

A Review Of Best Practices

Preventing Drowning In Manitoba

Prepared for Manitoba Health by



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INTRODUCTION

Drowning is the second leading cause of unintentional injury death for Canadian children and youth 0-19 years of age and the fourth leading cause of injury death for all ages.^{1,2} This report is a summary of drowning and near-drowning data, risk and protective factors, and best practice recommendations. It is designed to be a resource for communities and organizations working to reduce drowning and near-drowning incidents, and summarizes interventions applicable to varying levels of responsibility within communities. These include educational interventions, engineering/design interventions, and legislation.

Drowning and Near-Drowning: The Problem in Manitoba

Unintentional drowning and submersion is a leading (top 5) cause of injury death across most age groups.³ When only unintentional injury categories are included drowning is the leading cause of death for children one to four years of age and the second leading cause of death for individuals five to 34 years of age. However, when intentional causes are included drowning is the sixth leading cause of death for Manitobans, preceded by suicide, motor vehicle collisions, falls, fractures (cause unspecified), choking/suffocation, and assault. The latter two tied as the fifth leading cause of death. The figures³ below illustrate drowning deaths and hospitalizations by age groups and gender.

Figure 1. Deaths Due to Unintentional Drowning and Submersion 1992-1999

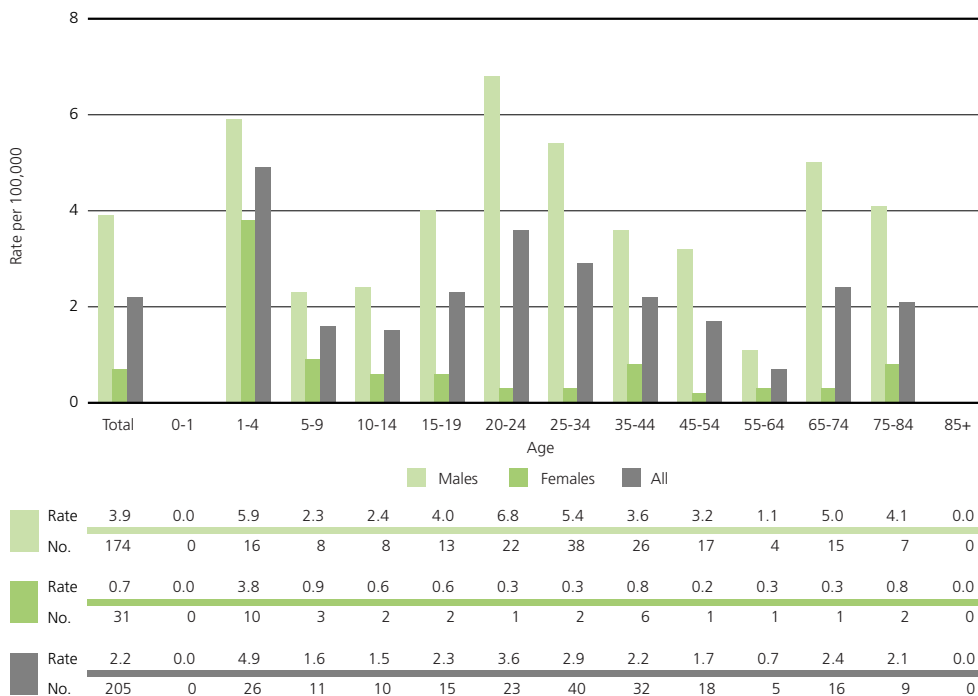
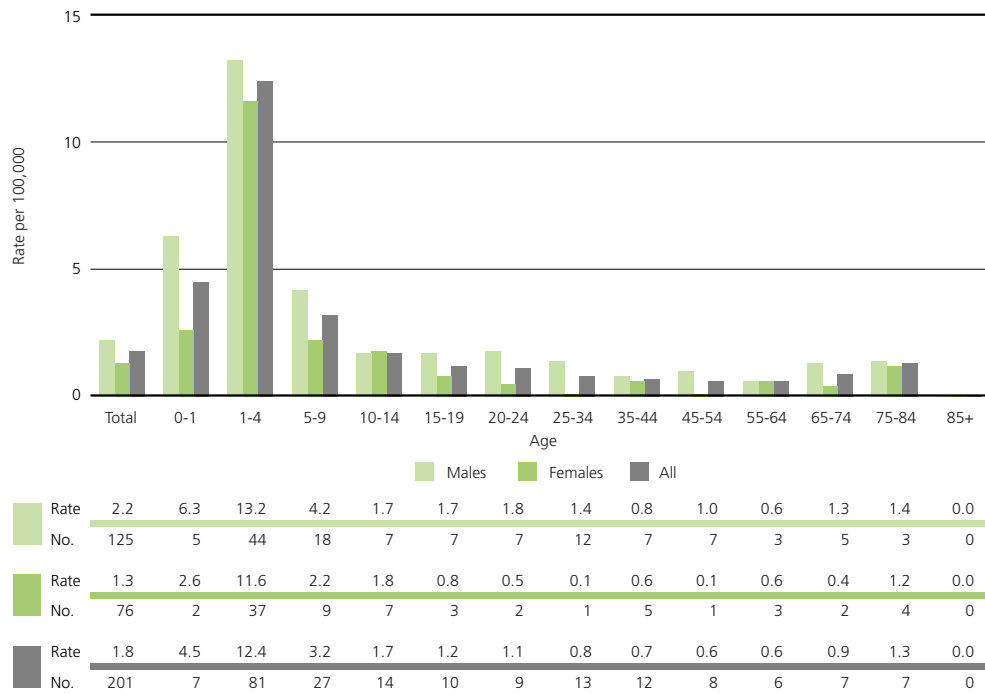


Figure 2. Hospitalizations Due to Unintentional Drowning and Submersion 1992-2001



Between 1992 and 1999 there were 205 deaths due to drowning and submersion. This correlates with results from the most recent decade (1993-2002) of Chief Medical Examiner data, with an average of 25 drowning deaths per year.⁴ Statistics Canada data (1990-1992) demonstrate that Manitoba has a significantly increased child drowning rate compared to the national average (3.1 per 100,000 versus 1.7).¹ Males are significantly more likely to be injured or die from drowning than females, and account for 85% of deaths. This increased risk is more pronounced for drowning than for injuries overall (5.6X vs. 2.1X).³ When all ages are combined, drowning is the third largest cause of potential years of life lost, with an average of 43.8 potential years of life lost per person.

