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Disability and participation in amusement attractions

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Abstract

Eligibility to participate on an amusement attraction may be limited for patrons with certain characteristics, including size, age, disability, and health conditions. Human rights and equal access laws increasingly mandate the inclusion of people with disabilities in as many activities as possible, although safety is an accepted basis for exemption. This paper reports on practices and evidence pertaining to eligibility and safety of patrons with disabilities, including a content analysis of status quo criteria from 100 amusement ride manufacturers’ manuals and prevalence of references to disability in reports of serious and fatal injury. The analysis found that restrictive criteria exclude people with disabilities broadly, while permitting other vulnerable populations to self-determine their participation. Publicly available injury data do not provide evidence to justify the extent of mandatory exclusion. Self-selection appears to be sufficient where it is used but expanding self-selection will require more communication to patrons about the functional requirements of each ride.

Keywords: amusement rides; rider injury; disability; eligibility; safety.

1. Introduction

Amusement attractions descended from show-oriented local fairs and carnivals and pleasure gardens providing popular diversions since the Middle Ages. The technical inventions of the Industrial Revolution were eventually incorporated into the mechanical rides and attractions now synonymous with amusement parks, such as the switchback railway (roller coaster) at Coney Island (1884), the first Ferris wheel at the Chicago World’s Fair (1893), and incorporation of rides into immersively themed lands at Disneyland park (1955). Amusement attractions are now a familiar component of the tourism sector for individuals, families, and groups of companions to experience immersive and interactive entertainment.

Attractions range from highly themed $100-million roller coaster attractions owned and operated by multinational companies with multi-billion-dollar annual revenues to small-business-owned portable rides worth $100,000. Attendance at just the top 25 theme parks worldwide had over 233 million visits in 2016 (TEA/AECOM, 2017).

The proportion of the population with a disability depends greatly on the definition of disability, whether a medical or social orientation is used, and the degree and nature of functional effect and accommodation required. While the UN refers to 10% worldwide prevalence of disabilities, the US Center for Disease Control uses a figure of 22% excluding deafness, and notes regional variation, from 16.4% in Minnesota to 31.5% in Alabama (Courtney-Long et al, 2015).

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Attending amusement parks and carnivals is a recreational activity that is part of a “normal” life, particularly coveted by children and adolescents. Families that include a person with a disability encounter additional challenges in the normal process of ensuring that plans for shared recreation adequately accommodate the needs of all members (Mactavish & Schleien, 2004). Barriers to the participation of one individual from a recreational activity may affect the recreational choices of that person’s companions.

Accessibility is a complicated issue with social as well as practical aspects. Disability has historically been, and often continues to be, stigmatized for both children (Green, 2003; UNICEF, 2013) and adults (Goffman, 1963; Susman, 1994; McLaughlin et al., 2004; Hernandez, 2011; Vornholt et al., 2013). The condition is perceived as an inferior quality of life associated with suffering, shame, and loss. Some individuals, and some entire cultures, find disability repulsive, or consider accommodation a nuisance. Other individuals feel awkward to have abilities in the company of others who do not, and avoid such encounters. A request for accommodation and a denial of accommodation are both interpreted in light of this social context.

Human rights and equal access laws increasingly mandate the inclusion of people with disabilities in as many activities as possible. The Americans with Disabilities Act (ADA) was passed in 1990. The ADA and similar legal mandates obligate businesses to remove barriers where necessary and accept participation by people with disabilities with few exceptions. The ADA greatly expanded awareness of disability rights and increased accessible activities in the United States. It also raised expectations of people with disabilities around the world, since an American implementation proves accommodation is possible. The UN Convention on the Rights of Persons with Disabilities (2006) promotes inclusion worldwide. The ADA mandate expanded to fixed site amusement rides in the United States under Title III of the ADA, with Accessible Design standards for attractions published in 2010 for compliance phased in by 2012 (US DOJ, 2011). Although the ADA has jurisdiction only in the United States, the industry association now named the International Association of Amusement Parks and Attractions (IAAPA), established in 1920, has championed global design standards harmonization (http://www.iaapa.org/about-iaapa/history-facts/iaapa-history).

Accessibility initiatives at attractions remove architectural, technical, and procedural barriers to participation. These include versions of universal design, including modified or temporarily adapted equipment, alternate modes of participation, and even special parks designed specifically for accessibility. Accommodations are sometimes made through procedures that mitigate barriers, such as by allowing the assistance of supervisory companions and providing complimentary admission to caregivers, or scheduling special days when operations are modified to reduce barriers. Alternatively, to acknowledge limited accessible attractions, operators may offer discounted or complimentary admission to people with disabilities.

To secure opportunity to experience particular attractions, some members of the public have sued theme parks (Gardner, 2012; Graham, 2014; Zambito, 2015) or prevailed on a park to revise its policies (Flack, 2014). However, occurrences as serious as fatal ejections have involved guests with disabilities (Uhlinger, 2004; Redick, 2011). These occurrences are perceived to validate the need for operators to limit access by patrons with disabilities in general and to reject self-selection. Grieving family members will often advocate mandatory exclusion as a counterfactual that conceivably could have protected their loved one, while manufacturers or operators may blame the ADA for preventing them from protecting the patron (Uhlinger, 2004). At the other extreme, operators may blame safety regulators for obliging them to exclude patrons despite the hazardous situation being “rare” (“Alton Towers bars”, 2017).

