



Belief-based predictors of portable pool safety behaviors among parents of young children

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ABSTRACT

Introduction: Swimming pools pose a significant drowning risk to young children, with little research investigating safety around portable pools. This study explores the beliefs Australian parents of children aged under 5 years hold toward portable pool safety behaviors. **Methods:** A two-phase online survey design guided by the belief-based framework of the theory of planned behavior was used. Phase 1 comprised open ended questions to identify parents' ($N = 50$) modal salient beliefs regarding three portable pool safety behaviors: (1) supervising their child within arm's reach; (2) ensuring adequate fencing for portable pools 300 mm and deeper; and (3) emptying and storing the pool safely when not in use. Phase 2 ($N = 214$) used a quantitative survey to examine the key behavioral, normative, and control beliefs predicting parents' intentions regarding the three safety behaviors. **Results:** A range of beliefs that impact parents' intentions for each of the three safety behaviors for portable pools were identified. These included, for example, behavioral beliefs around teaching water skills and preventing drowning/injury; normative beliefs of approval from family members; and control beliefs around time and ease. Differences in beliefs informing intentions across the three safety behaviors were also observed. **Conclusions:** Findings provide valuable insights into the beliefs parents hold regarding keeping their young children safe around portable pools. This knowledge can be used to inform education and awareness raising initiatives for parents of young children regarding portable pool safety, specifically targeting these identified beliefs to improve compliance. **Practical Implications:** Efforts of drowning prevention organizations and product and consumer safety authorities should prioritize these beliefs in messaging to foster parents' intentions to comply with portable pool safety behaviors.

1. Introduction

Drowning is a significant cause of mortality and morbidity among young children globally (World Health Organization, 2014). Despite significant reported reductions in unintentional drowning mortality among children under five globally since 1990, this age group continues to record significantly elevated rates of drowning, particularly compared to school-aged children (Tan et al., 2023). This risk is attributed to developmental factors associated with young age (Simons et al., 2020), as well as environmental factors such as unrestricted access to water (Denny et al., 2021; World Health Organization., 2017) and

behavioral factors such as lapses in adult supervision (Hamilton et al., 2019; Peden & Franklin, 2020).

In Australia, unintentional drowning claims an average of 279 lives per year (Royal Life Saving Society - Australia., 2024b). In addition to the fatal drowning burden, three times as many people are hospitalized for treatment due to a nonfatal drowning (Peden et al., 2018). Children under the age of five are the age group with the highest risk of drowning in Australia, with an annual average of 24 drowning deaths (Royal Life Saving Society - Australia., 2024b). This age group also records the highest ratio of fatal to nonfatal drownings, with eight hospital admissions for each fatal drowning incident (Peden et al., 2018). Home

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swimming pools, including portable pools, are the location that represents the highest risk of drowning for young children (Peden et al., 2021). Portable swimming pools can take several forms including inflatable pools, pools incorporating a canvas or flexible plastic liner attached to a frame, and hard plastic such as wading pools. Depths can vary from less than 150 mm to over one meter (Australian Competition and Consumer Commission ACCC, 2018). Portable pools are commonly used to describe structures used for water recreation which, once emptied, can be moved (Shields et al., 2011).

There has been little research exploring drowning risk in portable pools. One study from the United States reporting 209 fatal and 35 nonfatal drownings in portable above ground pools identified children under five years as being at disproportionate risk, accounting for 94% of the submersions (Shields et al., 2011). Other risk factors were identified as being the home location (73% of incidents) and the summer months (81%). An epidemiological study of portable pool drowning deaths in Australia identified 23 drowning deaths of children under five nationally between 2002 and 2018 (Peden et al., 2020). Increased risk of drowning was identified among children in socially and economically disadvantaged areas and in very remote locations, further highlighting the impact of determinants of health on drowning risk (Peden et al., 2020).

By law, all pools over 300 mm in depth in Australia require four-sided isolation fencing of at least 1.2 m in height, with a self-closing and self-latching gate (Australian Competition and Consumer Commission ACCC, 2018). In Australia, portable swimming pools are also subject to a mandatory safety standard (Australian Government, 2013) under federal consumer law, which requires both the product and packaging to display a warning message that is permanent, legible, of a certain height, is in contrast to the background color of the packaging, and is on the front of the package (Australian Competition and Consumer Commission ACCC, 2018). The warning message, by law, must include the following statement: “WARNING! Children have drowned in portable swimming pools. Ensure active adult supervision at all times. Do not leave children unsupervised in or around the pool – keep them within arm’s reach. Empty and store safely after use” (Australian Competition and Consumer Commission ACCC, 2018).

