Applying a public health approach to identify priorities for regulating child product safety

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Abstract

Objective: To identify leading injury risk factors and jurisdictional differences in Australian and US child-related product safety regulatory responses to inform the development of Australian policy and reform priorities.

Methods: The study established and evaluated a knowledge base of child-related product safety regulatory responses (recalls, bans, standards and warnings) made in Australia and the US over the period 2011–17 to identify risk factors and potential regulatory gaps.

Results: The research identified 1,540 Australian and US child-related product safety regulatory responses with the most common response type being product safety recall, and the leading product hazards in responses being choking, fire, fall, strangulation and chemical hazards. Jurisdictional differences identified potential regulatory gaps in Australia related to chemical hazards and high-risk durable infant and toddler products, and some data deficiencies in Australian responses.

Conclusions: Priorities include the need to improve the prevention orientation of the Australian product safety framework, to create an intelligence platform to assess injury risks more precisely and to address regulatory gaps related to the use of toxic chemicals in children's products and high-risk durable infant and toddler products.

Implications for public health: The study demonstrates the identification of policy and reform priorities for child product safety using a public health lens.

Key words: injury prevention, child product safety, public health approach

The Australian consumer product safety regime is contained in the Australian Consumer Law (ACL), which is administered and enforced jointly by the Australian Competition and Consumer Commission (ACCC) and state and territory consumer protection agencies.[1] Although product safety laws are not traditionally recognised as core public health laws, they influence the burden of product-related injury in the community by establishing government powers to respond to risks of injury from consumer products in the population. This includes the power to make product safety standards, issue product safety bans, recall unsafe products and issue product safety warnings.

Children's vulnerability to product-related injury

There are significant consequences of unsafe consumer products on population health. Watson and Ozanne-Smith's 1996 research found that approximately 500,000 Australians sought medical attention annually for an injury related to product failure or malfunction, resulting in about 18,000 hospital admissions and 200 deaths.[2] More than twenty years later, in 2019, the problem was no smaller, with the ACCC estimating the annual cost of injury and death caused by unsafe consumer products in Australia to be at least $5 billion with around 780 deaths and 52,000 injuries per year from consumer products (excluding motor vehicles).[3] Although no research was identified quantifying annual Australian child product-related injury, children have been recognised as a vulnerable population group at heightened risk of product-related injury.[4]

The risks of childhood injuries from product use are highly associated with stages of development and behaviour.[5-8] The physical characteristics of children also make them more vulnerable to product-related injuries than adults and their natural curiosity and desire to experiment can lead to products being used in a way not intended and their ability to understand or respond to dangers is reduced due to their developing cognitive ability.[8] Additionally, the vulnerability of children is heightened by their dependence on adults and their lack of control over the world in which they live.[8] The development of product safety injury prevention strategies must account for the identified vulnerabilities of children: various developmental stages, physical characteristics, risk-taking behaviours, developing cognitive ability and degree of dependence on adults.

Globalisation and product safety

The impact of globalisation has amplified the capacity for consumer products to be manufactured at scale, with variance in quality assurance and regulatory oversight at multiple points in the process of design,

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creation and supply to both national and international markets. As Gostin (2014) observes, the impact of both globalisation and expanding demand for consumer goods creates new hazards.[9] In the context of children's toys, this can occur through various means, including faulty design and contamination with chemicals and poisonous substances. Intense pressure to increase profits can readily lead to further diminution of manufacturing standards and quality control. These issues are likely to intensify as consumers increasingly shift to e-commerce due to the global COVID-19 pandemic escalating price competition and diversification of supply chains.

The emerging challenges to consumer product safety brought about by globalisation have prompted the Organization for Economic Co-operation and Development (OECD) to consolidate and strengthen its product safety acquis. In July 2020, the OECD Council adopted a recommendation calling for the establishment of robust consumer product safety regulatory and policy frameworks at domestic and international levels that include a consumer right to safe products, rapid alerts when unsafe products are detected and protection of vulnerable and disadvantaged consumers.[10]

Australian product safety reform

The Australian product safety system has been the subject of numerous reviews and in late 2019 the Commonwealth Treasury, on behalf of Australian Consumer Affairs Ministers, conducted a consultation on a range of options to improve the effectiveness of the system.[11] The reform process is ongoing and the outcome of this round of public consultation is yet to be released (as of November 2021).