Safety is an accepted basis for exemption from equal access under ADA. The ADA Accessibility Guidelines (U.S. Access Board, 2014) acknowledge that participation restrictions may be legitimate provided they are based on actual risks to the person or others, and not mere speculation, stereotypes or generalizations about individuals with disabilities. U.S. courts have upheld this requirement (Zambito, 2015).

Members of the community, their companions and other allies, as well as interested members of the industry have questioned not just whether barriers could be removed with reasonable modifications to design or operation, but whether some eligibility criteria are justifiable with current designs.

This paper examines limitations on the participation of people with all disabilities or specific disabilities to prevent accidental injury. It examines:
The nature and extent of restrictive eligibility in current practices
The involvement of disability in reported injuries on amusement rides
Safety rationales for eligibility criteria applied to patrons with disability

In the context of this discussion, it is noted that the authoritative International Classification of Functioning (World Health Organization, 2001) no longer uses the term “disability”. However, the term continues to have relevance as a status under civil rights and is widely accepted by consumers with disabilities when it is not more appropriate to refer to specific disabilities (such as blindness or paraplegia). Terms such as “special needs”, “differently able”, and “challenged” are ambiguous and have no civil rights status. For these and other reasons, they are discouraged by many disability activists. These terms and the obsolete term “handicapped” are avoided in this paper except when citing specific usages. Because people with disabilities are individuals, some may continue to use generally discontinued terms to describe themselves and others for various reasons, including lack of interest in nuances of terminology, perception of stigma and resulting reluctance to self-identify with “disability”, or other personal preference for a generally non-preferred term.

In society at large, usage of the term “disability” as well as “accessible” and “ADA” often describe provision of ramps and spacious restroom facilities. Just under 1% of the U.S. population uses a wheelchair regularly (Kaye et al, 2000), although many people without chronic disabilities may choose to use seated mobility aids due to the considerable walking and standing at theme parks. At the same time, many other disabilities entail no mobility limitations and may be invisible. For instance, vision disabilities (of a range of severities) affects about 3.1% of the American population (Adams et al, 1999), hearing disabilities (of a range of severities) 8.3% (Adams et al, 1999), typically about 4% for moderate or greater hearing loss (Woodcock & Pole, 2007). Disability also includes developmental disabilities such as Down syndrome (0.14%) and autism spectrum disorders (1 to 2%, cdc.gov, 2016) and acquired conditions such as arthritis (12.7%; Adams et al, 1999). This paper considers the broader scope of disability.

2. Disability and amusement ride injury

Most of the literature about amusement ride injuries addresses serious musculoskeletal or cerebrovascular harm sustained by vulnerable or susceptible adults or children due to the ride action (Braksiek & Roberts, 2002; Pelletier & Gilchrist, 2005; Kuschyk et al, 2005; Nouh et al, 2015). Ride acceleration limits in design standards such as ASTM F2291-18 (ASTM International, 2018a) have proven to be well tolerated by the vast majority of guests over many years of operation. Virtually all rides prohibit participation by those who might be vulnerable or susceptible due to recent surgery, heart conditions, neck or back conditions, pregnancy, high blood pressure or aneurysm, as well as those under the influence of drugs or alcohol. These relatively uniform restrictions are generally credited to the contributions of biomedical engineer Richard Brown (1941-2005) (Nelson, 2005).

Despite the potential severity of harm due to medical susceptibility, and the prohibition of exposure, owners often cannot visually identify it and rely on patrons to consider posted advisories and self-exclude when appropriate, intervening only when patrons self-identify and take action to participate. However, visible disabilities are used to intercept and exclude individuals. For example, some ride manufacturers or operators had imposed restrictions on riders visually identified as having Down syndrome due to concerns about stress and unsafe behavioural responses. Medical specialists and parent-advocates reported that guests with Down syndrome often disregarded these operational rules and participated successfully, sometimes using hats and sunglasses to conceal their facial features. They also noted that other syndromes with similar clinical characteristics but no distinctive facial features were not intercepted at all (Woodcock, 2013). The implication was that even if restriction was necessary for some guests with Down syndrome, it was not necessary for all guests with Down syndrome. Medical specialists with expertise about Down syndrome conducted a study in Italy in 2013, collecting pre- and post-exposure observations particularly related to stress and behaviour, including salivary cortisol during a day of exposure to rides of a variety of “intensity”. The clinical results showed no apparent maladaptation in the stress or behavioural indicators from the participants with Down syndrome (Borgi et al, 2015).

The need for restrictions often cites tragic events such as the ejection of a war veteran with bilateral leg amputation (Redick, 2011) and a patron with cerebral palsy (Uhlinger, 2004). However, restricting patrons with “disabilities” will affect 20% or more of the population. The prevalence of amputation in the USA is about 0.5% of the population.
Many fatal injury cases involving disability are often linked to apparent incompatibility between the rider’s body size and shape and the ride restraint system. This injury mechanism is not exclusive to people with disabilities. A guest described as obese fell more than 100 feet from a flume ride at Knott’s Berry Farm in 2001 (Gottlieb, Herndon, & Garrison, 2001). Obesity has been referenced in other cases, including a fatal ejection at Six Flags over Texas in 2013 (Baker, 2013). Large riders who can close the restraint may be permitted to ride, but large body mass may be distributed in such a way that strong ride forces will overcome the restraint if disproportionate body mass is on one side of the restraint.

