Chapter 3 – Conceptual Framework

3.1 Overview

It is basic human nature to avoid injury. Prior to the twentieth century injury prevention was of a simple nature. The need to provide some protection for the combatants participating in the age old pursuit of warfare, for example, led to the use of defensive or protective coverings such as shields or body armour (Rivara, 2001). In the eighteenth century the first societies with a focus on injury prevention were formed, one in Amsterdam and one in Britain, both promoting awareness of water safety (Pearn et al., 2004). It was only in the last half of the twentieth century that a scientific approach has been applied to injury control research (Rivara, 2001) and frameworks for injury prevention and control have been developed.

In Australia, the National Injury Prevention and Safety Promotion Plan 2004 – 2014 (National Public Health Partnership (NPHP), 2005) has a vision of “Governments, private sector and communities working together to ensure that people in Australia have the greatest opportunity to live in a safe environment free from the impact of injuries”. A major principal of this plan is evidence-based planning: “Injury prevention and safety promotion activity will be based on evidence of effective interventions and, where possible, good information about the political and social controls in which interventions will be introduced”.

Consistent with Australian Government vision, this PhD research will challenge the current emphasis on breed specific legislation as an intervention for dog bite injury, by
examining the evidence base for this approach, and examine the potential utility of an integrated approach to dog bite injury prevention. The conceptual basis is drawn from two fundamental approaches to developing prevention programs, one from the injury field, and the other from health education and promotion. These underpin the integrated approach to injury control and health education developed by Andrea Gielen (Gielen, 1992b). Gielen integrated William Haddon's injury strategies and Lawrence Green's PRECEDE framework into one program planning framework that addresses both behavioral and non-behavioral components of an injury problem. This Chapter outlines each of these approaches and the integrated framework and then applies the framework to dog bite injury, highlighting the contribution this thesis is intended to make.

### 3.2 Injury prevention program frameworks

#### 3.2.1 Haddon's matrix

William Haddon, Jr., in the late 1950’s developed a framework for analysing injury by dividing the injury problem into factors and phases involved in an injury event. Haddon’s Matrix provided a framework for injury causation and focused attention on interaction of aspects that had previously not been considered (Haddon, 1980; Robertson, 1983). Haddon’s Matrix is illustrated in Figure 1.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Phases</th>
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<tbody>
<tr>
<td></td>
<td>Pre-event</td>
</tr>
<tr>
<td></td>
<td>Event</td>
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<tr>
<td></td>
<td>Post-event</td>
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<tr>
<td>Human Host</td>
<td>Agent / Vehicle (vector)</td>
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</tbody>
</table>

**Figure 1:** Haddon’s Matrix
Haddon’s Matrix consists of the following Phases:

- **Pre-injury event phase / Primary prevention**
  By acting on the causes of an injury event, the injury event itself may be prevented (e.g. secure fencing to contain dogs, pool fences).

- **Injury event phase / Secondary prevention**
  An attempt is made to prevent an injury or reduce the seriousness of an injury when an event actually occurs by designing and implementing protective mechanisms (e.g. wearing a seatbelt or helmet).

- **Post injury event phase / Tertiary prevention (Treatment and Rehabilitation)**
  The seriousness of an injury or disability is reduced by providing adequate care immediately after an event has occurred, as well as in the longer term by working to restore the highest level of physical/mental function possible for the injured person.

Haddon’s Matrix consists of the following Factors:

- The **Human Host** refers to the person at risk of injury.

- The **Agent** of injury is energy (e.g. mechanical, electrical) that is transmitted to the host through a **vehicle** (inanimate object) or **vector** (person or animal).

- The **Physical Environment** includes all the characteristics of the setting in which the injury event takes place.
The matrix may be expanded by subdividing the human host factors into categories such as abilities and limitations. Vector factors might be divided into injury-enhancing versus protective characteristics, and the environment can be divided into physical and socio-cultural aspects. Interactions between different cells should also be considered (Robertson, 1983).