The well-established pillars of a public health approach – surveillance, risk factor identification, development and evaluation of interventions, and implementation of effective interventions – provide a scientific, systematic and coordinated approach to injury prevention.[8] Australia does not have a well-established national injury surveillance system with only two states, Victoria and Queensland, conducting routine injury surveillance, and the National Coronial Information System partially fulfilling this function for deaths. There are significant challenges with identifying product-related injury and emerging trends from Australian health datasets to detect unsafe products and inform reform strategies.[2,4,12-14] Issues include the protracted time to access data from health datasets, a lack of clear identification of consumer products in health datasets and the need to text mine narratives to identify product involvement. However, notwithstanding these challenges, it is critical for evidence to inform policy and the health of vulnerable populations, and a precondition for advancing public safety and public health policy is the generation of more robust data.

Another source of data is contained within product safety regulatory responses such as product recalls, bans, safety standards and warnings. Several overseas studies have demonstrated how systematic product safety recall research can reveal leading product categories, hazards and root causes of recalls.[15-17] No research has been identified that evaluates the full range of regulatory responses to products potentially hazardous to children to identify trends and risk factors. This research identifies child-related product safety regulatory responses made over the period 2011–17 in Australia and the US, two similar Western jurisdictions with developed economies that seek to maximise consumer choice and safety. It establishes and evaluates a knowledge base of regulatory response data with the aim to identify leading child product-related injury risk factors and jurisdictional response differences to inform the development of Australian policy and reform priorities. In doing so, the research adopts a public health approach and promotes a genuine knowledge translation approach through synthesis and ethically sound application of knowledge to improve the safety of products potentially hazardous to children, and improve population health.[18] While reform efforts are confronted by political challenges and diverse strategic, economic and policy interests, this endeavour is consistent with contemporary public health theory and public health law theory applied to both national and international settings.[19-22]

Methods

Data collection and recording

The research scope was to identify child-related product safety regulatory responses made by federal or state regulators in Australia and the US over the period 2011–17. The process involved a systematic key terms search of Australian and US federal and state enacted laws via legislation register websites, and Westlaw and Austlii legal databases, to identify regulatory powers that could be exercised to respond to a consumer product that posed a risk of injury to children from product use. The identified regulatory powers framed a search of publicly accessible regulatory registers and notifications websites, and regulators' websites, to identify each time a regulator had exercised their regulatory power over the period 2011–17.

A manual review of each identified regulatory response was conducted by one researcher and subjectivity bias was minimised by well-defined inclusion criteria. A regulatory response was included in the study if it related to a children's consumer product defined as a product designed or intended for use by persons 17 years of age or younger for personal, domestic or household use. Age determination was made according to specification in the regulatory response, or if the response included an image of the product that represented in its packaging, display, or advertising as appropriate for use by persons 17 years of age or younger. A regulatory response to a general consumer product was included in the study if the response or secondary supporting documentation prepared by the regulator identified child injuries or indicated the likelihood of child injury due to reasonably foreseeable use or misuse of the product. Together these responses are referred to as 'child-related product safety regulatory responses'. As the identified regulatory powers can only be exercised if the regulator is satisfied that the legal threshold related to the potential risk of injury from product use is met, a regulatory response was taken as representing that the product had hazardous features and no separate determination was made.

A regulatory response database was constructed for each of the two jurisdictions containing the following data, where available, extracted from the narrative description in each identified response: reference (response number, title, URL, date), product (product category, name, description, model, suppliers, country of origin, location of sale, dates available for sale), defects, hazards, incidents, injuries, remedy and regulator.

Data classification

Additional fields were added to the databases to enable analysis. First, each response was classified into one of the following

four response types: product safety recall (including any regulator facilitated voluntary recall or mandated recall), product safety standard or requirement (including any legislated safety requirement for a product), product safety ban (including any prohibition on supplying a product with hazardous features into the market) and product safety warning (including any formal warning issued by a regulator about a hazardous feature of a product). Secondly, all products were classified to the best fit Global Product Classification (GPC) standard (https://www.gs1.org/standards/gpc), a four-tiered classification system for grouping consumer products. Thirdly, for the 23% of Australian responses and 13% of US responses that included more than one product hazard in the response (e.g. fall, laceration), the most severe hazard was identified using the European Union RAPEX severity of injury guide and flagged as the primary hazard to be used for data analysis.[23] Lastly, if the regulatory response included an injury description, the number of injuries and corresponding injury mechanism was coded based on the most appropriate mechanism of injury category from the Australian National Data Standards for Injury Surveillance Version 2.1.