Rejection of slender guests is uncommon, although slender body size allows the rider to self-extract or be ejected out of a closed restraint. A 20-year review of public records of ride accidents (Stenzler et al, 2016) extracted 109 cases of riders not secured or separated from a ride, with no mechanical failure of the ride. The dominant factor in falls and ejections was anthropometric mismatch between the ride restraint and containment system and the patron’s size and shape. With a shared lap bar or small body size, a rider may be able to self-extract (intending to leave the ride) and fall or be struck by moving equipment, or to stand or misposition (not intending to leave the ride) allowing ride forces to eject them, although 57% of reports of falls and ejections mentioned no non-compliant behaviour. Neither young age nor cognitive disability was significantly associated with non-compliant behaviour. Only two cases of falls or ejections mentioned a cognitive disability.

The literature provides little support for restrictive eligibility specific to people with disability in general. Rather, as mismatch between an individual and a specific ride may affect people with disabilities, people of extreme size or other vulnerability. However, other than litigation to compel access or accounts of individual injury events, there is little indication of how extensively eligibility affects people with disabilities.

Several organizations develop standards pertaining to amusement device design, operation, and maintenance, particularly related to safety, including ASTM International (formerly American Society for Testing and Materials), EuroNorm and ISO (International Organization for Standardization). Standards are valued as a foundation for effective and safe design, but compliance with standards is also used as a legal defense (Baker, 2013). Design standards such as ASTM F2291-18 (ASTM International, 2018a) require the designer/engineer to perform a patron restraint and containment analysis and patron suitability assessment, but do not specify what form the assessment must take. Patron suitability assessment may include both a physical analysis of the required body size and shape to avoid acceleration-related ejection, and a subjective assessment of developmental stage required for appropriate behaviour, interpreted in relation to age and corresponding height.

The ASTM standard covering ride operations, F770-18 (ASTM International, 2018b) §5.3 provides that “The owner/operator of an amusement ride or device may deny entry to the amusement ride or device to any person, if in the opinion of the owner/operator the entry may cause above normal exposure to risk of discomfort or injury to the person who desires to enter...” This clause gives broad latitude to an owner/operator to deny the opportunity to experience “above normal discomfort” to some people while choosing not to deny that opportunity to others. For example, subject matter experts have noted specific ethnic differences in susceptibility to motion sickness and tolerance of intense acceleration, yet no ethnic screening is implemented to reduce risks of patron discomfort. It is also likely true that some people with disabilities have “above normal discomfort” while sitting at a picnic table.

Neither the design nor the operational standards prescribe or predict how extensively people with disabilities will be included or excluded, and for what reason.

3. Methods

This study used mixed methods to examine practices and evidence affecting the eligibility of people with disabilities. It comprised three elements:

- Description of system relationships and decisions, and current criteria and rationales through information elicited from subject matter experts
• Content analysis of a sample of manufacturers’ ride documentation for indication of patron eligibility
• Analysis of publicly available accident data for indication of involvement of disability in reported injury events

3.1 Knowledge elicitation from subject matter experts

System description was elicited from industry subject matter experts (SME) to identify industry structure and current eligibility practices and experiences, other influences determining practices, the ride process in which exposure risks could arise, and rationales for restrictive eligibility criteria. Over 50 industry experts including attraction owner/operators (such as theme parks), ride manufacturers, consultants, regulators, and academics from eight countries on three continents participated in an initial information elicitation workshop in November 2013 in Orlando, Florida hosted by the International Association of Amusement Parks and Attractions (IAAPA). Many of the original 50 participants, and an additional 70 industry experts attended one or more subsequent meetings hosted by IAAPA and ASTM Committee F24 between February and November 2015 at locations in the USA.

The information elicitation process consisted of facilitated small group interactive exercises and open discussion, validation of elicited information through circulation of summary notes and presentations, and progressive incorporation of feedback.

3.2 Content analysis of eligibility criteria in existing rides

A sample of ride manuals (N=100) was selected from an existing dataset containing 218 manuals from 53 manufacturers. A 25% sample with minimum one manual per manufacturer resulted in a list of 95 manuals, from one to nine manuals per manufacturer. Within multi-ride manufacturers, manuals were sampled intentionally to diversify ride action, to expose any relationship between eligibility requirements and ride intensity. To complete a set of 100 manuals, the remaining non-selected rides were reviewed to identify an additional five rides with ride actions not represented in the original sample, thus slightly oversampling manufacturers with a more diverse product line. Restrictions were extracted verbatim from the manuals and grouped qualitatively by semantic value in relation to several categories:

• Specific physical or mental disability or condition or general state of disability (or synonym)
• Body dimensions (height, weight, segment length, size relative to ride)
• Chronic conditions or medium to long-term condition (pregnancy, casts/braces, surgical convalescence)
• Illness
• Functional ability requirement (e.g., ability to grip)
• Performance requirement (e.g., ability to be secured by restraint)

Criteria pertaining to disability were sub-grouped based on reference to physical or mental conditions and the association of a rationale with the criterion.

