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# **Applying behaviour change principles for the prevention of eye injuries in squash**

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## **Table of Contents**

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<b>List of Tables</b>	<b>iv</b>
<b>List of Figures</b>	<b>vi</b>
<b>List of Appendices</b>	<b>vii</b>
<b>List of Abbreviations</b>	<b>viii</b>
<b>Abstract</b>	<b>1</b>
<b>General Declaration</b>	<b>5</b>
<b>Acknowledgements</b>	<b>7</b>
<b>Chapter 1: Introduction</b>	<b>11</b>
<b>Chapter 2: Literature review</b>	<b>17</b>
2.1 Physical activity and sports injuries	17
2.2 The epidemiology of squash injuries	18
2.3 Incidence and severity of squash eye injuries	21
2.4 Sports injury prevention	24
2.5 The prevention of squash eye injuries	26
2.6 Characteristics of protective equipment use in sport	30
2.7 Increasing the use of protective equipment	34
2.8 Compulsory use of protective equipment in sport	39
2.9 Increasing protective eyewear use in squash in Australia	42
2.10 Safety policies and practices of sports venues	47
<b>Chapter 3: The epidemiology of squash injuries requiring treatment at a hospital setting</b>	<b>48</b>
<b>Chapter 4: Nine-year retrospective injury surveillance, utilising insurance claim records</b>	<b>54</b>
<b>Chapter 5: Australian trends in player attitudes towards protective eyewear</b>	<b>81</b>

<b>Chapter 6: Eye injury safety practices of squash venue</b>	<b>88</b>
<b>Chapter 7: Players' eyewear behaviours, knowledge and attitudes</b>	<b>98</b>
7.1 Random selection of squash venues for conduct of player survey	99
7.2 Player survey sampling procedures	100
7.3 Player survey design	102
7.4 Details of player survey questions	102
7.4.1 Survey participant demographics	103
7.4.2 Squash playing habits and standards	104
7.4.3 Squash injury occurrence over past year	105
7.4.4 Squash players self-reported protective eyewear behaviours	107
7.4.5 Squash players self-reported protective eyewear knowledge	109
7.4.6 Squash players' attitudes to protective eyewear	111
7.5 Data analysis of player survey	113
7.6 Results of baseline player surveys	117
7.6.1 Squash player demographics	117
7.6.2 Results of squash playing habits and standards	119
7.6.3 Squash injury occurrence	123
7.6.4 Self-reported eyewear use in squash	128
7.6.5 Reasons for wearing polycarbonate lens/standards approved squash eyewear	132
7.6.6 Reasons why non-users do not wear polycarbonate lens/standards approved squash eyewear	134
7.6.7 General knowledge about protective eyewear	136
7.6.8 Player attitudes towards protective eyewear use	139
7.7 Combined summary results of annual player surveys	144
<b>Chapter 8: Factors relating to the use of protective eyewear</b>	<b>146</b>
<b>Chapter 9: Validity of self-reported appropriate protective eyewear use</b>	<b>168</b>
<b>Chapter 10: The conceptual framework for the Protective Eyewear Promotion strategy</b>	<b>179</b>
<b>Chapter 11: Implementation and evaluation of the Protective Eyewear Promotion</b>	<b>208</b>



11.1	The implementation of the Protective Eyewear Promotion	208
11.2	The evaluation framework of the Protective Eyewear Promotion	214
11.3	Comparison of the Protective Eyewear Promotion and control group survey data pre and post intervention	215
11.3.1	The Protective Eyewear Promotion group survey response rates	215
11.3.2	Pre and post-intervention player demographics	215
11.3.3	Survey respondents playing habits and standards	218
11.3.4	Eye injury occurrence	222
11.3.5	Eyewear use in squash	223
11.3.6	Reasons for wearing polycarbonate lens/standards approved squash eyewear	232
11.3.7	Reasons why non-users do not wear polycarbonate lens/standards approved squash eyewear	234
11.3.8	General knowledge about protective eyewear	236
11.3.9	Squash venue membership and attendance	238
11.3.10	Knowledge of the Protective Eyewear Promotion	240
11.3.11	Attitudes towards protective eyewear use	243
11.4	Impact and process evaluation of the Protective Eyewear Promotion	246
11.4.1	Impact evaluation of the Protective Eyewear Promotion	246
11.4.2	Self-reported protective eyewear use	246
11.4.3	Attitude score	248
11.4.4	Knowledge of appropriate eyewear	248
11.5	A controlled evaluation of a squash protective eyewear promotion strategy	249
<b>Chapter 12: Conclusion and recommendations</b>		<b>275</b>
<b>References</b>		<b>329</b>

## **List of Tables**

---

<b>Table 1.</b>	<b>Haddon's injury prevention strategies as they can be applied to the sports context</b>	<b>25</b>
<b>Table 2.</b>	<b>Two year player survey response rates</b>	<b>118</b>
<b>Table 3.</b>	<b>Player survey non-participant details</b>	<b>118</b>
<b>Table 4.</b>	<b>Classification of survey participants' occupation</b>	<b>119</b>
<b>Table 5.</b>	<b>Squash players' average playing frequency per week</b>	<b>120</b>
<b>Table 6.</b>	<b>Squash players' playing history of past two weeks</b>	<b>121</b>
<b>Table 7.</b>	<b>Squash players' years of squash experience</b>	<b>122</b>
<b>Table 8.</b>	<b>Standard of player</b>	<b>123</b>
<b>Table 9.</b>	<b>Squash injuries sustained (excluding eye)</b>	<b>125</b>
<b>Table 10.</b>	<b>Cause of injury (excluding eye)</b>	<b>127</b>
<b>Table 11.</b>	<b>Frequency of self-reported protective eyewear use</b>	<b>129</b>
<b>Table 12.</b>	<b>Type of eyewear worn by reported users of protective eyewear</b>	<b>130</b>
<b>Table 13.</b>	<b>Reasons for wearing polycarbonate lens/standards approved squash eyewear</b>	<b>133</b>
<b>Table 14.</b>	<b>Reasons why players do not wear polycarbonate lens/standards approved squash eyewear</b>	<b>135</b>
<b>Table 15.</b>	<b>Type of eyewear thought to be protective</b>	<b>137</b>
<b>Table 16.</b>	<b>Knowledge of where polycarbonate lens/standards approved squash eyewear can be bought</b>	<b>138</b>
<b>Table 17.</b>	<b>Risk perception of players most at risk of sustaining an eye injury</b>	<b>140</b>
<b>Table 18.</b>	<b>Players eye safety attitudes</b>	<b>142</b>
<b>Table 19.</b>	<b>Pre and Post-intervention survey response rates</b>	<b>215</b>
<b>Table 20.</b>	<b>Age of players</b>	<b>216</b>
<b>Table 21.</b>	<b>Classification of players occupation, pre and post intervention</b>	<b>217</b>
<b>Table 22.</b>	<b>Playing frequency per week</b>	<b>219</b>
<b>Table 23.</b>	<b>Playing history of past two weeks</b>	<b>220</b>

Table 24.	Years of squash experience	221
Table 25.	Standard of player	222
Table 26.	Eye injury occurrence	223
Table 27.	Self-reported protective eyewear use	224
Table 28.	Players' reports of when they started wearing protective eyewear	225
Table 29.	Indication of initial use of protective eyewear	225
Table 30.	Prompt to initially try protective eyewear	226
Table 31.	Brand of eyewear tried and/or purchased	227
Table 32.	Frequency of self-reported protective eyewear use	228
Table 33.	Type of eyewear worn by reported users of protective eyewear	230
Table 34.	Use of appropriate polycarbonate protective eyewear	231
Table 35.	Wearing of prescription glasses	232
Table 36.	Reasons for wearing polycarbonate lens/standards approved squash eyewear	233
Table 37.	Reasons why players do not wear polycarbonate lens/standards approved squash eyewear	234
Table 38.	Association of non-users and them having tried to wear protective eyewear	236
Table 39.	Type of eyewear thought to be protective	237
Table 40.	Squash venue membership	238
Table 41.	Attendance at PEP venues post-intervention	239
Table 42.	Protective Eyewear Promotion	240
Table 43.	Particular components of PEP that players noticed	241
Table 44.	Reported protective eyewear promotion message remembered	242
Table 45.	Players responses to Likert scale attitudinal statements	244
Table 46.	Use of protective eyewear	246
Table 47.	Reasons for not wearing appropriate eyewear	247

## **List of Figures**

---

<b>Figure 1.</b>	<b>Comparison of the injured body regions in squash across four international studies</b>	<b>20</b>
<b>Figure 2.</b>	<b>Eye injury occurring from being hit by the ball</b>	<b>22</b>
<b>Figure 3.</b>	<b>Example of Standards Approved polycarbonate lens eyewear</b>	<b>27</b>
<b>Figure 4.</b>	<b>An example of inappropriate eyewear: open eyeguards</b>	<b>29</b>
<b>Figure 5.</b>	<b>Standards Approved polycarbonate lens eyewear with normal prescription glasses underneath</b>	<b>30</b>
<b>Figure 6.</b>	<b>Protective Eyewear Promotion eyewear, Dunlop brand</b>	<b>209</b>
<b>Figure 7.</b>	<b>Protective Eyewear Promotion eyewear, IMAX brand</b>	<b>210</b>
<b>Figure 8.</b>	<b>Display of the Protective Eyewear Promotion posters and sticker at project squash venue reception desk</b>	<b>212</b>
<b>Figure 9.</b>	<b>Protective Eyewear Promotion sticker displayed on squash court door</b>	<b>212</b>
<b>Figure 10.</b>	<b>Protective Eyewear Promotion eyewear displayed prominently at the squash venue reception desk</b>	<b>213</b>

## **List of Appendices**

---

<b>Appendix One: Venue manager contact letter</b>	<b>292</b>
<b>Appendix Two: Player survey plain language statement</b>	<b>294</b>
<b>Appendix Three: Player survey project summary</b>	<b>296</b>
<b>Appendix Four: Player survey</b>	<b>298</b>
<b>Appendix Five: Eyewear company letter</b>	<b>301</b>
<b>Appendix Six: Protective Eyewear Promotion venue manager letter</b>	<b>304</b>
<b>Appendix Seven: Protective Eyewear Promotion player survey plain language statement</b>	<b>306</b>
<b>Appendix Eight: Poster displaying appropriate protective eyewear brands</b>	<b>308</b>
<b>Appendix Nine: Poster explaining intervention incentives</b>	<b>310</b>
<b>Appendix Ten: Poster explaining the risk of sustaining an eye injury</b>	<b>312</b>
<b>Appendix Eleven: Eye injury safety poster</b>	<b>314</b>
<b>Appendix Twelve: Protective Eyewear Promotion sticker</b>	<b>316</b>
<b>Appendix Thirteen: Protective Eyewear Promotion pamphlet</b>	<b>318</b>
<b>Appendix Fourteen: Protective eyewear feedback sheet</b>	<b>321</b>
<b>Appendix Fifteen: Intervention summary for squash team captains</b>	<b>324</b>
<b>Appendix Sixteen: Protective Eyewear Promotion survey</b>	<b>326</b>

## **List of Abbreviations**

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<b>VSF</b>	<b>Victorian Squash Federation</b>
<b>WSF</b>	<b>World Squash Federation</b>
<b>PEP</b>	<b>Protective Eyewear Promotion</b>
<b>SQERP</b>	<b>Squash Eyewear Research Project</b>
<b>ASTM</b>	<b>American Society for Testing Materials</b>
<b>AS</b>	<b>Australian Standards</b>
<b>VHSSC</b>	<b>VicHealth Sports Safety Committee</b>
<b>SPSS</b>	<b>Statistical Package for Social Sciences</b>
<b>NHMRC</b>	<b>National Health and Medical Research Council</b>

## **Abstract**

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The problem of eye injuries in the sport of squash was initially identified twenty five years ago. Various small-scale injury surveillance studies reported the frequency and severity of these injuries. Subsequently eye protection was developed. However, experiments since, have shown that some early models of eyewear do not offer adequate protection. In particular they do not adequately prevent the squash ball from touching or entering the eye orbit.

In Australia, three squash player surveys and one hospital based eye injury surveillance study had been conducted prior to 2001. The potential severity of eye injuries was a major finding; so too was the fact that very few adult players wore appropriate protective eyewear.

This Thesis takes a sequential journey through an injury prevention cycle of development, implementation and evaluation. It involves various background descriptive studies, including: a review of the Australian squash player surveys and international literature; injury surveillance at Victorian hospitals and emergency departments; a study investigating trends in squash injuries over a nine year period; injury surveillance utilising the Victorian Squash Federation squash insurance scheme; two consecutive annual player surveys; interviews with squash venue managers; and a comparison of self-reported with observed eyewear behaviours. Collectively, this information establishes the foundation of knowledge surrounding eye injuries and their prevention in Victoria, Australia.

This research ascertained that eye injuries are currently a problem in terms of injury severity, incidence and associated monetary costs. An overall eye injury rate

of 19 per 100,000 players was estimated. An eye injury was the highest injury paid for by the insurance scheme (AUS\$5000). Eye injuries were the most common squash injury presenting for treatment at emergency departments in Victoria (32.7% of all squash injuries). Males were consistently found to sustain more squash injuries overall, and more eye injuries than females. Squash venue managers and players alike believed that any type of eyewear worn on court was better than wearing none at all. Another commonly shared fallacy was that only lower standard players were at particular risk of sustaining an eye injury. Venue managers and players lacked adequate knowledge of eye injury risk and appropriate eyewear. However, their attitudes towards eye safety were quite favourable. Appropriate protective eyewear was not found to be readily available for players to borrow or purchase at squash venues. Significant predictors of wearing appropriate protective eyewear were found to be: being female (OR 2.8, 95%CI 1.7, 4.6); having sustained an eye injury in the past (OR 4.2, 95%CI 1.8, 10.0); playing on average for more than two hours per week (OR 2.3, 95%CI 1.3, 3.8); and having favourable eye safety attitudes (OR 11.2, 95%CI 5.3, 23.7). The validity of players' self-report eyewear behaviours was investigated, with the self-reported protective eyewear wearing rate estimated at 1.6 times more than the observed rate.

Through the application of specific behaviour change principles in accordance with the established comprehensive descriptive information, an injury prevention strategy, the Protective Eyewear Promotion (PEP), was developed and implemented utilising an ecological model approach. The Protective Eyewear Promotion was subjected to a controlled trial at intervention and control squash venues with cross-sectional surveys of players' pre and post-intervention. At the project venues, task specific posters, stickers and pamphlets were displayed



prominently. Appropriate eyewear was also provided at minimum cost to the venues for players to borrow or purchase. Incentives were offered for players who tried or purchased the eyewear during the four month trial. Sales and borrowing of eyewear was recorded during this time. The main aims of PEP were to modify players' and venue staff eye safety knowledge, attitudes and behaviour, and assist with the provision of appropriate eyewear. The PEP was then duly evaluated through a pre and post intervention comparison player survey. Major findings were that PEP players had 2.4 times the odds (Univariate OR 95%CI 1.3, 4.2) of wearing appropriate eyewear compared to the control players post-intervention compared to pre-intervention. Sales of eyewear at project venues (n=65) far outweighed those at the control venues (n=5). The PEP posters and stickers were contributing factors to players adopting favourable eyewear behaviours. Visiting a PEP venue 10 times or more during the trial correlated strongly with players noticing a component of PEP.

In conclusion, the prevention of sports injuries, such as eye injuries, can benefit from promotional strategies at the community level setting, the effectiveness of which have been evaluated in randomised trials. The need to establish a substantial amount of foundation information, encompassing a full understanding of the epidemiology of injuries, player factors, and the environment surrounding the sport, is a major lesson learnt from this project. The utilisation of a holistic approach involving different research disciplines, the sport's governing body, player associations, venue staff and players in the development and running of this project has been a key component of the success of PEP. In addition, this ecological model approach has lead to the sustainability of this project and the future dissemination throughout squash venues in Victoria. This project has laid the foundation for the successful future prevention of eye injuries in squash in

Australia. The continuing efforts of sustaining the existing PEP and continuing to broaden across Victoria will be valuable for long standing eye injury prevention in squash.

**Monash University****Monash Research Graduate School****Declaration for Thesis based or partially based on conjointly published or unpublished work****General Declaration**

In accordance with Monash University Doctorate Regulation 17 / Doctor of Philosophy and Master of Philosophy (MPhil) regulations the following declarations are made:

I hereby declare that this Thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this Thesis contains no material previously published or written by another person, except where due reference is made in the text of the Thesis.

This Thesis includes 3 original papers published in peer reviewed journals, 2 original papers in press in peer reviewed journals, 2 original papers submitted to peer review journals and 1 original paper yet to be submitted. The core theme of the Thesis is the prevention of eye injuries in squash. The ideas, development and writing up of all the papers in the Thesis were the principal responsibility of myself, the candidate, working within the Department of Epidemiology and Preventive Medicine, Monash University under the supervision of Professor Caroline Finch and Dr Rory Wolfe.

The inclusion of co-authors reflects the fact that the work came from active collaboration between researchers and acknowledges input into team-based research.

In the case of Chapters Three, Four, Five, Six, Eight, Nine, Ten and Eleven my contribution to the work involved the following:

Thesis chapter	Publication title	Publication status*	Nature and extent of candidate's contribution
Three	Epidemiology of squash injuries presenting for treatment at hospitals	Published 2003	Data analysis and writing of paper
Four	Trends in squash injury incidence over a nine year period	To be submitted	Data analysis and writing of paper
Five	Have Australian squash players' attitudes towards protective eyewear changed over the past decade?	Published 2002	Data analysis and writing of paper
Six	Knowledge, beliefs and attitudes of squash venue operators relating to use of protective eyewear	Published 2004	Design, data collection, analysis and writing of paper
Eight	Unprotected eyes in squash: not seeing the risk of injury	In Press	Data collection and analysis, design of paper methodology and writing
Nine	Do squash players accurately report use of appropriate protective eyewear?	Submitted June 2004	Data collection and analysis, design of paper methodology and writing
Ten	Protective Eyewear Promotion: Applying ecological principles of health behaviour in the design of a sports injury prevention program	In Press	Development of paper methodology and writing of paper
Eleven	A controlled evaluation of a squash protective eyewear promotion strategy	Submitted July 2004	Design, data analysis and writing of paper

[ \* For example, 'published' / 'in press' / 'accepted' / 'returned for revision']

Signed:  .....

Date:

30<sup>th</sup> July 2004

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Over my life time, many people have continually told me that I rush. However, my analogy of this is; that my parents laid a great work ethic foundation early in my life. This coupled with sound organisational skills, enthusiasm and drive has led me to finishing things sometimes earlier than expected. I must say, many people have tried to teach me about a funny little word called patience. Whilst I'm yet to fully grasp this, I have learnt from others and after working on my PhD and writing this thesis that.....

*"No great thing is created suddenly, any more than a bunch of grapes or a fig.*

*If you tell me that you desire a fig, I answer you that there must be time.*

*Let it first blossom, then bear fruit, then ripen." -Epictetus*



## **Chapter 1: Introduction**

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This Thesis takes a sequential journey through an injury prevention strategy cycle of development, implementation and evaluation. The problem of eye injuries in squash is initially identified. The attitudes, knowledge and beliefs of players' and venue managers in relation to injury risk and protective eyewear was an intermediary step. Subsequently, the design and implementation of a protective eyewear education campaign and behaviour change promotion is presented. To provide an evidence base, the effectiveness of the Protective Eyewear Promotion was evaluated. Finally, the findings and implications of the whole injury prevention cycle as it relates to eye injuries in squash are discussed as a whole. Each chapter is a unique project, comprising of a singular component of the injury prevention cycle. Because of this, each component project is described in detail in one chapter, including the introduction, methods, results and discussion. Corresponding peer review publications that have been published, or which are "in press", are presented and discussed in individual chapters.

It is imperative that the specific injury incidence and severity, as well as the mechanisms causing eye injuries in squash are initially identified, before any injury prevention strategy is put in place. The causes of eye injuries have been previously identified and so are not the focus of this Thesis. Descriptive statistics of squash injuries, including the severe nature of eye injuries have also been described in detail, largely in the 1980's. However, experience with the implementation of effective strategies to reduce eye injury rates has received far less attention. Squash eye injury incidence rates internationally, let alone Australia, have not been investigated recently. This information, as well as clear unit of exposure and population data is required as baseline descriptive data to

develop injury prevention strategies. This allows the calculation of specific injury rates per exposure or population.

Understanding the predictors and influences of protective equipment use in other sports can assist in filling the void in information in the context of squash. Safety promotion and injury prevention strategies aimed at behaviour change are also important to consider in this perspective. The use of protective equipment, as well as determination of its effectiveness in reducing the risk of injury, has been the focus of some sports injury prevention research. However, recent international research specifically associated with eye injuries in squash and their prevention is minimal.

In understanding the problem and characteristics of an injury prevention strategy, a holistic approach to the methodology is needed. This Thesis presents general squash studies, and specifically reports on injuries presenting to hospital and emergency departments for treatment. Players who claimed for an injury through the VSF squash insurance scheme were investigated. Other methods employed, included qualitative interviews of venue managers and self-reports surveying of squash players. These studies all incorporated adult squash players participating in Metropolitan Melbourne.

This Thesis presents eight papers that are presented in specific chapters of this Thesis. In the respective chapters, author declarations accompany these papers. Whilst many of these papers have been published and others accepted for publication in peer review journals others have only been submitted to journals and are still undergoing the review process. At the time of submitting this Thesis, the outcomes of these submitted papers is unknown but, in accordance with Monash University PhD regulations, these are still included in this Thesis.

This project aims, initially, to define the problem of eye injuries in terms of severity and incidence through the use of hospital treatment and admission data (Chapter Three) and a review of squash injury insurance claim records (Chapter Four).

Specific research aims for Chapter Three were:

- To describe the specific squash injuries that required seeking treatment at an Emergency Department or Hospital.
- To calculate injury rates for each year and express these adjusted for the number of squash players.
- To compare any differences between the injury types presenting for treatment at an Emergency Department and those cases admitted to hospital.
- To describe the causes of each injury presented for treatment.

The specific research aims for Chapter Four were:

- To describe trends in squash injuries in Victoria over a nine-year period.
- To calculate injury rates and express these per number of insured players.
- To describe the cause of injury including the specific type of squash activity when injury occurred.
- To identify the most common and the more severe squash injuries that occurred.
- To describe the average direct cost of squash injuries, and to define the highest costing injury.

The specific aim of Chapter Five was to review the evidence from the previous squash player surveys that had been conducted in the past in Australia. In particular, to investigate if there were any changes in players' eyewear behaviours and attitudes across three time points.

It is recognised both internationally and in Australia, for junior players' at least, that protective eyewear is a suitable protective measure against sustaining an eye injury. The knowledge, beliefs and attitudes of venue operators may be an important determining factor to the use of protective eyewear in this sport. Squash venue manager interviews were conducted, and the aims of Chapter Six were:

- To describe the eye safety policies and practices of squash venues.
- To investigate the availability of protective eyewear at squash venues .

The prevalence of eye injuries was also investigated through two self-report surveys over consecutive years. This investigation included information on the mechanism of injury and injury diagnosis. The specific aims of Chapter Seven were:

- To describe adult squash players' demographics, playing habits and standards.
- To define and describe adult squash players' previous injury history over the past 12 months.
- To define and describe players' eyewear behaviours, and their reasons for choosing to wear or not wear this protective equipment.
- To investigate players' knowledge and attitudes associated with the use of protective eyewear in squash.

Chapter Eight utilises the descriptive data presented in Chapter Seven and specifically aims to:

- Describe specific predictors of appropriate protective eyewear use.
- Understand the characteristics of 'non-users' of protective eyewear, to develop an eye injury prevention strategy based on these specific factors.

The validity of the self-reported protective eyewear behaviours were assessed through direct observations of individual players. This direct observation of protective eyewear use is presented in Chapter Nine. This Chapter aims to:

- Describe the validity of self-reported protective eyewear use.

Chapters Ten and Eleven describe the conceptual basis for design, implementation and evaluation of an injury prevention intervention, the Protective Eyewear Promotion (PEP). The development of PEP is based on theoretical concepts of behaviour change and the baseline results of Chapters Three through to Eight.

Scientific research can and must continually be translated into practice into the wider community. By involving the sport at all levels (sport governing body, sporting clubs and associations, and players), mainly at the community level the future sustainability of a project such as PEP is possible. This Thesis has laid the foundation for the successful prevention of eye injuries in squash in Australia. Importantly, PEP has been sustained and is currently being disseminated throughout squash venues in rural and metropolitan Victoria. It is the sustainability

and broadening of PEP, which is most valuable for long standing eye injury prevention in Squash, and the most rewarding component of this research project.

Throughout this thesis when a result or a change is stated as being 'significant' it implies a p-value of  $<0.05$  or that the 95% confidence interval for an odds ratio excludes unity. The author therefore acknowledges that among independent tests, one expects a 'significant' finding in one in twenty results just due to chance alone.