Ensuring compliance with portable pool safety practices is important to prevent drownings in young children. One avenue to address compliance issues is exploring the underlying beliefs parents hold toward enacting safety behaviors around portable pools. Social cognition theories, such as the theory of planned behavior (Ajzen, 1991), suggest that intentions are influenced by belief-based constructs of attitudes, subjective norms, and perceived behavioral control. Attitudes are underpinned by specific behavioral beliefs regarding the advantages or disadvantages of performing a behavior. Subjective norms are underpinned by specific normative beliefs regarding individuals or groups who approve or disapprove of performing the behavior. Perceived behavioral control is underpinned by control beliefs regarding the barriers and facilitators regarding behavioral performance (Ajzen, 1991). Identifying these specific beliefs allows development of theoretically-based and empirically-driven messages that are likely to be more effective than a theoretically-based messages (Fishbein et al., 2001; Hagger et al., 2020). The theory of planned behavior has been successfully applied to understand parent-for-child behaviors (Hamilton et al., 2020), with previous research using the belief-based framework of the theory to create health messages, including for interventions to promote safety behaviors around water (Hamilton et al., 2023; Hamilton et al., 2022; Hamilton et al., 2022).

To date, limited research has explored belief-based predictors of portable pool safety behaviors of parents of young children. Building on previous behavioral research exploring factors impacting drowning risk among young children (Hamilton et al., 2019; White et al., 2018), the current study provides the first investigation of parental beliefs associated with three safety behaviors that are government mandated and widely communicated in drowning prevention and consumer safety campaigns designed to prevent children drowning in portable swimming

pools: (1) supervising their child within arm’s reach, (2) ensuring adequate fencing for portable pools 300 mm and deeper, and (3) emptying and storing the pool safely when not in use (Royal Life Saving Society - Australia., 2024b). The study had two specific aims:

Aim 1 – Formative research: Identify the modal salient behavioral, normative, and control beliefs of parents regarding the three portable pool safety behaviors.

Aim 2 – Predictive research: Examine which beliefs are associated with parents’ intentions regarding the three portable pool safety behaviors.

2. Methods

This study comprised two phases. Phase 1 was a belief elicitation study (Ajzen & Schmidt, 2020; Ajzen, 2006) conducted using an online survey. Phase 2 tested these beliefs with a large sample to identify which beliefs are associated with parents’ intentions regarding the three portable pool safety behaviors. Across both phases, the majority of the respondents were female (74.0% phase 1; 79.4% phase 2) and in a registered marriage (72.0% phase 1; 62.5% phase 2). A similar mean age was reported among participants to both phase 1 (37.36 years [SD = 8.16]) and phase 2 (33.36 years [SD = 6.31]). See Table 1 for the demographic characteristics of the sample.

Table 1
Participant demographic characteristics for the two phases.

Demographic characteristic	Phase 1 (n = 50)	Phase 2 (n = 214)
Gender		
Male	13 (26.0%)	43 (20.1%)
Female	37 (74.0%)	170 (79.4%)
Other	0 (0.0%)	1 (0.5%)
Marital status		
Married registered	36 (72.0%)	134 (62.5%)
Married de facto	8 (16.0%)	37 (17.3%)
Divorced	1 (2.0%)	6 (2.8%)
Separated	1 (2.0%)	12 (5.6%)
Never Married	4 (8.0%)	25 (11.7%)
Employment status		
Full-time work	17 (34.0%)	76 (35.5%)
Part-time work	15 (30.0%)	57 (26.6%)
Full-time student	0 (0.0%)	3 (1.4%)
Part-time student	1 (2.0%)	2 (0.9%)
Unemployed/home duties	17 (34.0%)	76 (35.5%)
Family income (annual)		
Nil-\$18,200	2 (4.0%)	8 (3.7%)
\$18,201-\$37,000	3 (6.0%)	20 (9.3%)
\$37,001-\$80,000	18 (36.0%)	76 (35.5%)
\$80,001-\$180,000	26 (52.0%)	95 (44.4%)
>\$180,000	1 (2.0%)	15 (7.0%)
Highest educational attainment		
Completed junior school (Year 10)	6 (12.0%)	12 (5.6%)
Completed senior school (Year 12)	7 (14.0%)	20 (9.3%)
TAFE certificate / diploma	17 (34.0%)	86 (40.2%)
Undergraduate degree	12 (24.0%)	64 (29.9%)
Postgraduate degree	8 (16.0%)	32 (15.0%)
State or Territory of Residence		
New South Wales	10 (20.0%)	63 (29.4%)
Victoria	13 (26.0%)	47 (22.0%)
Queensland	15 (30.0%)	52 (24.3%)
South Australia	5 (10.0%)	23 (10.7%)
Western Australia	5 (10.0%)	19 (8.9%)
Tasmania	0 (0.0%)	5 (2.3%)
Northern Territory	0 (0.0%)	1 (0.5%)
Australian Capital Territory	2 (4.0%)	4 (1.9%)
Age		
Mean (SD)	37.36 (8.16)	33.36 (6.31)
Minimum	20	20
Maximum	68	60

2.1. Phase 1: Belief elicitation

2.1.1. Participant recruitment and data collection

In Phase 1, participants were 50 parents of at least one child aged under 5 years who were recruited to complete an online survey containing open-ended questions (Supplementary Files 1–3). Most of the parents in the sample (69.0%) reported currently owning a portable pool. Participants were sourced through an independent research panel company with targeted national recruitment to ensure parents from each Australian state and territory were represented in the sample. Participant demographic characteristics are shown in Table 1. Data were collected in December 2018.