3.3 Analysis of accident data from publicly available reports

Due to the nature of the industry, accident reports are not available from either owner/operators or regulators. While there are several self-reporting databases on the Internet, they are valid only for qualitative analysis, not to obtain quantitative insight. Media reports have previously been found to be limited in description of ride accident detail (Woodcock, 2008). In addition, among some public databases, there are concerns that people with disabilities may be underrepresented in injury data merely because they are excluded from participation.

Conveniently, some data are available from public records filed by several operators with minimally restrictive guest eligibility policies. The major Florida theme parks operated by Walt Disney Attractions, Universal Parks and Resorts, SeaWorld Parks and Entertainment, and Merlin Entertainment Group (Legoland) submit voluntary quarterly injury reports to the State of Florida Bureau of Fair Rides Inspection, itemizing each guest injury or illness resulting in hospitalization in excess of 24 hours for reasons other than observation. In addition, these operators
encourage guests to participate as fully as they prefer, through guest communication, disability accommodations, and specific access procedures, with a limited number of individual rides requiring specific functional abilities.

These quarterly reports are typically publicized by news release and remain publicly available on news media archives. A media search was used to collect a dataset of these reports of patron injury and illness records from theme parks that offer extensive participation for guests with disabilities. In the five-year period from second quarter of 2010 to the first quarter of 2015, three quarterly reports were not publicly available at the time of extraction (2012 2nd and 4th, 2014 1st). Thus, 17 quarterly reports were available, tabulating 190 reportable injuries and illnesses, 117 from six Disney parks, 57 from three Universal parks, 6 from SeaWorld’s two sites and 8 from Legoland.

From the reports, information was extracted for reports referencing mechanical rides. Injuries occurring in other areas of the theme parks including active play structures and waterpark attractions such as wave pools and lazy rivers were excluded from analysis. Data were tabulated regarding the nature of injury or illness event, age, gender, and reference to disability and pre-existing condition. Of particular interest were injury mechanisms related to falling or impact, which would be the most likely manner of injury anticipated as a result of impulsive behaviour such as self-extraction or standing on the ride.

Although the quarterly reports are intended to disclose serious injury (hospitalization 24 hours or longer other than for observation) at least some cases in the Florida quarterly reports appeared to be for observation or precautionary reasons. Thus, the Florida dataset may include less-severe outcomes. One way to resolve the ambiguity of severity is to tabulate only fatal injuries. Despite the high number of exposures to amusement rides, there are few or no fatal injuries each year. A second dataset was extracted from a published technical report (Emerson Associates, n.d.) that tabulated 51 fatal accidents in the USA in the period 1987 to 2000. As the technical report provided brief descriptions of each case, the data were semantically reclassified for analysis, using the following categories:

- Ejections – design mismatch
- Device failure
- Pre-existing health condition, susceptibility to ride operating as intended
- Medical complication secondary to otherwise minor injury
- Error by rider
- Disability

Data from both sources were extracted and descriptive analysis was performed.

4. Results

Subject matter experts (SME) described industry system relationships as shown in Figure 1.

People with disabilities are stakeholders in the political / regulatory environment and have recourse to that process to assert their rights. They also have a link to the owners of parks and carnivals through potential economic transactions of themselves and their companions and supporters.

Regulators have jurisdiction over ride owners, and ride owners are also taxpayers with interests that might be expressed through the political process influencing regulations.

Manufacturers have a relationship only with ride owners. Many manufacturers are outside the jurisdiction where the ride is operated, thus manufacturer accountability to regulatory bodies is strictly in relation to their business operations (such as employment, environmental impact, and tax), and not in relation to the design and operation of the product. However, an offshore manufacturer may be subject to personal injury litigation, and thus has more incentive to limit participation than to expand it, since a guest cannot be injured on a device that she did not ride.
SMEs also noted that the requirements upheld by safety regulators and accessibility regulators were sometimes contradictory. This model of establishment of eligibility criteria (Figure 2) reflects the design and acquisition process and illustrates the efforts made by owners to provide accessible experiences, and the limitation of control due to the manufacturer’s role and the enforcement by safety regulators. Owners vary from theme park chains with 350,000 visitors per day worldwide to small regional carnivals. A major park may identify the key to accessible attractions is choosing ride vendors carefully and demanding only well-justified eligibility criteria, or specify device features including new designs or customization, while a small carnival may be economically limited to off-the-shelf and even resale devices purchased from another carnival, with no recourse to the manufacturer whatsoever.
An owner/operator may add more restrictive criteria for reasons as diverse as increasing their assessed safety level or to standardize with other attractions at the same site. However, it is difficult for the owner/operator to relax eligibility criteria established by the manufacturer, as safety regulators will enforce operational compliance with the manufacturer’s documented requirements and recommendations.

Manufacturers and owner/operators are interested in protecting guests from harm, and in limiting their own liability for harm. Designers and owners perceive disability as a vulnerability that could lead to harm not only to the guest but also the manufacturer and owner through liability litigation. That liability is perceived as due to the rider’s vulnerability. Thus, designer/engineer and owner/operator see the solution to liability as keeping vulnerable guests away from exposure. This rider-centered perspective of risk will tend to see the vulnerability as persistent and insoluble, since a rider’s disabilities will not change. For example, despite finding no clinical indicators warranting exclusion, the Italian report (Borgi et al, 2015) recommended that patrons with disabilities be assessed on arrival at the park, in a process akin to clinical “intake”, and recommended compulsory non-disabled companions for “disabled” patrons without limitation.