## **Chapter 2: Literature review**

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### **2.1 Physical activity and sports injuries**

Participation in physical activity has long been recognised as an important aspect of a healthy physical and mental lifestyle (Jaffee, Lutter et al. 1998). It is broadly accepted that moderate amounts of physical activity, accumulated for 30 minutes per day, can substantially improve health and quality of life (U. S. Department of Health and Human Services 1996; Pratt 1999; Sallis and Owen 1999). The health benefits include a reduced risk of premature mortality and reduced risks of coronary heart disease, hypertension, colon cancer, and diabetes mellitus. Regular physical activity also appears to reduce depression and anxiety, improve mood, and enhance ability to perform daily tasks throughout life (U. S. Department of Health and Human Services 1996; Bauman and Owen 1999; Sallis and Owen 1999). Many people gain these health benefits through lifestyle physical activity and/or from participation in structured or organised sport (Pratt 1999). As a result, approximately three in ten Australian adults participate in organised sport and physical activity (Australian Bureau Of Statistics 1999).

The health and social benefits of participation in sport, as with all types of physical activity, are undeniable. Nonetheless, associated with participation in physical activity is a risk of sustaining an injury (Finch and McGrath 1997; van Mechelen 1997). The term 'sports injury' is hard to define, and as yet, there is no universally accepted sports injury definition (Finch and McGrath 1997). The literature is confounded by a lack of uniformity in injury definitions and vast differences in study designs, making it difficult to describe the overall epidemiology of injuries in

a particular sport. Consistency of the methodology of sports injury studies, in particular a broad acceptance of a common injury definition is required.

There is a lack of substantial information on the epidemiology of sports injuries internationally. Yet the subject of sports injury has been identified as a public health priority in Australia (Commonwealth Department of Health and Family Services 1998; National Injury Prevention Advisory Council 1999). The risk of injury is recognised as a major negative consequence of increasing the level of physical activity in the population (Owen 1999; Marshall and Guskiewicz 2003). It has been estimated that 1 in every 17 Australians sustain a sports injury every year (Egger 1991). Sports injuries are a cost burden on both individuals and society. The cost of injuries incorporates monetary expenses involved with the duration and nature of treatment. In addition, there are indirect costs such as pain and suffering and reduced quality of life as a result of an injury (van Mechelen, Hlobil et al. 1992; Finch and McGrath 1997).

## **2.2 The epidemiology of squash injuries**

The characteristics of sports injuries, including the incidence, nature, severity, cost and the effect of injuries, are unique to each particular sport (Egger 1991; Hume and Marshall 1994; Cunningham and Cunningham 1996; Pringle, McNair et al. 1998; Taylor and Attia 2000; Michaud, Renaud et al. 2001). The sport of squash is popular internationally, with over 15 million player worldwide (World Squash Federation (cited in March, 2000)). Of these players, approximately 1.1 million participate on 5000 courts throughout Australia (personal communication Paul Vear, Executive Director, Victorian Squash Federation). This fast, high intensity, intermittent sport is played on an indoor court (Hawkey 1980). Players equipped

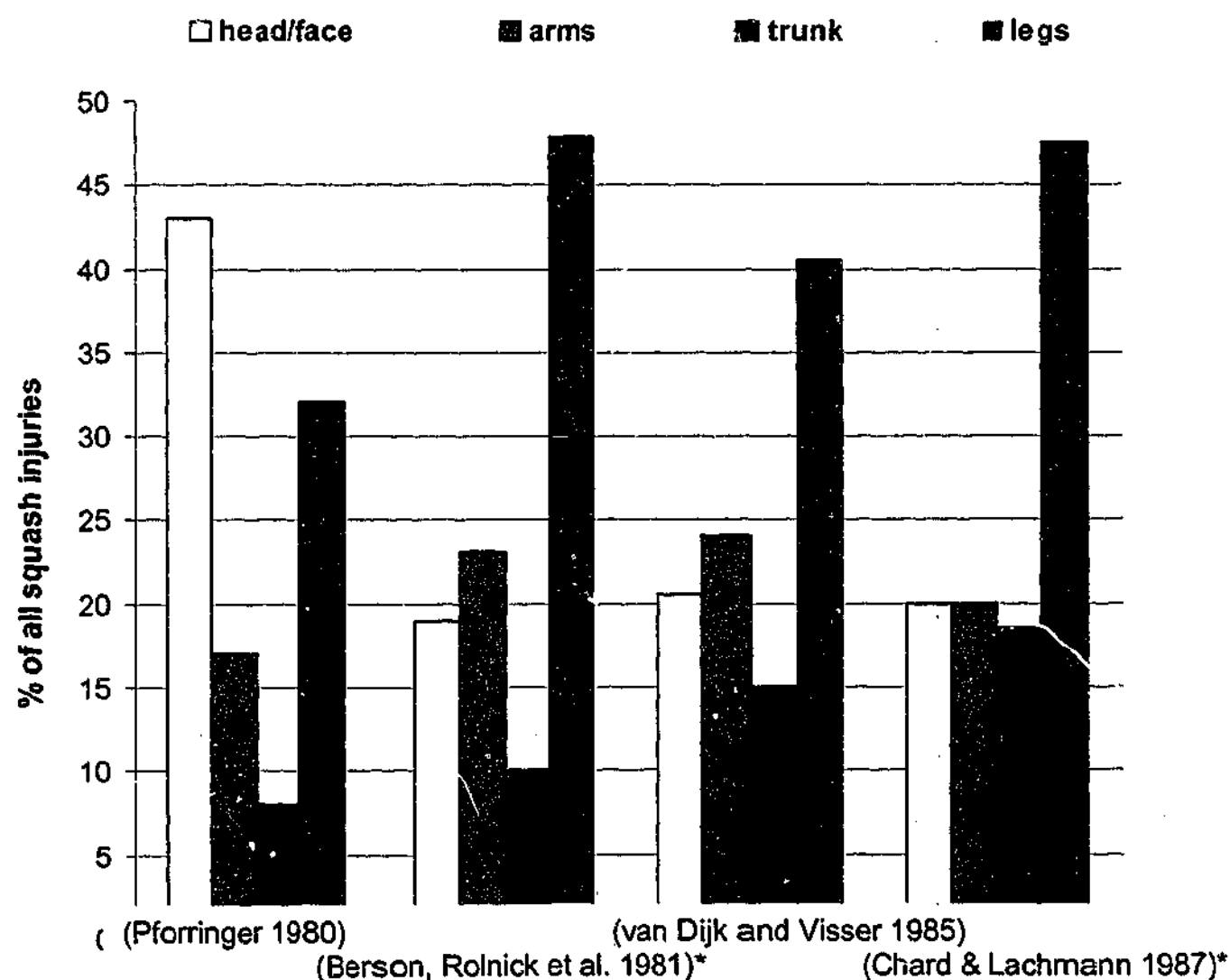


with racquets, run and hit a small ball that can potentially travel at speeds of 230 km/h (Montpetit 1990).

The physical demands of fast, repetitive twisting and turning movements on a hard surface places considerable strain on squash players' bodies. This contributes to an extensive variety of injuries particularly to the lower limb, mainly Achilles, ankle, and knee (Finch and Eime 2001). Other common regions of injury in squash include the back, shoulder, arm, wrist, head and face (Finch and Eime 2001). The confined area of play, and close proximity of players when a ball is hit and racquets are swung, contributes to a high risk of head and eye injuries (Montpetit 1990; Van Dijk 1994; Locke, Colquhoun et al. 1997; Clavisi and Finch 1999; Finch and Eime 2001). Whilst Figure 1, extracted from Finch and Eime (Finch and Eime 2001), summarises the epidemiology of squash injuries, by body region there were major differences in the methodologies employed by each study. Hence, any comparisons are to be made with caution. In the results of Figure 1, injuries to the head and face (including the eye) are reported to cause in excess of 19% of all squash injuries. The presented studies were published in the 1980's, and no further studies describing the epidemiology of squash injuries have been published since the review in 2001 (Finch and Eime 2001). In assessing the quality of the information of the studies presented in Figure 1, many aspects should be taken into account. For example, the study by Chard and Lachmann, was an 8-year retrospective review of squash injuries presenting for treatment at one particular hospital in the United Kingdom (Chard and Lachmann 1987). From this information it is not possible to describe squash injuries in detail, nor to generalise results. Only, the more severe squash injuries that require hospital treatment were included in this study. It is not stated why squash injuries, that were not caused by the racquet or ball were excluded for analysis in van Dijk's review (van Dijk and

Visser 1985). The results of the study by Berson et al., are also limited in their worth (Berson, Rolnick et al. 1981). The study methodology, involved phoning members of two squash clubs and asking them details of injuries sustained throughout their playing history (Berson, Rolnick et al. 1981). Not only was the sample population small, but the results were also subject to recall bias. Pforringer, reported on squash injuries sustained, in an area of Germany, from 1976-1979 (Pforringer 1980). This non-peer review article did not explain its data collection procedures (Pforringer 1980). The limitations of the squash injury epidemiological studies have been recognised and described recently (Finch and Eime 2001).

**Figure 1. Comparison of the injured body regions in squash across four international studies (Finch and Eime 2001)**



\* Head and face includes 'other' category

Squash players are most likely to sustain musculoskeletal and non-orthopaedic (soft tissue) injuries, accounting for 64-91% of all squash injuries (Chard and Lachmann 1987; Nicholl, Coleman et al. 1991; Clavisi and Finch 1999; Finch and Eime 2001). At the extreme of injury severity, cardiac injury, death and heat-related illness, have been reported to cause mortality rates of up to 5 squash related deaths per year in some countries (Northcote, Evans et al. 1984; Locke 1985; Northcote, Flannigan et al. 1986; Hansen and Brotherhood 1988; Brady, Kinrons et al. 1989; Montpetit 1990; Locke, Colquhoun et al. 1997; Quigley 2000; Finch and Eime 2001).

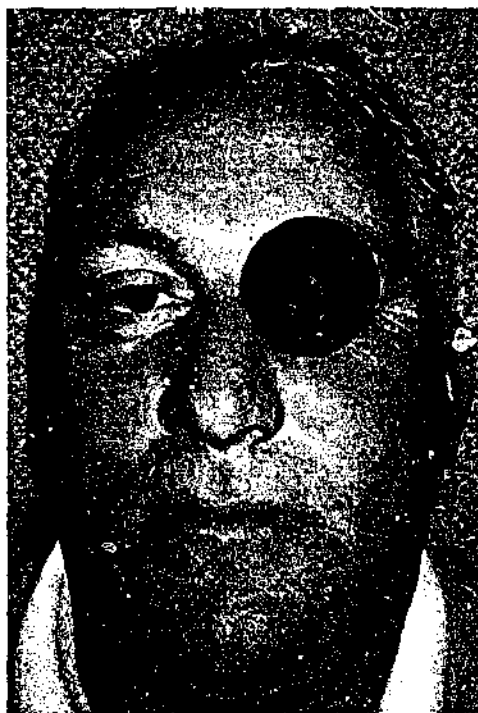
### **2.3 Incidence and severity of squash eye injuries**

Eye injuries are not the most common squash injury; however, the potential severity of these injuries is a major concern. They usually occur from being hit by the ball or opponents' racquet (Finch and Eime 2001). The squash ball is small, soft, and deforms upon impact. These characteristics make it possible for the ball to fit into an eye socket (Figure 2), making the eyes vulnerable to injury (Montpetit 1990; Van Dijk 1994; Locke, Colquhoun et al. 1997; Clavisi and Finch 1999). Squash eye injuries can range from minor hyphaemas, lid haemorrhages or lacerations, corneal abrasions, iritis and vitreous or retinal haemorrhages and detachments to the extreme of loss of an eye (Barrell, Cooper et al. 1981; MacEwen 1987; Whyte 1987; Jones and Turnbull 1991; Pashby 1992; Jones 1993; Fong 1994; Fong 1995; Knorr and Jonas 1996; Finch and Eime 2001).

In comparing the incidence rates of head and eye injuries in squash amongst studies of vastly different methodology, we estimate a rate of 5.2-33.3 injuries per 100,000 playing sessions (Ingram and Lewkonja 1973; North 1973; Clemett and Fairhurst 1980; Barrell, Cooper et al. 1981; Easterbrook 1981; Sodestrom 1982;

Bankes 1985; Gregory 1986; Quere and Pietrini 1986; Jones 1987; MacEwen 1987; Jones 1989; MacEwen 1989; Genovese, Lenzo et al. 1990; Loran 1992; Fong 1995; Finch and Clavisi 1998; Barr, Baines et al. 2000). Several studies have reported squash to be the first or second highest ranked sport associated with causing an eye injury (Barrell, Cooper et al. 1981; Jones 1987; Loran 1992; Fong 1995). From a review of all sports-related eye injuries treated at an Australian specialised eye and ear hospital, squash was estimated to have an annual incidence rate of 64 injuries per 100,000 participants (Fong 1994). This surveillance of eye injuries at a single location, a specialised eye hospital, is likely to result in an over-estimate of the injury rate in the population.

**Figure 2. Eye injury occurring from being hit by the ball**



The potential severity of eye injuries has lead to substantial research attention describing these injuries, in particularly in the 1980's (Clemett and Fairhurst 1980; Fowler, Seelenfreund et al. 1980; Barrell, Cooper et al. 1981; Easterbrook 1981; Easterbrook 1981; Sodestrom 1982; Bankes 1985; Clemett, McKenzie et al. 1987; Easterbrook 1987). A limited number of studies specific to squash eye injuries

have been published since (Genovese, Lenzo et al. 1990; Loran 1992; David, Shah et al. 1995; Knorr and Jonas 1996; Finch and Eime 2001). Most squash injury information available is based on retrospective studies of injuries requiring treatment at hospital, emergency departments, sports injury clinics or from case reports of ophthalmologists (Fowler, Seelenfreund et al. 1980; Barrell, Cooper et al. 1981; Soderstrom 1982; Bankes 1985; Easterbrook 1988; Knorr and Jonas 1996; Barr, Baines et al. 2000). In these cases, severe injuries, such as those to the eye, are overrepresented, as only those severe injuries would warrant presentation to a hospital setting for treatment. Another inherent problem with this data is that the majority of studies do not gather accurate player population numbers, nor exposure information, such as hours of play per week and years of squash participation. Hospital or emergency department based studies have reported squash as causing anywhere from 7% to 49% of all sporting eye injuries (Canavan, O'Flaherty et al. 1980; Barrell, Cooper et al. 1981; Gregory 1986; Jones 1987; MacEwen 1987; MacEwen 1989; Fong 1994; Vinger 2000). Due to the collection of data from the severe end of the spectrum of squash injuries, coupled with a lack of exposure information, these types of studies are unable to establish accurate injury rates. On the other hand, prospective studies at the community level (non-elite) squash players, has the potential to report all injuries and not just those severe enough to warrant medical attention. Player demographics and exposure data can be collected to allow the calculation of accurate injury rates per unit of player population or playing time. This methodology would allow the investigation of information from players who are uninjured, in addition to further injury information not available from point of treatment sources.

## 2.4 Sports injury prevention

Even though participation in sport can be associated with a risk of injury, it does not inevitably lead to an injury. Simply, many injuries can be prevented. Even so, internationally, and in Australia to date, there has been an emphasis on treatment of injuries rather than the prevention of them (Finch and McGrath 1997). The majority of the squash eye injury literature describes the diagnosis, nature of injury and subsequent treatment, and not prevention measures. In general, there needs to be a larger emphasis on injury preventive strategies in sport (Finch and McGrath 1997; Miller and Levy 2000).

As displayed in Table 1, Haddon effectively categorised injury prevention strategies into a sequential format (Haddon 1995). This can be used to assist determining the appropriate injury prevention measure that should be adopted for a specific sports injury. Separating people from the hazard by interposing a material barrier such as protective equipment is one such measure. This is the most commonly used strategy for protection of the head and facial region in sport (Finch and McGrath 1997). The aim of the use of protective equipment is to reduce the incidence and/or severity of injuries (Hrysomallis and Morrison 1997), and has proven successful in many sports (Seales, Kuebker et al. 1985; Saal 1991; Nelson 1993; Chalmers 1998; Finch, Elliot et al. 1999; Sherker and Cassell 1999).

**Table 1. Haddon's injury prevention strategies as they can be applied to the sports context (Source of table (Finch and McGrath 1997))**

	<b>Injury Prevention strategies</b>	<b>Example</b>
1	Prevent the creation of the hazard in the first place	Ban the sport
2	Reduce the amount of hazard that is created	Limit the exposure time of participants
3	Prevent the release of a hazard	Legislation not allowing hazardous sporting equipment onto the market
4	Modify the rate of spatial distribution of release of a hazard	Reducing the number of competitors in an event
5	Separate people in time or space from the hazard and its release	Separate participants at a distance from spectators in sports
6	Separate people from the hazard by interposing a material barrier	Protective equipment
7	Modify the relevant basic qualities of the hazard	Grouping athletes according to physical maturity rates
8	Make the person more resistant to damage	Pre-participation musculoskeletal screening
9	Begin to counter damage already done	Appropriate first aid/ medical personnel on hand
10	Stabilise, repair and rehabilitate the injured person	Treatment and rehabilitation of injury

## **2.5 The prevention of squash eye injuries**

It is widely accepted that squash eye injuries are preventable through the use of appropriate protective eyewear (Pashby; Gallaway, Aimino et al. 1986; International Federation of Sports Medicine 1990; Erie 1991; Silko and Cullen; Vinger 2000). The only eyewear approved by Squash Australia must meet the frontal impact requirements of AS4066: 1992 (Australian Standards) or ASTM (American Society for Testing Materials) F803 and is made of polycarbonate, a form of plastic which is lighter than glass (Figure 3) (Flores 1992; Squash Australia 1998). Polycarbonate is the most suitable lens material for sports eye protection due to its shatter resistant capacities (Feigelman, Sugar et al. 1983; Gallaway, Aimino et al. 1986; Erie 1991; Easterbrook 1992; Flores 1992; Saliba, Foreman et al. 1996; Brukner and Khan 2000; Vinger 2000). Figure 3 provides an example of Standards Approved polycarbonate lens eyewear.



**Figure 3. Example of Standards Approved polycarbonate lens eyewear**



Few adult squash players in Australia wear appropriate eye protection (Finch and Vear 1998; Eime, Finch et al. 2002). In a recent study, 18.8% of adult players reported wearing protective eyewear, but fewer than half of these players wore appropriate eyewear, that is, polycarbonate lens Standards-Approved eyewear (Eime, Finch et al. 2002). Similarly, 9% of 89 British players reported wearing appropriate protective eyewear (Pardhan, Shacklock et al. 1995). Players reportedly wear many types of eyewear that do not protect their eyes from injury (Genovese, Lenzo et al. 1990; Loran 1992; Finch and Vear 1998; Eime 2000). Glass lenses, plastic lenses, and open eyeguards (lensless) do not provide adequate protection to the eye, and can increase the risk and severity of injury (Clemett and Fairhurst 1980; Fowler, Seelenfreund et al. 1980; Easterbrook 1981; Feigelman, Sugar et al. 1983; Jones and Turnbull 1991; Easterbrook 1992; Silko

and Cullen; David, Shah et al. 1995; Pardhan, Shacklock et al. 1995; International Federation of Sports Medicine 1999).

Since the 1970's, there has been increased attention internationally to the occurrence and prevention of eye injuries in squash (Lambah 1968; Ingram and Lewkonia 1973; North 1973). Eyewear manufacturers initially responded by producing lensless or open-eyeguards (Figure 4). However, subsequent experiments found that eye injuries could still occur with their use (Pashby 1992). Even though the ineffectiveness of open-eyeguards has long been recognised (Clemett, McKenzie et al. 1987; Whyte 1987; Hickman 1989) a recent self-report survey of Australian squash players, showed that 16% of 57 players reporting wearing eyewear, wore open eyeguards when playing (Eime 2000). Of the 303 surveyed players, 29% believed that the open-eyeguards provided adequate protection against sustaining an eye injury (Eime 2000).

**Figure 4. An example of inappropriate eyewear: open eyeguards**



In the same study, more squash players reported wearing prescription glasses than appropriate, polycarbonate lens eyewear (Eime 2000). The use of prescription lens glasses is required for some players for improved sight. However, a number of players wrongly believe that their prescription glasses provide adequate protection against an eye injury (Eime 2000). It is important to recognise that certain types of appropriate protective eyewear can be worn with prescription glasses (Figure 5).

**Figure 5. Standards Approved polycarbonate lens eyewear with normal prescription glasses underneath**



## **2.6 Characteristics of protective equipment use in sport**

Within the rules of some sports, the use of specific protective equipment is often at the discretion of the player themselves (Jolly, Messer et al. 1996; International Rugby Board 2001; Jalleh, Donovan et al. 2001; Eime, Finch et al. 2002). A low proportion of players voluntarily wearing protective equipment is quite a common finding in many sports (Williams-Avery and MacKinnon 1996; Webster, Bayliss et al. 1997; Danis, Hu et al. 2000; Beirness, Foss et al. 2001; Sherker and Cassell 2001; Donaldson and Hill 2002). For example, an Australian study observed recreational in-line skaters and reported that 2% were fully protected with appropriate equipment (Sherker and Cassell 2001). Some skaters wore minimum protection, however, most (67%) did not wear any protection (Sherker and Cassell 2001). Similar to results by Sherker and Cassell (Sherker and Cassell 2001),

Williams-Avery and MacKinnon, surveyed a non-representative, convenience sample of US psychology students' skating activities, and found that only 1% reported wearing all four types (helmet, wrist guards, knee and elbow pads) of protective equipment suitable for that activity (Williams-Avery and MacKinnon 1996).

In many sports, personal protective equipment is a fundamental part of the game (British Standards Institute 1981; Nelson 1996; Rampton, Leach et al. 1997; Marshall, Waller et al. 2001), and there is a plethora of reasons why a player would voluntarily choose to wear a particular type of protective equipment. There is some research describing who particularly may choose to wear certain protective equipment in a sport. However, there is limited research on how to increase protective equipment use in a sport. Most available protective equipment use data relates to the increasingly popular skating, (in-line and rollerskating), and bicycling. Females are consistently reported to be more likely to wear protective equipment in gender generic sports (Rodd and Chesham 1997; Osberg and Stiles 2000).

Rehabilitation of an injury, or stabilisation of an existing/recurring injury are two reasons why a player may adopt wearing specific protective equipment (Hewson, Mendini et al. 1986; Gerrard 1998). Players' first hand experience of injury can be a major motivator in establishing voluntary use of protective equipment (Chapman 1989; Geller 1998). In a review of the US team rugby players' attitudes towards mouthguards, half of the players who had sustained an orofacial injury then commenced wearing a mouthguard (Chapman 1989). Knowing others who wear certain protective equipment or perform a specific safety behaviour, can also influence an individuals' safety behaviour (Sandman and Weinstein 1993; Perry, Marbella et al. 1999). The actual design, comfort, cost, look and availability of the

protective equipment, as well as group norms also impact on a person's decision to use equipment (Chapman 1989; Cameron, Vulcan et al. 1994; Geller 1998; Sherker and Cassell 2001; Eime, Finch et al. 2002). Other personal factors associated with protective equipment use include increased injury risk perception, knowledge of appropriate protective equipment, specific attitudes towards the equipment, as well as other, unrelated safety behaviours (Geller 1998).

In attempting to increase the number of people voluntarily using protective equipment, it is imperative that the equipment is readily available. It has been suggested that protective equipment be available and promoted at the point of sports equipment purchase or rental, preferably as a 'package deal' (Sherker and Cassell 2001). Allowing trials of protective equipment, either to become accustomed to wearing such protection, to assess its effectiveness, or as an opportunity to try before buying, are strategies that may assist individuals to overcome perceived or real barriers, and to increase awareness of available protective equipment (Danis, Hu et al. 2000; Sherker and Cassell 2001). The availability of helmet face guards was found to be a major contributor to the reduction of facial injuries to youth baseball league players (Danis, Hu et al. 2000). The baseball teams in that study were not randomised into either the control or equipment groups, nor compared at baseline, however, the study was large with the sample including 238 teams (Danis, Hu et al. 2000). Helmet face guards were made available to the intervention group of players. The overall head injury rate of the intervention group declined relative to the control group, and 62.5% of players in the intervention group reported that they would be content to continue to wear the protection when playing (Danis, Hu et al. 2000). The long term use of this protective equipment was not investigated in this study. Danis et al., (Danis, Hu et al. 2000) believe, and concur with Sherker and Cassell (Sherker and Cassell

2001) that for increased use of protective equipment, people must be able to effortlessly obtain it.