2.1.2. Measures

Measures of parents' beliefs regarding each of the three behaviors were constructed based on established guidelines (Ajzen, 2006), and beliefs identified using open-ended questions in Phase 1 were used to inform question development for Phase 2.

Behavioral Beliefs. Behavioral beliefs were measured with two open-ended questions about the advantages and disadvantages of performing the behavior. A third question was used to provide the opportunity to share any additional details. The three questions were administered for each of the three portable pool safety behaviors.

Normative Beliefs. Normative beliefs were measured with two open-ended questions about who would approve and disapprove of them performing the behavior. The two questions were administered for each of the three portable pool safety behaviors.

Control Beliefs. Control beliefs were measured with two open-ended questions about the facilitators and barriers of performing the behavior. The two questions were administered for each of the three portable pool safety behaviors.

2.1.3. Data analysis

Data were analyzed using content analysis to identify parents' modal salient beliefs regarding supervising their child within arm's reach of the portable pool, ensuring adequate fencing is in place to restrict access to portable pools 300 mm and deeper, and emptying and storing the pool safely when not in use. NVivo 12 (QSR International Pty Ltd, 2022) was used to facilitate the analysis, and the identification of modal salient beliefs was based on established guidelines (Ajzen, 2006), with beliefs occurring in a minimum of 10% of the sample reported.

2.2. Phase 2: Predictive survey

2.2.1. Participant recruitment and data collection

In Phase 2, participants were 214 parents of at least one child aged 0–5 years who have a portable pool at their place of residence. Participants completed an online survey containing a range of multiple choice and Likert-style questions, and open-ended questions (Supplementary File 4). Again, participants were sourced through an independent research panel company. Participant demographic characteristics are shown in Table 1. Data were collected in February 2019.

2.2.2. Measures

Measures of behavioral beliefs, normative beliefs, and control beliefs were derived from Phase 1 data using established guidelines for measurement of beliefs underpinning behavior (Ajzen, 2006). Participants responded to belief questions on 7-point scales (1 = *extremely unlikely* and 7 = *extremely likely*).

Behavioral Beliefs. Behavioral beliefs were measured using items derived from Phase 1. Five items were used for supervision behavior, three items were used for fencing behavior, and eight items were used for emptying and storing behavior, with a common stem referenced to each behavior (e.g., "If I supervise my young children within arm's reach of the portable pool, it would... be a good opportunity to spend time with my child and see their enjoyment").

Normative Beliefs. Normative beliefs were measured using items derived from Phase 1. Five items were used for supervision behavior, five items were used for fencing behavior, and five items were used for emptying and storing behavior, with a common stem referenced to each behavior (e.g., "The following people are likely to think I should ensure adequate fencing is in place to restrict access to the portable pool... family members").

Control Beliefs. Control beliefs were measured using items derived from Phase 1. Six items were used for supervision behavior, five items were used for fencing behavior, and four items were used for emptying and storing behavior, with a common stem referenced to each behavior (e.g., "How likely are the following to prevent you emptying and storing the portable pool safely when it is not in use... lack of storage space").

Behavioral Intention. Behavioral intention was measured using three items constructed from established guidelines for measurement of theory of planned behavior constructs (Ajzen, 2006). Participants responded to the intention questions on a 7-point scale from (1) *strongly disagree* to (7) *strongly agree*. The scale had adequate reliability when referenced to supervision ($\alpha = 0.89$), fencing ($\alpha = 0.99$), and emptying and storing ($\alpha = 0.90$).

2.2.3. Data analysis

Descriptive statistics and correlations were computed using SPSS V25 (SPSS Corp, 2020). Bivariate correlations and path coefficients from the structural equation models were considered statistically significant where $p < 0.05$. Beliefs that had significant bivariate correlations with intention (all beliefs except the fencing control belief 'being in a rental property' were correlated with intention) were then entered as predictors in structural equation models with intention as the outcome, using Mplus 7.4 (MPLUS, 2015). Nine structural equation models were estimated. In all models, individual belief items were entered as separate observed variables and used as predictors, and behavioral intention was entered as a latent variable and used as the outcome. Model 1 contained five behavioral beliefs predicting the outcome of intention to supervise. Model 2 contained five normative beliefs predicting intention to supervise. Model 3 contained six control beliefs predicting intention to supervise. Model 4 contained five behavioral beliefs predicting intention to fence. Model 5 contained five normative beliefs predicting intention to fence. Model 6 contained six control beliefs predicting intention to fence. Model 7 contained five behavioral beliefs predicting intention to empty and store. Model 8 contained five normative beliefs predicting intention to empty and store. Model 9 contained six control beliefs predicting intention to empty and store. Model fit was evaluated using multiple criteria including Tucker-Lewis index (TLI) and comparative fit index (CFI), which should have values close to or exceeding 0.95; standardized root mean squared residual (SRMR), which should have a value less than 0.08; and root mean squared error of approximation (RMSEA), which should have a value less than 0.06 (Hu & Bentler, 1999).