4.1 Current criteria and rationales

After excluding criteria outside of the scope of this paper, criteria in current use as reported by subject matter experts are reported in clusters in this section.

The first criteria were the most common criteria applied at the point of loading and dispatching the ride.

- Height
- Age

Height itself is rarely cited as the designer/engineer’s initial consideration. Rather, the design of a ride may require certain cognitive or physical maturity that the manufacturer associates with a particular minimum age. Patrons who have not attained the required cognitive or physical development could sustain physical injury due to normal ride forces or misinterpret situations and take inappropriate and dangerous actions while on the ride. Due to the operational difficulty of verifying the age of a child, the corresponding height is commonly used as a proxy for age. In some cases, adults of short stature would have the required maturity to ride safely but would be excluded due to the height requirement. Height is not always solely a proxy, as subsequent design decisions with safety implications may rely on this minimum height. Without knowledge of the designer/engineer’s rationale for the original eligibility criterion, owner/operators and patrons cannot know whether having attained the corresponding age is sufficient.

The second cluster of criteria pertained to rider containment, including the ability of existing restraints to contain guests of particular body shapes, the potential for detachment and ejection of prosthetic limbs under forces of a ride, and the potential injury to paraplegic guests resulting from loss of control of the paralysed limb under ride forces, or inability to use that limb to brace. This cluster also included medical conditions. These criteria are often referenced on posted ride warning signs.

- Weight
- Body shape fitting within restraint system
- Amputations
- Medical conditions that may be affected by the ride

Medical conditions such as asthma and epilepsy are often vulnerable to specific ride and show effects (such as smoke effects and strobes) and are typically identified on warnings for specific rides, and are not contraindicated on all rides. SMEs did not reference arthritis and other strength or pain conditions that would also potentially limit the ability to brace but would not “be affected by” the ride.

The third cluster of criteria comprised cognitive performance. These were extensively discussed by SME.

- Mental health conditions
- Mental/cognitive ability to understand instruction
SMEs described concerns that, due to mental development or disability, some guests may lack situation awareness, impulse control, understanding or recall of instructions, or prudent reasoning. At the same time, it was acknowledged that similar performance can also occur with individuals without diagnosed disability as well, due to immaturity, peer pressure, language barriers, or fatigue. Impulse control and judgement is a requirement to avoid unsafe positioning and standing, which can lead to ejection, or self-extraction at inappropriate times, which can lead to falling or being struck by moving equipment.

Some concerns are specific to the infrequent occurrence of a ride stop condition or emergency that cannot be corrected with a ride reset and restart. For physical, cognitive, or emotional reasons, some guests would be unable to self-evacuate or aid in their own rescue and others might react negatively in an emergency situation. This could delay completion of the evacuation, placing the park in violation of evacuation performance requirements. In some circumstances, a delay could expose guests to risks of fire or other environmental danger. However, subject matter experts also noted that disability, mental or otherwise, is not a prerequisite for coping difficulty in emergency evacuation situations. Guests with no diagnosed disability also panic in emergency conditions for a variety of reasons.

Specific types of mental health conditions were not identified other than in relation to understanding instructions. For instance, Down syndrome, autism, depression, and schizophrenia could all be subsumed under mental/cognitive conditions but have widely differing functional characteristics.

Notable by the absence in these lists were disabilities of deafness and blindness, although subject matter experts mentioned that these disabilities could also occasionally affect situation awareness and assistance in evacuation.

Another rationale that arose during information elicitation suggested a concern with reputational harm and potential for operators to be held in custody pending investigation, in the event of injury to any patron. A representative statement was, “[despite lack of evidence to justify restriction], because the guest safety is of utmost importance for the manufacturers and the managers of the amusement parks, in such situations it is better to have more caution and have less rides rather than running unnecessary risks,” and “only one relevant accident will be enough to defeat all the efforts made [toward accessibility]”.

However, other SMEs noted that many perceived hazards associated with disability could apply equally to any rider who becomes incapacitated for any reason during the ride. Therefore, rather than attributing risk to people with disabilities, their practice was to mitigate such hazards by design.

4.2 Content analysis of restrictions published for current rides

Many rides in operation have been in service for decades, and in some cases over 100 years, and are subject to eligibility criteria established by the manufacturer. While manufacturers do issue bulletins to update owners’ manuals, eligibility requirements may not have been revised since original design of the ride. To examine criteria still in effect from these previously installed devices, eligibility criteria were extracted by content analysis of 100 amusement device manuals.

Most (87/100) of the manuals included one or more restrictions: 553 altogether. Non-disability restrictions included the conventional contraindications of pregnancy (38 rides), casts and braces (9 rides), drugs (53) and alcohol (64), etc. previously defined as outside the scope of this paper. Minimum age was specified in 49 manuals. Some manuals contraindicated heart conditions (or heart disease, pathologies or “trouble”) (26), back/spine problems, diseases, injury, or “affections” [sic] (25), neck problems or injury (9), vertigo or dizziness (4), high blood pressure (3), susceptibility to motion sickness (2) and “suffering from seizures” (2) and “recent surgery” (1). In addition, there were 67 restrictions based on minimum height, four on minimum leg length, eight on maximum height; 42 contraindicated riders of size too large to fit the seat or restraint, and 6 restricted size based on a maximum weight.