The incidence and potential severity of injury are factors that have been found to be significant predictors of protective equipment use in sport (Williams-Avery and MacKinnon 1996). The body regions at highest risk of injury in a particular sport, are often the areas that are most frequently protected with equipment. It is well supported that the wrist is the most commonly injured body region in skaters, accounting for approximately 40% of all skating injuries (Thompson and Rivara 1996; Osberg, Stiles et al. 1998; Sherker and Cassell 1999; Beirness, Foss et al. 2001; Sherker and Cassell 2001). This has been repeatedly shown to correspond to the wrist being the body region most commonly protected when skating (Thompson and Rivara 1996; Osberg, Stiles et al. 1998; Sherker and Cassell 1999; Beirness, Foss et al. 2001; Sherker and Cassell 2001).

There is consistent evidence that for in-line skaters at least, older participants are more likely than younger ones to wear protective equipment (Beirness, Foss et al. 2001; Sherker and Cassell 2001). It has been suggested that older skaters, in this instance those over 30 years of age, are more aware of the risks of injury, perceive greater vulnerability to injury, hence, and are more likely to protect themselves than younger skaters (Beirness, Foss et al. 2001 208). Of a sample of injured cyclists aged 0-19 years, riders aged 15-19 were the most likely users of bicycle helmets compared to younger riders (Linn, Smith et al. 1998). It seems that age, as a contributing factor of protective equipment use, is unique to the sport and protective equipment of interest. Therefore, results should not be generalised to use of protective equipment in all sports.

Level of experience or expertise in a sport may contribute to an individual's decision to use protective equipment. Experienced motorcyclists have perceived

themselves to be at lower risk of injury than other less experienced motorcyclists, and therefore have been less likely to use preventive measures than riders with less experience (Rutter, Quine et al. 1998). Inconsistent with this, an observation amongst in-line skaters, found skaters with 'average' ability were more likely than beginners or advanced skaters to wear protective equipment (Osberg and Stiles 2000). However, this measure was only subjectively defined and recorded by a research observer (Osberg and Stiles 2000).

In attempting to understand why individuals choose, and continue to use protective equipment, it is necessary to explore the barriers as well as the influences to protective equipment use. There is little data available regarding the barriers to protective equipment use, as observational studies or those based on hospital/emergency department case reviews, have been limited to reporting injury patterns and the descriptive use of protective equipment. School aged rugby union players' attitudes towards headgear have been investigated in Australia (Finch, McIntosh et al. 2001). This particular study involved a group of players that were provided with headgear, as well as a control group of players that were not. Amongst the information gathered, reasons for wearing and/or not wearing headgear were reported. The major barriers to the use of headgear in this study were "found to be uncomfortable" and "it was hot" (Finch, McIntosh et al. 2001). Despite the compulsory ruling of bicycle helmet use, fewer than 25% of Australian children reportedly wore a helmet (Finch 1996). Again, the factors of comfort, as well as appearance, were two major deterrents for wide spread use (Finch 1996).

## **2.7 Increasing the use of protective equipment**

There may be some consistent factors contributing to the use of protective equipment in sport, however the specific predictors of this behaviour have rarely



been investigated. As van Mechelen suggests, a sports injury prevention strategy should only be implemented in the presence of knowledge regarding these specific predictors (van Mechelen 1997). Some examples of sport specific predictors of protective equipment use were discussed in Section 2.6. This section summarises strategies that have been used to increase the use of protective equipment, that is, modify particular safety behaviours. This section is not limited to the use of protective equipment in sport. Much can be learnt from the extensive array of safety strategies in general.

Primary prevention efforts usually require behavioural change (Kaplan 2000). It is well recognised that collectively, attitudes towards, and knowledge about safety protection can substantially influence safety behaviours (Geller 1998; Perry, Marbella et al. 1999; Michaud, Renaud et al. 2001).

Population based surveys were conducted in Toronto, one in 1983 and another in 1988 (Pederson, Bull et al. 1992). This study aimed to describe changes in peoples' knowledge, attitudes and behaviours with regards to legislative restrictions on smoking that came into place during this time. The authors concluded that the introduction of the restrictions of smoking in public places did not result in a change of knowledge regarding the health effects of active smoking or environmental tobacco smoke. The steady growth of information on the adverse effects of smoking and, particularly, the rapid growth during the 1980's of knowledge concerning the adverse effects of smoking was not reflected in an increase in the health knowledge scores. Whilst slightly more favourable anti-smoking attitudes were found, the health education efforts did not appear to facilitate marked attitude change (Pederson, Bull et al. 1992). Smoking status was loosely defined as, 'never smoked', 'quit over six months ago', or 'current smoker' and the frequency of smoking for individuals was not quantified. The survey results

showed that smoking status of the population did not change from 1983 to 1988, nor did the percentages of current smokers by age for each sex. A total of 1463 people's responses post legislative restrictions were compared to only 279 at baseline. The authors believe that efforts to increase knowledge may not be as important for attitude change, as are other factors such as social norms, perceived changes in smoking habits of associates and personal experience, and restrictive measures (Pederson, Bull et al. 1992). Positive attitudes to regulation of smoking bans are critical if such changes are to be accepted (Borland, Owen et al.), as are attitudes having a strong influence on impending safety behaviour (Geller 1998; Perry, Marbella et al. 1999).

Education strategies have been used frequently in an attempt to increase peoples' knowledge, and subsequently to alter specific safety behaviours. Carlin et al., evaluated a safety education program in Australia, aimed at increasing bicycle helmet use (Carlin, Taylor et al. 1998). Children presenting to either of two Melbourne hospital emergency departments with bicycle injuries were cases in this study, and random telephone interviews with children were controls of the same population base. From this case-control study the authors concluded that there was no evidence that the school based education program was successful (Carlin, Taylor et al. 1998).

A study investigating the regulation of compulsory bicycle helmet use in Australia, found that educating bicyclists, as one component of a broad injury prevention campaign was successful in increasing helmet wearing rates, and subsequently decreasing the risk of head injury (Cameron, Vulcan et al. 1994). Other campaign components included mass media publicity, and an equipment rebate scheme (Cameron, Vulcan et al. 1994).

Svanstrom in a literature review of international bicycle helmet use studies, concluded that few interventions based on increasing bicycle helmet use were found to be effective (Svanstrom 2000). Only helmet promotion programs that used a variety of educational and publicity strategies and that were organised by community-wide coalitions were shown to be effective. Svanstrom describes one particular successful study, by Bergman et al., (1990) which included classroom education, discount purchase programmes, bike rodeos, distribution of print material through a variety of venues, and intensive promotional efforts by sports leaders, bike clubs, and media to increase children's helmet use (Svanstrom 2000).

Evaluation of a special education program encouraging seat belt use in the US showed that the extensive television advertising used in the program had no effect on wearing rates of seat belt use (Caine, Caine et al. 1996). From this, Caine et al., stated that "although it may be difficult to change behaviour through educational efforts alone, an important function of educational efforts is to inform the public and modify their knowledge and attitudes about injuries" (Caine, Caine et al. 1996).

Information posters and pamphlets can be effective tools at encouraging safety behaviour (Geller 1998). To be successful, the material must contain the specific desired behavioural information and be displayed where the behaviour should occur (Geller 1998). Other community based health promotion interventions have tried to increase use of child safety seats. In a systematic review of 72 studies of interventions aimed at increasing the use of child safety seats, Zaza et al., found that community-wide information plus enhanced enforcement campaigns, and incentive plus education programs had sufficient evidence of effectiveness (Zaza, Carande-Kulis et al. 2001). Insufficient evidence was identified for education-only

programs (Zaza, Carande-Kulis et al. 2001). A particular child safety seat study, using distribution strategies and education programs was found to be successful (Zaza, Carande-Kulis et al. 2001). Approved child safety seats were provided to parents of small children through a loan, low-cost rental or giveaway in addition to an educational program (Zaza, Carande-Kulis et al. 2001). The prevalence of the use of the safety seats in the short and long term was not measured. Nonetheless, the effectiveness was determined by a decline in injury claims made to an insurance agency and the increase in possession of a child safety seat, over a four month period (Zaza, Carande-Kulis et al. 2001). There is widespread confirmation that education-only programs are ineffective at behaviour change, even in the short term (Pederson, Bull et al. 1992; Caine, Caine et al. 1996; Carlin, Taylor et al. 1998; Zaza, Carande-Kulis et al. 2001).

A collaborative eye safety project involving the provision of safety eyewear for metal, welding and woodworkers in a rural village in Bangladesh has been recently conducted (Parker 2003). In a review of work safety behaviours, it was established that these workers had no personal eye protection. Parker explains that in the community, a worker who sustained an eye injury could often not afford basic medical treatment and the whole family would then suffer. This project involved businesses in Australia donating safety glasses, welding helmets and oxyacetylene goggles. One thousand pairs were donated and students from an Australian school volunteered their time to clean the eyewear. In Bangladesh, an Australian researcher invited employers and employees to a series of eye safety training sessions where the eyewear was given to participants. The joint project also involved the development of culturally appropriate educational safety information and signage for the small businesses. It is not known whether the eyewear is continually being worn, and in the appropriate manner it was made for.

Nonetheless, the author states that the study is planning and developing the project to further benefit the workers in Bangladesh (Parker 2003). Unfortunately, this study was not published in the peer review literature and there is no formal evaluation or evidence-base that the project actually works.

Safety research has demonstrated that significant incentives provided to people can be an effective motivator for the desired behaviour (Geller 1998). Attempts to persuade people to use seat belts or bicycle helmets, before the introduction of the respective regulations, were unsuccessful without incentives (Cameron, Vulcan et al. 1994; Geller 1998). When prizes were awarded for use of seat belts and bicycle helmet use, the proportion of people using these safety devices increased (Cameron, Vulcan et al. 1994; Geller 1998). Even relatively low-cost incentives have been shown to produce large increases in seat belt use, which demonstrates that people are not opposed to seat belts (Geller 1998). The incentives assisted in the particular seat belt intervention because the risk of injury per trip is low and because drivers have unrealistic optimism regarding their own driving skills (Geller 1998). In a systematic review of interventions aimed at increasing the use of child safety seats, Zaza et al., also found there was sufficient evidence of effectiveness of community-wide information/education programs with incentives (Zaza, Carande-Kulis et al. 2001).

## **2.8 Compulsory use of protective equipment in sport**

Just as there are often regulations for community wide safety behaviours such as the use of car seat belts and bicycle helmet use in Australia, protective equipment use is compulsory in some sports. It is the role of individual sport governing bodies to establish these protective equipment regulations. Within a sport, these regulations are not necessarily the same internationally, nor consistent throughout

one country (Squash Canada; United States Squash; Regnier, Sicard et al. 1995; Squash Australia 1998; Scott, Finch et al. 2001). Sometimes there are different protective equipment regulations for distinct player levels, gender and ages (Webster, Bayliss et al. 1997; Squash Australia 1998; Scott, Finch et al. 2001). On the other hand, players are sometimes restricted as to when they can use it, and some types of protective equipment are not allowed to be worn in game settings (Webster, Bayliss et al. 1997; International Rugby Board 2001; Scott, Finch et al. 2001). In some sports, it is compulsory for players to use protective equipment, specific to the injury risks of the particular sport (Regnier, Sicard et al. 1995; Squash Australia 1998; International Rugby Board 2001).

Mandating compulsory protective equipment is sometimes considered the most suitable strategy for the prevention of a specific sports injury. Even so, the process for developing such a policy takes considerable time and a multi-strategic approach. Other safety initiatives in the wider community and in a particular sport can assist understanding the underlying principles, the structure, process and success of a project or compulsory policy development and implementation.

Behaviour change is complex. Strategies, to increase players' knowledge regarding the equipment and to promote favourable attitudes towards its use must be in place, before compulsory regulation is a consideration. Experience with legislating bicycle helmets suggests that it is critical to have a high proportion of voluntary use of protective equipment before such a regulation can be effectively implemented and enforced (Cameron, Vulcan et al. 1994).

There are few examples of formal policies on public health based legislation in the literature. Such examples include, seat belt laws, workplace smoking bans and compulsory bicycle helmet use. Bicycle helmet use and the debate internationally of the necessity of compulsory use, as well as smoking bans in Australia have

received much attention (Borland, Owen et al. 1990; Mills and Gilchrist 1991; Owen, Borland et al. 1991; Borland, Owen et al. 1994; Cameron, Vulcan et al. 1994; Kennedy 1996; Linn, Smith et al. 1998; Osberg, Stiles et al. 1998; Kopjar 2000; McGuire and N 2000; Scuffham, Alsop et al. 2000). Public opposition of legislative interventions is a potential barrier to effective implementation (Dinh-Zarr, Sleet et al. 2001).

The World Squash Federation (WSF) recommends that all squash players should wear protective eyewear when playing squash (World Squash Federation 2001), however it is not as yet compulsory for all squash players to wear protective eyewear. There has been an international protective eyewear policy regulation mandating protective eyewear use for all junior competitors at WSF individual and team competitions since 1999. Several of the major squash countries have established local standards for squash eye protection, which have been approved by Canadian Standards Association, United States ASTM and Standards Australia/New Zealand (World Squash Federation 2001). To date standards approved protective eyewear is compulsory for all players and coaches in the United States, and for junior and doubles players in Canada (Squash Canada; United States Squash). In addition, Canadian senior players who compete in National Championships, and provincial teams as well as all doubles players are required to wear appropriate eyewear (Squash Canada). In England approved protective eyewear use is mandatory for all doubles players and certain junior events (England Squash). In Australia it is currently compulsory for all junior and doubles players to wear protective eyewear (Squash Australia 1998).

## 2.9 Increasing protective eyewear use in squash in Australia

Although Squash Australia, the premier squash body in Australia, had discussions during the 1990's about the possibility of mandating protective eyewear use for all squash players by the end of 2001, this policy development did not eventuate (Paul Vear, Personal Communication). A staged process of regulation introduction was adopted but the compulsory junior regulation introduced in 1997 did not result in the expected 'trickle-up effect' of these players continuing to use it as adults (Paul Vear, Personal Communication). Implementing a protective equipment policy can be a protracted process. It requires initial strategies to increase players' knowledge regarding the equipment and to promote favourable attitudes towards its use, before compulsory regulation is a consideration.

The concept of a 'trickle-up' effect was not observed to occur with protective equipment in ice hockey or bicycle helmets (Voaklander, Saunders et al. 1996; Osberg, Stiles et al. 1998). It was found that legislated injury control measures for a specific population might have little residual effect when the population members are not within the scope of the legislation (Voaklander, Saunders et al. 1996). Merely supplying eyewear, was not found to be sufficient enough to increase wearing rates amongst squash players (Wong and Seet 1997).

Despite the demonstrated effectiveness of specific preventive measures, increasing the safety or preventive behaviour in the population is difficult (Segui-Gomez 2000). When introducing a compulsory regulation of protective eyewear it must be recognised that most of the people who are required to use the protection would never have sustained an injury even if they did not wear the protection (Kaplan 2000). In squash this is particularly true, as the incidence of eye injuries is



low (Finch and Eime 2001; Eime, Finch et al. 2002). However, unlike other minor sports injuries, the severity of squash eye injuries means that it is not beneficial for players to adopt wearing protective eyewear once they have sustained an eye injury (Chapman 1989; Finch, McIntosh et al. 2001).

It is argued that adults who do not use seat belts, are less likely to buckle up children and laws that increased safety belt use among adults are likely to result in increased use among child passengers (Dinh-Zarr, Sleet et al. 2001). It is therefore plausible to believe that parents of squash players have an ability to increase use among junior players, and not that compulsory use by junior players will largely affect those protective eyewear behaviours of adults.

In Victoria, Australia, initial attempts were made by the Squash Court Owners Association to introduce protective eyewear into both squash and racquetball in 1980. Within a year, the East Area of Melbourne made it compulsory for junior players to wear protective eyewear during pennant matches. Inadequacies in the available interventions and major objections from junior players parents resulted in the ruling being changed. Protective eyewear was then 'recommended' instead of 'compulsory' for junior squash players. As a consequence of this, virtually no junior players continued to wear protective eyewear when playing (personal communication, Paul Vear).

The Victorian Squash Federation (VSF) was established in 1988, and three years later this organisation explored the possibility of introducing protective eyewear for use by all squash players. This was partly set in motion by the release of extensive data on eye injuries provided by the Royal Victorian Eye and Ear hospital in association with other medical professionals (personal communication, Paul Vear). In 1991, the VSF, together with VicHealth Sports Safety Committee (VHSSC), worked towards introducing the use of protective eyewear for squash, racquetball

and badminton players. Despite the support from health professionals for the compulsory use of protective eyewear in these racquet sports, it was identified that the availability of suitable eyewear was inadequate, and it was thought by the VSF and VHSSC that an education program was required. Subsequently, a policy was adopted to work with eyewear manufacturers in producing appropriate eyewear.

The VSF, still in collaboration with the VHSSC worked towards the marketing and endorsement of one model of protective eyewear, with two sizes. It was thought that with only one model, it would alleviate existing confusion amongst the squash playing public as to which eyewear was appropriate. The VSF encouraged venue operators to provide this model of eyewear for hire and for purchase (personal communication, Paul Vear).

The eye protection strategy developed by the VSF and VHSSC included various procedures for increasing the rates of protective eyewear use. The marketing plan involved a 'trickle up' approach, where it was anticipated that if players wore protective eyewear in their junior competition, they would continue to do so throughout their playing life. All squash junior coaches/development officers and program coordinators, whom act as role models to junior players, were obliged to wear appropriate eyewear when on court. However, this was not measured. Other strategies involved displaying posters and brochures at squash venues and publishing feature articles in state and national squash magazines and newsletters (personal communication, Paul Vear). At the 1994 Australian Open squash championships the Leader Eye Guard was launched.

At about this time, the VSF started to use the player insurance scheme to monitor eye injuries that were sustained by players when competing in squash or racquetball pennant competitions. The insurance scheme was then promoted to

junior and social players, enabling substantial monitoring of eye injuries throughout both sports (personal communication, Paul Vear).

After these steps were taken, the VSF approached squash associations at the state/territory, national and international level to work towards the staged introduction of compulsory eyewear for junior players at all levels, plus in new competition formats such as doubles squash (personal communication, Paul Vear).

In 1995, a survey of 197 squash players' protective eyewear behaviours and their knowledge and attitudes associated with its use was conducted in the Eastern Suburbs of Melbourne (Finch and Vear 1998). Surveys were distributed to seven squash venues, with survey response rates between 3-50% at the venues. Results of this study include previous eye injury occurrence to 15% of the survey participants. Less than 10% of participants reported wearing protective eyewear when playing (Finch and Vear 1998). A continuation of this included a field trial of two forms of protective eyewear available in Australia. Fifty-eight players from outer eastern suburbs of Melbourne participated in a six-month trial (Professor Caroline Finch, personal communication).

In March 1997, the Squash Australia Protective Eyewear Policy was introduced, whereby, it was mandatory for all squash players 19 years of age and younger, to wear protective eyewear, meeting or exceeding the frontal impact requirements of AS4066: 1992 or ASTM F803, whenever they participated in any tournament, other competition, coaching clinic, or any other squash related activity, which had been organised or sanctioned by Squash Australia and/or any of its member Associations or affiliates. This ruling also included all players participating in doubles competitions, as well as to all accredited coaches, when coaching players who are 19 years of age and younger (personal communication, Paul Vear). A

continuation of this was compulsory use of protective eyewear for all World Junior Championship players in 1999.

To support the targeting of the junior squash player, an education and awareness program for both competition and social players was introduced into seven squash centres located in Melbourne's Eastern suburbs. Throughout this process squash venue managers were encouraged to stock protective eyewear for their clientele.

In 1998, Squash was included in the Commonwealth Games, where both singles and doubles events were played. All players participating in doubles events were required to wear protective eyewear.

The Professional Squash Coaches Association of Australia endorsed the policy on the implementation of protective eyewear and undertook to support, and actively promote, the educational program nationally.

A survey of 303 adult squash players in Eastern Melbourne, was conducted in 2000 (Eime 2000). This study confirmed that the status of adult players' knowledge, behaviours, and attitudes towards protective eyewear did not favour the immediate regulation of protective eyewear at that time (Eime 2000).

At the time of writing this Thesis, the following eyewear complies with the Squash Australia Protective Eyewear Policy:

**AS/NZS 4066: 1992 Approved**

- **i-MASK (previously i-MAX)**
- **DUNLOP - Protective Eyewear**
- **LEADER Albany, Champion, New Yorker, Vision II**

**USA, ASTM F803- 94 OR - 97 Approved**

- **LEADER** – Dallas
- **PRINCE** – Featherlite
- **R.A.D** - RAD Triumphs, Turbos, Neons, Junior Feathers
- **GS SPORTS** - I-X Speed Pro & I-X Power Pro, Challenger
- **BARON** - Boast, Champ, Elite

## **2.10 Safety policies and practices of sports venues**

Little is known about the sports safety policies and practices of community level sports organisations in Australia (Finch and Hennessey 2000). Once current practices are identified, areas for improvement can be addressed and participants should be informed of the safety measures they can adopt to prevent sports injuries (Goulet 2001).

In the immediate environment of squash venues, equipment such as racquets, balls and apparel is widely available for purchase and/or borrowing purposes. In this context, squash venue operators could potentially influence players' safety habits through specifically promoting the availability and use of appropriate protective eyewear. However, the availability of general protective equipment has been found to vary considerably across sporting venues. (Finch and Hennessey 2000) (personal communication Goulet, C 2001). The safety policies and practices of sports venues, including the availability of protective equipment, can play a pivotal role in promoting and influencing the safety practices of players (Eime 2000; Finch and Hennessey 2000; Sherker and Cassell 2001). The current practices and policies of squash venue operators are thus important in order to fully address the environmental and social contexts in which the risk of squash-related eye injuries is greatest.

### **Chapter 3:     The epidemiology of squash injuries**

#### **requiring treatment at a hospital setting**

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Internationally, descriptive epidemiological studies of squash injuries have consistently been based on data from the formal records of hospital settings or self-reports from player surveys (Finch and Eime 2001). Acute sports injuries are generally treated at a hospital setting, whereas sports specialist clinics generally treat chronic injuries. An eight-year retrospective study of squash players treated at a British hospital sports injury clinic concluded that 80% of all injuries were acute onset (Chard and Lachmann 1987). Injury surveillance methods utilising data from emergency department and hospital admissions do not capture all injuries, but include the higher spectrum of severe injuries, those warranting medical attention. This information can assist in identifying priority areas for future injury prevention strategies for the more severe, acute injuries sustained in a particular sport.

Little is known about the epidemiology of squash injuries in Australia. It is imperative that the problem of eye injuries in squash be initially determined, in the context of injury incidence in relation to all squash injuries sustained in addition to the severity of these injuries. The study presented in this Chapter describes the squash injury cases treated in hospital settings in Victoria, Australia for the first time.

It is concluded from this hospital-based injury surveillance study that eye injuries pose a considerable problem for squash players, in terms of incidence and potential severity. Causal mechanism need to be further investigated.

The peer review paper *Epidemiology of squash injuries requiring hospital treatment* by R Eime, T Zazryn and C Finch, was published in *Injury Control and Safety Promotion*, 2003, Volume 10, Number 1, pages 243-245.

## Monash University

**Declaration for Thesis Chapter Three**

In the case of *Chapter Three*: paper titled "*Epidemiology of squash injuries requiring hospital treatment*", contributions to the work involved the following:

Name	% contribution	Nature of contribution
Rochelle Eime	60%	Analysis and writing of paper
Tsharni Zazryn	25%	Assistance with analysis of the results and paper writing
Caroline Finch	15%	Methodology of the paper and contribution to paper writing

**Declaration by co-authors**

The undersigned hereby certify that:

- (1) they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;
- (2) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;
- (3) there are no other authors of the publication according to these criteria;
- (4) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit; and
- (5) the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s)

Injury Risk Management Research Centre, University of New South Wales, and Department of Epidemiology and Preventive Medicine, Monash University

Signature 1

Signature 2

Signature 3

		Date
		16/1/04
		30/01/04
		16/01/04



## SHORT REPORT

# Epidemiology of squash injuries requiring hospital treatment

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### Introduction

Information about sports injuries, including the cause, nature, diagnosis and patient details can be effectively obtained from treatment settings.<sup>1</sup> While sports injury surveillance, based on injuries presenting for medical treatment at a hospital only provides details on a small proportion of the total number of injuries,<sup>2</sup> these datasets are useful for describing the more severe injuries sustained during sport.<sup>3</sup> Injury surveillance methods utilising data from emergency department and hospital admissions can assist in identifying priority areas for future injury prevention strategies for the more severe, acute injuries sustained in sport. There have been very few studies of squash injuries based on hospital treated data. These studies have shown that squash has a relatively high incidence of severe injury when compared to other sports.<sup>4</sup> The lower extremities account for 32–58% of all squash injuries.<sup>4–7</sup> Whilst not the most frequent, injuries to the eye have the potential to be very severe.<sup>4</sup> Due to methodological differences eye injury rates range from 3.7 to 33.3 per 100,000 playing sessions.<sup>4</sup> The prevention of squash injuries in Australia has recently gained attention, and these research efforts require relevant up to date information. This study therefore aimed to describe the squash injury cases treated in hospital settings in Victoria, Australia for the first time.