Data analysis

Analysis of the regulatory response data was conducted using Microsoft Excel to identify the number and type of regulatory responses made over the period 2011–17, and the associated product hazards. Leading hazards were then analysed to identify the prevalence of the hazard in GPC industry sectors, patterns of hazard descriptions, and associated incidents and injuries. The regulatory responses were evaluated to identify jurisdictional differences to highlight potential gaps in Australian regulatory responses and in terms of completeness of data on hazards, incidents and injuries.

Results

The search revealed 733 Australian and 807 US regulatory responses to products potentially hazardous to children during the seven-year period 2011–17 (Tables 1 and 2). The most common regulatory response type in both jurisdictions was 'product safety recall' (Australia 652, US 668), followed by 'product safety ban' (Australia 43, US 70), then 'product safety standard or requirement' (Australia 30, US 57) and finally 'product safety warning' (Australia 8, US 7).

Table 1: Australian Child-related Product Safety Regulatory Responses 2011-17 – Hazards per type of regulatory response.

Product Safety Hazard	Recall	Ban	Standard or requirement	Warning	Total
Choking	213	9	4	1	227
Fire	66	16	4	2	88
Fall	56	3	2	1	62
Unspecified	52		4	2	58
Strangulation	51		5		56
Battery Ingestion	48				48
Chemical	27	6	2		35
Damage to sight	29		1		30
Drowning	26		4		30
Magnet Ingestion	13	4	1	1	19
Thermal	15		2		17
Laceration	13	2			15
Entrapment	10	2	1		13
Electric shock	12				12
Fire/Electric shock	12				12
Inhalation	4	1		1	6
Suffocation	2				2
Environment	1				1
Ingestion	1				1
Microbiological	1				1
Total	**652**	**43**	**30**	**8**	**733**

Table 2: US Child-related Product Safety Regulatory Responses 2011-17 – Hazards per type of regulatory response.

Product Safety Hazard	Recall	Ban	Standard or requirement	Warning	Other[a]	Total
Choking	154		5			159
Fire	97	17	6	1		121
Strangulation	106	4	7	1		118
Fall	108		6	2		116
Chemical	33	43	3	1	4	84
Suffocation	33	3	9	2		47
Laceration	34					34
Injuries	23	1	7			31
Ingestion	20		4			24
Drowning	12		4			16
Entrapment	11		1			12
Magnet Ingestion	10		1		1	12
Thermal	10		1			11
Battery Ingestion	7					7
Microbiological	5		1			6
Electric shock	3	1	1			5
Unspecified			1			1
Damage to hearing	1					1
Entanglement	1					1
Puncture		1				1
Total	**668**	**70**	**57**	**7**	**5**	**807**

Note:
a: Five 'Other' US product safety responses were identified that could not be classified under one of the four types of regulatory responses.

Leading hazards in child-related product safety responses

An overview of the hazards being addressed in regulatory responses is provided in Tables 1 and 2. The leading product safety hazards identified in the regulatory responses were 'choking' (Australia 227, US 159) and 'fire' (Australia 88, US 121), followed by 'fall' (62), 'unspecified' injury risk (58), and 'strangulation' (56) in Australia, and 'strangulation' (118), 'fall' (116) and 'chemical' (84) in the US. The results for the leading hazards follow.

Choking hazards

Regulators responded to products with choking hazards across 13 GPC industry sectors in Australia and 10 GPC industry sectors in the US, with most responses being for products in the toys/games (Australia 113, US 74), furniture/furnishings (Australia 41, US 8), clothing (Australia 23, US 41) and healthcare (Australia 21, US 11) sectors. Common hazard descriptions were that the product, or a component of the product, posed a choking risk due to its size and shape, or because product breakage could release a small part(s). Australian regulatory responses to products with choking hazards identified four fatalities, one near asphyxiation and 46 unspecified injuries, and US responses identified 65 fatalities and 40 choking incidents.