A large number of manuals (47) contraindicated guests in various states of illness, some of which could subsume some forms of disabilities. These criteria provided impractical descriptions, failing to define terms such as “recent”, “serious” and “precarious”, or required the operator to assess the health of the guest (“visibly ill”, “physically unhealthy”) or expected the guest to self-assess (“feel sick”). Other criteria could arguably include anyone with even
irrelevant or resolved health conditions ("recently ill", "with recent injury", "anyone under medical care" "under medical treatment", "in doctors [sic] care").

Half (50/100) of the manuals contained one or more restrictions or criteria that addressed eligibility related to physical or mental disability or condition (Table 1). These included specified physical functional abilities (12 criteria in 10 manuals) to maintain a proper seated posture (8), the ability to sit upright or prohibiting a person "suffering from lack of muscle control", or requiring the ability to grip (3) or walk off the ride under their own power (1).

Some functional requirements were implied by qualitative criteria that would exclude any person with “handicaps”, physical disability, or "physical condition" who could not be properly seated or secured by the restraints or safety system (13 criteria in 12 manuals) although these criteria rely on the judgement of the operator as to whether the patron was “properly” secured and their safety "guaranteed sufficiently". However, other references (39 criteria in 29 manuals) provide neither specific description nor rationale, but instead restrict patrons who are “disabled”, “impaired” or “handicapped” (or “phisically [sic] handicapped” or “hendicapped” [sic]) or “not in full possession of their physical faculties”, “not in the full possession of his psychomotor faculties”, or simply “not in good condition”. As phrased, these criteria do not support the operator to determine whether a specific patron meets the minimal functional performance level. One manual contraindicated guests “unable to be confined”, a description that is ambiguous as to whether the concern is physical size or shape or if the concern is claustrophobia, sensory processing disorder, or another mental or cognitive condition.

The latter ambiguity is related to some manufacturers’ concerns that some disabilities would induce a dysfunctional reaction to thrills and surprises. Just one manual (two criteria) related the concern in relation to a specific rationale: “with such a mental disability that they cannot use the safety devices / be safely held by the passengers [sic] containment system” although even this does not clarify how the disability would prevent safe containment or how the operator would objectively assess eligibility. Other criteria contraindicated guests “not in full possession of their mental faculties”, “mentally impaired persons”, “mental disability”, “mentally handicapped”, “not in good psychological conditions”, “serious psychological problems”, with “self control problems”, or who “might endanger himself or others”. Some manuals require operators to restrict guests with “inappropriate behaviour”, “acting in an unsafe manner”, or “whose behaviour puts at risk their health and that of others”, “behave in such a way to offend other people”. These criteria conflate mental illness (e.g., depression, schizophrenia), developmental disabilities (e.g., Down syndrome, autism), and character flaws and criminal behaviour (e.g., hooliganism), and in some cases go beyond safety. Seven manuals asked operators to observe and restrict guests in seven manuals based on emotional appearance, including “child being forced to ride”, “child is scared”, “children being visibly upset”, and “hot headed people”. The latter is unclear whether it refers to testy temperament or heat stress. Awkward or unclear language in these criteria often appeared to be partially due to weaknesses of translation. However, there are no standards prescribing specific terminology.

Table 1. Restrictive eligibility criteria found in 100 manuals: Tally by category, with example phrases.

<table>
<thead>
<tr>
<th>Disability-related category</th>
<th>Criteria</th>
<th>Manuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical with explicit functional requirement: sit upright, grip, walk off ride under own power</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Physical with qualitative rationale: compatible with containment and safety devices</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Physical disability with no clarification or rationale: disabled, handicapped, impaired</td>
<td>39</td>
<td>29</td>
</tr>
<tr>
<td>Mental illness or developmental disability: not in full possession of mental faculties, mentally handicapped, not in good psychological conditions, with self-control problems</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Behaviour with implicit rationale: inappropriate, acting in unsafe manner, in such a way as to offend others, puts at risk their health</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Emotional appearance: being forced to ride, scared, visibly upset, “hot-headed people” (unclear whether latter refers to temperament or thermal condition)</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>“Unable to be confined” uncertain whether due to physical dimensions or emotional response</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Operator's opinion</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>94</strong></td>
<td><strong>87</strong></td>
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</tbody>
</table>
Finally, two manuals provided for the operator to restrict any guest that “in his opinion” “might be in danger”, or have “above normal exposure to risk or discomfort or injury to the person who desires to enter, … or jeopardize [sic] the safety of the other patrons or employees or jeopardize the fitness of the ride.”

Rider eligibility varied little within manufacturer despite varying ride action and ride intensity, thus further analysis of association between eligibility criteria and ride action was not feasible. This pattern suggests that manufacturers’ restrictions were boilerplate, and not derived from specific ride characteristics.

Only one manual in the sample asserted a prerogative of informed self-selection of participation by the person with a disability: “persons with physical impairments should view the ride for potential risks before riding.”

Overall, the manuals established undifferentiated restriction of guests with disabilities without providing a rationale or sufficient indication how the operator would determine whether a guest met the eligibility requirement.