### Methods

Summary data on squash injuries receiving medical treatment in hospitals in Victoria, Australia, were obtained from two sources: the Victorian Admitted Episodes Dataset (VAED, hospital admissions) and the Victorian

Emergency Minimum Dataset (VEMD, emergency department presentations).

### Hospital admissions

All injuries that require admission to a private or public hospital throughout Victoria are captured within the VAED. This provides 100% coverage of admitted episodes. All squash injury admissions during the period July 2000–June 2001 were identified. Before this period, it was not possible to identify the specific sport at the time of injury in the VAED.

### Emergency department presentations

The VEMD records the details of injuries presenting to 28 Victorian emergency departments (ED), and is estimated to cover approximately 80% of such statewide presentations. Squash injury information for the period January 1997–December 2001 was obtained.

### Injury rates

The Victorian Squash Federation (VSF), the governing body for squash in Victoria, provided details of the number of squash players (both competitive/pennant players and social players). Injury rates for each year were calculated and expressed per 100,000 players. The ED incidence estimates were obtained after factoring-up the numbers of actual cases to account for the 80% capture rate. The calculations of overall injury rates also took into account the proportion of ED presentations that were subsequently admitted to hospital.

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## Results

### Overall injury rates

Fifty people with squash-related injuries were admitted to a hospital during 2000–2001. This corresponds to an overall injury rate of 35.5 injured players per 100,000 players. Over 1997–2001, 339 patients with squash injuries presented at an ED. After adjusting for the capture rate, this corresponds to an injury rate of 58.5 injured players per 100,000 players. The overall rate of hospital-treated squash injuries (after adjustment for cases both presenting to an ED and admitted) was 80.9 injured players per 100,000 squash players.

Overall, the lower extremities were the most frequently injured body region (34.7 lower limb injuries per 100,000 players). The overall injury rate of eye injuries was 19.0 per 100,000 players.

### Hospital admissions

The vast majority (90.0%) of hospital admissions were males; most (84.0%) were  $\geq 30$  years. Seventy two percent were

admitted for  $< 2$  days, and all others were admitted for 2–7 days.

The majority of injuries in admitted squash players were to the lower extremities (Table 1). The causes of the treated injuries are displayed in Table 2. The most common type of injury was a sprain or strain, which accounted for half of the admitted cases.

### Emergency department presentations

Almost 80% of ED presentations were males. Three quarters of the players presenting at an ED were  $\geq 25$  years. Only 6.2% were subsequently admitted to hospital; 92.3% were discharged home.

Eye injuries were the most common reason for an ED presentation, and accounted for almost a third of all cases (Table 1). The majority of these injuries were sustained by being struck by the ball or a racquet or through a collision with another person (Table 2).

Table 1 Injured body regions in squash players treated in a hospital setting.

Injured body region	Hospital admissions (n = 50)			Emergency department presentations (n = 339)		
	% of all injuries	95% CI	Injury rate per 100,000 players	% of all injuries	95% CI	Injury rate per 100,000 players
Lower extremities	68.0	(55.1, 80.9)	24.2	23.3	(18.8, 27.8)	8.7
Upper extremities	16.0	(5.8, 26.2)	5.7	17.4	(13.4, 21.4)	6.5
Eyes	12.0	(3.0, 21.0)	4.3	32.7	(28.0, 38.0)	12.2
Face (excl eyes)	4.0	(0.0, 9.4)	1.4	13.6	(10.3, 17.7)	5.0
Trunk	–	–	–	2.7	(1.2, 4.8)	0.9
Head (excl face)	–	–	–	2.4	(0.8, 4.0)	0.9
Unspecified/missing	–	–	–	7.9	(5.1, 10.9)	3.0

– category not present in this dataset.

Table 2 Causes of the injuries sustained by squash players treated at a hospital setting.

Causes of injury	Hospital admissions (n = 50)			Emergency department presentations (n = 339)		
	%	95% CI	Injury rate per 100,000 players	%	95% CI	Injury rate per 100,000 players
Overexertion/strenuous movements	50.0	(36.1, 63.7)	17.8	–	–	–
Struck/knocked (not further specified)	22.0	(10.5, 33.5)	7.8	8.6	(5.6, 11.5)	3.2
Unintentional (not further specified)	20.0	(8.9, 31.1)	7.1	–	–	–
Hit/rushed	4.0	(0.0, 9.4)	1.4	–	–	–
Struck by object	–	–	–	33.0	(28.0, 38.0)	12.3
Collision with person	–	–	–	21.8	(17.6, 26.4)	8.2
Ball	–	–	–	17.4	(13.7, 21.4)	6.5
Other	–	–	–	9.7	(6.6, 12.9)	3.6
Missing	4.0	(0.0, 9.4)	1.4	9.5	(6.3, 12.5)	3.5

– category not present in this database.

## Discussion

This study provides unique data about the epidemiology of hospital-treated squash injuries in Australia. Collectively, the two datasets have a high capture rate of sports injuries presenting for hospital treatment in Victoria. They provide data on all types of injuries and allow information about specific sports associated with injury to be easily identified. However, there could be an underestimation of the true rates of hospital-treated injuries if the sport of squash was not identified in all cases.

Even though males represent a higher proportion of the squash players in Victoria (66%),<sup>8</sup> they are over-represented in both hospital and ED presentations. The reasons for this are unclear but could be related to the age, the exposure or the skill level of the injured players compared to uninjured players. It is also possible that males are more likely than females to present to hospitals for treatment. Males are consistently reported as sustaining proportionally more sports injuries than their female counterparts.<sup>4,6</sup> However, well-designed prospective studies are needed to elucidate this further.

The majority of both admitted and ED injured players were younger than the mean age of Victorian squash players, which is 41 years.<sup>9</sup> There is a possibility that younger players participate at a higher intensity and more often (i.e., higher exposure) than their older counterparts, placing them at a higher risk of injury on an exposure basis, alone.

Injuries to the lower extremities, eyes and upper extremities were the most common. However, the proportion of these injuries differed depending on whether or not the case was admitted. The lower extremity accounted for 68% of all injuries admitted to hospital; this is higher than published studies quoting figures between 32%–58% of all squash injuries.<sup>4</sup> Conversely, 23% of all injuries presenting at an ED were to the lower extremities, which is lower than that reported in the international literature. Unfortunately, due to the injury-coding that was used, it was not possible to identify more specifically the body region injured, other than lower extremity.

At ED's, the eye was the most commonly injured body region, accounting one in three injuries treated. Eye injuries have been reported to account for between 19% and 42% of all squash injuries.<sup>4</sup> In an earlier Victorian study of sports-related eye injuries presenting to the Royal Victorian Eye and Ear Hospital for treatment,<sup>10</sup> the eye injury rate for squash was calculated as being 64 injuries per 100,000 players. Our rate is lower and can partly be explained by the earlier study's use of data from only one hospital and potentially inaccurate population-based estimates for the population denominators.

A limitation of this study is that it only covers severe injuries, defined as those warranting medical treatment at a hospital setting. However, whilst squash players have a relatively low frequency of overall injury, they sustain a relatively high rate of severe injuries, particularly to the eye.<sup>4</sup> As such, obtaining data from ED and hospital admission databases appears to be an appropriate way to assess the epidemiology of squash injuries.

## Implications for prevention

An analysis of sports injury surveillance data can assist in identifying putative injury risk factors that should be tested in future aetiological studies. It is recommended that future squash injury prevention strategies continue to focus on the severe and common eye injuries. Investigations into the rate of protective eyewear use, and interventions to increase the use of protective eyewear amongst all players are warranted given the high rate of eye injuries. Increased attention also needs to be given to the more common lower limb injuries. Possible causal and risk factors that require investigation include shoe-surface interaction, fitness, skill level, age and gender of participants. More specific details are required to identify causal mechanisms of both the most frequent, lower extremity injuries, and the more severe, eye injuries.

## Acknowledgements

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## **Chapter 4:     Nine-year retrospective injury                   surveillance, utilising insurance claim                   records**

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In understanding the descriptive nature of squash injuries, and in particular eye injuries, injury surveillance is an important primary process. Gathering injury data from only one formal source has many limitations. Self-report information and data from emergency department databases are two injury surveillance methods often used to describe squash injuries sustained by the general player population (i.e. both competitive and social/recreational players, amateurs and elite). Another valuable source of injury information is insurance claim forms which detail information about injuries sustained to formal competition players. As with cases presenting for treatment at a hospital, sports injuries that warrant an insurance claim are generally severe in nature, involving medical costs and sometimes loss of income. For this reason, a squash insurance claim database is particularly useful for investigating injuries in squash.

Insurance data has the potential to describe a range of sports injuries that do not present to hospitals or emergency departments (Finch, Ozanne-Smith et al. 1995; Simpson, Chalmers et al. 1999). In addition, insurance claim forms have the ability to gather a wide range of specific injury data including the region, cause, type and nature of the sporting injury (de Loes 1995; Kujala, Taimela et al. 1995; Simpson, Chalmers et al. 1999).

A major benefit of this form of injury surveillance is its complete capture ability. Information regarding all insurance claim injuries can be collected and updated regularly with minimal effort. As all player's by definition are injured, identifying injured players using claim forms can be more effective at detecting changes in injury incidence than survey methods (Simpson, Chalmers et al. 1999). The value of using sports injury insurance data has been demonstrated by Finch (Finch 2003) and recommended by the Australian Sports Injury Data Working Party (Finch, McGrath 1997) for the use of describing injury trends and for injury prevention purposes.

This Chapter describes the trends in squash injuries over a nine year period. An audit of the VSF insurance scheme claim forms was performed and analysis included calculation of injury rates per player numbers. This study complements the squash injury incidence and severity data collected and discussed in Chapter Two. In addition, the necessary information of the cause and mechanism of squash injuries is provided through this insurance claim records, surveillance technique. The most commonly injured body regions were the knee, calf and ankle. The highest costing injury was the eye. Over the nine year period there was a decrease in the overall squash injury rate. Reasons for this are provided.

The following paper *Trends in squash injury incidence over a nine year period* by R Eime, C Finch, T Zazryn and P Vear to date has not been submitted to a journal for publication.

## Monash University

**Declaration for Thesis Chapter Four**

In the case of *Chapter Four: Trends in squash injury incidence over a nine year period*, contributions to the work involved the following:

Name	% contribution	Nature of contribution
Rochelle Eime	60%	Analyses of data and writing of paper
Caroline Finch	20%	Methodology of analysis and contribution to writing of paper
Tsharni Zazryn	15%	Data collection and contribution to writing of paper
Paul Vear	5%	Assistance with the conduct of the research and editing of paper

**Declaration by co-authors**

The undersigned hereby certify that:

- (1) they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;
- (2) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;
- (3) there are no other authors of the publication according to these criteria;
- (4) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit; and
- (5) the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s)

The Victorian Squash Federation, the Injury Risk Management Research Centre, University of New South Wales, and Department of Epidemiology and Preventive Medicine, Monash University

Signature 1

Signature 2

Signature 3

Signature 4

		Date
		16/1/04
		16/01/04
		30/01/04
		19/3/04

# **TRENDS IN SQUASH INJURY INCIDENCE OVER A NINE YEAR PERIOD**

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**Key words:** squash, insurance claims, injury surveillance

## **ABSTRACT**

**Objectives:** To describe the frequency, distribution and associated costs of severe injuries sustained by competitive squash players in Victoria over a nine-year period.

**Methods:** All injury insurance claim forms lodged with the Victorian Squash Federation over the nine-year period January 1993 – December 2001 were audited. Information pertaining to the injured player and their injuries, as well as the circumstances surrounding the injury, were extracted. The associated injury costs for a two and a half year period were also analysed.

**Results:** Data from 695 insurance claim forms, documenting 783 injuries, were extracted. Injury rates significantly decreased from 18.3 to 6.9 per 1000 insured players over the nine years ( $p < 0.01$ ). The three most commonly injured body regions were the knee, calf and ankle, representing 47.3% of injuries. The most common diagnoses were a calf strain (17.2%) and a strain/complete rupture of the Achilles tendon (7.4%). An unspecified acute over-exertion was the most frequently reported cause of injury (20.5%). Serious injuries including dislocations, fractures and eye injuries accounted for only 6.3% of all injuries. The highest costing injury was an eye injury (AUS \$5000), with the average cost of all claimed injuries being (AUS \$495.37).

**Conclusions:** The decrease in injury rate over time is likely to be related to a decline in the number of lodged insurance claims, rather than due to significant



safety improvements in the sport. The injury rate changes reflected changes in the Australian health insurance sector over that time. Insurance claim records provide detailed information on the trends of incidence, severity and cost of squash injuries that could be effectively used in future injury prevention strategies.

## INTRODUCTION

Although the overall frequency of injury in squash is reported to be low, there is a relatively high risk of severe injury to squash players.<sup>1</sup> The international literature consistently reports that the majority of injuries occur to the lower extremities, accounting for 32-58% of all squash injuries.<sup>1-4</sup> Other commonly injured regions are the back, shoulder, arm, wrist, head and face. Of all squash injuries, those to the eyes have received the most attention in the literature.<sup>1</sup> It is the potential severity, and not necessarily the incidence, of these eye injuries that is of main concern.

Whilst the body regions most commonly injured by squash player are clearly identified in the published literature, the causes of these injuries have been rarely reported. For example, in a report of racquet sports injuries that presented to a hospital-based sports injury clinic in Britain, the description of injuries was limited to defining the body region injured.<sup>3</sup> Van Dijk restricted his discussion of injuries to those that were either caused by being hit by the racquet or the squash ball.<sup>5</sup> In order to prevent squash injuries, causal information is paramount.

Although the available literature describes the types of injuries and body regions most commonly injured during squash, there have been no published studies describing the squash injury incidence trends, nor the associated costs of these injuries. The majority of studies have reported retrospective data obtained from medical case record reviews or by self-report from squash players.<sup>1</sup> A

potentially useful source of injury data is that from insurance claim databases.<sup>6</sup> Injuries reported in insurance claims are generally severe in nature, and associated with considerable medical costs and possible loss of income. As all players making an insurance claim are known to be injured, using insurance claim forms can be more effective at detecting injury trends than survey methods.<sup>7</sup>

Victorian squash players participating in formal competition (interclub pennant) in Metropolitan clubs affiliated with the Victorian Squash Federation (VSF), the governing body of squash in Victoria, Australia, are required to have as part of their annual membership, injury insurance cover for all practice and match sessions. Inhouse (informal competitive) players from country areas may also choose to be covered by this insurance scheme. The number of insured players over the past nine years is approximately 25% of all players participating in all forms of competition (unpublished VSF records). The purpose of this study was to describe the trends in injuries to squash players lodging an insurance claim over a nine year period. Details of injuries and injury trends assist in identifying priority areas such as injuries with a high incidence, more severe injuries and/or costly injuries for future injury prevention strategies.

## **METHODS**

When a VSF-insured squash player is injured whilst playing squash and requires treatment, they can claim the medical treatment costs and any associated loss of income if they are unable to work, through the VSF squash

insurance scheme. Once a player notifies the VSF that they have sustained an injury, they are supplied with a sports insurance claim form. This is a generic form covering all sports insured by the particular company. The injured player completes the form and returns it to the VSF, where a copy is made and kept on-file, and the original sent to the insurance company. The treating physician, an official from the player's club, and the injured player all sign the form to certify the authenticity of the injury.

Data were extracted on all cases of insured players who lodged squash injury insurance claims through the VSF during the period January 1993 – December 2001, inclusive. As only insured players have insurance coverage organised by the VSF, the sample only relates to all interclub pennant players in Metropolitan Melbourne and inhouse-competition country Victorian players; it does not include social players. The number of insured players over the nine-year period was obtained from the formal records of the VSF. Injury rates for each year of the audit period were calculated as the number of injuries divided by the number of insured/registered players for that year, and were expressed per 1000 insured/registered players. Linear regression analysis was used to assess the trend of the number of insured players over the nine year period as well as the trend in injury rates per 1000 insured players.

Over the study period, there were changes to the private health insurance schemes in Australia. The number of Victorians with private hospital insurance cover and private ancillary services health insurance coverage for the nine-

years covered in this study was obtained from the Private Health Insurance Ombudsman Annual Report.<sup>8</sup> This data was used to compare squash injury insurance claim trends with the proportion of people with private health insurance coverage.

Three insurance companies provided coverage over the audit period, and four variants of the insurance claim form were used. Overall, there was little variation in the information describing the circumstances and nature of injuries over the audit period, however information collected on injury treatment did change. The more recent claim forms also allowed the capture of more detailed information regarding the injury details.

The insurance claim data was extracted manually onto a data record sheet. Data available from the insurance claim records included: player demographic details (e.g. gender, date of birth, occupation) and injury details (e.g. date of injury, nature, cause, diagnosis). No personal identifying information was extracted from the records to protect the privacy of the injured players. All data was coded according to the Australian Sports Injury Data Dictionary.<sup>9</sup> The injury diagnosis data items were coded, by a medical practitioner, using the Orchard Sports Injury Classification System (OSICS).<sup>9</sup>

Information on the amount of money paid-out to claimants was obtained from the current insurance company. This injury expense data was only available

from January 1999 to July 2001. The cost of the injuries most frequently claimed for, and the cost and type of the most costly injury, were identified.

Once coded, the data was double entered and transferred into the Statistical Package for Social Sciences (SPSS) Version 11.0 for statistical analysis. Descriptive statistics including proportions and associated 95% confidence intervals were calculated. T-tests, chi-square tests and linear regression analysis were performed to determine the association between gender and age of injured players as well as trends in injury rates. For the chi-square analyses, the age of injured players was categorised into players aged <40 and those aged  $\geq 40$  years at the time of injury, because 40 years was the mean age of claimants. The body region injured was categorised into a) head/face/neck, b) trunk, c) upper limbs, d) lower limbs, e) hip/groin/buttocks. The nature of the injury was categorised into a) superficial and lacerations, b) fracture/dislocation, c) sprain, d) strain, e) dental injury, f) pain (not injury), and g) other.

## RESULTS

Over the nine-year period, 695 insurance claim forms were lodged with the VSF. This corresponds to approximately 77 insurance claim forms lodged by insured squash players per year. A total of 783 injuries were reported on these claim forms. The average annual injury rate was 13.5 injuries per 1000 insured players.

Table 1 presents the injury rate trends, expressed per number of insured players over the nine years. The number of insured players decreased significantly over the nine years (slope of the trend line = -302.5 95%CI -340.5, -264.5). The rate of injury, adjusted for the decline in insured numbers also declined significantly over the nine years (slope of the trend line = -1.45 95%CI -2.0, -0.9).

*<Insert Table 1 about here>*

Almost two-thirds of the squash injury claimants were male (60.7%). The mean age of all injured claimants was 39.7 years (95% CI: 39.7, 41.1), with more than half being aged at least 40 years. The injured male squash players were significantly older than injured female players (41.0 years vs 39.5 years; 95%CI for difference: 0.07, 2.94). Over the nine year period, the age of injured players significantly increased (slope of the trend line = 1.02; 95% CI: 0.72, 1.32). One-quarter of the injured squash players were professionals (24.4%), with a further 13.2% having occupations involving advanced clerical work; 12.6% were managers and 12.4% intermediate clerical, sales or service work.

At the time of injury, the majority of players were participating in a competitive game (83.0%); a further 16.7% were training and 0.3% were undertaking warm-up. Almost 95% of the claim forms returned to the VSF indicated that the injury was a new, not recurring, injury.

Table 2 lists the causes of injury as reported by the squash players. Over 15% of claimants did not specify the cause of the injury event other than to say 'playing squash'. No significant associations were found between the cause of injury and the two categories of player age ( $<40$  or  $\geq 40$ ), or gender.

*<Insert Table 2 about here>*

Table 3 summarises the ten most commonly injured body regions reported by the injured players. Together, these ten body regions accounted for 87.8% of all injuries. Combined, injuries to the neck, head, face and mouth (including eye and dental injuries) accounted for 8.2% of all injuries. There were eight eye injuries accounting for 1.0% of injuries. There was no significant association between the injured body region and either gender or age.

*<Insert Table 3 about here>*

Table 4 displays the nature of the injuries sustained. There was no significant difference in the nature of injury in males and females.

*<Insert Table 4 about here>*

As shown in Table 5, over three-quarters (86.1%) of the ten most common injury diagnoses related to the lower limb (knee/calf/Achilles tendon/ankle). The ten most common injury diagnoses accounted for only 50.3% of the injury cases, with a large number of different injury diagnoses reported (162 diagnoses).

*<Insert Table 5 about here>*



Figure 1 shows the trends in the insurance claim injury rates and compares these with the proportion of Victorians with private health insurance over the nine year period. In 1999, the Australian Government introduced a tax incentive to encourage more Australians to have their own private health insurance. Figure 1, shows that the injury rate per VSF-insured players declined as the proportion of the general population covered by private health insurance increased.

*<Insert Figure 1 about here>*

The average cost of paid squash claims to Victorian players for the period, 01/01/2000 to 30/06/2001 was AUS\$495. An eye injury had the largest payout of for one injury, followed by an Achilles rupture injury costing AUS \$3400. The mean cost of an eye injury was AUS\$1290, though this ranged from AUS \$25 to \$5000. The cost of knee injuries ranged from AUS\$45 to AUS\$2339 with an average of AUS\$711. The average pay-out for a calf muscle injury was AUS\$278. The total amount of money paid for squash injury claims for the year 2000 was AUS\$19,747.02. It is important to recognise that these insurance payments exclude many other indirect monetary and non-monetary costs associated with injuries, such as pain and suffering and reduced quality of life.

## DISCUSSION

There is currently no standardised collection of sports injury data in Australia. Such data is collected from various sources including hospital admission, emergency department presentations and self-report surveys. Insurance claims

have the potential to supplement these sources. The VSF squash insurance claim database allowed investigation of trends in the incidence of severe squash injuries, as well as details of the injuries sustained.

The demographic profile of our injured players reflects the general squash playing population in Melbourne. There is unlikely, therefore, to be any significant selection bias in this sample of injured players. In a self-report study of 303 Melbourne adult squash players in 2000,<sup>10</sup> the mean age of players was 40.5 years, compared to 39.7 years of age for the injured players making insurance claims over the past nine years. The majority of injured players submitting an insurance claim were male, this is in accordance with more males participating in the sport than females. This gender differential has been reported in other studies.<sup>5, 11</sup>

Overall, the number of insured players significantly declined over the nine year period. It is likely that a large number of squash venue closures over this period of time contributed to the decrease in player numbers. There has also been a transferral of players from formal competition (interclub pennant) to inhouse competition and social play which would explain some of the decline in insured player numbers. Even after adjusting for the annual number of insured players, there was a significant decline in injury rates over this period. It is unlikely that this can be explained by a significant decrease in injury risk, as there have been no changes to the game of squash itself, nor major changes in equipment that would explain such a decline.

In 1999, a new insurance company took over the insurance coverage of VSF players. In that year, the insurance claim injury rate was less than half that of the previous year. The only difference in the new insurance claim procedures was that the players were required to provide more injury details, and it is not expected that the differences in the content of the form would be reflected in an injury rate decline. Furthermore there were very few differences in the insurance policies pre and post 1999 and none influencing the eligibility criteria for who could make a claim. The only change was that the current insurance company pays 75% of non-government (Medicare) funded expenses, compared to the previous policy which only covered 50% of such costs. However, since the current policy actually covers more of the out-of-pocket expenses of the injured player, than did the previous policy, it is unlikely that this would have led to a decline in claims.

A decline in the number of forms forwarded by the VSF to the insuring companies over the nine-year period was found, and this would account for some for the decline in claims paid out by the insurance companies. There were also changes to the Australian health care insurance system over the period. In 1999/2000, the Federal Government implemented a major initiative to encourage people to take out private health insurance. The increase in the percentage of individuals being covered by private health insurance post this initiative, may also have contributed to the decline in injury claims being made through the VSF insurance scheme.<sup>8</sup> It is possible that injured players sought

compensation from their health insurance funds, rather than from their sports insurance.

One third of all injured players in the present sample, did not record their level (standard) of play on the insurance claim form. Although other player demographic information was available for analysis, there was no association between injury incidence nor nature of injury and the age and gender of players. Further research is required to better understand the relationship between age, gender and risk of injury.

The reported types of injuries that these players sustained were similar to other player self-report, medical and hospital data sources.<sup>1</sup> The proportion of lower limb injuries is well within the previously reported range of 32-58%.<sup>1</sup> Unfortunately little is known about sports injury rates in Australia, making comparison between sports impossible. Similarly international squash studies have not presented injury rates.

The rate of eye injury was not high when compared to the rate of other injuries. However, the potential severity of these injuries requires consideration. Injuries to lower extremities such as an Achilles tendon rupture or an anterior cruciate ligament tear can be very disabling, yet they can be effectively treated allowing the player to return to normal activities. Unfortunately, injuries to the eyes can result in permanent visual damage or even loss of an eye. Not only is it very difficult to play squash with one eye, normal day to day activities could be

permanently affected. In addition to the physical and psychological outcomes of a severe eye injury, the associated costs with treatment are very high, when compared to the more common lower extremity injuries.