Drowning and submersion was not a leading cause of hospitalization for any age group. Hospitalizations between 1992 and 2001 for drowning and submersion included 201 cases, with 62% being male. As the above rates indicate, children less than 15 years of age were hospitalized most often, especially toddlers and infants. Adults 75-84 years of age and youth 15-19 years of age were also hospitalized at increased rates. In the same period 148 children

under 17 years of age visited the Winnipeg Children’s Hospital Emergency Department for pool-related injuries.⁵ With most types of injuries the number of hospitalizations far exceeds the number of deaths, yet with drowning and submersion the morbidity to mortality ratio is nearly equal, resulting in a steep “injury pyramid”.⁶ This indicates that drowning and submersion incidents have a much higher likelihood of death than other types of injuries

Recent Drowning Inquests

Case 1 & 2

During the summer of 2000 there were two cases where children drowned at Birds Hill Park Beach (6 & 7 years of age).

Case 3

In June 2002, a boy, five years of age, drowned while on a field trip with his kindergarten class to a City of Winnipeg pool.

METHODOLOGY

This section of the report identifies the key risk factors for drowning and submersion. In Manitoba, toddlers and young males are the population groups most at risk of drowning, while boating is the activity implicated in most drowning cases.

Literature Search

Databases

Seven electronic databases were searched for research literature regarding drowning and near-drowning. These databases included CINAHL (1982-2004/07), EMBASE (1980-2004/08), MEDLINE (1966-2004/08 wk 3), PsycInfo (1972-2004/08 wk 3), PubMed (1951-2004), SportDiscus (1830-2004/08) and Social Sciences Full Text (1983/02 to 2004/06). Search terms included 'drowning best practices', 'drowning prevention', 'drowning review', submersion, near-drowning, water safety, and 'drown*' (searches all extensions). On-line archives of the Injury Prevention journal were searched (ip.bmjournals.com) using the headings 'drowning', 'drown' and 'submersion' to identify any additional articles or relevant editorial content. Cochrane databases were also searched for systematic reviews and studies of drowning prevention interventions.

Internet Searches

The Google search engine (www.google.ca) was used to search for best practices and systematic

reviews using the search terms above. In addition, many injury-specific websites were targeted and searched manually, including:

- Centre for Disease Control's National Centre for Injury Prevention and Control (NCIPC) (www.cdc.gov/ncipc),
- Safe Kids Canada (SKC) (www.safekidscanada.ca),
- Health Canada's Injury Section (www.hc-sc.gc.ca/pphb-dgspsp/injury-bles),
- Harborview Injury Prevention & Research Centre (www.depts.washington.edu/hiprc),
- World Health Organization's Department of Injuries and Violence Prevention (www.who.int/violence_injury_prevention),
- and international injury prevention centres.

Other Sources

Additional sources included the IMPACT library resource material, reference texts, and published systematic reviews of child and youth injury prevention best practices.

RISK FACTORS

Individual Factors

Knowledge of risk factors associated with drowning and near drowning can aid in the development of effective prevention strategies. These have been clearly identified and include:

Age

Drowning is the second leading cause of unintentional injury death for Canadian children less than 20 years of age.⁷ Toddlers have a significantly increased risk of drowning.⁷⁻¹⁰ In Manitoba, drowning is the leading cause of injury death for toddlers one to four years of age, with seven fatalities per year (1996-2000).^{3,11} Recent research has shown that First Nations toddlers are one of the populations at greatest risk of drowning in Manitoba.⁷ For each pediatric drowning fatality, three children visit the emergency department for submersion-related injuries and about 40% of those are admitted to hospital.¹² Locations of drowning incidents vary by age group, with infants drowning more often in bathtubs, buckets, and toilets, and toddlers drowning more often in artificial pools and bodies of freshwater. Older children more often drown in freshwater.^{13,14} For near drowning, infants are at greatest risk in bathtubs, while toddlers are at greatest risk in swimming pools.¹⁵ Unintentional falls into water are common causes of pool and freshwater drowning in young children.^{14,16} In addition to swimming pools, unfenced spas have led to drowning incidents.¹⁷ Standing water is a potential drowning risk for young children. Children have drowned in many types of accessible garden items including bins, dustbins, wading pools, ponds, buckets, tanks, or pots where water existed or had accumulated.¹⁸ Drowning and near drowning in young children is often the combined result of easy access to water and a lack of supervision, often described as a momentary lapse.

Bath seats are a drowning risk for young children. According to the Consumer Product Safety Commission (CPSC), bath seat drowning hazards include the seat tipping over, children becoming trapped in the leg openings, and children climbing out of the bath seat.¹⁹ The main risk with bath seats

is the false sense of security that parents are given, which leads to infants being left alone.²⁰ CPSC Statistics demonstrated that between 1996 and 1999, 10% of bathtub drowning incidents among children less than five years of age were the result of using a bath seat.²¹ Canada has seen seven bath seat-related drownings in the past five years, representing 58% of bathtub drownings.²² This equates to an average of 1.4 incidents per year. In Manitoba, two bath seats drowning incidents have been documented in the past year.

A recent 10-year data report by the Canadian Red Cross Society found that adult males, youth, and young children are the age-related subgroups most at risk of drowning.² For adults and youth, alcohol and drugs, risk taking behaviour and inadequate swimming ability have been identified as significant contributing factors.^{23,24} In adolescence and adulthood alcohol plays a significant role in drowning deaths. Boating is a major risk factor for adults and teens, and young males are also at risk of drowning from swimming activities.²⁵⁻²⁸

Drowning Hazards: Home and Yard

- Bathtub
- Toilet
- Bucket
- Wading pool
- Pool
- Hot-tub or spa
- Fish pond
- Drainage ditch
- Dugout

Gender

Drowning rates are significantly higher for males than females in Canada, however females outnumber males for bathtub drowning.²⁸ Overall, 92% of

Canadian boating victims, 83% of Canadian drowning fatalities, and 79% of Manitoba drowning victims are male.²⁹⁻³¹ In Manitoba the child drowning rate is twice as high for males than females (3.9 vs. 1.9 per 100,000).⁷ A study of pediatric pool immersions in California found that there were 1.9 times as many male near-drowning incidents compared to female cases.³² The Canadian Institute for Health Information has documented that 68% of water-related injury hospitalizations involve male victims.³³

Typical profiles of male drowning victims include male risk takers aged 18-34 years who power boat, swim, fall into bodies of water, and are often consuming alcohol; adults aged 35-64 years in similar scenarios; and teens consuming alcohol and diving into shallow water.³⁴ Shallow water diving is the most frequent cause of severe water-related injury not resulting in drowning.^{28,35} Males are less likely to use protective devices in water-related and other recreational activities (e.g., bicycle helmet use)^{8,9,36} One study found that females were 1.5 times more likely to wear a personal flotation device (PFD) relative to males.³⁷ This may be one important explanatory factor for the gender difference in boating-related drowning.