Fire hazards

Most regulatory responses to products with fire hazards were in the clothing sector (Australia 45, US 53), followed by furniture/furnishings (22) in Australia and sports equipment (23) in the US. For the clothing sector responses, the common hazard description related to the flammability risk of sleepwear and/or failure to label the garment with the fire danger rating. The only injury information identified was one severe burn injury in the US. The 22 Australian furniture/furnishings sector responses related to the risks of fire and/or burns from combustible candle holders with no injuries identified, and decorative alcohol-fuelled burners with 36 house fires and 105 burn injuries identified. Whereas the four US furniture/furnishings sector responses related to the flammability risk of mattresses with no reported incidents, and a fire risk related to a baby seat with one reported incident of the motor housing catching fire. The sports equipment sector regulatory responses all related to fire and/or burn risks caused by overheating scooter/hoverboard batteries, with Australian responses identifying six house fires and seven incidents of batteries overheating and US responses identifying two fatalities, 18 burn injuries, seven incidents of property damage and 206 incidents of batteries overheating.

Fall hazards

Regulators responded to products with fall hazards across five GPC industry sectors in Australia and eight GPC industry sectors in the US, with most responses being for products in the sports equipment (Australia 27, US 51) and furniture/furnishings (Australia 15, US 28) sectors. For the sports equipment sector, there was a range of hazard descriptions that can be summarised as the risk of fall due to product breakage (frame/wheel/restraint) or malfunction (wheels/brake/locking mechanisms) for scooters, cycles, skateboards, baby swings, prams and child carriers, insufficient braking systems for baby walkers, and instability of prams and baby swings. Australian regulatory responses reported 135 unspecified injuries related to baby walkers, and US regulatory responses reported one fall fatality, 861 fall injuries and 5,510 safety incidents. Similarly, there was a range of hazard descriptions for responses in the furniture/furnishings sector, which can be summarised as the risk of fall due to product breakage (frame/guardrail/seat/restraint), malfunction (clamp/hinge/locking mechanism) or inadequate restraints or height of guardrails for baby baths, cots, toddler beds, bunk beds, baby highchairs and seating. There were no reported Australian injuries, and US regulatory responses reported nine fall fatalities, 128 fall injuries and 1,174 safety incidents.

Strangulation hazards

Regulators responded to products with strangulation hazards primarily in the furniture/furnishings (Australia 38, US 45) sector and the clothing sector for the US with 49 responses. Common hazard descriptions within the furniture/furnishings sector were entrapment spaces and frame protrusions for baby cots/bassinets, portable cots and bunk beds, and loose cords or threads for window blinds and blankets. It was difficult to identify strangulation injuries in two Australian and US responses that provided estimated annual injury data of 4,000 and 34,300, respectively, for bunk beds due to a range of hazards including strangulation. The remaining responses identified two Australian and 140 US fatalities related to strangulation hazards in the furniture/furnishings sector. The US clothing sector responses primarily related to children's clothing with neck or waist drawstrings due to strangulation and entanglement hazards with 84 safety incidents, 26 fatalities and 41 entanglement injuries reported. A similar response was not identified in the Australian regulatory response data.

Chemical hazards

Most Australian responses to products with chemical hazards were product safety recalls in the toys/games (16) sector due to high levels of lead, ammonia, diethylhexyl phthalate or hydrated magnesium silicate, and the clothing (10) sector due to azo colourants. The US also had many product safety recall responses in the toys/games (15) sector primarily due to high levels of lead. The majority of US responses were product safety bans or standards and could not be allocated a specific GPC sector as the response applied broadly to children's products or childcare products. These responses either prohibited or set maximum levels for chemical hazards related to eight phthalates, bisphenol A, cadmium or formaldehyde. Similar Australian responses were not identified.

Jurisdictional differences in regulatory responses

The analysis of leading hazards identified that Australia had not responded to new chemical hazards in children's products during the study period. A review of the US responses highlighted a specific class of children's consumer products subject to regulatory responses: 'durable infant or toddler products'. This class is legislatively defined in the US as a durable product intended for use by children under the age of five years.[24] Over the study period, product safety standards or requirements were mandated for 19 products falling under the definition of durable infant or toddler products. Table 3 provides an overview of these 19 products and the injury information contained in the regulatory responses which identified 11,972 safety incidents, 3,776 injuries and 592 fatalities. Australia does not use this classification and a review of the regulatory response data identified five products subject to Australian product safety standards with the remaining 14 products being unregulated.