This study included insured, competitive players only, and therefore may not be applicable to a wider group of squash players. Moreover, the results presented underestimate the problem of injuries to the community of squash players. There is motion from the VSF to have all Victorian players insured for injuries resulting from them playing squash. This would allow a greater representation of injury data collected through this insurance surveillance.

A limitation of the claim forms used is that they have no scope to detail exposure time for players, and as such injury rates based on time spent training and competing could not be calculated. This information is important to aid the development of prevention strategies with relation to when an injury is likely to occur. This information could easily be gathered from minor changes to the form.

In conclusion, the data extracted from insurance claim insurance claim data has provided detailed information of the body region injured, the cause and nature of the injury. It has also allowed the identification of trends in injury rates. The surveillance of squash injuries, whilst not preventing injuries in it self, provides vital foundation information for the generation of priorities for further research. The factors relating to injuries as identified through the insurance database require consideration. Future injury prevention strategies should incorporate

injuries that are most common, most severe and most costly and not single out high incidence cases.

### **ACKNOWLEDGEMENTS**

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**Table 1: Trend in injury rates per number of players over a nine year period**

Year claim form returned to VSF	Number of insured players	Number of reported injuries (n=783)^	Number of injuries per 1000 insured players	Number of injured players (n=695)*	Number of injured players per 1000 insured players
1993	7150	131	18.3	117	16.4
1994	6850	116	16.9	101	14.7
1995	6700	100	14.9	90	13.4
1996	6400	111	17.3	98	15.3
1997	6100	94	15.4	83	13.6
1998	5850	80	13.7	68	11.6
1999	5600	63	11.3	59	10.5
2000	5050	34	6.7	30	5.9
2001	4650	32	6.9	32	6.9
AVERAGE	6039	84.56	13.5	75.33	12.0

<sup>^</sup>n=22 injuries missing a date of injury occurrence

<sup>\*</sup>n=17 players missing a date of injury occurrence

**Table 2. Self-reported causes of injury events leading to a squash injury claim in Victoria (n=542 injuries)\***

Cause of injury	Proportion of reported injuries	95% CI
<b>Game movement or play</b>		
Unspecified acute over-exertion of a body part	20.5	(17.1, 23.9)
Playing	15.1	(12.1, 18.1)
Sudden change of direction	14.2	(11.3, 17.1)
Playing/retrieving a shot	10.5	(7.9, 13.1)
Running	8.7	(6.3, 11.1)
Fall, slip or trip	5.2	(3.3, 7.1)
Other	5.9	(3.9, 7.9)
	<b>TOTAL 80.1</b>	
<b>Impact</b>		
Struck by/contact with squash racquet	9.8	(7.3, 12.3)
Contact with opponent	4.6	(2.8, 6.4)
Contact with squash court wall/door	4.1	(2.4, 5.8)
Struck by/contact with squash ball	0.7	(0.0, 1.4)
	<b>TOTAL 19.2</b>	
<b>Overuse/Other</b>		
Overuse/degenerative	0.5	(0.0, 1.1)
Shoe split causing player to roll ankle	0.2	(0.0, 0.6)

\* n=153 missing values

**Table 3. The ten most commonly injured body regions in squash players making an insurance claim (n=783 injuries)**

Body region	Proportion of reported injuries	95% CI
Knee	20.1	(17.3, 22.9)
Calf	17.1	(14.5, 19.7)
Ankle	10.1	(8.0, 12.2)
Back	9.6	(7.5, 11.7)
Head/face/mouth	8.2	(6.3, 10.1)
Achilles tendon	7.3	(5.5, 9.1)
Shoulder	6.5	(0.1, 4.8)
Other (combined)	19.6	(16.8, 22.4)
Not specified	1.5	(0.6, 2.4)

**Table 4. Nature of the injuries sustained by squash players making an insurance claim (n=783 injuries)**

Nature of injury	Proportion of reported injuries	95% CI
Strain	38.1	(34.7, 41.5)
Sprain	19.5	(16.7, 22.3)
Superficial*	8.3	(6.4, 10.2)
Dental injury	5.1	(3.6, 6.6)
Open wound/laceration	3.1	(1.9, 4.3)
Dislocation	2.7	(1.6, 3.8)
Fracture^	2.6	(1.5, 3.7)
Eye injury	1.0	(0.3, 1.7)
Not specified	9.7	(7.6, 11.8)
Symptom (pain – not injury)	8.8	(6.8, 10.8)
Other	1.1	(0.4, 1.8)

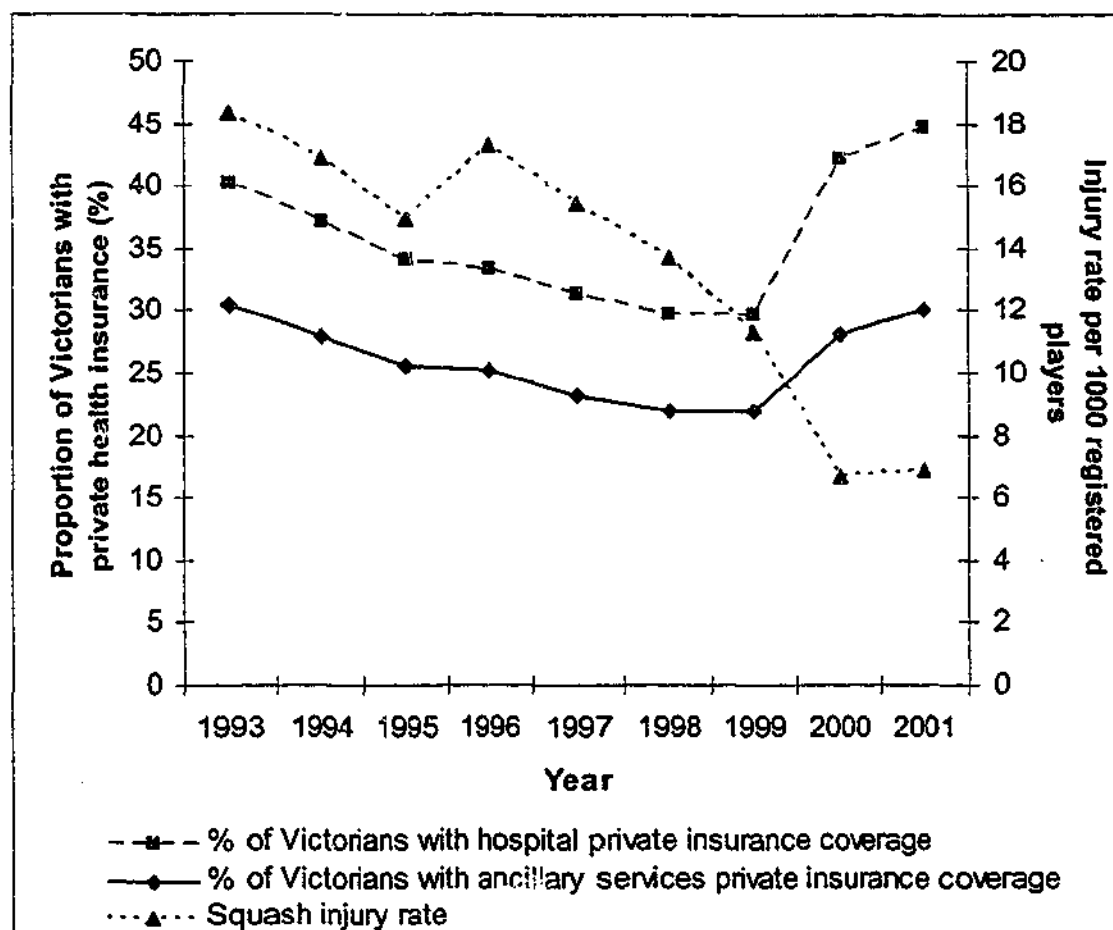
\* includes bruising, blisters, swelling, inflammation and grazes

^ includes one stress fracture

**Table 5. The top ten most frequent injury diagnoses in squash players making an insurance claim (n=783 injuries)**

<b>Injury diagnosis</b>	<b>Proportion of reported injuries</b>	<b>95% CI</b>
Calf muscle strain	17.2	(14.6, 19.8)
Achilles tendon rupture or strain	7.4	(5.6, 9.2)
Ankle lateral ligament sprain	6.9	(5.1, 8.7)
Fractured tooth	5.1	(3.6, 6.6)
Anterior cruciate ligament sprain, tear or rupture	3.8	(2.5, 5.1)
Knee joint cartilage damage	2.2	(1.2, 3.2)
Hamstring strain or tear	2.0	(1.0, 3.0)
Knee pain undiagnosed	2.0	(1.0, 3.0)
Tennis elbow	1.9	(0.9, 2.9)
Knee injury (not specified)	1.8	(0.9, 2.7)
Other (combined)	49.7	(46.2, 53.2)

**Figure One: Comparison of squash injury rate per insured/registered players and private health insurance coverage**



## **Chapter 5: Australian trends in player attitudes towards protective eyewear**

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Treatment facilities have been shown to be a valuable source of specific descriptive injury data for the severe spectrum of injuries. From these formal records, injury rates are able to be calculated, and priority prevention areas can be subsequently identified. The preceding Chapters Three and Four have discussed the spectrum of severe squash injuries, and injury trends over time. It was established in the preceding Chapters that squash eye injuries were a considerable problem in terms of incidence, severity and associated costs. The question is why aren't eye injuries in squash being prevented? An investigation into the rate of protective eyewear use was described as a necessity.

At the start of this program of research, three Australian squash player surveys had been conducted to date (Genovese, Lenzo et al. 1990; Finch and Vear 1998; Eime, Finch et al. 2002). As part of these, players' eyewear behaviours and attitudes towards the use of protective eyewear were investigated and described. Geller, explains that people must have favourable attitudes towards specific protective equipment if they are expected to adopt using it (Geller 1998). It is for this reason that a study of the three Australian squash player surveys was conducted, to review any progress in players attitudes towards protective eyewear, and to inform future injury prevention strategies based on the use of this equipment. The review is presented in this Chapter Five. In particular, the trends in players' attitudes towards protective eyewear were examined. It is concluded from this paper that players' current attitudes do not favour the use of appropriate protective eyewear, and that the far majority of players are not adequately protecting their eyes. Mandating eyewear use for all Australian squash players is

therefore not deemed to be an appropriate strategy at this time, due to the current standing of players' eye safety knowledge, attitudes and behaviours.

The peer reviewed study *Have the attitudes of Australian squash players towards protective eyewear changed over the past decade?* by R Eime and C Finch was published in, *British Journal of Sports Medicine* 2002; 36: 442-445.



## Monash University

**Declaration for Thesis Chapter Five**

In the case of *Chapter Five*: paper titled "*Have the attitudes of Australian squash players towards protective eyewear changed over the past decade?*", contributions to the work involved the following:

Name	% contribution	Nature of contribution
Rochelle Eime	70%	Statistical analysis and writing of paper
Caroline Finch	30%	Assistance with methodology and writing of paper, as well as advice on analysis

**Declaration by co-authors**

The undersigned hereby certify that:

- (1) they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;
- (2) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;
- (3) there are no other authors of the publication according to these criteria;
- (4) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit; and
- (5) the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s)

Injury Risk Management Research Centre, University of New South Wales, and Department of Epidemiology and Preventive Medicine, Monash University

Signature 1

Signature 2

		Date
		16/1/04
		16/01/04

## ORIGINAL ARTICLE

## Have the attitudes of Australian squash players towards protective eyewear changed over the past decade?

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**Objective:** To assess indicative trends in the use of protective eyewear by Australian squash players and their attitudes towards its use since 1989.

**Methods:** Data were extracted from three Australian surveys of squash players conducted in 1989, 1995, and 2000. Responses to directly similar attitudinal questions relating to protective eyewear use from each survey were compared. The proportion of players giving each response was calculated for each survey, along with 95% confidence intervals for the differences between the 2000 survey and those from the earlier surveys.

**Results:** Self reported use of protective eyewear ranged from 10.0% in 1989, to 8.6% in 1995, and 18.8% in 2000. However, only 8.9% of the players surveyed in 2000 actually wore appropriate standards approved polycarbonate lens eyewear. This can be compared with 8.0% and 2.0% of players who reported wearing appropriate polycarbonate lens eyewear in the 1989 and 1995 surveys respectively. Compared with the 1995 survey, significantly more players in 2000 believed that more players should wear protective eyewear (95% confidence interval (CI) for difference 1 to 18). A significantly higher proportion of players also supported the compulsory use of protective eyewear by juniors in 2000 than in both 1989 (95% CI for difference 6 to 24) and 1995 (95% CI for difference 5 to 22). No other attitudes had significantly changed over the decade.

**Conclusion:** These data suggest that self reported use of protective eyewear has probably increased over the past decade. However, many players report wearing inappropriate eyewear. A transition from positive attitudes to appropriate eyewear behaviours is required before mandatory protective eyewear use can be effectively introduced.

Squash is a popular sport, with about 15 million players in 135 nations participating annually on 52 575 courts.<sup>1,2</sup> It has been shown to be one of the sports most commonly associated with eye injuries, accounting for 7.0-49.0% of all sporting eye injuries, depending on the source of the injury data.<sup>3,4</sup> Reported eye injury incidence ranges from 3.7 to 33.3 per 100 000 playing sessions.<sup>5-7</sup> The most recent Australian study reported 64 eye injuries per 100 000 squash participants.<sup>8</sup> Although most eye injuries are not severe, they have the potential to cause permanent visual impairment.<sup>9-11</sup>

Eye injuries in sports are almost completely preventable with standards approved polycarbonate protective eyewear.<sup>12-14</sup> However, a number of studies have shown that only 9-10% of squash players choose to wear protective eyewear.<sup>15-17</sup> Some players report wearing eyewear that is either not protective or that is actually risk enhancing, such as lensless eyewear, prescription glasses, industrial eyewear, and contact lenses.<sup>18-20</sup> It has been suggested that prevailing attitudes towards protective equipment are a major influence of protective equipment behaviours.<sup>21,22</sup>

To date, there have only been four published studies, two Australian<sup>23,24</sup> and two British<sup>25,26</sup>, investigating players' self reported eyewear behaviour. Three of these studies also reported players' attitudes towards protective eyewear use.<sup>23-25</sup> A third Australian study has recently been conducted.<sup>26</sup> Consistently, these studies have found few adult players to be supportive of compulsory protective eyewear, but many believe it should be compulsory for junior players.<sup>23-26</sup>

Since 1989, three surveys of squash players' attitudes towards, and use of, protective eyewear have been conducted in Australia. Protective eyewear was made compulsory for junior and doubles players throughout Australia in 1997. Since

this regulation was introduced, there have been no concerted efforts to further promote protective eyewear use. In the absence of such efforts, especially concentrated on the adult population who are not the target of this regulation, it could be expected that there would be no substantial change in rates of protective eyewear use by squash players. The aim of this study was to describe the indicative trends in protective eyewear use and attitudes towards such use, to see if this was, indeed, the case.

## METHODS

A search of the literature specific to squash players' protective eyewear behaviours and associated attitudes towards its use was conducted. Three studies, all Australian, conducted in 1989,<sup>23</sup> 1995,<sup>24</sup> and 2000<sup>26</sup> were identified as having similar methodologies and survey questionnaires. Table 1 describes the key methodological methods used in each of these studies. Although the studies were conducted in different Australian states, and different sampling frames were used, they asked similar questions about player attitudes.

The numbers and percentages of squash players responding to behavioural and attitudinal questions relating to protective eyewear use was extracted from each of the published studies and compared. For each study, protective eyewear rates during squash were determined from players' self reports. Information about the type of eyewear used was also obtained, and the reported eyewear was categorised as "appropriate" or "inappropriate". Appropriate eyewear was defined as polycarbonate lens/standards approved squash eyewear. As no other eyewear is suitably protective,<sup>12-14</sup> all other eyewear was classified as inappropriate.

In each of the three studies, players were asked to report their attitudes towards four or five statements about

**Table 1** Methodology comparisons between three Australian studies of players' attitudes towards the use of protective eyewear

	1990 <sup>11</sup>	1996 <sup>12</sup>	2000 <sup>13</sup>
City of study	Perth	Melbourne	Melbourne
Timing of survey	1989	July-October, 1995	June, 2000
Sampling of venues	Not known (n=3)	Randomly selected venues from Eastern metropolitan Melbourne (n=7)	Randomly selected venues from Eastern metropolitan Melbourne (n=3)
Selection of players	Distribution by hand to players on 1 particular night	350 questionnaires left at reception desk for players to pick up	All adult squash players presenting at randomly selected sessions over a 3 week period
Type of players surveyed	Pennant squash players	All squash players attending one of the venues	All adult squash players
Number of survey respondents	165	197	303
Response rate	99% of players approached	56% of distributed questionnaires	98% of players approached
Age	Not reported	40% aged 24-44 years, 15% aged 15-22 Mean 41 years. Adults only	
Sex	53% male	65% male	66% male
Eyewear use question	Protective eyewear use questions not stated	"Do you wear protective eyewear?" Type of protective eyewear worn	"Do you wear protective eyewear?" Type of protective eyewear worn

Table heading shows year of study and reference

protective eyewear use on a five point Likert scale (strongly agree, agree, uncertain, disagree, strongly disagree) (table 2). The wording of three of the statements was exactly the same in all surveys. Players' attitudes towards one identically worded statement were available for the 1995 and 2000 studies only. The remaining statement, although having the same meaning in all studies, was worded: "protective eyewear should be made compulsory" in the 1989 and 1995 studies. In the 2000 study, the words "for all players" were included at the end of this statement.

For comparative purposes, responses in the "strongly agree" and "agree" categories were combined, as was the data in the "strongly disagree" and "disagree" categories. For four of the attitudinal questions the "strongly agree/agree" response was the most desirable (table 2). For the remaining question, the "strongly disagree/disagree" response was most desirable (table 2). Ninety five percent confidence intervals were calculated for the differences in attitudes from the 2000 survey and earlier surveys.<sup>23</sup> A confidence interval containing the value "0" was taken to indicate no significant difference between the comparison surveys.

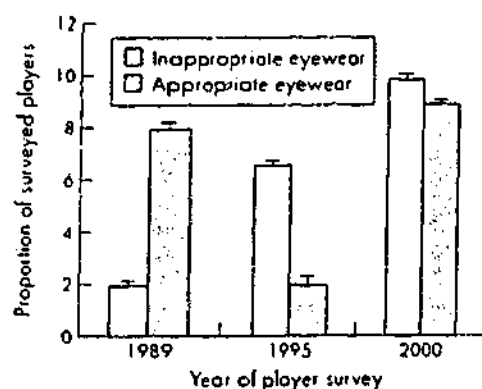


Figure 1 Indicative trends in self-reported eyewear use by Australian squash players, 1989-2000. The 95% confidence interval is given.

## RESULTS

### Protective eyewear behaviours

Figure 1 summarises the rates of protective eyewear wearing in the three studies. Over the 11 year period, self-reported protective eyewear use changed from 10% in 1989 to 8.6% in 1995, then increased to 18.8% in 2000. However, the rate of self-reported use of inappropriate eyewear also increased over time. Nevertheless, levels of appropriate protective eyewear use were highest in the most recent survey.

### Attitudes towards protective eyewear use

Table 2 presents a comparison of players' attitudes across the three studies. Overall, this suggests that there have not been major changes in players' attitudes towards the risk of eye injuries since 1989. There was a slight, but non-significant, increase in players' positive responses to the statement that eye injuries are a particular problem in squash, from 1995 to 2000, with comparison data not available from the 1989 survey. In the 2000 survey, significantly more support for general protective eyewear use was given with 67.0% of players stating that they believed more players should use protective eyewear, compared with only 57.0% of players in 1995. There was no significant difference between the 2000 and 1989 survey responses to this attitudinal statement.

The extent of players' positive views towards the implementation of compulsory use of protective eyewear for all players ranged from 17.0% of all surveyed players in 1989 and 16.0% in 1995 to 24.0% in 2000. However, this increase was not significant. Although most players in 2000 did not support compulsory protective eyewear for all players, a high proportion (69.0%) were in favour of it for junior players. There was a significantly higher level of support for junior eyewear use in 2000, compared with both earlier surveys. Most players in each study indicated that they would not stop playing squash if protective eyewear was made compulsory, and this attitude did not vary significantly across the studies.

## DISCUSSION

Before compulsory use of any form of protective equipment can be effectively implemented, efforts need to be made to

Table 2 Comparison of players' attitudes towards protective eyewear use in squash from three Australian studies

	Percentage of all players			95% confidence intervals for the differences between the 2000 survey results and earlier surveys	
	2000 <sup>a</sup> (n=303) (A)	1995 <sup>b</sup> (n=197) (B)	1989 <sup>c</sup> (n=165) (C)	2000 v 1995 (A-B)	2000 v 1989 (A-C)
Strongly agree/agree					
Eye injuries are a particular problem in squash	61	57	-	[-5 to 13]	-
More players should use protective eyewear	67	57	65	[1 to 18]	[-7 to 11]
Protective eyewear should be made compulsory for all players	24	16	17	[0 to 15]	[-1 to 14]
Protective eyewear should be made compulsory for junior players	69	56	54	[5 to 22]	[6 to 24]
Strongly disagree/disagree					
I would stop playing if protective eyewear was made compulsory	65	64	71	[-8 to 9]	[-15 to 2]

address player attitudes and how these have changed over time.<sup>24</sup> If voluntary use of protective equipment among players is not at an acceptable level before the introduction of a regulation requiring its use, then in the absence of strong penalties and regulatory monitoring, its introduction is unlikely to be successful as there will be little support for it. As has been shown with the introduction of mandatory bicycle helmets, a broad level of acceptance for protective equipment is essential before mandatory use can be successful.<sup>25</sup> For example, voluntary use of bicycle helmets in Victoria, Australia was raised to 36% before mandatory legislation.<sup>26</sup> Attention should therefore be given towards player education about protective equipment use before a regulation is introduced. Identification of player attitudes towards such equipment is necessary to guide this process.

This study has compared indicative results from three Australian studies, which surveyed squash player behaviours and attitudes associated with protective eyewear use. It is recognised that there are limitations associated with these comparisons, as the studies did not all have consistent methodology. For example, the 1989 survey included only competition players. Players with more squash experience are significantly more likely to report playing with protective eyewear, than those players with less experience.<sup>27</sup> Whereas only adult players participated in the 2000 survey, there was a small proportion of junior players in the 1995 survey, and the age distribution of players from the 1989 survey was not reported, although it was probably mainly adults. The 1995 survey relied on a volunteer sample of players and this may have led to a biased sample, as players that wore protective eyewear may have been more inclined to participate in the survey. Alternatively, it could be that the method of player recruitment in the 1995 study was so different from that in the other studies that it influenced the results. Given these limitations, it is possible that the reported rates of eyewear use in the two earlier surveys were overestimated. However, it is unlikely that this would have led to a differential bias in the reporting of appropriate versus inappropriate eyewear use. The information available did not allow a direct comparison of player characteristics across surveys to be made. It should also be pointed out that each survey potentially excluded any player who was absent because of an eye injury at the time of the survey.

Overall, the indicative trends presented in this paper suggest that self reported voluntary protective eyewear use has nearly doubled since 1989. There was no a priori expectation that rates of protective eyewear use would have changed over the past decade, as there has been no active promotion of protective eyewear throughout this period in adult players. However, the high, and apparently increasing, proportion of

players reporting inappropriate eyewear use is a concern. Squash standards approved polycarbonate lens eyewear is the only eyewear that provides suitable protection. All other eyewear reported has been shown to potentially heighten the risk of ocular damage.<sup>28,29</sup>

A comparison of the attitudes reported in these three Australian squash player surveys suggests an encouraging change in players' attitudes towards the implementation of compulsory protective eyewear for junior players. However, the proportion of players favouring compulsory protective eyewear for all players is much lower than that supporting use of such equipment by junior players. The compulsory use of protective eyewear for junior players introduced in 1997 in Australia<sup>30</sup> may have contributed to these trends.

Use of protective eyewear while playing squash is compulsory at many clubs in certain states and provinces in the United States of America and Canada.<sup>31</sup> However, its use is not as yet mandatory for Australian adult players, nor for players from the United Kingdom or Europe.<sup>32</sup> The implementation of mandatory protective eyewear use in parts of the United States of America was reportedly met with minimal player resistance and has eliminated the occurrence of most eye injuries caused by squash.<sup>33</sup>

It is expected that, if protective eyewear use was made compulsory for adult squash players in Australia, the occurrence of eye injuries in squash would subsequently be minimised. Ideally, future strategies for eye injury prevention in squash will assist players in the transition to appropriate protective eyewear use and their acceptance of this behaviour change. It is possible that, if protective eyewear is made compulsory for all players before, or without, a coincident increase in knowledge about the risks of injury and what is appropriate eyewear, then there may not be high compliance with this ruling.<sup>34</sup> Nonetheless, it is likely that managers of squash venues would support this regulation and not risk litigation from injured players.