Epilepsy

Epilepsy has been identified as a risk factor for drowning, especially for children.^{2,38-40} A review of national drowning data found that the most common risk factor for bathtub drowning was a seizure from epilepsy.²

First Nations

In Manitoba First Nations communities, drowning and submersion is the third leading cause of injury death preceded by suicide and motor vehicle traffic injuries.³ These higher drowning rates have been attributed to higher rates of alcohol use and higher PFD nonuse documented in First Nations drowning victims compared to non-First Nations populations.⁴¹ The magnitude of the difference between First Nations and non-First Nations Manitobans is evident when mortality rates are examined. Drowning is four times more likely in First Nations Manitobans (8.8 deaths per 100,000 vs. 2.0).³ This drowning mortality discrepancy is much (6.5X) greater when First Nations and non-First Nations children are compared (12.4 vs. 1.9 per 100,000 respectively).⁷

Lack of Training

A lack of training in boating safety has been identified as a drowning risk factor for boaters.²⁹ Transport Canada is attempting to counter this problem by phasing in requirements for boat operators to obtain Pleasure Craft Operator Cards and requiring operators to be at least 16 years of age. Initially requirements will target young adults, followed by operators of small boats (<4m). The Transport Canada Office of Boating Safety (www.tc.gc.ca/boatingsafety) requires operators of motorized recreational watercraft to have proof of competency on board at all times. All motorized recreational boat operators must obtain the card by September 15th, 2009. The accredited courses include basic boating safety information (i.e., safety equipment, sharing waterways, and regulations) and emergency preparedness. Training is not required if an individual challenges the test and is successful.

Activities & Environmental Factors

Boating

In Canada, boating results in the greatest number of drowning incidents, with failure to wear a PFD and alcohol consumption being the most common contributing factors.^{2,28,34} Most incidents result from recreational boating (i.e., leisure, sport) as opposed to other types of boating.²⁸ A 10-year review of water-related fatalities in Manitoba demonstrated that boating accounts for 30% of deaths.³⁴ Typically those who drown while boating either fall overboard or capsize (66% of cases), are not wearing a PFD, nor have one present (25%) in the boat, and few boat owners report being educated regarding boating safety.^{29,42} In Canada, 91% of boating-related drowning victims are males, 48% are 35-64 years of age and 33% are 18 to 34 years of age.²⁷

Power boating accounts for over half of Canadian boating deaths, particularly in small vessels (less than 18 feet).²⁹ There is almost twice the risk of death from power boating (seven versus four deaths per 100,000) relative to unpowered boating.

Snowmobiles

While boating is a significant risk factor for drowning in spring and summer, in winter, snowmobile riders are at an increased risk, as snowmobiles are often ridden without adequate protection (e.g., flotation suit), and while the operator is under the

influence of alcohol.³⁰ Should an incident occur, extreme weather conditions, falls through ice and subsequent hypothermia affect the likelihood of rescue and survival. Wearing appropriate protective equipment and not operating the vehicle under the influence of alcohol are as relevant with snowmobile operators as they are with power boaters.

Swimming Pools

In Canada, swimming pool drowning is the most common type of toddler drowning, with over half of all backyard pool deaths involving children under the age of five.^{14,42} Studies show that caregiver factors and supervision are not enough to prevent drowning.⁴³ Toddler drowning in swimming pools tends to occur at the child's own home or at pools lacking fencing, having inadequate fencing, or due to propping or leaving gates open.^{7,44,45} The absence of adequate fencing surrounding private swimming pools is the main contributing factor in drowning.⁴⁶ Spas, hot tubs and whirlpools present similar drowning risks, with the added risk of hair entanglement in suction drains.⁴⁷

Situational Factors

Alcohol Use

Boating while intoxicated (BWI) is a criminal offence under the Criminal Code of Canada. Results from a decade of Canadian drowning data show that the use of alcohol during boating is a significant risk factor for drowning.² The World Health Organization (WHO) states that alcohol consumption prior to swimming or falling in water is a common contributing factor for drowning among older children and adults in many countries.⁴⁸ Alcohol use is most prevalent for drowning victims 35-64 years of age, followed by 20-34 years, and finally 15-19 years.²⁵ In 2000 in Manitoba, 55% of water-related fatalities involved or were believed to involve alcohol use, with 27% of those at or exceeding three times the legal limit.³¹ Alcohol is recognized as a key risk factor in many boating fatalities in Canada, with 40% of fatal power boating victims exceeding the legal limit.^{27,49} In 2002 in Manitoba, alcohol and drug use was detected in drowning victims as young as 13 years.⁵⁰

A study examining the influence of alcohol on recreational aquatic activity found that having a blood alcohol concentration over 0.10 g/100ml was associated with a 10-fold increased risk of drowning for recre-

ational boaters.⁵¹ An Australian study of water-related deaths found that 56% of men 30-64 years of age had blood alcohol concentrations over 0.08 g/100ml, yet no women exceeded this level.⁵² Alcohol has also been shown to adversely affect performance in swimming, snowmobile use and diving activities.^{2,30}

Lack of Supervision

When children drown it is often the result of a lack of supervision or brief supervisor distraction. The WHO states that a lapse in adult supervision is the largest contributor to child drowning.⁴⁸ In Manitoba, recent findings demonstrate that over half of pediatric drowning victims were alone at the time of the incident, and half occurred during a momentary lapse in supervision.^{31,34,53} Parents may substitute sibling supervision, which is inadequate. One study found that all bathtub drowning among children less than five years of age were associated with supervision by a sibling less than seven years of age.¹⁶ Canadian data show that toddlers were supervised by a minor in 17% of drowning cases.⁵⁴ Parents of children less than five years of age report leaving their children unsupervised in the bathtub for up to five minutes.⁵⁵

Areas without lifeguards are also associated with higher drowning rates. A Center for Disease Control report states that trained, professional lifeguards have positively affected drowning prevention in the United States.⁵⁶ Supervision of public areas by lifeguards leads to fewer rule violations by swimmers.⁵⁷ Fewer rule violations also tended to occur when adult to child ratios were smaller, indicating a positive association between parental monitoring and rule compliance.