3. Results

3.1. Phase 1: Identify salient Behavioral, Normative, and control beliefs

3.1.1. Supervision

Phase 1 identified parents' salient beliefs about supervising young children within arm's reach (see Table 2). Advantages included, for example, 'prevent drowning or injury and ensures safety' ($n = 36$; 72.0%) and 'quick response to any problem' ($n = 10$; 20.0%). Just over half of respondents identified no disadvantages to supervision ($n = 29$; 58.0%). Family members ($n = 16$; 32.0%), everyone ($n = 14$; 28.0%), and lifeguards, swimming instructors and emergency services ($n = 14$; 28.0%) were identified as people who would approve of the behavior of supervising young children within arms' reach when using a portable pool. Sixty percent ($n = 30$) of respondents believed no one would disapprove of the behavior. Common facilitators for providing

Table 2
Beliefs associated with supervising young children within arms’ reach when using a portable pool as identified in Phase 1 (n = 50).

Beliefs	Theme	Frequency (n)	Percent (%)	Representative Quote
Advantages	Prevent drowning or injury and ensures safety	36	72	“My child doesn’t die/drown or get injured in any way”
	Quick response to any problem (danger happens quickly)	10	20	“Quick response to any problem, may be able to prevent an accident from occurring”
	Opportunity to spend time engaging with child and seeing their enjoyment	9	18	“It is rewarding watching my child have fun and enjoy themselves in the pool”
Disadvantages	Able to help child learn swimming and pool safety	7	14	“Being able to assist with water play and teach them how to be safe in the pool”
	No disadvantages	29	58	“No disadvantages”
People who would Approve	Time consuming – you cannot do other things	8	16	“Can take up a lot of time”
	Family members	16	32	“My family members”
People who would Disapprove	Everyone	14	28	“Everyone will approve”
	Lifeguards, swimming instructors, and emergency services	14	28	“Lifeguards”, “Swimming instructors”, “Emergency/ paramedics”
	Friends	13	26	“Friends”
	The child’s other parent	9	18	“My husband”, “His mum”
	Grandparents	6	12	“Grandparents”
	Other parents	6	12	“Other parents”
Facilitators	No one would disapprove	30	60	“No one will disapprove”
	A place to sit in the shade	7	14	“Have shade & a comfortable chair”
Barriers	Time	5	10	“Time”
	Fenced pool	5	10	“Ability to fence off the pool when not able to supervise”
	A clear view of the pool	5	10	“A view of the pool so you can see your child”
	No distractions	5	10	“No distractions”
	No barriers	20	40	“There are none”
	Distractions	7	14	“If I get distracted by something else – the neighbour, doing gardening, my phone, toilet breaks”
	Too many other things to do – trying to multitask	7	14	“Too much to do to be able to stay within close proximity”
	Too many children to monitor	6	12	“Too many children not enough adults”
	Obstructed view	6	12	“Obstructed view of him”

Table 2 (continued)

Beliefs	Theme	Frequency (n)	Percent (%)	Representative Quote
	No shaded area to sit near the pool	5	10	“To not have seating”, “To not have shade”

supervision were ‘a place to sit in the shade’ (n = 7; 14.0%) and time, a fenced pool, a clear view of the pool and no distractions (n = 5; 10.0% respectively). Forty percent of respondents identified no barriers to providing supervision, while 14% (n = 7) identified distractions and too many other things to do – trying to multitask, as key barriers.

3.1.2. Fencing

Phase 1 identified parents’ salient beliefs about fencing portable pools deeper than 300 mm (see Table 3). Advantages included, for

Table 3
Beliefs associated with fencing portable pools deeper than 300 mm as identified in Phase 1 (n = 50).

Beliefs	Theme	Frequency (n)	Percent (%)	Representative Quote
Advantages	Prevention of drowning and accidents	24	48	“Prevents accidents and drowning in children”
	Prevention of unsupervised portable pool access	23	46	“Stops kids getting access to water unsupervised”
Disadvantages	Cost	22	44	“Cost of installing fence”
	No disadvantages	14	28	“No disadvantage”
People who would Approve	Pool is temporary, fence is permanent	6	12	“Pool is only temporary, fencing is expensive and permanent”
	Family members	20	40	“All family members”
	Everyone	13	26	“Everyone”
	The government and local council	10	20	“Councils, government”
	Friends	9	18	“Friends”
	Lifesaving community	6	12	“Life saving community”
People who would Disapprove	No one would disapprove	27	54	“No one will disapprove”
	Temporary fencing for portable pools	6	12	“If I had a portable fence”
Facilitators	If cheap, secure, and easy to assemble	6	12	“Fencing was cheap and easily available”
	fencing was available	5	10	“If the pool came with the fencing”
	If portable pool was sold with a fence	5	10	“Discounts/ government rebate for pool fencing”
	Government support and subsidies	5	10	“Discounts/ government rebate for pool fencing”
	Cost	25	50	“The cost involved”
Barriers	No barriers	10	20	“Nothing”
	Being in a rental property	7	14	“Being a rental property”