Jurisdictional differences were identified in the level of supporting injury data to inform or justify regulatory responses. For product safety recalls, only 2% of Australian responses provided de-identified safety incident and injury information. In contrast, 99% of US recalls provided de-identified information providing a source of product-related injury data with 15,350 safety incidents, 1,301 injuries and 30 fatalities identified. Minimal supporting injury data for Australian product safety bans was identified with only 26% of bans referring to product-related injury data.

Most Australian product safety standards or requirements were supported by product-related injury data, but they contained significantly less detailed injury information and hazard identification when compared with the supporting documents for US product safety standards or requirements.

Limitations

The research had several limitations. First, data collection and analysis were confined to the information contained in the regulatory responses or supporting regulatory documents. Secondly, for those responses reporting incidents, injuries or fatalities, there was no consistent data gathering process or period. The incident, injury and fatality data provide valuable insight into the hazards being addressed but do not provide a complete measure of the scale of injuries related to a particular hazard. Thirdly, there are limitations with comparing response trends that could be impacted by differences in a jurisdiction's product safety regulatory requirements, its regulator resourcing and priorities, and the deterrent impact of its product liability regime. While acknowledging these limitations, review and comparison of response trends provides a method to identify issues worthy of further investigation.

Discussion

Public health approach

It is well-recognised that public health law is a useful dimension of a public health approach.[19-22,25-28] Legal constraints can promote a balance between freedom of the market and public health and safety. Through mechanisms including the power to alter the informational environment (e.g. requiring product labelling), indirect regulation through the tort system, and direct regulation of businesses through measures including standards, law is both a responsive mechanism and an 'upstream factor' in influencing social determinants to promote health.[21,25,29] The Lancet–O'Neill Institute/Georgetown University Commission on Global Health and Law advocates for the beneficial use of law as a public health mechanism to implement fair, evidence-based interventions, to mitigate risk factors and increase health across entire populations, or in high-risk subpopulations.[30,31] Consistent with this approach, our research findings inform strategies to both improve product safety at the population level, and to address the particular vulnerability of children to product-related injury.

Strategies to improve product safety with broad application

a) Improve the prevention orientation of the product safety framework

Applying a public health approach to product safety brings a strong emphasis on identifying strategies aimed at preventing

Table 3: US Durable Infant and Toddler Product Safety Standards 2011-17 – Incidents and Injuries.

Durable Infant or Toddler Product	Safety Incident	Fatalities	Injury Mechanism	Non-Fatal Injuries	Nature of Injuries	Injury Mechanism
Bassinets/Cradles	71	38	Suffocation(Asphyxia); Unspecified	16	Head Injuries; Unspecified	Fall; Unspecified
Bedside Sleepers	40	4	Suffocation(Asphyxia/Entrapment/ Strangulation)	3	Respiratory Difficulties; Bruises	Near-suffocation; Entrapment
Carriages/Strollers	1,297	4	Suffocation(Compression/Drowning/ Entrapment)	391	Head Injuries; Amputations (finger); Teeth Injuries; Lacerations	Fall; Crushing; Unspecified
Children's Folding Chairs/Stools	108	-	-	52	Head Injuries; Amputations (finger); Fractures; Bruises	Fall; Crushing
Frame Child Carriers	49	-	-	34	Closed-head Injuries; Fractures; Dislocated Arms; Lacerations; Contusions	Fall; Unspecified
Full-Size Baby Cribs	3,520	147	Suffocation(Asphyxia/Entrapment/ Strangulation); Unspecified	1,675	Head Injuries; Fractures(Limb/skull); Unspecified	Fall; Entrapment; Unspecified
Hand-Held Infant Carriers	252	43	Suffocation(Asphyxia/Entrapment/ Strangulation); Fall; Unspecified	60	Head Injuries; Bruises; Lacerations; Allergic Reactions; Near-choking	Fall; Unspecified
Infant Bath Seats	474	174	Suffocation(Drowning)	300	Submersion; Entrapment(Limb); Lacerations	Entrapment; Crushing; Near-suffocation
Infant Bathtubs	247	31	Suffocation(Drowning)	32	Near-drowning; Concussion; Burns; Lacerations; Respiratory Infections	Near-suffocation; Fall; Thermal; Crushing
Infant Bouncer Seats	349	14	Suffocation(Asphyxia); Fall; Unspecified	54	Serious Head Injuries; Fractures(Skull/Limb); Bruises; Lacerations; Burn	Fall; Struck; Crushing; Thermal
Infant Swings	2,619	17	Suffocation(Asphyxia); Unspecified	624	Head Injuries; Bruises; Lacerations; Unspecified	Fall; Unspecified
Infant Walker	86	8	Fall; Suffocation(Drowning/Airway Obstruction); Struck	78	Burns; Lacerations; Abrasions; Pinching; Unspecified	Fall; Crushing; Thermal; Unspecified
Non-Full-Size Baby Cribs	64	6	Suffocation(Asphyxia/Entrapment); Unspecified	28	Fractures; Bruises; Laceration; Unspecified	Fall; Entrapment
Play Yards	2,169	64	Suffocation(Asphyxia/Entrapment/ Drowning/Strangulation); Unspecified	173	Head Injuries; Brain Damage; Lacerations; Unspecified	Fall; Near-suffocation; Crushing; Unspecified
Portable Bed Rails	155	17	Suffocation(Entrapment/Strangulation); Unspecified	48	Fractures; Lacerations; Entrapment(Limb); Choking; Contusion	Entrapment; Fall; Crushing; Foreign Body; Unspecified
Portable Hook-on Chairs	100	1	Suffocation(Strangulation)	57	Fractures; Concussions	Fall; Entrapment
Sling Carriers	122	16	Suffocation(Asphyxia); Unspecified	54	Head Injuries; Fractures(Skull, Wrist); Contusions; Abrasions; Lacerations	Fall; Near-suffocation; Unspecified
Soft Infant/Toddler Carriers	124	4	Suffocation(Asphyxia)	54	Fractures(Skull/Limb); Contusions; Abrasions	Fall; Unspecified
Toddler Beds	126	4	Suffocation(Asphyxia/Entrapment/ Strangulation)	43	Fractures; Teeth Injuries; Bruises; Sprains; Abrasions; Lacerations; Near-choking	Fall; Entrapment; Crushing; Foreign Body
Total	**11,972**	**592**		**3,776**		