Personal Flotation Device Non-use

Between 1991 and 2000, 85% of Canadian boating-related drowning victims were not wearing a personal flotation device.³⁰ In Manitoba, boating is one of the leading causes of water-related fatalities, and not using a personal flotation device is a significant issue among boat operators and passengers.^{29,50} Recent Manitoba observational data found that 53% of boaters, including 61% of power boaters, were not wearing a PFD while boating.⁵⁸ In 50% of Manitoba's fatal boating cases where a PFD should have been used there was not one present.⁵³ Other studies have reported similar low PFD use rates and the tendency for PFD non-use among power boaters.¹

INTERVENTIONS

Overall Findings

Scientific Rigor

Analysis of the drowning literature demonstrates that the evaluation of potential prevention interventions has been limited. In general, there are few well-evaluated interventions for reducing sport and leisure injuries.⁵⁹ Similarly, a review of injury prevention interventions for children concluded that few interventions exist that have been evaluated in a rigorous manner.⁶⁰

Pool Fencing

The most effective intervention to prevent swimming pool drowning is four-sided fencing with a self-closing, self-latching gate.^{61,62} Four-sided fencing serves as a barrier between the hazard (pool) and those at risk (children).^{63,64} However, pool fencing will only be an effective intervention strategy if the gate is consistently closed to restrict access, and if the home itself is not considered one of the “sides” of the fence.⁶⁰ Several systematic reviews have concluded that pool fencing is the best strategy for reducing the risk of young children drowning in domestic swimming pools.^{15,59,63,65} A review by the Cochrane Collaboration concluded that pool fencing significantly reduces the risk of drowning and that isolation fencing (four-sided) is superior to perimeter (three-sided) fencing.^{62,66} Isolation fencing separates the pool entirely from the rest of the backyard and the home, while perimeter fencing only limits access to the property.⁶⁷ Pool fencing laws have led to fewer fatalities and near-drowning incidents when compared to jurisdictions without legislation.^{10,69}

The CDC reports that 69% of young drowning victims gain unintended access to the pool and often (77%) have been missing for five minutes or less.⁸ Most of the research on the effectiveness of pool fencing has not assessed fencing type (three or four sides) but rather the presence or absence of fencing. One study estimated that the likelihood of drowning in an unfenced pool is 2-5X greater than for a fenced pool.⁷⁰ The Harborview and Cochrane sys-

tematic reviews concluded that four-sided fencing is an effective preventive strategy for restricting access to swimming pools by toddlers.^{62,71} While pool inspectors and safety experts strongly support the need for isolation fencing, compliance with these recommendations and even with existing fencing by-laws is poor.⁶⁹ One Florida study found that only 10% of pool owners had isolation fencing in place.⁷² Only 3% of Canadian pool drowning cases occur in a swimming pool with a self-latching, self-closing gate and a fence that meets local by-laws.¹⁴ Of note, the City of Winnipeg does not require isolation fencing.⁶⁸

City of Winnipeg By-Laws for Outdoor Private Swimming Pools⁶⁸

All outdoor pools must be fully enclosed with a fence or suitable barrier including: a self-closing, self-latching gate at least 5 foot high, a minimum vertical height of 5 feet, and the fence must be kept in good repair.

Pool owners’ attitudes towards pool safety have been found to be inconsistent with their safety practices.^{73,74} In one study, owners stated that they supported CPR certification and pool fencing, yet only half had a household member with certification and only 35% of those favouring a complete pool barrier had fenced their pool. Those with young children were also found to be more supportive of pool fencing legislation.⁷³ Evidently, legislation and enforcement are important in ensuring that effective safety measures are being adopted.⁷⁵

Specific pool fencing guidelines are available for pool owners. The Consumer Product Safety Commission requirements for effective pool barriers include a fence which is at least five feet tall with no openings exceeding four inches between the vertical slats.¹⁹ The fence should be installed completely around the pool with a self-closing, self-latching gate.^{19,76,77} The need for an effective barrier is also applicable to hot tubs

and spas as drowning and near-drowning have occurred with these products. Owners should check their local by-laws and building codes with respect to specific pool and spa safety requirements.

Pool safety devices such as pool covers and pool alarms have not been sufficiently evaluated yet may provide an extra layer of protection. ASTM provides standards for these devices for swimming pools and spas. These devices are not recommended as a source of primary prevention.⁷⁸

Personal Flotation Devices

To date, no rigorous studies have confirmed the effectiveness of personal flotation devices in preventing drowning.⁴¹ Instead, water safety experts and organizations cite the high prevalence of PFD non-use among drowning fatalities, and estimate the number of potential lives saved. For example, a United States Coast Guard study concluded that in 2000 approximately 445 lives could have been saved if PFDs had been worn by boating victims (factoring in inevitable deaths), while an Arkansas study claimed that approximately 38 lives were saved by PFDs in the absence of other protective factors.^{79,80}

Thus far attempts to increase PFD use through education have not been rigorously evaluated and have demonstrated marginal results.⁸¹⁻⁸³ In Canada, current laws require that a PFD be on board, while Transport Canada encourages that individuals wear a properly fitting PFD at all times.⁴⁹ Current Canadian legislation is clearly not sufficient, as most drowning victims are found not wearing a PFD.²⁷ In addition, boating incidents often separate the boat from the passenger (e.g., capsized), it can be difficult to fasten a PFD while in deep or cold water, and some victims may be rendered unconscious during the incident.

Legislation regarding mandatory PFD wearing on boats has been introduced in the majority (77%) of US states as well as in Australia. However, legislation has addressed only mandatory wearing by children for all of these jurisdictions except Tasmania.⁴¹ These laws are also variable, in terms of age, other criteria, and exceptions. For the states without PFD wear legislation, an interim rule has been developed by the United States Coast Guard (2002) requiring all children under 13 years of age to wear PFDs unless they are in an enclosed area on the vessel. The effectiveness of PFD wear legislation on wear rates is not known. However, mandating the use of protec-

tive equipment has been effective in increasing use for bicycle helmets.⁸⁴ It is expected that similar trends would occur with PFD wear legislation. Legislation should target all ages, especially power boat and motorized boat users (e.g., personal watercraft).^{37,85}

CPR Certification for Pool Owners

The ability to perform cardiopulmonary resuscitation (CPR) has not been well studied but is recommended for all pool owners.^{19,86} The US Consumer Product Safety Commission recommends providing drowning victims with early resuscitation at the scene.⁷⁶ Having a bystander provide CPR immediately following submersion has been found to be the most important factor contributing to survival and neurological outcome.^{15,87-90} Documented benefits of early resuscitation at the scene, suggest that pool owners and their families can benefit from CPR certification. CPR training has also been recommended for teens.^{78,92} Given the reported attitude-practice gap among pool owners, with only 50% of those who favoured a CPR certification requirement having a current household member with that qualification, mandatory certification has been suggested in the literature.⁷⁴

What about Supervision Ratios?