4.3 Prevalence of disability among reported injuries

Most accident descriptions in the Florida quarterly reports documented the age, gender, attraction, and type of injury. Reporting the existence of pre-existing conditions became increasingly common over the five-year period, but plausibly reflect reporting practices, not increasing involvement of pre-existing conditions. The brief reports do not clarify the nature or relevance of the pre-existing condition. SMEs noted that disability status is unlikely to be collected unless volunteered as a relevant factor in the report.

Ride involving a mechanically or human powered ride vehicle (including truck, boat, and motion theatre) comprised 86% of the reports (164). Other reports mentioned a seated theatre, waterslide or pool, or other park structures, e.g., gate (26).

Contrary to a common perception of amusement ride injuries as a pediatric risk, and previous studies showing high involvement of age 0 to 15 (Woodcock, 2014), the average age in the Florida severe injury quarterly reports was 50 (s.d. 19.5 years), with only 10 reports (6%) for guests aged 1 to 15 (Table 2). However, women were more numerous among reporters, consistent with prior findings (Woodcock, 2014).

<table>
<thead>
<tr>
<th>Age Group</th>
<th>N</th>
<th>With pre-existing conditions</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>Age &lt;16</td>
<td>10</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Age 16-24</td>
<td>12</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Age 25-34</td>
<td>9</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Age 35-64</td>
<td>85</td>
<td>19</td>
<td>42</td>
</tr>
<tr>
<td>Age 65+</td>
<td>43</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>ALL *</td>
<td>164</td>
<td>34</td>
<td>72</td>
</tr>
</tbody>
</table>

Note: Age and gender figures exclude two reports with unspecified gender, and four reports with unspecified age.

Injured males and females had similar average age overall but average ages varied by type of report (Table 3). The dataset included no ejection cases, and none of the falls occurred during the ride (i.e., self-extraction). None of the falling or impact injury mechanisms mentioned any type of pre-existing conditions.

None of the reports mentioned disability, however it is possible that some cases of disability had been described as “pre-existing conditions”. The average age was about 10 years lower for females with pre-existing conditions than without, but similar for men with and without indication of pre-existing conditions.
Males are more numerous among reports of chest pain/heart attack and general illness, possibly because of higher prevalence of cardiovascular conditions in men, or perceived elevated risk leading to more precautionary hospitalization.

The dataset included no ejection cases, and none of the falls occurred during the ride (i.e., self-extraction). None of the falling or impact injury mechanisms mentioned any type of pre-existing conditions.

Table 3. Injuries on mechanical rides in Florida quarterly reports, nature of report, gender and mean age.

<table>
<thead>
<tr>
<th>Nature of reported event</th>
<th>N</th>
<th>Pre-existing conditions</th>
<th>Male</th>
<th>Female</th>
<th>Mean</th>
<th>s.d.</th>
<th>Male avg</th>
<th>Female avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall, trip before or after a seated ride</td>
<td>30</td>
<td>0</td>
<td>6</td>
<td>24</td>
<td>59.6</td>
<td>17.8</td>
<td>50.4</td>
<td>61.6</td>
</tr>
<tr>
<td>Chest pain, heart attack</td>
<td>31*</td>
<td>7 (22.6%)</td>
<td>19</td>
<td>11</td>
<td>56.8</td>
<td>16</td>
<td>54.3</td>
<td>59.9</td>
</tr>
<tr>
<td>Dizziness, nausea, vertigo, motion sickness</td>
<td>30</td>
<td>5 (16.7%)</td>
<td>14</td>
<td>16</td>
<td>51.3</td>
<td>16.9</td>
<td>52.4</td>
<td>50.3</td>
</tr>
<tr>
<td>Loss of consciousness, seizure, altered consciousness, fainting</td>
<td>42*</td>
<td>11 (26.2%)</td>
<td>17</td>
<td>24</td>
<td>47.0</td>
<td>20.9</td>
<td>51.2</td>
<td>44.0</td>
</tr>
<tr>
<td>Felt unwell, ill, headache, blood clot, shortness of breath, anaphylactic, anxiety</td>
<td>21*</td>
<td>11 (52.3%)</td>
<td>13</td>
<td>8</td>
<td>46.7</td>
<td>19.4</td>
<td>51.5</td>
<td>38.9</td>
</tr>
<tr>
<td>Musculoskeletal pain</td>
<td>10</td>
<td>1 (10%)</td>
<td>3</td>
<td>7</td>
<td>41.9</td>
<td>11.5</td>
<td>40.3</td>
<td>42.7</td>
</tr>
<tr>
<td>Impact, other (including pinching and foreign objects)</td>
<td>7</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>27.3</td>
<td>26.9</td>
<td>19.8</td>
<td>42.5</td>
</tr>
<tr>
<td>Pre-existing condition mentioned</td>
<td>34 (21%)</td>
<td>16</td>
<td>17</td>
<td></td>
<td>45.4</td>
<td>20.3</td>
<td>48.6</td>
<td>42.3</td>
</tr>
<tr>
<td>No pre-existing condition mentioned</td>
<td>130 (79%)</td>
<td>56</td>
<td>73</td>
<td></td>
<td>51.5</td>
<td>19.2</td>
<td>49.4</td>
<td>52.8</td>
</tr>
<tr>
<td>ALL *</td>
<td>164</td>
<td>34</td>
<td>72 (42.7%)</td>
<td>90 (54.9%)</td>
<td>50.2</td>
<td>19.5</td>
<td>49.1</td>
<td>50.8</td>
</tr>
</tbody>
</table>