example, ‘Prevention of drowning and accidents’ ($n = 24$; 48%) and ‘prevention of unsupervised portable pool access’ ($n = 23$; 46%). Disadvantages associated with fencing portable pools included ‘cost’ ($n = 22$; 44%) and the fact that the ‘pool is temporary, fence is permanent’ ($n = 6$; 12%). Twenty eight percent of respondents ($n = 14$) identified no disadvantages associated with fencing. ‘Family members’ were identified as the group most likely to approve of fencing ($n = 20$; 40%), whereas 27 respondents (54%) indicated no one would disapprove. Salient facilitators for fencing included ‘temporary fencing or portable pools’ ($n = 6$; 12%) and ‘if cheap, secure, and easy to assemble fencing was available’ ($n = 6$; 12%). ‘Cost’ was also identified as barrier to fencing portable pools ($n = 25$; 50.0%).

3.1.3. Emptying

Phase 1 identified parents’ salient beliefs about emptying and storing their portable pool safely when it is not in use (see Table 4). Advantages included, for example, ‘Prevents drowning or injury and ensures safety’ ($n = 27$; 54%) and ‘prevents dirty water, bacteria, and the need for cleaning’ ($n = 18$; 36%). Disadvantages included ‘waste, cost and disposal of water’ ($n = 26$; 52%) and ‘the effort and time to pack the portable pool away’ ($n = 23$; 46%). Family members were believed as the people most likely to approve of this behavior ($n = 17$; 34%), while 60% of respondents ($n = 30$) believe no one would disapprove. Salient facilitators included ‘if it could be made quicker and easy’ ($n = 8$; 16%) or ‘access to cheaper water and the ability to reuse water’ ($n = 7$; 14%). ‘No barriers’ ($n = 16$; 32%) and ‘lack of storage space’ ($n = 16$; 32%) were reported as barriers.

3.2. Phase 2: Examining beliefs associated with portable pool safety intentions

Phase 2 examined the ability of each of the beliefs identified in Phase 1 to predict parents’ intention for each of the three portable pool safety behaviors. Initially, bivariate correlations were run to examine the association between each belief and intention for each of the three behaviors. Bivariate correlations were initially examined and all except the behavioral belief regarding emptying ‘prevent the pool from becoming dirty’ was associated the outcome. Therefore, all items were included in the regression models reported below.

3.2.1. Supervision

Results of the structural equation models predicting parents supervising within arms’ reach are presented in Table 5. We found a range of beliefs explained parents’ intention for this safety behavior. In terms of behavioral beliefs, the advantages of ‘allowing me to quickly react to danger and provide immediate aid’ and ‘being an opportunity to teach swimming and water safety to my child,’ and the disadvantage of ‘being time consuming’ significantly predicted intention. In terms of normative beliefs, approval of ‘family members’ and ‘friends’ significantly predicted intention. In terms of control beliefs, only the barrier of ‘lack of time’ significantly predicted intention. The models containing behavioral beliefs (CFI = 0.99, TLI = 0.99, SRMR = 0.04, RMSEA = 0.03), normative beliefs (CFI = 0.95, TLI = 0.92, SRMR = 0.05, RMSEA = 0.07), and control beliefs (CFI = 0.97, TLI = 0.95, SRMR = 0.04, RMSEA = 0.06) exhibited good fit to the data. Due to multicollinearity arising from the high correlation ($r = 0.875$) between the behavioral beliefs ‘allow me to quickly react to danger and provide immediate aid’ and ‘prevent my child from drowning or getting injured,’ only the former was included in the behavioral beliefs model. Both behavioral beliefs were correlated with the outcome, but ‘allow me to quickly react to danger and provide immediate aid’ was retained due to greater specificity of the advantage of the behavior.

3.2.2. Fencing

Results of the structural equation models predicting parents fencing portable pools more than 300 mm in depth are presented in Table 6. We

Table 4

Beliefs associated with emptying and storing portable pools safely when not in use as identified in Phase 1 ($n = 50$).