In summary, this study has found that many players do not wear suitable protective eyewear when playing squash. Indicative trends suggest an increasing proportion who report wearing protective eyewear, but a large number of players actually using inappropriate eyewear. A lack of knowledge about the risks of eye injury and of what eyewear is suitably protective may contribute to the low rates of protective eyewear use. However, there is also a suggestion that players' attitudes do not currently support widespread mandatory protective eyewear for all players. It is recommended that the results of this study be considered by squash bodies, eyewear manufacturers, venue managers, and players associations for the development of eye injury prevention strategies for this sport. Future research is required to explore strategies to

### Take home message

It is important to understand the attitudes of squash players towards protective eyewear before its use is made compulsory. Many players do not wear appropriate eyewear when playing. Education strategies are required to increase the use of appropriate protective eyewear, while decreasing the use of inappropriate eyewear.

enhance protective eyewear through squash venues, as well as the best ways to educate players of the risk of eye injury and of appropriate eyewear for the game of squash.

### ACKNOWLEDGEMENTS

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## **Chapter 6: Eye injury safety practices of squash venues**

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It is evident from the review presented in Chapter Four, that Australian squash players' current knowledge about eye injury risk, and of appropriate eyewear is limited. This, combined with unfavourable eye safety attitudes is not conducive to many adult players wearing appropriate eyewear. The implications of this current situation, in relation to the prospect of a compulsory eyewear regulation for all Australian players have also been discussed in Chapter Two. The recommendations from the paper presented in Chapter Five, included research to explore strategies to enhance protective eyewear through squash venues.

Interviews with squash venue managers were conducted to assist with understanding the underlying environmental influences of the eyewear behaviours, knowledge and attitudes of players. Through these personal discussions, the squash venue eye safety policies and practices were also investigated.

A qualitative method was used because of the exploratory nature of this study component. The use of semi-structured interviews enabled flexibility in the ordering of questions, and allowed participants to respond to the broader contextual issues framing their explanations about safety equipment (Hudelson 1996). An interview guide or theme list was used to guide the interviews, however participants were encouraged to discuss, in-depth, any issues that had particular relevance to them. Probing was used to encourage participants to elaborate on certain questions or topics that were relevant to their own beliefs, intentions and thoughts (Bernard).

This Chapter Six presents the results of this study.

The paper titled *Knowledge, beliefs and attitudes of squash venue operators relating to use of protective eyewear* by R Eime, C Finch, N Owen, S Gifford and P Vear was published in the peer review journal, *Injury Control and Safety Promotion* 47-53 11(1) 2004.

## Monash University

Declaration for Thesis Chapter Six

In the case of *Chapter Six*: paper titled "*Knowledge, beliefs and attitudes of squash venue operators relating to use of protective eyewear*", contributions to the work involved the following:

Name	% contribution	Nature of contribution
Rocheile Eime	65%	Conduct of the research, analysed the data and wrote paper
Caroline Finch	15%	Study design advice and contributions to writing
Neville Owen	10%	Study design advice and contributions to writing
Sandra Gifford	10%	Advice on qualitative methodologies and contributions to the writing of the paper

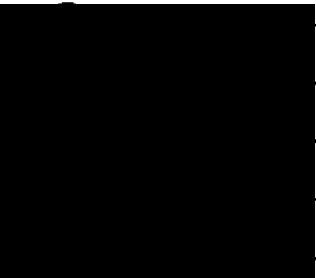
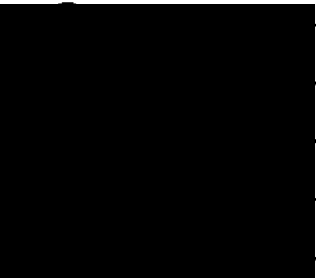
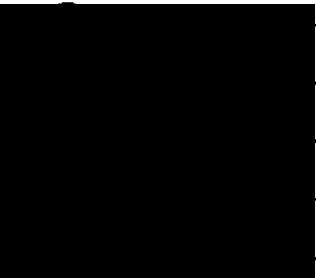
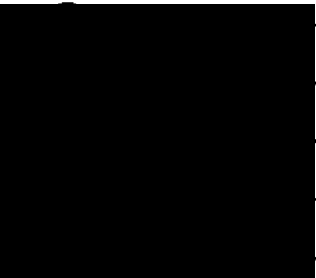
Declaration by co-authors

The undersigned hereby certify that:

- (1) they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;
- (2) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;
- (3) there are no other authors of the publication according to these criteria;
- (4) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit; and
- (5) the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s)

Injury Risk Management Research Centre, University of New South Wales, and Department of Epidemiology and Preventive Medicine, Monash University

		Date
Signature 1		16/1/04
Signature 2		16/01/04
Signature 3		30/01/04
Signature 4		22/2/04





ORIGINAL PAPER

## Knowledge, beliefs and attitudes of squash venue operators relating to use of protective eyewear

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### Abstract

Sports venues are in a position to potentially influence the safety practices of their patrons. This study examined the knowledge, beliefs and attitudes of venue operators that could influence the use of protective eyewear by squash players.

A 50% random sample of all private and public squash venues affiliated with the Victorian Squash Federation in metropolitan Melbourne was selected. Face-to-face interviews were conducted with 15 squash venue operators during August 2001. Interviews were transcribed and content and thematic analyses were performed. The content of the interviews covered five topics: (1) overall injury risk perception, (2) eye injury occurrence, (3) knowledge, behaviors, attitudes and beliefs associated with protective eyewear, (4) compulsory protective eyewear and (5) availability of protective eyewear at venues.

Venue operators were mainly concerned with the severe nature of eye injuries, rather than the relatively low incidence of these injuries. Some venue operators believed that players should wear any eyewear, rather than none at all, and believed that more players should use protective eyewear. Generally, they did not believe that players with higher levels of experience and expertise needed to wear protective eyewear when playing. Only six venues had at least one type of eyewear available for players to hire or borrow or to purchase. Operators expressed a desire to be informed about correct protective eyewear.

Appropriate protective eyewear is not readily available at squash venues. Better-informed venue operators may be more likely to provide suitable protective eyewear.

**Keywords:** prevention; protective eyewear; safety strategies; sports injury; squash.

### Introduction

Sports injuries and their longer term consequences have negative impacts on participation and are a significant determinant of reduced participation in physical activity, particularly for older adults.<sup>1</sup> The prevention of sport-related injuries is a key element of population health strategies for promoting physical activity. Participation in sport can make significant contributions to the well-being and life options of individuals and sports injuries have major implications for health care costs.<sup>2</sup> The research agenda on sports injury prevention is relatively new,<sup>3,4</sup> and should be built on a sound understanding of the sporting context and the views and opinions of key 'gatekeepers.' Members of sporting organizations and service promoters have the ability to contribute to our understanding of the environmental and social contexts in which sporting injuries occur. Systematizing such knowledge will help to promote a basis for epidemiological studies of injury causation and can do much to inform evidence-based prevention strategies.

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Squash has been reported as one of the sports most commonly associated with eye injuries, with studies identifying squash accounting anywhere from 7–49% of all sporting eye injuries.<sup>6,10</sup> Four of these studies include case reviews of hospital emergency department records from 6 months to 10 years in duration, describing a range of 84 to 5671 injury cases, making comparisons between the studies difficult. It has been estimated that in Australia the incidence of eye injury requiring hospital treatment is 64 eye injuries per 100,000 squash participants per year.<sup>11</sup> Whilst most eye injuries are not severe in nature, there is the possibility of permanent visual impairment, usually from being hit by either the ball or the racquet.<sup>10,12</sup>

Eye injuries in squash are almost completely preventable through the use of appropriate protective eyewear.<sup>10,13,14</sup> Appropriate eyewear for squash is made of polycarbonate lens and meets specified frontal impact requirements.<sup>14</sup> However, surveys of squash players have shown that fewer than 10% of players actually wear appropriate eyewear.<sup>7,15–18</sup> It is also a concern that some players believe that the eyewear they use is protective, when in fact it does not meet the relevant standards.<sup>7,15–18</sup> Inappropriate eyewear can exacerbate or increase the likelihood of injuring an eye.<sup>6,19,20</sup> Such unsuitable eyewear includes normal prescription glasses, open eye guards (lenseless), contact lenses and industrial eyewear.

Squash equipment such as racquets, balls and apparel is widely available for purchase and/or hire at squash venues. In this context, squash venue operators can potentially influence players' safety habits through promoting the availability and use of appropriate protective eyewear. The availability of general protective equipment has been found to vary considerably across sporting venues<sup>21</sup>. Other research has shown that the 'point of sale' of playing equipment is an important influence of the use of safety equipment and the dissemination of safety information.<sup>22</sup> The safety policies and practices of sports venues, including the availability of protective equipment, can play a pivotal role in promoting and influencing the safety practices of players.<sup>21,22</sup> Efforts to decrease the incidence and severity of eye injuries in squash through the widespread use of appropriate protective eyewear, may therefore be informed by initially understanding the current practices and policies of squash venues regarding protective eyewear. The knowledge, beliefs and attitudes of venue operators may be an important determining factor in this context.

## Methods

Semi-structured interviews were conducted to investigate squash venue operator's self-reported knowledge, beliefs, attitudes and behaviors regarding protective eyewear availability at their venue.<sup>23</sup>

Venue managers/co-ordinators of a 50% random sample of Victorian Squash Federation (VSF) affiliated venues (seven private and 17 public venues) were personally invited

to participate in the interview. At public venues, the venue manager was contacted and the equivalent person at the private venues, the squash co-ordinator, was approached. A brief explanation of the interview format was given, with participants (venue managers/co-ordinators) told that the interview was to be recorded and that confidentiality was guaranteed. The length of each interview varied with most lasting 15–20 minutes. A portable tape recorder was used to record each interview. The interviews were then transcribed, and coded to ensure confidentiality of the participant. The study was approved by the Monash University Ethics Committee and conducted in association with the state squash governing body the VSF. A total of 15 interviews were conducted, giving a response rate of 63%. However, two interviews could not be transcribed due to equipment failure, resulting in analysis of 13 interviews. Of those who were invited to participate in the study, but declined, reasons included sickness, work commitments and travel.

A qualitative method was used because of the exploratory nature of the study. The use of semi-structured interviews enabled flexibility in the ordering of questions and allowed participants to respond to the broader contextual issues framing their explanations about safety equipment.<sup>23</sup> An interview guide or theme list was used to guide the interviews; however, participants were encouraged to discuss, in-depth, any issues that had particular relevance to them. Probing was used to encourage participants to elaborate on certain questions or topics that were relevant to their own beliefs, intentions and thoughts.<sup>24</sup>

Interview topics were generated to investigate the current venue practices and policies relating to protective eyewear use (see Table 1). These topics were based upon the content and results of a self-report player survey.<sup>15</sup> Questions were also developed to assess possible relationships between the question topics and the availability of eyewear at squash venues. The aims of the topic questions covered in each interview are shown in Table 1.

## Results

All managers and co-ordinators had some direct squash experience; most classified themselves as high or medium standard players; the majority had participated for more than 10 years. The majority of participants ( $n = 9$ ) were male, and were owners and/or managers of a public squash venue in metropolitan Melbourne. Two male participants were the squash coordinators of a private squash venue.

### Interview data

Thematic analysis of the interview transcripts identified 15 categories. These were then grouped into five themes. Table 2 provides a listing of the themes, categories and the number of times that each response was identified from the transcripts.

Table 1 Interview topics.

Overall injury risk perception: knowledge and thoughts about the most common injuries in squash, the causes of these injuries and perceived injury risk
Eye injury occurrence: knowledge and experience of squash related eye injuries and perception of eye injury risk
Knowledge, behaviors, attitudes and beliefs associated with protective eyewear: prevention of eye injuries, inappropriate and appropriate eyewear, reasons why players do or do not wear protective eyewear, and increasing the use of protective eyewear
Compulsory protective eyewear: attitudes towards compulsory protective eyewear use for all players, and beliefs about how players would react to this regulation
Availability of protective eyewear at venues: whether or not venues had eyewear available for persons to hire/borrow and/or purchase, and their thoughts about the availability issue

Table 2. Themes, categories and responses of the 13 squash venue managers and coordinators who were interviewed.

Theme	Category	Interviewee responses (number of responses indicated in brackets)
Overall injury risk perception	Body region	Calf muscle (4); Achilles tendon (3); Eye (3); Head and face (excluding the eye) (2); Arm (2); Lower leg (not further specified) (2); Shoulder (1); Groin (1)
	Causes of injury	Racquet (3); Ball (2); Wall (1); The enclosed area of the court (1); Overuse injuries (1)
	Risk of injury	Those who are not physically prepared are at most risk (3); The risk of injury is similar to other sports (2); Those with bad technique are at most risk (1)
Eye injury occurrence	Personal knowledge and experience Eye injury risk perception	Knowledge of an eye injury occurring at this squash venue (9) Beginners/inexperienced most at risk (5); Low standard most at risk (3); Poor technique/skill (3); All players are at risk (3); Don't know (2); Personally sustained a squash causing eye injury (2); Junior players (1); 'Wild' players (1); Males because they hit harder (1); Social players because they have not been coached (1); The risk of eye injury in squash is high (1)
Knowledge, behaviors, attitudes and beliefs associated with protective eyewear	Ways to prevent eye injuries in squash	Wear protective eyewear (8); IMAX* eyewear is most appropriate (7); Do not know (2); Anything is better than nothing (2)
	Beliefs about most suitable eyewear	Open-eyeguards thought to be inappropriate (2); Change the shape of the ball (1); Educate players of dangers (1); Open-eyeguards are most appropriate (1); Prescription glasses thought to be inappropriate (1)
	Perception of why players do not wear protective eyewear	Habit not to wear eyewear (6); Believe they are not at risk (5); Because the elite players do not wear eyewear (4); Juniors take the eyewear off when playing (3); Juniors do not continue to wear protective eyewear when in senior competition (3); Eyewear not comfortable/fog up (3); Eyewear is not available (2); Cost is too high (2); Do not know (1); Eyewear is not promoted (1); They do not want to (1); It is available but players do not ask for it (1); Do not know where to buy eyewear (1); Feel disadvantaged if opponent not wearing eyewear (1)
	Perception of why players do wear protective eyewear Thoughts of how to increase the use of protective eyewear	Because they have had an eye injury (3); Because they know someone who has had an eye injury (1) Start with juniors wearing it (2); Eyewear companies promote its use (2); Encourage adults to use (1); Word of mouth (1); Make players aware of it (1); Emphasize risk to players (1); It needs to be the norm amongst players (1); Use pictures of

Table 2 Continued

Theme	Category	Interviewee responses (number of responses indicated in brackets)
	Responsibility to increase protective eyewear use	eye injuries (1). Increase availability (1). People must see others wearing it (1). Make it free (1)
	Attitudes towards hire and sale of protective eyewear	Squash Federation (3). Venue/club (2). Masters competition association (1). Coaches (1). Newsletters (1). Senior captains (1). Insurance company (1)
Compulsory protective eyewear	Thoughts about compulsory protective eyewear	Good idea (3). Players do not borrow eyewear (1). If available players would borrow (1). Not possible to hire out eyewear (1)
Availability of protective eyewear at venues	Thoughts about the availability of protective eyewear at venues	Yes a good idea (6). Players would whinge/complain (4). It will decrease player numbers (6). Cannot force players to wear eyewear (2). Will not decrease player numbers (2). It is compulsory for doubles players, but not all players wear protective eyewear (1). If the cost of injury is high it should be compulsory (1). Increase use without making it compulsory (1). Do not know if players would stop playing (1)
	Whether or not 'own' venue had eyewear available	Good idea to have protective eyewear for purchase and hire/borrow (3). Players would use eyewear if it were made available to them to hire/borrow (1). Players do not borrow eyewear (1). You can't hire out protective eyewear (1)
		Eyewear was available for hire/borrow and purchase (6). Eyewear was available for purchase only (3). Eyewear was available for hire/borrow only (2). No eyewear available at venue (2)

\* MAX is a brand of protective eyewear.

### Detailed analysis of themes

The venue managers and coordinators discussed many aspects of their knowledge, beliefs, attitudes and behaviors associated with the themes. Detailed responses to the questions analyzed according to these themes are described and discussed below. Text in italics corresponds to direct quotes from the interview transcripts.

### Overall injury risk perception

This theme refers to the venue managers' and co-ordinators' thoughts about the risk of injury in squash. Operators' responses varied considerably and covered body regions commonly injured, causes of injury as well as characteristics of players thought to be at most risk of injury. The most frequently cited body regions were the calf muscle and Achilles tendon. The responses to causes of injury included the racquet, ball, court wall, and the enclosed nature of the court.

The majority of responses to 'players most at risk of injury' included those with poor skills or a low level of experience, with others mentioning poor physical preparation as a cause of injury: *'Inexperienced players are (most at risk), because they don't have the awareness of their opponent and they can be wild in their shots, not placing their shots.'*

Some interviewees did not believe squash players were at greater risk of injury than players of other sports: *'I see few people get injured... I don't see it as any more dangerous than any other sport.'*

### Eye injury occurrence

The first category in this theme reflected interviewees' knowledge and experience of an eye injury, either to themselves or someone else. The majority of operators indicated that they knew of at least one person who had sustained an eye injury at their venue. Two had personally experienced an eye injury caused by playing squash. An example of one incidence: *'I've had one... I was playing in a grand final and a bloke, he's hit a ball at a million miles an hour and I was up the front, I drove the shot and I thought it was passing and I looked around and whack!'*

Venue operators were asked about their perceptions of the risk of sustaining an eye injury in squash. Most thought the incidence was low: *'In the 30 years that I've been here, I know of two people... with eye injuries.'* However there was some concern about the severity of eye injuries: *'I haven't seen one, but you know, you wouldn't want to, would you?'*

### Knowledge, behaviour, attitudes and beliefs associated with use of protective eyewear in squash

Most discussion related to this theme. The most frequently suggested preventive measure for eye injuries was protective eyewear, however it was noted that this was not the only possible strategy. Other comments included to 'change the shape of the ball' and 'educate players.'

The venue operators were asked which eyewear they considered would be most suitable for squash, which incorporated their knowledge of appropriate eyewear. The most common response was the IMAX brand, with much uncertainty as to the type offering best protection, or whether one type was any better than another: *'To be honest, I wouldn't know which ones are better or worse'* and *'No, I think anything is better than nothing.'*

Open eye guards, which have been shown to actually increase the risk of injury, were also mentioned as the best protective eyewear for squash: *'I would say the one I wear definitely which is... a plastic one with the open eye frame... that saves you being hit on the brow and on the cheek... and stops the ball going in your eye... well that's certainly saved me.'*

In regard to the best type of eyewear, some interviewees discussed the comfort and design of eyewear or availability, and not all were necessarily concerned with the safety aspect.

Venue operators gave a range of reasons as to why they thought players did not wear protective eyewear. The main barrier mentioned was 'habit' of not wearing eyewear, and because *'they don't think that they're at risk'* *'I think that's the biggest problem, people don't feel that it could happen to them'* and *'After we've had an eye injury, for a week or two after I've got players coming in pricing eyewear and then it sort of wears off.'*

The fact that the majority of players do not wear protective eyewear, particularly elite players, was expressed as a barrier to widespread protective eyewear use: *'The other issue is that the top players don't wear it... The role models... Until the top players start playing (with protective eyewear) the others won't, you know'* and *'They perceive also that they are being handicapped by wearing it when their opponent is not wearing it.'*

The negativity concerning the design and availability of eyewear was also a common barrier to widespread protective eyewear use: *'(The players) don't like the look of them and it distorts their vision and they get hot and sweaty... and they just haven't been brought up to it'* and *'Cost is a factor, and eyewear is not promoted.'*

One suggested that protective eyewear is somewhat obtrusive, although, it takes little time to become accustomed to it: *'When they (players) put them on (protective eyewear) they reckon that it hurts, that it's uncomfortable... but within an hour you get used to them.'*

Interviewees expressed concerns with junior players not wearing protective eyewear even though it is compulsory for them to do so, or that juniors do not continue to wear eyewear

throughout their adult playing years: *'The trouble is we give them (juniors) the eyewear, we tell them they have to wear it, they go on to the court, they are playing and the next thing you find them (eyewear) in the back corner of the court.'* On the other hand, not all venue managers/coordinators had difficulty in getting juniors to wear protective eyewear: *'We don't have a problem with getting juniors to wear eyewear, they all wear it.'*

Once again, the idea that players need to see more players wearing protective eyewear before they consider it themselves was expressed: *'The only problem is that of course the seniors don't play (with protective eyewear) and the juniors take notice of what the seniors don't wear.'*

The venue operators did not discuss many aspects of why they thought players do not wear protective eyewear, relating to few players wearing such eyewear. When it was discussed, the main reason reported was that *'It takes an injury before they wear it... they don't have any idea of safety'*

There was much discussion of ways to increase the use of protective eyewear. Most responses related to those given in the category 'why players do not wear protective eyewear.' This included, 'habit', 'it's not going to happen to me', and because other players, in particular the elite, do not wear protective eyewear. Several stated having juniors wear eyewear will influence other players. This is even though many interviewees expressed concerns that juniors did not continue to wear protective eyewear into senior competition: *'If we had our top players here at least using it... I think that would really influence.'*

There was a general belief that the less skilled, less experienced players are more at risk of sustaining an eye injury: *'Well, I think if they've got... the new ones (players) have got to start... The old players... say that, 'oh, we don't need it'. But if you start it, if you start them off with the new players coming in so that it becomes the norm, then everyone's wearing it.'*

Some felt that the availability of eyewear at venues is an issue to be addressed, and that eyewear companies could assist in the promotion of their product: *'It's (protective eyewear) got to be in your face, you've got to see people using it'* and *'This venue has IMAX for sale but not borrow. All venues should have for sale. The trouble for venues promoting it, it is seen by players as money making orientated.'* and *'I suppose if the eyewear company wants to have promotions, obviously you (venue managers) could push them'*

The venue operators often indicated who they thought was responsible for increasing protective eyewear use. Interviewees stated the need for increased communication to player's through influences of the player associations, squash venues and the VSF: *'I suppose a person like me, the person behind the counter is one that could encourage people more than anybody else'* and *'Well, to encourage the players on the court, better operators. To encourage the operators would be the (squash) federation.'*

One believed it was neither the venue operators nor the VSF's responsibility but rather one of the insurance com-

panies that insure injured squash players: *'The insurance industry... you're (insurance companies) the ones who are the losers, I mean you are the ones that should push it about claims. I mean there's product up there to stop getting damaged eyes. So just stop them making the claim. I think the insurance companies are the ones that should push it.'*

Whilst most agreed that it would be a good idea to have protective eyewear for sale, some interviewees stated that they did not have eyewear available at their venues. Others were shocked by the lack of availability at other squash venues. Interviewees indicated that only a few venues had eyewear available for players to borrow with most not supportive of this option: *'I don't think you can hire out eyewear'* and *'We don't have it for purchase, we just have it if anyone wants to borrow it'* and *'This venue has IMAX for players sale, not borrow. All venues should have it for sale.'*

#### Thoughts about compulsory protective eyewear use

Venue operators generally discussed whether or not they were in favor of protective eyewear being compulsory for all players, and how they believed players would react if it were made compulsory. Most thought it was a *'good idea'*, although there was some concern that it could lead to a decrease in player numbers. Others were uncertain in their opinions and reactions of players. However, many thought that players would whinge and complain: *'If it's a problem and it's costing the community a lot of money for the insurance and whatever it is, I think it's probably a good idea.'* and *'I don't think any court owner would risk saying you can't play (without wearing protective eyewear) because you are going to lose money.'* and *'Well, most people play squash because they like it, it is not the sort of game that you play if you don't like it'* and *'It would be very hard to get them to do it... I think there would be some who've been playing a long time that just wouldn't do it.'*

#### Availability of protective eyewear

Several venue operators spoke of the availability of protective eyewear at their venues. Six venues, all public facilities, had eyewear available for borrow and sale. In addition, four venues had eyewear available for either borrow or sale only. Neither of the two private venues had any eyewear available for players to borrow or purchase.

#### Discussion

Little is known about the sports safety policies and practices of community level sports organizations in Australia.<sup>21,25</sup> However, in Canada it has been shown that once current practices are identified, areas for improvement at sporting venues and organizations can be addressed.<sup>26</sup> It is recognized that venue managers may, themselves, require education about injury prevention measures such as protective equipment,

before they can influence the safety habits and practices of players who use their facilities.<sup>27</sup>

This study has found general support from venue managers for both increasing protective eyewear use and introducing a compulsory protective eyewear regulation. However, it is likely that the non-availability of protective eyewear at squash venues, which itself has been influenced by venue managers' lack of knowledge about appropriate protective eyewear, has contributed to the lack of use of protective eyewear. It would seem that most venue operators do not have knowledge about appropriate protective eyewear, and some would prefer to have players wearing any type of eyewear on court. Whilst most would like to see players wearing eyewear, some do not believe it is necessary for players with more experience and skill, such as themselves.