Notes.
Age and gender statistics exclude two reports with unspecified gender, and four reports with unspecified age.
Total N adds to more than 164 due to 7 cases fitting into more than one classification in the classifications marked with asterisk (*).
Among the fatal injury cases in the Emerson Associates report (n.d.) (Figure 3), the “error” category included 11 cases where the guest’s own action contributed to the event. Health conditions were involved with four fatalities involving pre-existing conditions and four fatal complications following on from otherwise minor injury. Thirty cases involved either the failure of the ride or parts of it, or ejections not involving rider error (e.g., no restraint, large gaps in restraint, restraint not secured). Two of the fatality reports identified adolescents with intellectual disabilities but there were no reports referring to other disabilities.

5. Discussion

Industry relationships isolate the manufacturers who establish the eligibility criteria from the patrons who seek access. Eligibility criteria reflect past practices when society had a low expectation for inclusion of people with disabilities. Exposure of people with disabilities is considered a new risk, although many hazards are not new or unique to people with disabilities.

Although half of the manufacturers’ manuals reviewed in this study imposed restrictive eligibility related to disability, there was minimal explicit documentation of the rationale. A rationale may have existed, as SME described legitimate mechanisms of harm for some criteria. Not only are rationales not explicit but the criteria are ambiguous. An eligibility criterion cannot be implemented as intended by the designer/engineer if operators cannot understand, or misunderstand, it.

Phrasing of eligibility criteria as “disabilities” (or other broad terms such as “special needs” or “handicap”) is needlessly broad, as it effectively limits the participation of patrons with unrelated disabilities notwithstanding the absence of elevated risk. For instance, an exclusion or requirement for a supervising companion for any person with “disabilities” based on a concern about children with cognitive disabilities or paraplegia, for example, will needlessly limit an adult with a leg brace or deafness.

Excessively broad criteria may reflect designer/engineers’ sense of powerlessness over unpredictable performance of riders in contrast to predictable performance of mechanical components, a lack of analytical tools to determine more precise criteria, a false association of cognitive or physical incapacity or vulnerability with disability in general, or some combination of these, but this study did not probe designers’ underlying reasoning or values. Its focus was on documenting and evaluating the processes in place, in relation to evidence for exclusion.

It is obvious that some rides will be unsuitable for some patrons. Transparent description of the nature of the ride and strong advisories are used at some operators to enable self-selection, consistent with the general practice for medical contraindications. In the Florida quarterly reports, there were no pre-existing conditions noted for any impulse-control failure injury patterns (falls or impact). In contrast, riders aged 35 and older were overrepresented in the quarterly reports, with the mean age in falling and tripping accidents approximately 60, but no SMEs or manufacturers’ manuals indicated any consideration of maximum age criteria. In the Emerson Associates dataset, an association with intellectual disability was noted for only two fatal injuries in 13 years; 11 other fatalities involved rider behaviours with no such disability, but no SMEs or manufacturers’ manuals indicate screening criteria to identify and exclude these other patrons.

It is possible that the disability status of the casualty was treated as confidential personal data and thus not disclosed in the reports, but unlikely as pre-existing conditions were documented. It is also possible that restrictive eligibility requirements suppressed participation by people with disabilities, but this is less likely in the Florida quarterly reports. More likely, patrons have self-selected out of participation as needed, after considering guest information provided at the parks. It is important to note that the prerogative of self-selection does not mandate exposure.

The more nuanced the criteria, and the more focused on function than appearance, the more self-selection needs to be used. Ride operators and attendants can verbally confirm patrons are of the required age to ride or serve as a supervisory companion, visually observe patron stature and verify that rider body shape is compatible with the ride’s restraint devices, but it may be prohibitively difficult for them to assess many nuances of a patron’s fitness to ride. A legal framework that gives both the decision and the responsibility to the patron will facilitate this approach more readily than a legal framework that obliges them to make a nearly clinical evaluation of the fitness of each rider to tolerate each ride.
The sample of 100 ride manuals were predominantly devices found in travelling carnivals and smaller amusement parks. The observations may not generalize to documentation for larger theme park rides. Injury data sources were limited to publicly available reports. Industry members collect injury data for internal safety programs and report incident to IAAPA for analysis by the National Safety Council (IAAPA, 2017), but details about individual cases are not published. Since omissions from the quarterly reports would compromise the agreement between the parks and Florida regulators, reports are likely inclusive of relevant cases, although appear to include more cases than strictly required. It is likely that richer insight could be developed using confidential data if disability identification was collected.

6. Conclusions

Eligibility criteria that exclude “disability” or the equivalent are more prevalent than injury evidence appears to warrant, as there is no clear evidence that people with disabilities are at undue risk when permitted to self-select, given clear description of ride requirements. Although there are rides that are not suitable for some patrons, existing manufacturers’ manuals lack the information needed to restrict only those patrons who cannot participate safely. Self-selection appears to be sufficient to exclude vulnerable riders with disabilities (although not all vulnerable riders, such as the adults overrepresented in the quarterly reports). However, patrons will need information about functional requirements of the ride to make appropriate, safe choices.

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References