Beliefs	Theme	Frequency (n)	Percent (%)	Representative Quote	
Advantages	Prevents drowning or injury and ensures safety	27	54	“No one gets hurt, or is at risk of drowning”	
	Prevents dirty water, bacteria, and the need for cleaning	18	36	“Fresh water/cleanliness of pool”	
	Prevention of unsupervised portable pool use	15	30	“Kids can’t jump in unsupervised”	
	More space	11	22	“Clears up room in the yard”	
	Prevents bugs and mosquitos	6	12	“Preventing mosquitos breeding in the backyard”	
	Disadvantages	Waste, cost, and disposing of water	26	52	“Where to empty all that water”, “The cost to fill them up again”
The effort and time to pack the portable pool away		23	46	“The effort it takes to fill it and empty it and store it”	
No disadvantages		12	24	“None at all”	
Storage space is required		6	12	“Finding a space to store the pool when not in use”	
People who would approve		Family members	17	34	“My family members”
		Everyone	12	24	“Everyone”
	Lifeguards, swimming instructors, and emergency services	11	22	“Life saving community”, “Emergency services”	
People who would disapprove	Friends	7	14	“Friends”	
	No one would disapprove	30	60	“Can’t think of anyone who would disapprove”	
	Water authorities and friends who do not like wasting water	5	10	“Some people who don’t like to waste water like that”	
Facilitators	Children	5	10	“Kids”	
	If it could be made quick and easy	8	16	“A quick way to do it. Some sort of innovative product that auto fills or auto empties”	
	Access to cheaper water or ability to reuse water	7	14	“Cheaper water rates”	
	Ease and speed of draining water	7	14	“Ease and speed of drainage”	
Barriers	No barriers	16	32	“Nothing will prevent me”	
	Lack of storage space	16	32	“Lack of storage space”	
	No easy drainage solution	12	24	“Heaviness when pool won’t drain properly”	

(continued on next page)

Table 4 (continued)

Beliefs	Theme	Frequency (n)	Percent (%)	Representative Quote
	Cost and water wastage for refilling pool	7	14	“Concern over the cost of refilling the pool next time we want to use it”, “Water shortages”

Table 5

Structural equation modelling of beliefs identified in Phase 1 on intention of Phase 2 respondents to supervise young children within arms’ reach when using a portable pool.

	M (SD)	Intention	
		β	p
Behavioral Beliefs – Supervision: R² = 0.259, p = 0.003*			
Be a good opportunity to spend time with my child and see their enjoyment	6.69 (0.70)	0.069	0.494
Allow me to quickly react to danger and provide immediate aid	6.82 (0.57)	0.252	0.015*
Be an opportunity to teach swimming and water safety to my child	6.63 (0.85)	0.247	0.031*
Be time consuming	3.67 (2.34)	-0.163	0.006*
Normative Beliefs – Supervision: R² = 0.344, p = 0.008*			
Family members	6.71 (0.88)	0.286	0.034*
Friends	6.50 (0.98)	0.310	0.011*
Lifeguards, swimming instructors, and emergency services	6.58 (1.09)	0.139	0.246
The government and local council	6.23 (1.56)	-0.017	0.880
Other parents with young children	6.34 (1.43)	-0.054	0.706
Control Beliefs – Supervision: R² = 0.137, p = 0.023*			
Distractions (e.g., phone, visitor at the door, other children)	3.49 (2.18)	0.049	0.505
Lack of time	2.39 (1.88)	-0.338	0.017*
Other children to monitor	2.96 (2.05)	-0.149	0.165
An obstructed view of the pool	2.25 (1.90)	0.032	0.867
No shaded area to sit near the pool	2.17 (1.80)	0.047	0.708

Note: * p < 0.05.

found a range of beliefs explained parents’ intentions for this safety behavior. In terms of behavioral beliefs, the advantage of ‘preventing my child from drowning or getting injured’ and the disadvantage of ‘being more permanent than the pool’ predicted intention. In terms of normative beliefs, approval of ‘family members’ predicted intention. In terms of control beliefs, the barriers of ‘lack of temporary fencing’ and ‘lack of fencing that is easy to assemble’ predicted intention. The models containing behavioral beliefs (CFI = 1.00, TLI = 1.00, SRMR = 0.01, RMSEA = 0.00), normative beliefs (CFI = 0.98, TLI = 0.97, SRMR = 0.01, RMSEA = 0.08), and control beliefs (CFI = 1.00, TLI = 1.02, SRMR = 0.00, RMSEA = 0.00) exhibited good fit to the data.

3.2.3. Emptying

Results of the structural equation models predicting parents emptying and storing portable pools after use are presented in Table 7. We found a range of beliefs explained parents’ intentions for this safety behavior. In terms of behavioral beliefs, only the advantage of ‘preventing my child from drowning or getting injured’ predicted intention. None of the normative beliefs predicted intention. In terms of control

Table 6

Structural equation modelling of beliefs identified in Phase 1 on intention of Phase 2 respondents to fencing portable pools deeper than 300 mm.