Having identified the factors that contribute to a set of injuries and the phases of the injury process in which the factors interact, Haddon developed ten strategies for identifying specific interventions (Gielen, 1992b; Haddon, 1980; Robertson, 1983). The ten strategies defined by Haddon are:

1. prevent the creation of the hazard in the first place
2. reduce the amount of the hazard brought into being
3. prevent the release of the hazard that already exists
4. modify the rate or spatial distribution of release of the hazard from its source
5. separate, in time or space, the hazard from that which is to be protected
6. separate the hazard and what is to be protected by interposition of a material barrier
7. modify relevant basic qualities of the hazard
8. make what is to be protected more resistant to damage from the hazard
9. begin to counter the damage already done by the hazard
10. stabilise, repair, and rehabilitate the object of the damage
Haddon’s strategies contributed to a shift away from education as the principal method of injury prevention to also include modifying the environments in which injuries occur and developing a multi-strategic approach to injury prevention (Williams, 1999).

Haddon’s Matrix combined with the ten strategies for identifying specific interventions has been useful for the systematic identification of the range of possible intervention points for any specific injury type. Intervention strategies usually fall into the following major groups: legislation/regulation (accompanied by enforcement), environmental/design changes, education/behaviour change/incentives, advocacy or community or organisation based (Ozanne-Smith and Williams, 1995). However, Haddon’s concepts do not provide a ready translation into a prevention program plan. Others have sought to address shortcomings in Haddon’s matrix with Gielan most comprehensively addressing this limitation by integration with the PRECEDE framework.

### 3.2.2 PRECEDE framework

PRECEDE, an acronym for predisposing, reinforcing, and enabling causes in educational diagnosis and evaluation, is used to develop educational behaviour change interventions. This framework focuses on predisposing factors that provide the rationale or motivation for behaviour (including knowledge, attitudes, beliefs, values and perceptions), enabling factors that allow a motivation or aspiration to be realised (including personal skills and availability and cost of health resources), and reinforcing factors subsequent to behaviour that provide reward, incentive, or punishment for a behaviour and contribute to its persistence or extinction (NCIPC, 1989).
3.2.3 Gielen’s integrated planning framework

The unified framework proposed by Gielen, integrating Haddon’s injury countermeasures and Green’s PRECEDE framework is used to “facilitate multidisciplinary, comprehensive approaches to developing injury prevention programs that are efficient and effective” (Gielen, 1992a). Gielen stated that “the diagnostic process requires analysis of epidemiological data on the injury problem; the legal environment affecting the injury problem; the engineering and technical aspects of the problem; behavioural contributors to the problem; effectiveness of previous intervention efforts; feasibility of new approaches; and availability of program resources”. Gielen details four steps to the process (omitting the social diagnosis which is the first phase of the PRECEDE model) which are illustrated in Figure 2 and described as follows:

**Step 1: Epidemiological Diagnosis – analysis of epidemiological data on the injury problem.**

In this step, epidemiological literature and data on the injury problem are analysed to enable specification of the epidemiological dimensions of the problem. These include morbidity and mortality statistics, identification of characteristics that may predispose the individual to risk of injury and the specific injury hazard.

**Step 2: Environmental and Behavioural Diagnosis**

This step involves identifying (1) the non-behavioural determinants, the vector and its environment, and (2) the behavioural determinants, the relevant host factors that contribute to injury risk. An accurate diagnosis may be reliant on robust research evidence.
With respect to dog bite injury, the vector is the dog. Characteristics of particular types of dogs that make them high risk for contributing to a bite injury should be investigated and documented as well as characteristics on high risk environments. For example, to what extent does breed or size contribute to the injury hazard? Similarly, what are the characteristics of the environment in which the dog is kept that contribute to injury risk?

The behavioural component refers to the host factors. An assessment is required of the extent to which behaviours on the part of individuals at risk contribute to the injury hazard. With respect to dog bite injury, a major behavioural risk factor may be a young child running up to a dog and hugging them, particularly if the child is unknown to the dog. Children may also excite dogs by running and screaming and elicit an inappropriate response from the dog.

**Step 3: Influencing Factors Diagnosis**

For both the non-behavioural and behavioural determinants of an injury, there are multiple factors that operate to determine whether an injury event will occur and the severity if it does occur. These factors can be categorised into predisposing, enabling, and reinforcing factors. As in Step 2, an accurate diagnosis may be reliant on robust research evidence.