product-related injuries and deaths (primary prevention) rather than relying on reactive approaches after an injury has occurred. The research identified that regulators in Australia and the US primarily adopt a reactive approach to product safety by imposing post-market controls to recall (Australia 652, US 668) or ban (Australia 43, US 70) products potentially hazardous to children from the market once they are identified as unsafe. This approach relies heavily on consumers, health professionals and suppliers reporting safety incidents. It also poses significant surveillance and resource challenges, requiring regulators to conduct surveillance of domestic markets and an escalating number of online markets and platforms, assess potentially unsafe products and, where necessary, develop intervention strategies, exercise regulatory responses, and monitor and enforce compliance.

Regulators, consumers and suppliers all have a role to play in product safety, and a more balanced product safety framework is needed that places safety as an upstream factor before products are supplied to market. This could be achieved by improving the prevention orientation of the ACL through the prescription of a general safety provision (GSP) that places a legal obligation on suppliers to take reasonable steps to ensure the safety of their products before they are placed on the market. The introduction of a GSP to the Australian product safety framework would align it with a contemporary product safety regulatory best practice trend as identified by the OECD, operate as an upstream factor used to achieve better and fairer product safety conditions across the population, and ensure the law has a strong preventative orientation.[21,29,32]

b) Improve sources of product-related injury data

Adopting a public health approach to product safety means using data to inform each of the four-step strategies for identifying and responding to child product safety issues. Deficiencies in supporting injury data to inform or justify Australian regulatory responses to products hazardous to children were identified in the research. The detailed injury data and hazard analysis contained in US regulatory responses is supported by data extracted from the National Electronic Injury Surveillance System. The implementation of a similar surveillance system is likely to be beyond Australian resources, but improvements could be made with the current recording of product-related injury in Australian health datasets and more timely access to injury data.

There is also potential to draw together disparate sources of product-related injury data to assess public health risks more precisely for children. This could fall under the ambit of an emerging field called Precision Public Health (PPH).[33,34] Big data technologies enable the integration of a variety of disparate data to inform PPH, and there is potential for the following disparate data to be linked with health data and coronial data to develop an intelligence platform to inform regulatory responses:

1. Recall data: the research identified a source of child product-related injury data in US product safety recalls that disclosed de-identified safety incidents, minor and major injuries, and fatalities.
2. Mandatory reporting data: a further source of child product-related injury data is contained within the mandatory reports submitted to the ACCC by suppliers if they become aware of a death or serious injury or illness caused by the use or foreseeable misuse of their product.
3. Online product review data: routine surveillance of online consumer feedback could provide an additional source of child product-related injury data. New approaches to the detection of product safety issues have been demonstrated by text mining sentiment words and smoke words in large volumes of consumer feedback in online product reviews.[35]

This linked data approach could assist with more precisely measuring the susceptibility of product-related injury in the population to inform priority setting, targeting regulatory responses and public communication strategies. Further research to explore the feasibility, strengths and weaknesses, robustness, and validity of outcomes from such linked data is recommended.