The Manitoba Lifesaving Society recommends having a ratio of one parent or childcare provider for every four swimmers (1:4), one parent or childcare provider for every two young children (1:2), and one parent or childcare provider for each very young child or child with special needs such as epilepsy (1:1).⁹¹

Adult Supervision

Infants and young children should never be left alone near water. In order for supervision to be effective it must be constant and the supervisor should be within arm's reach of the child.²⁶ One recent child supervision study concluded that physical proximity was the only form of supervisory behaviour (compared with visual or auditory supervision) that was protective for children.⁹³ Another study reported lower case fatality rates for general

and bathtub supervision as opposed to no supervision. In this study, victims being supervised by adults had lower case fatality rates than those supervised by lifeguards or peers.⁹⁴ The need for adult supervision around water is emphasized in most community drowning campaigns and water safety materials. Some researchers have concluded that adult supervision of public swimming areas may be associated with injury reduction.^{83,95}

Lifeguard Supervision

Lifeguard supervision has not been found to directly decrease drowning rates.⁵⁶ This could be the result of insufficient lifeguard coverage, poor lifeguard to patron ratios, or poor study design. It is recommended that when lifeguards are present, swimmers should remain in the supervised areas.³⁴

Swimming Lessons for Young Children

Both the Canadian Pediatric Society (CPS) and the American Academy of Pediatrics (AAP) have published position statements on the issue of swimming lessons for young children.^{95,96} These organizations have concluded that swimming lessons do not prevent drowning in children less than four years of age. However, participation in swimming and water safety programs is supported by both organizations, and has been associated with improved swimming ability and better on-deck practices (e.g., not running).^{60,95}

Swimming lessons in isolation do not provide sufficient protection against drowning; strong swimmers are a subset of drowning victims every year.⁹⁷ There is however a need to study the extent to which

swimming lessons can be protective in reducing the risk of drowning and near drowning, especially in those over the age of four.^{3,95}

'Boating While Intoxicated' Enforcement

In order to prevent alcohol-related drowning the only solution lies in separating alcohol consumption and water-related activities (i.e., swimming, diving, and boating).^{10,98,99} Not surprisingly, increasing blood alcohol levels are associated with an increased risk of drowning.¹⁰⁰ The Canadian Red Cross Society recommends making the use of alcohol near water illegal or socially unacceptable.²⁸ A US study documented that banning alcohol in public waterfront areas resulted in a significant decrease in drowning incidents.¹⁰¹ Another study found that 25-50% of adult drowning victims had consumed or were exposed to alcohol.¹⁰²

When considering strengthening legislation, it is vital to build in enforcement strategies.¹⁰³ Health Canada emphasizes that drowning prevention efforts should include reinforcing Article #253 of the Criminal Code, which stipulates that boating while intoxicated is not permitted. They also advocate for the extension of this regulation to include passengers, not merely vessel operators.¹ Mandating a ban on alcohol use in open waters and ensuring that it is upheld would target many of the deaths that occur among the high risk subcategories of boaters as well as adult and adolescent swimmers. It may also enhance parental supervision at waterfronts and while boating.

Strength of Evidence

For the purposes of this report the methodology of the Canadian Task Force on Preventive Health Care was adopted (see Appendix A).¹⁰⁴

Table 1. Summary of Evidence and Ratings for Drowning Interventions

Type	Intervention	Grade*	Quality of Evidence	Ref	Methods	Age Group	Data Sources	Outcome Measures	Results
Legislation	Pool fencing regulations	Fair	II-2	67	Pre-post with control area	Child	Coroner's data, hospital data, data on pool registrations	Child drowning and near-drowning incidents	Fatality rate without a law was nearly double the rate for area with a law (14.3 vs. 7.7 per 100,000)
		Fair	II-2	105	Case-control study	Child <10 years	Coroner's data	Drowning	Ordinances have not led to a reduced rate of childhood drowning
		Fair	II-3	10	Historical cohort with comparison group	Child <20 years	Medical Examiner and hospitalization data (King County, WA)	Pool submersion cases at private and public pools (1974-1983) resulting in death or hospitalization	Significant decrease in submersion incidents at public pools but not at private pools during the study period
Four-sided Fencing	Mandatory PFD wear legislation	Poor	III	41	Literature review	All ages	Published literature, experts, public opinion poll	Drowning, PFD use	PFD "wear" legislation is the most effective method to increase PFD use
	Isolation Fencing	Fair	II-2	66	Case-control	Child <4 years	Survey data	Incidence rates, risk	Decreased risk of drowning in isolation vs. perimeter fenced pools (OR=0.16, 95% CI 0.05-0.49)
		Poor	III	69	Case series	Child <5 years	Coroner's data	Drowning	Increased risk of drowning in a 3- vs. 4-sided fenced pool (1.78, 95% CI 1.40-1.79)
Presence of Fencing	Fencing vs. no Fencing	Fair	II-2	70	Case-control	Child <14 years	Survey data, drowning data	Drowning and near-drowning	Pool fencing had a protective effect (OR=0.29, 95% CI 0.15-0.57) and led to a reduced risk of drowning
		Fair	II-2	61	Prospective cohort	Child <14 years	Hospital-based prospective surveillance system	Drowning and near-drowning	Risk of drowning in an unfenced pool is 3.8 times the drowning/near-drowning risk in a fenced pool (95% CI 2.14-6.62)
Education	Increasing PFD use via education and social marketing	Fair	II-3	82	Pre-post with control group	Child <15 years	Telephone surveys	Reported PFD ownership and use	Small but significant increases in PFD ownership and use
				83	Pre-post, no control group	All ages	Observational study of PFD use	PFD use	Small but significant increase in PFD wear rates
Environment	Swimming lessons for children less than four years of age	Poor	III	95, 96	Policy statement	Child	Literature review, expert panel	Drowning, near-drowning	No evidence that swimming lessons prevent/reduce risk of drowning/near-drowning in children <4 yrs.
	Immediate (bystander) resuscitation	Fair	II-2	87	Case-control study	Child <15 years	Submersion events with apnea	Neurological impairment and/or death	Children with a good outcome were 4.75 times more likely to have a history of immediate resuscitation than children with a poor outcome (95% CI 3.44-6.06, p = .0001)
	Efficacy of lifeguard supervision of public swim areas	Poor	III	56	Expert panel meeting	All ages	Expert panel	Drowning incidents pre-post lifeguard services	Lifeguards contribute to drowning prevention