Some venue managers expressed concern with having protective eyewear available at their venue. Uncertainty about the type of suitable eyewear to have available and where to obtain such eyewear were reasons stated. There seems to be a difference in protective eyewear availability between private and public venues, with the surveyed private venues not having any eyewear available.

Most venue managers and coordinators reported that they do not adopt an active role in promoting protective eyewear use amongst players. In the main, this is because they have insufficient knowledge about what is appropriate eyewear and where it can be obtained. Nevertheless, they were eager to be informed about appropriate eyewear and would have it available at their venues for players to purchase.

Squash equipment and apparel is readily available at most public squash venues. It would seem, therefore, that the retail area at squash venues would provide an ideal place for the sale or hire of appropriate protective eyewear. Few venues had eyewear available; therefore eyewear-manufacturing companies are not currently taking advantage of this market area by providing venues with their product.

The venue managers and coordinators were generally supportive of compulsory protective eyewear. However, they expressed concern with their ability to enforce the regulation and the reaction of players to the compulsory ruling. Nonetheless, most said that they would be keen to assist in increasing voluntary use of protective eyewear at their venues.

Qualitative studies such as ours can provide relevant and persuasive information, particularly about factors that may be difficult to capture using quantitative survey methods. Such findings can inform policy and practice in sports injury prevention.

Future efforts aimed at increasing the use of protective eyewear need to further explore the differences evident between public and private venues. An initial process must involve informing all venues about appropriate eyewear, and eliminating inappropriate eyewear. The introduction of protective eyewear for players to purchase, hire or borrow would



be a very positive step to increasing protective eyewear use amongst all players.

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## **Chapter 7:     Players' eyewear behaviours, knowledge and attitudes**

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Through the employment of various injury surveillance techniques, squash injuries have been defined and described in Chapters Three and Four. In particular, eye injuries were identified as a problem in terms of injury severity and incidence. Although the wearing of appropriate eyewear protects against these injuries, the results in Chapter Five showed that very few adult players adopted this safety behaviour. Squash venues are potentially a viable environmental influence on players' eyewear behaviours, but at this stage, their eye safety practices do not facilitate eyewear use amongst players (Chapter Six). This Chapter Seven describes the current standing of Victorian adult players' eye injuries, eye safety behaviours as well as their knowledge and attitudes associated with eyewear use. This information is useful in identifying predictors of, and barriers to, eyewear use, as well as describing all types of squash injuries, not just those at the severe spectrum. Not all eye injuries sustained would have required medical treatment at an emergency department, admission to hospital nor led to a player claiming through the VSF insurance scheme. Therefore, the survey assisted in capturing these details not available from the other formal sources of eye injury data.

Few researchers have investigated eye injuries at the community level (Genovese, Lenzo et al. 1990; Loran 1992; Pardhan, Shacklock et al. 1995; Finch and Vear 1998; Eime 2000). This Chapter Seven presents results of two consecutive annual surveys of community level squash players', one in 2001 and another in 2002. The conduct of two surveys in consecutive years allowed for analyses of any changes throughout this time. In particular it was important to see if protective eyewear behaviours, knowledge and attitudes differed over this time.



Information gathered from these surveys included self-report eye injury data. The survey methodology and descriptive results is presented in detail in Section 7.1 through to Section 7.6 inclusive. These descriptive results are then presented and summarised in Section 7.7. Multivariate analysis of this data is presented in Chapter Eight.

The context of eye injuries was investigated through two self-report surveys over consecutive years. The specific aims of the two player surveys were:

- To describe adult squash players' demographics, playing habits and standards.
- To define and describe adult squash players' previous injury history over the past 12 months.
- To define and describe players' eyewear behaviours, and their reasons for wearing or not wearing this protective equipment.
- To investigate players' knowledge and attitudes associated with the use of protective eyewear in squash.

### **7.1 Random selection of squash venues for conduct of player survey**

Half of the VSF-affiliated squash venues in metropolitan Melbourne with at least two squash courts were randomly selected in each of 2001 and a fresh sample randomly selected in 2002. In 2001, the total sample consisted of 17 private venues and 33 public venues. In 2002, due to closure of some venues and

inclusion of other new venues, the sample consisted of 19 private and 30 public venues. The venue managers of the selected squash venues were contacted via phone to ask for their participation in this project. All managers agreed to be involved and were sent a letter explaining the project (Appendix One).

## **7.2 Player survey sampling procedures**

The sampling procedures were identical for both surveys, except where specified below. From discussions with the individual venue managers it was determined that peak participation at the venues was on weekday evenings, excluding Friday. Some smaller venues, in particular the private ones, had players participating on only one, or a few evenings of the week. For this reason, the survey times were selected, where possible, on the most popular evening at all venues. The day of the week and particular week for survey sessions at all other venues were chosen at random. A data collector visited only one venue per evening and ensured that all players present at that venue on that evening had the opportunity to complete a survey. The surveying took approximately 7 weeks to complete. In 2002, a random selection of 8 venues (from the survey sample) were chosen for the conduct of a specific eyewear promotion intervention. The specific details of this are explained in Chapter Eleven.

At each squash venue, courts are booked either privately by pairs of players in advance or are pre-booked for teams in competition. Each adult player present at the selected venues during the sampling times was approached to complete a self-report survey. Players' squash participation was not interrupted as players were only approached for involvement in the survey either before or after playing. Participants were asked to complete the survey and a short description of the study was provided verbally and accompanying the survey was a plain language

statement (Appendix Two). If participants requested further information regarding the study they were provided with a project summary (Appendix Three). Participants completed the anonymous survey in private at a desk close by, and were prompted to return the completed survey to the labelled survey return box situated at the reception desk. Any player not wishing to participate was noted as a non-response. Any distributed surveys not returned were also recorded as a non-response. The survey session times were generally 2-3 hours in length and usually commenced at 7:30pm at the public venues and approximately 6:30pm at the private venues representing peak playing times at each individual venue.

The survey session times captured competition players as well as social/recreational and practicing players. The timing of commencement of the survey sessions at the venues allowed surveying of social players at the end of their playing time and the beginning of Pennant competition play. The competition play was structured such that one player from each team was playing, whilst other team players were either refereeing or watching the match. In this instance, players not refereeing or playing were asked to participate in the survey. After the match finished, another two players (one from each team) commence play. The players and referees (other players) from the initial match were then approached for their participation in the survey. The players not participating in competition structure (social play or practice) were approached either before or after play.

In the design of this survey a sample size of 550 players was required to ensure adequate precision in the estimated proportion of players with an eye injury. The sample size calculations were based on the survey results of a similar survey in 1995 (Finch and Vear 1998). In this study 197 players, 15% reported a previous eye injury. Assuming the same proportion in 2001, and a sample size of 550

players, the precision of the estimate of the proportion of players reporting an eye injury would be  $\pm 3.0\%$ .

### **7.3 Player survey design**

The survey was presented as a four-page colour booklet, with the survey on three pages headed with the SQERP and VSF project logo (Appendix Four). The self-report survey questionnaire collected information about:

- Basic player demographics (e.g. age, sex);
- Squash history (e.g. number of hours played per week, total years of squash played, participation level);
- Self-report previous injury (e.g. eye or other injury, cause of injury);
- Use of protective eyewear (e.g. frequency, type);
- Related protective eyewear knowledge and attitudes.

Closed multiple-choice questions were generally used to facilitate analysis. Most questions allowed participants to give a reply not provided in the multiple choice options, in an open-ended format. Some open-ended questions were used to further explore players' relevant knowledge, attitudes and behaviours associated with the use of protective eyewear.

### **7.4 Details of player survey questions**

The content of the player survey was largely based on a previous one used in 2000 (Eime 2000). The following gives a description and rationale for the questions used in the survey. The questionnaire content and format was identical

for the 2001 and 2002 surveys. Some questions did not apply to all participants. In these instances, participants were prompted to skip certain questions. For example, in question eight, if a participant indicated that they had not sustained an eye injury in the past 12 months for playing squash they were asked to (go to Q11) skip questions relating to the cause and mechanism of eye injuries.

#### **7.4.1 Survey participant demographics**

The subject demographic information was useful to determine predictors of protective eyewear use. For example, to determine if participants' age or gender was associated with protective eyewear use. Previous studies have indicated that males sustain a considerable higher percentage of eye injuries in squash than females (Easterbrook 1981; MacEwen 1987; Fong 1995). Other research has found that females are more likely to wear protective eyewear when playing squash than males (Genovese, Lenzo et al. 1990). Participants' gender was recorded as male and female. They were also asked to indicate their age by answering the question "How old were you on your last birthday?" Squash players' age has previously been shown to be a significant factor relating to protective eyewear use (Eime 2000).

Participants were asked to state their occupation in an open-ended question format. Sports participants' occupation has been shown to be associated with use of protective equipment in sport, with professionals, paraprofessionals, clerks, salespersons and students being most likely to wear mouthguards in football in Victoria (Jolly, Messer et al. 1996).

### 7.4.2 Squash playing habits and standards

In a future attempt to increase the use of protective eyewear, it was important to be able to examine if certain player characteristics are associated with the knowledge, attitudes and behaviours regarding protective eyewear. Exposure data that was collected included:

- The level of competition or play;
- The average hours per week spent playing on a squash court;
- The amount of actual squash play in the previous two weeks;
- Years spent playing squash.

Four questions were designed to provide information about squash players' current playing habits, experience and their standard of play. Average playing frequency in hours per week was indicated in one of the following groups:

- less than 1 hour;
- 1 hour to less than 2 hours;
- 2 hours to less than 5 hours;
- 5 hours to less than 10 hours;
- 10 hours or more.

Actual squash participation in the previous two weeks was indicated in one of the following groups:

- less than 1 hour;

- 1 hour to less than 2 hours;
- 2 hours to less than 5 hours;
- 5 hours to less than 10 hours;
- 10 hours or more.

In order to gather information regarding players' experience, participants were asked to indicate how many years they had been playing squash for, in one of the following groups:

- less than 1 year;
- 1 to less than 5 years;
- 5 years to less than 10 years;
- 10 to less than 20 years;
- 20 years or more.

Participants were asked about their level or type of squash participation. The competition category included those players who played against players from other squash venues or clubs (pennant competition), as well as those players who competed against other club/venue members (inter-club competition).

#### **7.4.3 Squash injury occurrence over past year**

An aim of this survey was to specifically determine how many eye injuries occur on average per player through the game of squash. Therefore, participants were asked to report if they had sustained an eye injury in the past 12 months whilst playing squash. A 12 month recall period was chosen to reduce the possibility of

recall bias. The definition given of an eye injury was "An eye injury is defined as one to the eye itself or its surrounding structures, including the eyelids, eyebrows and cheek or socket bones." If participants responded with a 'yes', the number of eye injuries within the 12 month period was recorded. If participants had sustained an eye injury, the specific cause of the most recent eye injury (within the past 12 months) was recorded from one of the following options:

- Racquet;
- Ball;
- Fall;
- Collision with opponent;
- Collision with court wall;
- Other.

Eye injured participants were then asked if the most recent eye injury (within the past 12 months) required medical attention. If participants responded with 'yes', the type of injury was indicated from one of the following options:

- Cut or other injury to eyelid;
- Bruising around the eye (black eye);
- Retinal detachment/tear;
- Corneal abrasion/laceration;
- Orbital fracture;
- Bleeding within the eye/hyphaema;



- Permanent visual impairment;
- Other.

These participants were then asked to give details of treating doctor or ophthalmologist in an open-ended format.

To be able to assess the occurrence of eye injuries in relation to all other squash causing injuries, participants were asked to indicate if they had had an injury to a part of their body (excluding the eye) in the past 12 months whilst playing squash, and if so, the cause of the most recent injury was asked. Participants could respond to one of the following options:

- Racquet;
- Ball;
- Fall;
- Collision with opponent;
- Collision with court wall;
- Other.

The part of the body injured most recently (within the past 12 months) was stated.

#### **7.4.4 Squash players self-reported protective eyewear behaviours**

The initial question in this section asked participants if they wore protective eyewear when playing squash. Appropriate eyewear was not defined in this initial question. Information regarding current protective eyewear use was collected and

defined by participants wearing any type of eyewear when they played squash which they believed was protective against sustaining an eye injury whilst playing squash. At this stage of the survey, participants were not informed that certain brands of polycarbonate lens/standards approved squash eyewear were the only type of eyewear that provides adequate protection to the eyes when playing squash. The initial questions were designed to discover participants' knowledge of appropriate protective eyewear, along with the eyewear actually worn and those types thought protective. If participants indicated that they wore protective eyewear when playing, the frequency of this use was recorded by indicating one or more of the following options:

- Always during competition;
- Sometimes during competition;
- Always during social play;
- Sometimes during social play;
- Always during practice sessions;
- Sometimes during practice sessions.

Even though the participants responding to this question reported wearing protective eyewear, previous studies have revealed that players do not necessarily always wear it when playing, particularly in competitive situations, and there is a tendency to wear protective eyewear during matches but not practice sessions (MacEwen 1987; Fong 1994; Finch and Vear 1998).

It is apparent that not all of the eyewear worn by squash players provides suitable protection against sustaining an eye injury (Eime, Finch et al. 2002), therefore

participants who reported wearing protective eyewear were required to state the specific type from one of the following options: industrial eyewear, polycarbonate lenses (eg IMAX, Leader), contact lenses, open-eyeguards, normal prescription glasses, other. Participants indicating that they wore polycarbonate eyewear were asked to specify the type (brand) of eyewear worn.

The following question was designed to determine those participants who wore normal prescription glasses when playing squash, however, that did not believe they wore 'protective eyewear'. Therefore, these participants would not have indicated that they wore normal prescription glasses in the previous question which asked about 'protective eyewear' use.

To examine the influences of appropriate protective eyewear use, those participants who indicated that they wore polycarbonate lens/standards approved squash eyewear, were asked to indicate all reasons why they did in a multiple choice set-up, that applied to them, or they could specify any reason(s) not listed. Subsequently, the non-users of polycarbonate lens eyewear were given a variety of response options to indicate why they did not wear such eyewear. These participants were also prompted to indicate all options that applied to them, or to specify a reason(s) not provided.

The participants that did not report wearing polycarbonate lens eyewear, were asked if they had ever tried using such eyewear.

#### **7.4.5 Squash players self-reported protective eyewear knowledge**

Defining the knowledge and attitudes of both groups of participants that do and do not wear appropriate protective eyewear is needed for structuring future

behavioural change strategies. All participants were asked to indicate all types of eyewear from the following options that they thought would be protective against sustaining an eye injury in squash:

- I do not know;
- Industrial eyewear;
- Polycarbonate lenses;
- Normal prescription glasses;
- Contact lenses;
- Open-eyeguards;
- Other.

Participants' knowledge of where they thought polycarbonate lens/standards approved squash eyewear could be bought was given as any of the following:

- I do not know;
- This squash venue;
- Other squash venues;
- Sport store;
- Hardware store;
- Optometrist;
- Other.

Results from a previous survey conducted in 2000, (Eime 2000) showed that many players stated that protective eyewear could be purchased from squash venues, however not the particular venue where the survey was completed. For this reason the option: 'other squash venues' was included in this survey.

Participants' knowledge of any regulations to implement compulsory use of protective eyewear in squash was also investigated.

#### **7.4.6 Squash players' attitudes to protective eyewear**

Information regarding participants' attitudes towards the availability of polycarbonate eyewear was gathered, including participants' opinion of whether or not polycarbonate lens eyewear should be made available for purchase and/or hire respectively at the attended squash venue at the time of competing the survey.

The question, 'Who do you believe is more at risk of an eye injury in squash?' with response options:

- State grade/area interclub competition player;
- Inhouse player;
- Casual/social player;
- There is an equal risk to all players.

The intent of this question was to determine if the participants considered themselves to be at more or less risk of an eye injury due to their playing experience or standard.

Finally, ten statements assessing participants' attitudes towards protective eyewear were presented, with replies on a 5 point Likert scale. The responses included: strongly agree, agree, uncertain, disagree, and strongly disagree.

Participants were asked their attitudes regarding the severity of eye injuries in squash, by indicating a yes or no response to: 'Eye injuries are a particular problem for squash players'. Following on from this, participants were asked whether or not more players should use protective eyewear. Three statements related to players' thoughts regarding compulsory use of protective eyewear. This included their opinion of compulsory use of protective eyewear for all players; for junior players and also whether or not they would stop playing squash if protective eyewear was made compulsory. Whether or not participants thought that the risk of eye injury in squash was high was then assessed. So as not to lead participants into agreeing to all statements, the following statement was worded: 'The benefits of using protective eyewear are low'. Previous survey results have shown that players believe protective eyewear restricts their vision when playing (Eime 2000). To determine participants' attitudes towards the ease of wearing protective eyewear, they were asked to respond to: 'It is just as easy to use protective eyewear as it is to wear ordinary prescription glasses or sunglasses'. Most of the statements required participants' thoughts relating to the general squash population. To assess participants' personal thoughts about protective eyewear use and the risk of sustaining an eye injury whilst playing, the following two statements were worded: 'It is important that I personally use protective eyewear when playing squash': 'Protective eyewear would significantly reduce my risk of sustaining an eye injury whilst playing squash'.

## 7.5 Data analysis of player survey

All surveys were allocated a unique survey number. This protected confidentiality of the participants whilst enabling the matching of the entered data once entered electronically with the actual survey. All missing variables were coded with a -1. Responses to the following questions in the player surveys were pre-coded before entry into a database. The response questions that were pre-coded were: occupation; grade that player played in competition; and body region that was injured in the most recent injury, within the past 12 months. Occupation was coded using the Australia Bureau of Statistics, Australian Standard Classification of Occupation (McLennan 2001). This classification scheme has 9 major categories:

1. Managers and administrators;
2. Professionals;
3. Associate professionals;
4. Tradespersons and related workers;
5. Advanced clerical and service workers;
6. Intermediate clerical, sales and service workers;
7. Intermediate production and transport workers;
8. Elementary clerical, sales and service workers;
9. Labourers and related workers.

Each specific job is listed as a sub-major category. Each occupation listed by the participant was given a two digit number code. The first number related to one of the nine major categories, and the second number was the sub-major category,

which was the specific occupation name. For example, automotive tradesperson was coded 4 (for tradesperson) and 2 (as it was listed by ASCO as the second of all in the tradesperson category). A manager was the only occupation that was coded with a single number as many participants only stipulated 'manager' and did not specify what type of manager they were. Participants that had indicated that they performed homeduties/housewife/househusband were allocated a code number 10. Students were coded as 11. Self-employed participants that did not specify their specific occupation were coded as 12. Retired participants were coded as 13, and unemployed participants as 14.

Grade of play was then categorised as the following:

1. State grade;
2. Grade 1-4;
3. Masters grade 1-4;
4. Grade 5 and lower;
5. Masters grade 5 and lower.

State grade represents the highest grade of competition, whilst grade 1-5 represents a highly skilled player. If participants indicated that they participated in more than one competition at different grade level the participant was coded with the highest grade. For example, if a participant specified that they participated in grade 3 pennant and grade 5 masters competition, this question would have been coded with a number 2, representing their highest grade competition currently being played.



If players indicated that they had sustained an injury to a part of the body (excluding the eye) in the past 12 months whilst playing squash, they were asked to specify the injured body part, in an open-ended format. Responses were coded as the following:

1. Elbow;
2. Leg (not specifically classified);
3. Lower leg (not specifically classified);
4. Calf;
5. Ankle;
6. Heel;
7. Back;
8. Multiple injuries;
9. Knee;
10. Shoulder;
11. Groin;
12. Ribs;
13. Hamstring;
14. Face/head/mouth (excluding eye);
15. Arm (not specifically classified);
16. Thigh;

- 17. Foot;
- 18. Wrist;
- 19. Neck;
- 20. Heart;
- 21. Bicep;
- 22. Hand;
- 23. Hip;
- 24. Achilles (calcanean) tendon;
- 25. Miscellaneous;
- 26. Chest.

Once the pre-coding of certain questions was performed, the data was manually entered into an access database (2002 version). The year of the survey was also entered into the database for identification purposes. The data was then transformed into an (version 11.0) database. All missing variables from an unanswered question were coded with a -1 and formatted as a missing value in SPSS. The age of participant was entered as the continuous variable. The binary, yes/no questions were coded with a 1 for yes and a 2 for no. The tick box questions were coded with an incremental number (from 1) for each response item with a 0 being assigned to the responses to the questions that were not applicable to the particular participant. If participants gave a response in an 'other' category, all responses were allocated a specific code number. Similarly, responses to the Likert scale questions were coded with a number:

1. Strongly agree;
2. Agree;
3. Uncertain;
4. Disagree;
5. Strongly disagree.

Once each survey dataset was entered twice, frequencies' and 'range checks' were run to identify any missing data and any data entry errors. When errors became identified the appropriate questionnaire was sought and the correct value then entered.

## **7.6 Results of baseline player surveys**

A comparison of two annual player survey data follows. Two sets of baseline data was gathered to investigate any differences particularly in players' knowledge, behaviours and attitudes associated with protective eyewear. If a trend was evident it would have been necessary to analyse this before designing or implementing an eye prevention strategy.

### **7.6.1 Squash player demographics**

Table 2 displays the response rate obtained in each year of surveying. Details of the estimated age distribution of non-participants is provided in Table 3. In 2001, 89% of the non-participants were male, in 2002, 58% (95% CI for difference 0.25, 0.37). In 2002 the response rate was lower because some players chose not to complete the survey as they had participated in 2001.

**Table 2. Two year player survey response rates**

	2001	2002	95% CI for difference
Total number of participants	555	608	
Non-participants	9	61	
Response rate	98.4%	90.0%	(0.05, 0.11)

**Table 3. Player survey non-participant details**

Estimated years of age	2001	2002
20-29	0	8
30-39	2	26
40-49	5	20
50+	2	7
Total non-responders	9	61

The mean age of non-participants did not differ markedly from the mean age of survey participants. In 2001, the mean age of players was 39.7 years (range 18-72 years of age), compared to mean age of 40.3 years in 2002 (range 18-72 years of age). The majority of players were male (2001: 77.9%, 2002: 69.7% 95% CI for difference 0.03, 0.13). As summarised in Table 4, most players were employed in professional or managerial positions. The 95% CI's show that there were no significant differences in the proportion of players in the occupation categories of players in 2001 compared to those of the 2002 survey.

**Table 4. Classification of survey participants' occupation**

Classification of occupations	2001 n= 534*	2002 n= 593*	2001/2002 difference	95% CI difference
Managers	18.0%	16.7%	- 1.3%	(-0.03, 0.06)
Professionals	28.2%	33.2%	+ 5.0%	(-0.10, 0.00)
Associate professionals	12.1%	10.1%	- 2.0%	(-0.02, 0.06)
Tradespersons & related workers	14.6%	10.8%	- 3.8%	(0.00, 0.08)
Advanced clerical & service workers	3.0%	5.4%	+ 2.4%	(-0.05, 0.00)
Intermediate clerical, sales & service workers	7.5%	7.9%	+ 0.4%	(-0.04, 0.03)
Intermediate production & transport workers	3.4%	2.7%	-0.7%	(-0.01, 0.03)
Elementary clerical, sales & service workers	0.6%	0.2%	- 0.4%	(0.00, 0.01)
Labourers & related workers	1.3%	1.3%	0.00	(-0.01, 0.03)
Other#	11.3%	11.6%	+0.3%	(-0.04, 0.03)

# Includes students, self-employed persons not further specified, retired and unemployed persons and those performing home duties

\* n= 21 missing values in 2001, 15 missing values in 2002

### 7.6.2 Results of squash playing habits and standards

As displayed in Table 5 most players (2001: 79.1%, 2002: 83.0%) indicated that they participated in squash for between one and five hours per week. This included all types of play from social practice to competition. Similarly, over the past fortnight before completing the survey, the majority (2001: 67.8%, 2002: 69.8%) of players participated between one and five hours (Table 6). There were strong similarities between the average playing frequency in 2001 and 2002.