Strategies to improve product safety with targeted application

The need to address specific vulnerability aligns with a public health approach that has social justice at its core.[25] Children are a vulnerable population group at heightened risk of product-related injury and have a fundamental international right to protection from injury.[36] Protecting this right can provide justification for limiting the rights of suppliers by mandating the reduction or elimination of hazardous components of products or prohibiting the distribution of products potentially hazardous to children into the marketplace. The research findings highlighted two gaps in Australian regulatory responses to products potentially hazardous to children.

a) Durable infant and toddler products

The research identified that the US had introduced 19 product safety mandatory standards for products falling under a specific class called 'durable infant or toddler products' and a review of the standards identified significant child injuries and fatalities associated with these products (Table 3). This continues to be a priority area for the US Consumer Product Safety Commission (CPSC) with its 2020 Operating Plan identifying the development of a further four standards for products falling under this product class.[37] Australia does not use this classification and analysis of product safety standards in force during the study period revealed Australia had five safety standards for products falling under this class with 14 products unregulated suggesting a potential gap in regulatory coverage. It is recommended that Australian regulators investigate the need for further mandatory standards to address the high risk of child product-related injury associated with this class of products.

b) Chemical hazards in children's products

In contrast to Australia, the research identified there had been significant US regulatory activity at the federal and state level related to chemical hazards. At the federal level, the CPSC extended its phthalate regulation to prohibit the use of eight phthalates in toys and child-care articles due to adverse effects on male reproductive development and contribution to cumulative risk from antiandrogenic phthalates.[38] Australia currently prohibits the use of one phthalate in toys and child-care articles that commenced prior to the study period. There were also a substantial number of US regulatory responses identified at the state level ranging from extending federal coverage of limitations on cadmium in toys to a broader range of children's products, filling regulatory voids related to the use of flame retardants in children's products and introducing frameworks to regulate a broad range of chemicals of high concern in children's product safety. It is not clear whether any policy work is underway in Australia to review chemical hazards in children's products, and it is not listed as one of the ACCC product safety priorities. Young children are at

particularly high-risk from toxic exposure from products due to their frequent hand-to-mouth tendency, which creates a pathway for toxic chemicals to enter the mouth and can accumulate as children receive low dose exposure from a variety of products.[39] Given the potential for harm, it is recommended that Australian regulators establish a product safety priority project to review international regulatory developments to determine whether further regulation of chemical hazards in children's products is required in Australia.

Conclusion

This research has evaluated 1,540 Australian and US child-related product safety regulatory responses with a public health lens to identify Australian policy and reform priorities. Jurisdictional differences identified product risks for further investigation in Australia associated with high-risk durable infant and toddler products and chemical hazards in children's products. Other priorities include the need to improve the prevention orientation of the product safety framework by introducing a GSP and to investigate the linking of disparate sources of product-related injury data to create an intelligence platform to assess injury risks more precisely for children. In an effort to translate knowledge to action, these recommendations have been communicated to government during consultation on current reforms and priority setting.

Implications for public health

The significant consequences of unsafe consumer products on children's health warrant the identification of policy and reform priorities using a public health lens. The research demonstrates how systematic product safety regulatory response research can identify child product-related injury risk factors and jurisdictional comparison of response trends can identify potential gaps to inform the development of strategies. Through the application of contemporary public health theory and public health law, the research identifies a range of policy and reform priorities where the law can be used as an upstream factor to achieve better and fairer product safety across the population, and as a responsive mechanism with a targeted application to identified high-risk products to lower exposure to risk factors for young children.

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Supporting Information

Additional supporting information may be found in the online version of this article:

Supplementary Table 1: Australian Child-related Product Safety Regulatory Responses 2011-17 – Leading Hazards per GPC Industry Sector and Class.

Supplementary Table 2: US Child-related Product Safety Regulatory Responses 2011-17 – Leading Hazards per GPC Industry Sector and Class.