	M (SD)	Intention	
		β	p
Behavioral Beliefs – Fencing: R² = 0.247, p < 0.001*			
Prevent my child from drowning or getting injured	6.14 (1.44)	0.425	<.001*
Be expensive	4.93 (1.98)	-0.104	0.151
Be more permanent than the pool	5.88 (1.58)	-0.144	0.033*
Normative Beliefs – Fencing: R² = 0.315p < 0.001*			
Family members	5.48 (1.86)	0.411	0.004*
Friends	5.36 (1.84)	0.228	0.102
Lifeguards, swimming instructors, and emergency services	6.29 (1.36)	0.100	0.281
The government and local council	6.25 (1.34)	-0.012	0.877
Other parents with young children	5.58 (1.74)	-0.141	0.096
Control Beliefs – Fencing: R² = 0.232, p < 0.001*			
Lack of temporary fencing	4.54 (2.31)	-0.417	0.002*
Lack of affordable fencing	4.50 (2.30)	0.181	0.224
Lack of fencing that is easy to assemble	4.37 (2.24)	-0.266	0.042*
Lack of government support and subsidies	3.95 (2.24)	0.028	0.767

Note: * p < 0.05.

beliefs, the barrier of ‘no easy way to drain the pool’ predicted intention. The models containing behavioral beliefs (CFI = 1.00, TLI = 1.03, SRMR = 0.02, RMSEA = 0.00), normative beliefs (CFI = 0.99, TLI = 0.98, SRMR = 0.04, RMSEA = 0.04), and control beliefs (CFI = 0.98, TLI = 0.97, SRMR = 0.03, RMSEA = 0.06) exhibited good fit to the data. Due to multicollinearity arising from the high correlation (r = 0.872) between the control beliefs ‘the cost of refilling the pool’ and ‘lack of ability to reuse the water,’ only the former was included in the control beliefs model. Both control beliefs were correlated with the outcome, but ‘the cost of refilling the pool’ was retained due to greater specificity of the barrier to performing the behavior.

4. Discussion

Despite often preventable, drowning is a significant cause of premature mortality and morbidity among children (Peden et al., 2021). Portable pools are an aquatic location that pose significant drowning risk to young children and are therefore the focus of this study (Peden et al., 2020; Shields et al., 2011). Adopting a theory of planned behavior belief-based approach (Ajzen, 1991), we used a two-phase design to investigate the salient beliefs of parents of young children regarding portable pool safety behaviors. Specifically, we examined supervising young children within arm’s reach, ensuring adequate fencing is in place to restrict access to portable pools 300 mm and deeper, and emptying and storing portable pools safely when not in use. We identified a range of beliefs associated with parents’ intentions regarding these behaviors.

Active adult supervision is a key child drowning prevention strategy, yet an absence of, or lapses in, supervision are sadly often implicated in cases of child drowning, including in portable pools (Peden & Franklin, 2020). In the current study, supervision was valued as an opportunity to teach swimming and water safety to children and allowing parents to react to danger and provide immediate aid if needed. Safety was also highlighted as a salient advantage across all the other portable pool

Table 7
Structural equation modelling of beliefs identified in Phase 1 on intention of Phase 2 respondents to empty and store safely portable pools when not in use.

	M (SD)	Intention	
		β	p
Behavioral Beliefs – Empty and Store: $R^2 = 0.350, p < 0.001^*$			
Prevent my child from drowning or getting injured	6.64 (0.93)	0.403	0.003*
Prevent the pool from becoming dirty	6.40 (1.21)	0.004	0.948
Save space in the yard	6.40 (1.30)	0.050	0.473
Prevent bugs and mosquitos from getting in the pool	6.52 (1.05)	0.106	0.274
Take up too much storage space	3.29 (2.12)	-0.116	0.184
Waste water and be expensive to refill	3.69 (2.10)	0.065	0.339
Be difficult to dispose of the water	2.77 (2.00)	-0.127	0.109
Take time and effort	3.78 (2.10)	-0.122	0.078
Normative Beliefs – Empty and Store: $R^2 = 0.145, p = 0.058$			
Family members	6.30 (1.26)	0.053	0.643
Friends	6.21 (1.30)	0.206	0.096
Lifeguards, swimming instructors, and emergency services	6.46 (1.21)	0.233	0.058
The government and local council	6.23 (1.54)	-0.121	0.108
Other parents with young children	6.18 (1.39)	0.067	0.477
Control Beliefs – Empty and Store: $R^2 = 0.219, p = 0.002$			
Lack of storage space	2.39 (1.97)	-0.084	0.276
No easy way to drain the pool	2.43 (1.96)	-0.354	0.002*
The cost of refilling the pool	2.67 (2.03)	0.041	0.736

Note: * $p < 0.05$.