With non-behavioural determinants of an injury these factors refer to the qualities of the physical hazard itself rather than the individual at risk. Haddon strategies are used as a guide for this component of the framework. Predisposing factors are those that govern how much hazard exists. In relation to dog bite injury the relevant non-behavioural predisposing factors are the existence of dogs and the number and size of dogs in the
community. Enabling factors are those that allow the hazard to be released and determine the amount that is released. As applied to dog bite injury, these factors could include allowing dogs to roam freely in neighbourhoods, parks or other public spaces, and temperament issues resulting from poor breeding or lack of appropriate socialisation or management. Reinforcing factors govern the extent of the damage that occurs once the hazard is released, such as the vulnerability of the individual involved and the availability of adequate first-aid or emergency and rehabilitation services.

With respect to behavioural determinants of an injury, the predisposing, enabling, and reinforcing factors refer to behaviours or beliefs of the individual or society that contribute to the occurrence and severity of the injury. Predisposing factors relate to the knowledge, attitudes and beliefs of the individual that may contribute to the hazards release and determine the amount that is released. In relation to dog bite injury, predisposing factors may include individual’s understanding, knowledge and attitudes about dog behaviour and responsible interactions with dogs. Enabling factors refer to the availability and accessibility of skills and resources related to the hazardous behaviour. For the dog bite injury problem, enabling factors include the availability of training in dog behaviour and management or poor skills regarding the physical and environmental requirements of a healthy dog. Reinforcing factors relate to the social acceptability of the hazardous behaviour. With respect to the dog bite injury problem, reinforcing factors may include a lack of societal expectations for responsible dog ownership and practices or encouragement from dog training clubs, veterinarians, government agencies and others.

**Step 4: Intervention Planning**
Steps 1 to 3 outline the most important factors associated with the injury problem and specific interventions may then be targeted to address the predisposing, enabling and reinforcing factors for both the non-behavioural and behavioural determinants. Potential interventions may then be considered in light of social and political acceptability. The types of interventions can be categorised as technological/environmental, legislative/enforcement and education/behaviour change interventions (NCIPC, 1989). Technological/environmental interventions generally address factors associated with non-behavioural determinants; education/behaviour change interventions may address factors associated with behavioural determinants; and legislative/enforcement interventions may address factors associated with either non-behavioural or behavioural determinants (Gielen, 1992a).

A preliminary application of the integrated planning framework to the issue of dog bite injury is illustrated in Figure 3.

### 3.3 Summary and study context

As raised in Section 3.1, this study will challenge the current emphasis on breed specific legislation as an intervention for dog bite injury, by examining the evidence base for this approach, and examine the potential utility of an integrated approach to dog bite injury prevention.

Information to enable epidemiological diagnosis for dog bite injury will be derived in Chapter 4, with the review of dog bite injury data in Victoria used to describe the epidemiological dimensions of dog bite injury in Victoria. Potential behavioural and non-behavioural determinants and factors that may influence whether a dog bite will occur,
and the severity, if a bite does occur, will also be considered for the environmental and behavioral diagnosis.
Figure 2: An integrated planning framework for injury prevention programs as proposed by Gielen.
Figure 3: Preliminary application of Gielen’s integrated planning framework to dog bite injury
The serious injury and death data compiled for Chapter 4 will be further utilised to test the null hypothesis of no regulation effect in relation to breed specific legislation in Victoria. A quasi-experimental design is employed utilising time series techniques to compare relative rates of dog bite related serious injury or death between before and after periods of regulation in Victoria. A secondary analysis explores the legitimacy of using the combined state and territories of Tasmania and the Australian Capital Territory, where there have been no regulations restricting specific breeds of dogs, as a control for periods of regulation in Victoria.

Although a number of case-series and cross sectional survey studies have been conducted in Australia (Al Podberscek, 1990; Greenhalgh et al., 1991; MacBean et al., 2007; Ozanne-Smith et al., 2001; Podberscek and Blackshaw, 1991; Thompson, 1997) which have identified potential risk factors for dog bite injury there has been no analytic study conducted to determine risk factors for dog bite injury. Injury determinants and influencing factors for dog bite injury will be partially addressed through a case-control study presented in Chapter 7 which will consider dog bite injury in a domestic environment to children aged nine years and under. This will identify those characteristics that are over- (or under-) represented among those children and dogs associated with dog bite related injury. This study has a case-control design, which tests the hypothesis that certain child, environmental, dog and dog-owner factors are significantly associated with serious injury among children aged 9 years and under who are exposed to dogs in a domestic setting. This work will contribute to the environmental, behavioral and influencing factors diagnosis for dog bite injury.
Bibliography