*Grade of Recommendation (see Appendix A)

Inquest Outcomes

Two inquests into three Manitoba drownings led to many recommendations for swimming pool and beach safety. Results from the inquest into the drowning death that occurred at a city pool during a school outing targeted supervision and training changes. The report recommended that public pools should ensure appropriate supervision levels for young children, particularly for groups. It also highlighted the need for enhanced supervision and policy changes at public pools.¹⁰⁶ In particular, the Public Health Act should be amended to ensure that all lifeguards are sufficiently qualified (e.g., First Aid, NLS Lifeguard Service Award), and an adequate ratio of lifeguards to children is satisfied (1 for 0-30, 2 for 1-74, 3 for 75+). It is also recommended that operators develop and display written emergency procedures, that the provincial government launch a water safety, and that the Department of Education and Youth develop field trip guidelines.

Recommendations from the combined inquest into the drowning deaths of two children at the Bird's Hill Park Beach include:¹⁰⁷

- Continuing to have Beach Safety Officers on provincial park beaches since child supervision by parents and guardians is often insufficient
- Assessing training needs for these officers and determining if heightened medical training is required
- Increasing the staffing of officers at the Bird's Hill Site
- Development of a Risk Management Plan, a Beach Patrol Station, child-supervisor guidelines for group outings, and a strategy to increase public education efforts

Unevaluated Interventions

Anticipatory Guidance for Water Safety

Drowning prevention counselling by physicians is recommended for routine health care encounters, and is generally tailored to the specific risks associated with the child's stage of development.¹⁰⁸ Age-related recommendations include discussing supervision and home-related hazards such as bathtub supervision with parents of young children and focusing on alcohol-related risks and the risks asso-

ciated with boating for adolescents.^{7,55} The American Academy of Pediatrics recommends that physicians provide prevention counselling following injury incidents, on the basis of age, injury and surrounding circumstances.¹⁰⁹ Pediatric nurses can educate parents about drowning prevention conceptions and associated risk factors.¹¹⁰

Research has not determined whether counselling is effective in reducing drowning and/or near-drowning. What has been assessed is the likelihood of providing such information and the topics that merit discussion, based on evidence. Female health care providers are nearly twice as likely as male providers to discuss drowning prevention. Some practitioners (nurse practitioners, physicians, pediatricians) introduce other injury prevention topics (e.g., poison prevention) which they deem more important.⁷⁹ In this study, perceiving other injury topics as more important was associated with an odds ratio of 0.73 [95% CI 0.61-0.85] for providing drowning prevention information. One study assessed parents' ability to recall prevention advice provided during a visit to the Emergency Department. While written messages were well received by parents, recall was low (41%).⁸¹

Water Safety Training and Education

Many organizations provide recommendations and information to the community regarding water safety. Researchers have concluded that community education and awareness is necessary for drowning prevention.⁷⁸ However the effectiveness of community education and awareness programs in terms of adopting safer practices or reducing drowning and near-drowning rates is not known. A wide range of topics is covered in water safety promotion efforts by local and national agencies. The common goal of these agencies is to prevent drowning through the use of protective devices, barriers, judgment (no alcohol, drugs), "common sense" tips, and greater awareness. As stated by the Centers for Disease Control, many recommendations exist, yet few have been rigorously evaluated.¹¹¹ Community-oriented and population-specific water safety resources can aid in the public health approach to drowning prevention; these have been developed for northern and remote areas, which have been shown to have unique needs and risks.¹¹² A summary of water safety guidelines and their endorsing organizations is provided in Table 2. These tend to be directed at the general public and reflect "best practices" to a varying degree.

Given that Canada is still in the process of instituting the boat operator education program, evaluations have not been conducted regarding the effectiveness of this training. The boating safety course is intended to focus on safety issues, safety equipment, and the potential risks of speeding and alcohol use. The ability to spot the hazards is emphasized, as are the risks of carbon monoxide poisoning. Rigorous evaluation of the impact of such guidelines on

behaviour change and injury outcomes is required. It is important to determine the effectiveness of these programs in order to allocate resources efficiently. In some instances safety education and water safety-oriented campaigns have led to negative outcomes.¹¹³ Research showed that safety training was associated with an increase in unsafe boating practices, likely the result of over-confidence.^{114,115}

Table 2. Organizational Support for Drowning Prevention Strategies

Intervention	American Academy of Pediatrics ^{8,5,96,108,116}	Centers for Disease Control ^{8,89,117}	Canadian Paediatric Society ^{9,5}	Consumer Product Safety Commission ^{19,7,6,77}	Canadian Red Cross Society ^{2,14}	European Child Safety Alliance ¹¹⁸	Health Canada ¹	Lifesaving Society ^{30,42,119}	Manitoba Lifesaving Society ^{50,92}	Manitoba Conservation ¹²⁰	National Spa and Pool Institute ¹²¹	Safe Kids Canada ¹²²	Safe Kids (USA) ¹²³	Transport Canada ⁴⁹	US Health Department ¹²⁴	World Health Organization ^{48,125}
Alcohol Use																
Ban on alcohol for boating	•						•		•							•
No alcohol during water-related activities	•	•			•	•		•	•	•	•			•		•
Education/Training																
Boating																
Be aware of the risk of carbon monoxide poisoning in boating		•														
Drive responsibly (powerboat, personal watercraft, snowmobile)					•			•								
Get trained (boating safety course)		•			•			•	•					•		•
Restrict watercraft operation to children over 16 years (PWC, motor boats)	•					•		•						•		
General																
Know weather, risks before you go	•	•			•			•	•					•		
Parents should learn water safety skills		•			•											
Parents, pool owners, public should be trained in CPR & First Aid	•	•	•	•	•	•		•	•	•						•
Provide anticipatory guidance on drowning prevention	•		•													
Epilepsy																
Need constant supervision near water	•				•											
Those with epilepsy should shower rather than bathe	•				•											