safety behaviors, although time was noted as a disadvantage and barrier to supervision. The importance of these advantages over the disadvantages underscores the need for considered message framing when attempting to change behavior, especially as current public health practices tend to emphasize the negative consequences of behaviors. Campaigns using *fear appeals* (which seek to elicit an emotional response of fear to encourage behavior change) have been shown to be ineffective, and in some cases, have adverse effects (Peters et al., 2013). The exception is that when fear appeals are strong and accompanied by tangible resources to increase self-efficacy toward the behavior seeking to be changed, reliable, albeit weak, effects can be attained (Witte & Allen, 2000). In contrast, gain-framed messages emphasizing the positive consequences of engaging in the desired behavior tend to be more effective as they engender greater message engagement (O’Keefe & Jensen, 2008), and because most audiences are not highly involved in the behaviors, highlighting the importance of audience-centered messaging (Wansink & Pope, 2014). Therefore, messaging targeting the positives of portable pool safety behaviors are recommended. This could also include messaging that harnesses the importance of normative beliefs, especially the support of family members and friends, to improve parents’ intention to comply with portable pool safety behaviors, especially regarding supervision and fencing. These recommendations are particularly pertinent to drowning prevention focused groups who regularly advocate child drowning prevention strategies to the public via campaigning and media (Cohen & Swift, 1999). Careful consideration of the framing of messages for advocates is required.

Given the importance of normative beliefs for these safety behaviors, continuing to harness parental advocates will be important (DeFrancesco et al., 2003; Denehy et al., 2017).

Installing barriers to prevent unintended access to water are a proven drowning prevention strategy (Franklin & Peden, 2017; Thompson & Rivara, 2006), and a legal requirement in Australia for pools deeper than 30 cm (Australian Competition and Consumer Commission ACCC, 2018), including non-permanent structures such as portable pools. However, enforcement is rare and, thus, the likelihood of there being fencing present around a portable pool in Australia is very low (Peden et al., 2020). Our study reflects challenges impacting likelihood of installing fencing for portable pools, particularly the permanent nature of fencing for an impermanent pool. Several practical strategies regarding fencing and warning labels could be considered to address these beliefs. These may include greater specificity regarding warnings on product and packaging regarding fencing of portable pools, in particular a need to consult local authorities to determine their specific requirements for fencing. In addition, manufacturers could explore fencing which better meets the needs of portable pool owners, considering transitory and ease of assembly design aspects. Policy and legislative levers are part of any comprehensive approach to injury prevention; however, without education and enforcement, achieving behavioral change is challenging (Groeger, 2011). Given the challenges this study has highlighted for parents in meeting their legislative requirement to fence portable pools of a particular depth, relying on legislation alone is unlikely to be effective.

Portable pool designs could also consider the ease of draining the pool, given this belief was identified as being salient for parents’ intentions to empty the portable pool and store it after use. Restructuring the physical environment may also be considered to address this barrier. Putting in place processes to drain the pool and recycle the water such as having a hose in place is one such example. Similarly, the pool could be positioned in a place that makes the process easier, such as positioning the portable pool next to a garden bed so the water flows directly onto the plants when being emptied. Communicating these practical tips to parents at point of sale and ahead of periods of warmer weather should be considered, and their effectiveness on changing behavior evaluated.

4.1. Strengths and Limitations

This study’s strengths include a focus on an at-risk group for drowning (i.e., children aged under 5) and a key drowning location for which drowning prevention literature is limited. Further, this study used a theory of planned behavior belief-based framework to examine three key portable pool safety behaviors that are known to reduce drowning risk. However, there are several limitations to note. Firstly, this study used a cross-sectional observational design limiting causal inferences, and included self-reported measures that may increase the likelihood of biased responses on the basis of social desirability. Additionally, although purposive sampling was undertaken to ensure participants were recruited from diverse locations across Australia, recruitment was via convenience methods. This resulted in some biases in those who were recruited for the study; namely a predominance of mothers of Caucasian decent who were partnered, educated, employed, and residing in Metropolitan and suburban areas of Queensland, Australia. Further work is needed to understand beliefs held by parents from different cultural groups, family structures, rural/remote settings, or lower socio-economic backgrounds.

5. Conclusion

Portable pools pose a significant drowning risk to young children. Findings from this study provide important insights into the behavioral, normative and control beliefs of parents of young children with a portable pool at home, regarding several key portable pool safety behaviors known to reduce child drowning risk. Importantly, specific

beliefs governing intention associated with these safety behaviors were identified. These identified beliefs can be used to create messages that are theoretically and empirically based, increasing the likelihood of effectiveness in improving parents' safety behaviors around portable pools. Based on current findings, we recommend modification of current messaging as well as the display of messaging on the portable pool product itself and its packaging to enhance recall and likelihood of impacting behavior, specifically creating messages targeting the salient beliefs. We recommend future research also test the efficacy of any belief-based messages developed in modifying parents' intentions, and moreover, their behavior.

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Ethics approval statements

This study received ethical approval from the Griffith University Human Research Ethics Committee (2018/951).

CRedit authorship contribution statement

Kyra Hamilton: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Jacob J. Keech:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization Data curation, Investigation. **Amy E. Peden:** Writing – review & editing, Writing – original draft, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jsr.2025.02.016>.

Data availability statement:

All study data, analysis scripts, and materials are available at the Open Science Framework project site at: <https://osf.io/vjh6z/>.

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