based data; and 53 parks provided both. The respondents used in the analyses represented about 37% of the total estimated attendance and 28% of the total estimated number of rides on water slides taken at IAAPA-member parks in North America.

Attendance and Ridership Estimates

Because of the COVID-19 pandemic, average reported attendance among operating parks in 2020 decreased 82%, while average ridership decreased 73%. In 2021, average attendance rebounded 310% and ridership increased 221% from 2020 lows. However, average attendance is still down 23% and ridership is down 14% compared to 2019. These estimates rely on the assumption that the parks that participated in this survey

are representative of all IAAPA- member parks with water slides regarding attendance, number of water slides, and number of water slide rides taken.

Table 4. Estimated Number of IAAPA-Members in North America with Water Slides, Attendance, and Ridership, 2016-2021

Year	Estimated Number of Member Facilities with Water Slides in North America	Estimated Annual Attendance (millions)	Estimated Annual Ridership (millions)
2016	229	81.7	335.6
2017	239	113.2	344.5
2018	254	125.9	381.5
2019	245	123.4	370.1
2020*	209	19.1	85.9
2021	208	78.1	274.4

Source: NSC estimates based on fixed-site amusement ride injury survey.

While most water park operators have procedures in place to count the number of visitors to the park, many parks do not have similar procedures to count every time a visitor rides down a slide. Because ridership is an important measure of exposure, water park operators were encouraged to provide an estimate of water slide ridership through exit surveys, sample counts, or other methods. Operators were also asked to provide a summary of their estimating procedures. Results showed that a wide variety of estimating procedures are being used by water park operators. A summary of water slide ridership estimating procedures is provided below:

- 22 parks: Directly count using turnstiles, laser counters, or other devices
- 10 parks: Estimate from a sampling of on-location counts using hand-held counters or other devices
- 7 parks: Estimate from average water slide rides per guest figures obtained using an exit survey or similar method
- 16 parks: Estimate using their own alternative method. These methods varied widely but tended to be based on number of rides per guest estimates multiplied by the number of guests. Another method included multiplying the hourly capacity per attraction by the operating hours of each attraction.
- 3 parks: Declined to provide an estimating method

Methodology

NSC conducted the survey using a master list of IAAPA-member water parks and amusement parks. The sampling attempts to represent 100% of North American member parks with water slides. In addition to surveying all of the IAAPA park members listed as water parks, other member parks reporting to have at least one or more water slides were also included in the survey sampling. The initial survey in late summer consisted of an initial notification email that included a link to the survey as well as instructions and FAQs. Follow-up emails were then sent monthly for the duration of the

data collection period to all non-respondents. IAAPA staff also contacted select members to further increase the response rate.