Intervention	American Academy of Pediatrics ^{85,96,108,116}	Centers for Disease Control ^{8,89,117}	Canadian Paediatric Society ⁹⁵	Consumer Product Safety Commission ^{19,76,77}	Canadian Red Cross Society ^{2,14}	European Child Safety Alliance ¹¹⁸	Health Canada ¹	Lifesaving Society ^{30,42,119}	Manitoba Lifesaving Society ^{30,92}	Manitoba Conservation ¹²⁰	National Spa and Pool Institute ¹²¹	Safe Kids Canada ¹²²	Safe Kids (USA) ¹²³	Transport Canada ⁴⁹	US Health Department ¹²⁴	World Health Organization ^{48,125}
Home/Yard																
Don't leave five gallon buckets filled	•	•														
Don't use bath seats				•												
Eliminate standing water	•	•		•	•											•
Fill or cover garden ponds						•										
Personal Flotation Devices																
PFDs should be worn when boating or swimming in deep water, and for non-swimmers	•	•	•		•	•		•	•	•		•	•	•		
Pools/Spas																
Avoid drain entrapment									•		•					•
Don't allow young children to use spas and hot tubs	•			•					•							
Don't leave toys near or in the pool	•			•							•					
Don't prop open the pool fence gate				•												
Don't rely on pool alarms to prevent drowning	•				•											
Don't rely on pool covers to prevent drowning	•				•						•					
Install isolation pool fencing	•		•	•	•	•			•			•	•			•
Install pool fencing (unspecified)											•				•	•
Fences need a self-closing, self-latching gate	•		•	•	•	•			•		•		•		•	
Have vertical slats less than 4 inches apart, with a height over 4 feet				•	•											
Have an Emergency action plan			•			•										
Have lifesaving equipment and a phone nearby	•			•	•	•		•	•		•			•		•
Supervision																
Infants should be bathed in small tubs					•		•									
Provide constant, arms-length adult supervision in, near, and around water	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•
Swimming																
Be aware of strong currents		•			•											
Don't assume floating aids can prevent drowning or substitute for supervision (vs. PFDs)	•	•		•						•	•					

Intervention	American Academy of Pediatrics ^{85,96,108,116}	Centers for Disease Control ^{8,89,117}	Canadian Paediatric Society ⁹⁵	Consumer Product Safety Commission ^{19,76,77}	Canadian Red Cross Society ^{2,14}	European Child Safety Alliance ¹¹⁸	Health Canada ¹	Lifesaving Society ^{30,42,119}	Manitoba Lifesaving Society ^{50,92}	Manitoba Conservation ¹²⁰	National Spa and Pool Institute ²¹	Safe Kids Canada ¹²²	Safe Kids (USA) ¹²³	Transport Canada ⁴⁹	US Health Department ¹²⁴	World Health Organization ^{48,125}
Swimming																
Don't dive into water under 9 ft. deep or of unknown depth	•	•			•			•		•			•			•
Don't eat or chew gum while swimming, diving, or playing in water		•						•								
Don't engage in rough play around water	•					•		•			•					
Feet first, first time; diving safety	•	•			•	•		•			•					
Have a lifeguard on duty in public areas	•							•								•
Learn to swim (above 4 years)	•	•				•		•			•	•				•
Obey public signage						•		•	•							
Swim where the lifeguards are, use only designated swim areas		•				•			•							
Swim with a buddy (never alone)	•	•			•			•	•	•	•			•		•
Swimming lessons do not prevent drowning	•		•	•							•					
Winter Safety																
Practice safe snowmobile use (no alcohol, use flotation suit) and avoid thin ice	•				•			•	•					•		

RECOMMENDATIONS

Methodology

A hierarchical method was used to evaluate the quality of the evidence, adapted from the Canadian Task Force on Clinical Preventive Health Care and the Community Guide (see Appendix).¹⁰⁴ Many drowning prevention interventions have been insufficiently assessed and therefore cannot be strongly recommended; some interventions have limited or conflicting evidence.⁵⁹

Recommendations

An alphabetical grading system indicates whether the level of research evidence for each intervention was determined to be good (A), fair (B) or poor (C). Similar systems have been employed in other assessments of intervention effectiveness.⁸³ This grade translates into a recommendation of *strongly recommended* (or discouraged), *recommended*, *recommended based on expert opinion*, or *insufficient evidence to recommend* (see Appendix).

Strongly Recommended

Recommendations that receive a ‘good’ (A) grade (*strongly recommended*) are supported by the best type of evidence, and are effective methods to prevent drowning and near drowning. These are interventions have been evaluated using randomized controlled trials. Unfortunately, the drowning prevention literature does not include any evidence of this calibre.

Recommended

Recommendations that receive a ‘fair’ (B) grade (*recommended*) are supported by fair evidence and include quality ratings beginning with ‘II’ (i.e., II-1, II-2, II-3). The highest level of evidence found within the drowning and submersion literature was II-2, which includes cohort or case-control studies.

Recommended Based on Expert Opinion

Much of the drowning prevention literature is descriptive, or represents recommendations of respected authorities or expert committees.

Other investigators have found similar results after examining the body of evidence for drowning prevention interventions. The Canadian Guide to Preventive Health Care (1994) came to the following conclusions in addressing child and adult drownings.^{126,127}

Children Under Fifteen Years

Teach young children water safety and swimming skills

- Requiring private and public pools to conform to safety standards reduces drowning¹⁰ – ‘Fair’
- Anticipatory guidance on water safety and swimming classes for young children⁶ – ‘Poor’

Never leave young children alone in the bathtub

- Association found between drowning and unattended infants¹²⁸ – ‘Fair’
- Anticipatory guidance on bath supervision¹²⁸ – ‘Poor’

Adults

Do not drink and dive (in water sports)

- Association between alcohol/drug use and recreational drowning in adolescents¹²⁹ – ‘Fair’
- Anticipatory guidance could benefit those at increased risk of injury (i.e., adolescents, young adults, alcohol and drug users)¹²⁶ – ‘Poor’

Best practice recommendations supported by the current literature are summarized below and many can be applied within the community setting to target drowning prevention on a local scale.

Drowning Prevention Best Practices

Recommended

Pool fencing

Pool fencing legislation

Isolation (four-sided) pool fencing

Early/bystander resuscitation for the victim (CPR training)

Recommended based on expert opinion

PFD wearing when boating

PFD wearing campaigns – education/social marketing

Arms-length adult supervision of young children near water

Lifeguard supervision of public waterfronts and pools

Self-closing and self-latching pool gates

Swimming lessons for children over four years of age

Eliminate standing water in the home and yard

Do not use bath seats for infants

Enhanced staffing and training of personnel supervising public beaches and pools

Development of appropriate guidelines for group outings and water-related emergencies

Public education on issues related to water safety and drowning prevention

APPLICATION OF FINDINGS

Recommendations for preventing drowning are applicable to the general public (including parents), individuals and organizations in the health care sector, private and public waterfronts, and all levels of government. Outlined below are strategies to reduce drowning deaths and injuries.

Parents

- Parents should be familiar with home drowning prevention practices (e.g., not using bath seats, constant supervision, no standing water).
- Parents should supervise young children near water at all times – at arms' length distance for infants and toddlers. Infants and toddlers should never be left unattended in the bathtub. This should be communicated to all other caregivers.
- Water-related home hazards should be eliminated.
- Parents must ensure that their children wear PFDs at all times when boating.
- Backyard pools should be secured by a four-sided (isolation) fence installed around the pool and a self-closing, self-latching gate.
- Pool owners should familiarize themselves with CPR and First Aid and have rescue equipment and a telephone near the pool.
- Swimming lessons are encouraged once a child is four years of age. Infants, toddlers and their parents can benefit from water safety and recreation programs.

Waterfronts Operators (Public or Private)

- Waterfront operators should encourage individuals to wear PFDs at all times when boating.
- Waterfront operators should insist on adequate supervision of children.
- Use of alcohol around water should be discouraged.

- Where possible, lifeguards or other trained personnel should supervise public and private waterfronts.

Physicians

- Physicians should provide anticipatory guidance regarding drowning prevention, emphasizing continuous supervision of infants and toddlers around water, eliminating or restricting access to standing water in or around the home (e.g., toilets), and not using bath seats.
- For pool owners, pool fencing recommendations and other pool safety issues should be discussed.
- Physicians should encourage young adults and adults not to mix alcohol and boating and to wear a PFD at all times when boating.
- Continuing Medical Education activities should include sessions for physicians and trainees on the risk factors and interventions associated with drowning and near drowning.
- Physicians should be encouraged to educate the public regarding drowning prevention, through the media or other venues.
- Age-specific standardized checklists and patient information materials should be developed to facilitate these efforts.

Public Health Nurses

- During home visits and other encounters with families public health nurses should provide anticipatory guidance to prevent drowning among young children in the home.
- Home visitors and health care providers should be alert for drowning hazards in homes they visit, and inform parents of observed risks.
- Age-specific standardized checklists and parent information materials could be developed to facilitate these efforts.

Regional Health Authorities (RHAs)

- RHAs should ensure that sufficient data regarding drowning are collected and monitored. This should include the consideration of sentinel or periodic surveillance of emergency department visits.
- RHAs should work with community partners such as municipalities, recreation centers, schools, child care providers, and other organizations to build regional capacity for implementing drowning prevention programs and strategies.
- RHAs should ensure that drowning prevention strategies are implemented and evaluated.
- RHAs should provide educational opportunities for their employees regarding the best practices for designing, implementing and evaluating drowning prevention programs.

Manitoba Health

- Manitoba Health should consider the use of the National Ambulatory Care Reporting System (NACRS) in regional Emergency Departments to improve the data collection, analysis and monitoring of drowning.
- Manitoba Health should support the development of standardized assessment tools and educational materials for drowning prevention strategies, for use by the RHAs.
- Age-specific standardized checklists and parent information materials could be developed to facilitate these efforts.

Manitoba Government

- Manitoba Government should consider PFD wear legislation, prohibitions on boating while under the influence of alcohol, and mandatory four-sided pool fencing legislation.

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APPENDIX A: EVALUATION CRITERIA

In developing grades of recommendation for each intervention, first the body of evidence was graded according to the level of evidence, which reflects study design (Table A). For levels of evidence, the Canadian Task Force on Preventive Health Care methods were used. These correspond to grades of recommendation (good, fair, conflicting, and insufficient). Then a summary grade of recommendation

was assigned, using the Community Guide methods (Table C), in order to provide a common framework for this series of Manitoba injury prevention best practices reports. This system provides a clear hierarchy of recommendations, and clearly indicates where expert opinion is considered to increase the strength of the recommendation.

Table A. Levels of Evidence and Grade of Recommendation

Grade	Level of Evidence	Criteria
Good	I	Evidence obtained from at least one properly randomized control trial
Fair	II-1	Evidence obtained from well-designed controlled trials without randomization
	II-2	Evidence obtained from one or more cohort or case-control analytic studies
	II-3	Evidence obtained from comparisons between times or places with or without an intervention. Dramatic results in uncontrolled experiments could be included
Poor	III	Opinions of respected authorities based on clinical experience, descriptive studies or reports of expert committees

Table B. Recommendations Grades for Specific Clinical Preventive Actions

A	There is good evidence to recommend the clinical preventive action.
B	There is fair evidence to recommend the clinical preventive action.
C	The existing evidence is conflicting and does not allow making a recommendation for or against use of the clinical preventive action, however other factors may influence decision-making.
D	There is fair evidence to recommend against the clinical preventive action.
E	There is good evidence to recommend against the clinical preventive action.
I	There is insufficient evidence (in quantity and/or quality) to make a recommendation, however other factors may influence decision-making.

Table C. Grades of Recommendation

Code	Evidence Level of Evidence	Canadian Task Force Recommendation	Strength of Evidence	Community Guide Recommendation
I	Good	Strongly recommended or Discouraged	Strong	Strongly recommended
II-1 II-2 II-3	Fair	Recommended or Recommended based on expert opinion	Sufficient	Recommended
III	Insufficient	Recommended based on expert opinion	Insufficient empirical information supplemented by expert opinion	Recommended based on expert opinion
			Available studies do not provide sufficient evidence to assess	Insufficient evidence to determine effectiveness
Any level		Insufficient evidence to determine effectiveness	Sufficient or strong evidence of ineffectiveness or harm	Discouraged

Adapted from 'Canadian Guide to Clinical Preventive Health Care' www.hc-sc.gc.ca/hppb/healthcare/pdf/clinical_preventive/methe.pdf and the Community Guide www.thecommunityguide.org/.