**Table 5. Squash players' average playing frequency per week**

Hours of play per week	2001	2002	2001/2002 difference	95% CI difference
	% of Sample	% of Sample		
	95% CI	95% CI		
	n= 554*	n= 606*		
	12.1%	7.9%		
<1 hr	(9.4, 14.8)	(5.8, 10.0)	- 4.2%	(0.01, 0.08)
	33.4%	35.1%		
1hr to <2hr	(29.5, 37.3)	(31.3, 38.9)	+ 1.7%	(-0.07, 0.04)
	45.7%	47.9%		
2hr to <5hr	(41.6, 49.8)	(43.9, 51.9)	+ 2.2%	(-0.08, 0.04)
	7.6%	7.6%		
5hr to <10hr	(5.4, 9.8)	(5.5, 9.7)	0.00	(-0.03, 0.03)
	1.3%	1.5%		
10hr or more	(0.4, 2.2)	(0.5, 2.5)	0.2%	(-0.02, 0.01)

\*n= 1 missing values in 2001, 2 missing values in 2002

**Table 6. Squash players' playing history of past two weeks**

Hours of play in past two weeks	2001	2002	2001/2002 difference	95% CI difference
	% of Sample	% of Sample		
	95% CI n=544*	95% CI n= 604*		
<1 hr	12.7% (9.9, 15.5)	10.8% (8.3, 13.3)	- 1.9%	(-0.02, 0.06)
1hr to <2hr	26.8% (23.1, 30.5)	22.0% (18.7, 25.3)	- 4.8%	(0.0, 0.10)
2hr to <5hr	41.0% (36.9, 45.1)	47.8% (43.8, 51.8)	+ 6.8%	(-0.13, -0.01)
5hr to <10hr	15.4% (12.4, 18.4)	15.4% (12.5, 18.3)	0.00	(-0.04, 0.04)
10hr or more	4.0% (2.4, 5.6)	4.0% (2.4, 5.6)	0.00	(-0.02, 0.02)

*\*n= 11 missing values in 2001, 4 missing values in 2002*

As displayed in Table 7, most players (2001: 72.1%, 2002: 72.8%) were quite experienced and had been playing squash for at least 10 years. Many reported playing squash for more than 20 years. There were no significant differences in years of squash experience in 2001/2002.

Table 7. Squash players' years of squash experience

Years of squash experience	2001	2002	2001/2002 difference	95% CI difference
	% of Sample	% of Sample		
	95% CI n= 551*	95% CI n= 606*		
	6.2%	3.5%		
<1yr	(4.2, 8.2)	(2.0, 5.0)	- 2.7%	(0.0, 0.05)
	9.8%	11.1%		
1yr to <5yr	(7.3, 12.3)	(8.6, 13.6)	+ 1.3	(-0.05, 0.02)
	12.0%	12.7%		
5yr to <10yr	(9.3, 14.7)	(10.0, 15.4)	+ 0.07	(-0.04, 0.03)
	28.7%	27.1%		
10yr to <20yr	(24.9, 32.5)	(23.6, 30.6)	- 1.6%	(-0.04, 0.07)
	43.4%	45.7%		
20yr or more	(39.3, 47.5)	(41.7, 49.7)	+ 2.3%	(-0.08, 0.03)

\*n= 4 missing values in 2001, 2 missing values in 2002

The standard of players is summarised in Table 8. State Grade is the highest level of competition in Victoria. The categories Grade 1-4 and Grade 5  $\geq$  represent metropolitan association competition players such as pennant and masters players. Those that did not play competition were grouped as social and recreational players. The majority played competition with many participating (2001: 59.2%, 2002: 62.8% 95%CI for difference -0.09, 0.03) in grades 4 and above.



Table 8. Standard of player

Highest grade participated in by player	2001	2002	2001/2002 difference	95% CI difference
	% of Sample	% of Sample		
	95% CI n=500 *	95% CI n= 547*		
Grade 1-4	45.6% (41.2, 50.0)	52.1% (47.9, 56.3)	+ 6.5%	(-0.13, 0.0)
Grade 5>	27.0% (23.1, 30.9)	26.1% (22.4, 29.8)	-0.9%	(-0.04, 0.06)
Social- recreational	13.8% (10.8, 16.8)	11.0% (8.4, 13.6)	- 2.8%	(-0.01, 0.07)
State Grade	13.6% (10.6, 16.6)	10.8% (8.2, 13.4)	- 2.8%	(-0.01, 0.07)

\*n= 55 missing values in 2001, 61 missing values in 2002

### 7.6.3 Squash injury occurrence

In 2001 and 2002, 20 players (3.6%) and 19 players (3.1%) respectively had sustained an eye injury in the past year (95%CI for difference -0.02, 0.03). The racquet (2001: n=9 45.0%, 2002; n=9 50.0%) and ball (2001: n=8 40.0%, 2002; n=8 38.9%) were the most common causes. Other reported causes included a collision with wall, and a collision with both a racquet and opponent.

Of the eye injuries, injury to the eyelid (2001; 29.4%, 2002; 18.8% 95% CI for difference -0.16, 0.38) and bruising around the eye (2001; 29.4%, 2002; 50.0% 95% CI for difference -0.51, 0.10) were most common. Only one player in 2001, and four in 2002 gave details of treating hospitals or emergency departments.

Many players indicated that they had sustained an injury to a part of their body, excluding the eye, within the past year whilst playing squash (Table 9). There were no significant differences in the proportion of body regions injured in 2001, compared to those injuries reported in the 2002 survey. The calf, ankle, knee and lower leg (not further specified) were the most common injuries reported in 2001, accounting for 42.6% of injuries. In 2002, the knee, followed by the lower back, multiple injures and the lower leg body regions, collectively being injured in 44.2% of injury cases. The cause of injuries, which is displayed in Table 10. There was significantly more injuries classified as a strain in 2001 as opposed to 2002 (95% CI for difference 0.10, 0.21). The squash racquet was a common cause of injury in 2001 (10.6%) and in 2002 (14.4%).

**Table 9. Squash injuries sustained (excluding eye)**

Body part injured	2001	2002	2001/2002 difference	95% CI difference
	% of Sample	% of Sample		
	95% CI	95% CI		
	n= 192*	n= 395*		
	12.3%	9.4%		
Calf	(7.7, 16.9)	(6.5, 12.3)	- 2.9%	(-0.02, 0.08)
	9.9%	12.7%		
Knee	(5.7, 14.1)	(9.4, 16.0)	+ 2.8%	(-0.08, 0.03)
	10.5%	8.9%		
Ankle	(6.2, 14.8)	(6.1, 11.7)	- 1.6%	(-0.03, 0.07)
	9.4%	11.3%		
Lower back	(5.3, 13.5)	(8.2, 14.4)	1.9 %	(-0.07, 0.03)
	9.9%	9.9%		
Lower leg (including leg 'not further specified')	(5.7, 14.1)	(7.0, 12.8)	0.0	(-0.05, 0.05)
	5.3%	10.3%		
Multiple injuries	(2.1, 8.5)	(7.3, 13.3)	+ 5.0%	(-0.10, 0.0)

*Table 9 continued.*

	5.8%	8.5%		
Head (including face)	(2.5, 9.1)	(5.7, 11.3)	+ 2.7%	(-0.07, 0.02)
	7.6%	3.8%		
Shoulder	(3.9, 11.3)	(1.9, 5.7)	- 3.8%	(0.0, 0.08)
	6.4%	4.7%		
Thigh	(2.9, 9.9)	(2.6, 6.8)	- 1.7%	(-0.02, 0.06)
	6.4%	5.6%		
Arm (excluding elbow)	(2.9, 9.9)	(3.3, 7.9)	- 0.8%	(-0.03, 0.05)
	16.3%	15.0%		
Other	(11.1, 21.5)	(11.5, 18.5)	- 1.3%	(-0.05, 0.08)

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\*21 missing values in 2001, 12 missing values in 2002

Table 10. Cause of injury (excluding eye)

Cause of injury sustained, excluding injuries to the eye	2001	2002	2001/2002 difference	95% CI difference
	% of Sample	% of Sample		
	95% CI n= 161*	95% CI n= 399*		
Strain	19.3% (13.2, 25.4)	3.8% (1.9, 5.7)	- 15.5%	(0.10, 0.21)
Racquet	10.6% (5.8, 15.4)	14.4% (11.0, 17.8)	+ 3.8%	(-0.10, 0.02)
Fall	8.7% (4.3, 13.1)	11.0% (7.9, 14.1)	+ 2.3%	(-0.08, 0.03)
Overstretched	10.6% (5.8, 15.4)	4.8% (2.7, 6.9)	- 5.8%	(0.01, 0.10)
Collision with wall	9.3% (4.8, 13.8)	6.7% (4.2, 9.2)	- 2.6%	(-0.02, 0.07)
Overuse	9.3% (4.8, 13.8)	4.8% (2.7, 6.9)	- 4.5%	(0.0, 0.09)

Table 10 continued.

	8.1%	6.2%		
Unknown	(3.9, 12.3)	(3.8, 8.6)	- 1.9%	(-0.03, 0.06)
	5.6%	5.3%		
Collision with opponent	(2.0, 9.2)	(3.1, 7.5)	- 0.3%	(-0.04, 0.04)
	4.3%	4.8%		
Ball	(1.2, 7.4)	(2.7, 6.9)	+ 0.5%	(-0.04, 0.03)
	3.7%	7.2%		
Twisting	(0.8, 6.6)	(4.7, 9.7)	+ 3.5%	(-0.08, 0.01)
	10.6%	31.1%		
Other	(5.8, 15.4)	(26.6, 35.6)	+ 20.5 %	(-0.28, -0.12)

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\*31 missing values in 2001, 16 missing values in 2002

#### 7.6.4 Self-reported eyewear use in squash

In 2001, 85 players (15.5% of the sample) reported wearing protective eyewear; in 2002 this number was 106 players (17.5% of sample) (95% CI for difference -0.06, 0.20). As displayed in Table 11, most players always wore eyewear during competition matches. The reported frequency of eyewear use did not significantly differ for each of the categories between 2001 and 2002 responses.

**Table 11. Frequency of self-reported protective eyewear use**

Frequency of protective eyewear use	2001	2002	2001/2002 difference	95% CI difference
	% of protective eyewear users	% of protective eyewear users		
	95% CI	95% CI		
	n=80*	n= 97*		
Always during competition	75.0% (65.5, 84.5)	79.4% (71.4, 87.4)	+ 4.4%	(-0.17, 0.08)
Sometimes during competition	13.8% (6.2, 21.4)	10.3% (4.3, 16.3)	- 3.5%	(-0.06, 0.13)
Always during social play	42.5% (31.7, 53.3)	35.1% (25.6, 44.6)	- 7.4%	(-0.07, 0.22)
Sometimes during social play	1.3% (0.0, 3.8)	7.2% (2.1, 12.3)	+ 5.9%	(-0.12, 0.0)
Always during practice	43.8% (32.9, 54.7)	46.4% (36.5, 56.3)	+ 2.6%	(-0.17, 0.12)
Sometimes during practice	3.8% (0.0, 8.0)	8.2% (2.7, 13.7)	+ 4.4%	(-0.12, 0.03)

\*n= 5 missing values in 2001, 9 missing values in 2002

Players were informed to indicate all options that applied to them

Players that reported wearing protective eyewear were required to state what type they wore (Table 12). Polycarbonate lens eyewear was the most frequent

response. Many players stated that they wore prescription glasses when playing, whilst believing it to be protective.

**Table 12. Type of eyewear worn by reported users of protective eyewear**

Type of protective eyewear worn	2001	2002	2001/2002 difference	95% CI difference
	% of protective eyewear users	% of protective eyewear users		
	95% CI	95% CI		
	n=80*	n= 100*		
Polycarbonate lens	47.5% (36.6, 58.4)	46.0% (36.2, 55.8)	- 1.5%	(-0.13, 0.16)
Prescription glasses	36.3% (25.8, 46.8)	39.0% (29.4, 48.6)	+ 2.7%	(-0.17, 0.12)
Open-eyeguards	13.8% (6.2, 21.4)	12.0% (5.6, 18.4)	- 1.8%	(-0.08, 0.12)
Industrial eyewear	3.8% (0.0, 8.0)	4.0% (0.2, 7.8)	+ 0.2%	(-0.06, 0.05)
Contact lenses	1.3% (0.0, 3.8)	0	- 1.3%	(-0.01, 0.04)

\*n= 5 missing values in 2001, 6 missing values in 2002

*In 2001, two players indicated that they wore two types of eyewear: 1 indicated contact lenses and open eyeguards; the other prescription glasses and polycarbonate lens eyewear*

*In 2002, one player indicated that they wore industrial eyewear in addition to prescription glasses*



Players that reported wearing polycarbonate lens eyewear were asked to specify which brand they wore. IMAX was the most common brand (2001; 58.6%, 2002; 83.9% of responses) (95% CI for difference -0.38, -0.12). In 2001, other brands of eyewear in order of reported use were; Dunlop, Leader, Wilson, Prince and Hoggies. In 2002, other brands were Dunlop, Carrera Sports and an "American brand". Both in 2001, and 2002 one player indicated that they wore both IMAX and Dunlop brands of protective eyewear.

Players that reported not wearing protective eyewear were asked if they wore normal prescription glasses when playing squash (i.e. they wore glasses for visual acuity, not because they thought it was protective eyewear). Of the players that did not report wearing protective eyewear, some players (2001; n=63, 2002; n=46 95% CI for difference -0.29, 0.01) indicated that wore prescription glasses when playing. In addition, some players (2001; n=29, 2002; n=39, 95% CI for difference -0.01, 0.29) reported wearing protective eyewear and specified the type as prescription glasses. Therefore in 2001, 92 players and in 2002, 85 players reported wearing prescription glasses when playing, (95%CI for difference -0.03, 0.05).

In summary, in 2001, 85 players (15.5% of total sample) and in 2002, 106 players (17.4% of sample) stated that they wore protective eyewear (95% CI for difference -0.06, 0.02), however only 38 (6.9% of total sample) in 2001 and 46 (7.6% of total sample) in 2002 wore polycarbonate lens eyewear (95% CI for difference -0.04, 0.02).

### **7.6.5 Reasons for wearing polycarbonate lens/standards approved squash eyewear**

The main reasons for wearing polycarbonate lens/standards approved squash eyewear included having knowledge of the risk of eye injury and either personally experiencing an eye injury, or knowing someone who has had an eye injury in the past (Table 13). Some players had been recommended to wear protective eyewear, usually by other players or doctors. 'Other' reasons for wearing protective eyewear included, having eye treatment, being afraid that prescription glasses could damage the eye; common sense. The responses were not significantly different in 2001 compared to 2002.

**Table 13. Reasons for wearing polycarbonate lens/standards approved squash eyewear**

Reasons for wearing polycarbonate lens eyewear	2001	2002	2001/2002 difference	95% CI for difference
	%	%		
	polycarbonate eyewear users	polycarbonate eyewear users		
	95% CI n= 46*	95% CI n= 48*		
I have knowledge of the risks of eye injury	50.0% (35.6, 64.4)	56.3% (42.3, 70.3)	+ 6.3%	(-0.26, 0.14)
I know someone who has had an eye injury and I do not want to get one myself	32.6% (19.1, 46.1)	37.5% (23.8, 51.2)	+ 4.9%	(-0.24, 0.14)
I have had an eye injury before and do not want to get another one	26.1% (13.4, 38.8)	27.1% (14.5, 39.7)	+ 1.0%	(-0.19, 0.17)
Protective eyewear use has been recommended to me	17.4% (6.4, 28.4)	18.8% (7.7, 29.9)	+ 1.4%	(-0.17, 0.14)
It is compulsory for me to wear protective eyewear	17.4% (6.4, 28.4)	12.5% (3.1, 21.9)	- 4.9%	(-0.09, 0.19)
Other reasons	13.0% (3.3, 22.7)	12.5% (3.1, 21.9)	- 0.5%	(-0.13, 0.14)

\*n= 1 missing values in 2001, 2002 6 missing values

### **7.6.6 Reasons why non-users do not wear polycarbonate lens/standards approved squash eyewear**

The most common reasons players gave for why they did not wear polycarbonate lens/standards approved eyewear in both surveys was 'I do not want to' (Table 14). This was significantly higher in 2001 compared to 2002. No other reasons for not wearing protective eyewear significantly differed in proportions for 2001 and 2002. Many players indicated that it restricted their vision when playing. Another frequent response was that players' had never thought about wearing protective eyewear.

Players that did not report wearing polycarbonate lens eyewear were asked if they had ever tried to use such eyewear. Most of these players (2001; n=338 74.6%, 2002; n=562 70.3% of non-users) (95% CI for difference -0.01, 0.1) reported that they had not ever tried to wear this type of eyewear.

**Table 14. Reasons why players do not wear polycarbonate lens/standards approved squash eyewear**

Reasons why players do not wear polycarbonate lens eyewear	2001	2002	2001/2002 difference	95% CI for difference
	% of non-users	% of non-users		
	95% CI	95% CI		
	n= 463*	n= 516*		
	34.8%	27.7%		
I do not want to	(30.5, 39.1)	(23.8, 31.6)	- 7.1%	(0.01, 0.13)
	27.2%	26.7%		
It restricts my vision whilst playing	(23.1, 31.3)	(22.9, 30.5)	- 0.5%	(-0.05, 0.06)
	23.3%	27.5%		
I have never thought about it	(19.4, 27.2)	(23.6, 31.4)	- 4.2%	(-0.10, 0.01)
	22.5%	25.2%		
It is too uncomfortable to wear	(18.7, 26.3)	(21.5, 28.9)	+ 2.7%	(-0.08, 0.03)
	11.0%	11.0%		
I am not at risk of an eye injury because of my playing level	(8.1, 13.9)	(8.3, 13.7)	0.00	(-0.04, 0.04)
	10.6%	10.3%		
Because I wear normal prescription glasses when playing	(7.8, 13.4)	(7.7, 12.9)	- 0.3%	(-0.04, 0.04)
	9.7%	11.2%		
It is not necessary, as the risks of eye injury are not that great	(7.0, 12.4)	(8.5, 13.9)	+ 1.5%	(-0.05, 0.02)

**Table 14 continued.**

I do not like the look of protective eyewear	4.1% (2.3, 5.9)	7.0% (4.8, 9.2)	+ 2.9%	(-0.06, 0.0)
It costs too much	2.2% (0.9, 3.5)	2.9% (1.5, 4.3)	+ 0.7%	(-0.03, 0.01)
I do not know where to obtain protective eyewear	1.3% (0.3, 2.3)	2.1% (0.9, 3.3)	+ 0.8%	(-0.02, 0.01)
Other	10.2% (7.4, 13.0)	10.3% (7.7, 12.9)	+ 0.1%	(-0.04, 0.04)

\*n= 48 missing values in 2001, 26 missing values in 2002

### 7.6.7 General knowledge about protective eyewear

Table 15 shows that the most frequent response to 'knowledge of what eyewear provides suitable protection' was polycarbonate lens eyewear. The proportion of players reporting this was significantly higher in 2002 than in 2001. This increase in correct answers (polycarbonate lens eyewear) corresponds to significantly fewer players stating that they did not know what type of eyewear was suitably protective in 2002 than in 2001. Open-eyeguards was another common response in both survey years.

**Table 15. Type of eyewear thought to be protective**

Eyewear thought to be protective	2001	2002	2001/2002 difference	95% CI for difference
	% of Sample	% of Sample		
	95% CI n=531 *	95% CI n= 586*		
	42.4%	53.4%		
Polycarbonate lenses	(38.2, 46.6)	(49.4, 57.4)	+ 11.0%	(-0.17, -0.05)
	32.0%	28.0%		
Open-eyeguards	(28.0, 36.0)	(24.4, 31.6)	- 4.0%	(-0.01, 0.09)
	29.8%	23.7%		
I don't know	(25.9, 33.7)	(20.3, 27.1)	- 6.1%	(0.01, 0.11)
	12.4%	16.6%		
Industrial eyewear	(9.6, 15.2)	(13.6, 19.6)	+ 4.2%	(-0.08, 0.0)
	7.3%	9.4%		
Normal prescription glasses	(5.1, 9.5)	(7.0, 11.8)	+ 2.1%	(-0.05, 0.01)
	2.8%	3.4%		
Contact lenses	(1.4, 4.2)	(1.9, 4.9)	+ 0.6%	(-0.03, 0.01)
	5.5%	6.3%		
Other	(3.6, 7.4)	(4.3, 8.3)	+ 0.8%	(-0.04, 0.02)

\*n= 24 missing values in 2001, 22 missing values in 2002

Players reported all places where they believed polycarbonate lens eyewear could be purchased from (Table 16). Many players were uncertain but, fewer players gave this response in 2002 than in 2001 (95% CI for difference 0.01, 0.12). Other players indicated that eyewear was available at a sport store. Some players also indicated that eyewear could be bought at squash venues at squash venues other than the one that they completed the survey at.

**Table 16. Knowledge of where polycarbonate lens/standards approved squash eyewear can be bought**

Where polycarbonate lens eyewear can be bought	2001 % of Sample n= 517*	2002 % of Sample n= 601*	2001/2002 difference	95% CI for difference
I do not know	40.2% (36.0, 44.4)	33.4% (29.6, 37.2)	- 6.8%	(0.01, 0.12)
Sport store	37.5% (33.3, 41.7)	42.8% (38.8, 46.8)	+ 5.3%	(-0.11, 0.0)
Other squash venues	34.6% (30.5, 38.7)	38.9% (35.0, 42.8)	+ 4.3%	(-0.10, 0.01)
This squash venue	31.3% (27.3, 35.3)	36.8% (32.9, 40.7)	+ 5.5%	(-0.11, 0.0)
Optometrist	8.3% (5.9, 10.7)	7.3% (5.2, 9.4)	- 1.0%	(-0.02, 0.04)



*Table 16 continued.*

	0.2%	0.7%		
Hardware store	(0.0, 0.6)	(5.0, 9.0)	+ 0.5%	(-0.01, 0.0)
	1.4%	1.8%		
Other	(0.4, 2.4)	(0.7, 2.9)	+ 0.4%	(-0.09, 0.10)

*\*n= 38 missing values in 2001, 7 missing in 2002*

Few players indicated (2001; n=89 16.5%, 2002; n=108, 18.6%) (95% CI for difference -0.06, 0.02) that they were aware of a regulation to implement compulsory use of protective eyewear in squash. Of these, (2001; 87.6%, 2002; 90.6%) (95% CI for difference 0.07, 0.01) players stated that its use is compulsory for junior players. Some players said doubles players were required to wear protective eyewear when playing. Other volunteered options were: eye safety committee recommends it; it is compulsory overseas; it has been mooted by squash associations and VSF; and it is compulsory at some venues.

#### **7.6.8 Player attitudes towards protective eyewear use**

Most players (2001; 88.6%, 2002; 91.0%) (95% CI for difference -0.06, 0.01) thought that polycarbonate lens eyewear should be made available for purchase at the particular squash venue where they completed the survey. Similarly, the majority (2001; 76.3%, 2002; 83.0%) (95% CI for difference -0.11, -0.02) thought that protective eyewear should be able to hire at squash venues.

Table 17 represents players' opinions as to what category of squash player they believed was most at risk of sustaining an eye injury. Some players indicated more than one category. The most frequent response was that there is an equal risk to all players. There was a significant shift from more players believing that there is

an equal risk to all players in 2001 than in 2002 to players believing that the casual/social player is most at risk in 2002.

**Table 17. Risk perception of players most at risk of sustaining an eye injury**

Eye injury risk perception	2001	2002	2001/2002 difference	95% CI for difference
	% of	% of		
	Sample	Sample		
	95% CI n= 554*	95% CI n= 593*		
There is an equal risk to all players	59.9% (55.8, 64.0)	53.0% (49.0, 57.0)	- 6.9%	(0.01, 0.13)
Casual/social player	35.0% (31.0, 39.0)	48.2% (44.2, 53.3)	+ 13.2%	(-0.19, -0.08)
State grade player	1.8% (0.7, 2.9)	2.5% (1.2, 3.8)	+ 0.7%	(-0.02, 0.01)
Inhouse player	1.1% (0.2, 2.0)	7.3% (5.2, 9.4)	+ 6.3%	(-0.09, -0.04)

\*n= 11 missing values in 2001, 15 missing values in 2002

Table 18 presents the responses to the Likert scale attitudinal eye safety statements. The proportions of players who 'strongly agreed' and 'agreed' to each statement are presented in Table 18. If players indicated that they 'strongly agreed' or 'agreed' to the statement it meant a positive eye safety attitude. Two questions were worded differently, meaning that a response of 'strongly disagree' or 'disagree' was in fact a favourable eye safety attitude. For these two cases, the

results of those players who indicated that they 'strongly disagreed' or 'disagreed to the statement are provided. There were no significant differences in the proportions of responses to each statement, with one exception. Significantly more players in 2002 would not in fact stop playing squash if protective eyewear was made compulsory.

**Table 18. Players eye safety attitudes**

	<b>Strongly Agreed/Agreed 95% CI 2002 n=555</b>	<b>Strongly Agreed/Agreed 95% CI 2002 n=608</b>	<b>95% CI for difference</b>
Protective eyewear should be made compulsory for junior players	71.2% (67.4, 75.0)	74.3% (70.8, 77.8)	(-0.08, 0.02)
Protective eyewear would significantly reduce my risk of sustaining an eye injury whilst playing squash	69.2% (65.4, 73.0)	73.9% (70.4, 77.4)	(-0.10, 0.0)
More players should use protective eyewear	61.7% (57.5, 65.7)	65.4% (61.6, 69.2)	(-0.09, 0.02)
Eye injuries are a particular problem for squash players	58% (53.9, 62.1)	63.1% (59.3, 66.9)	(-0.11, 0.01)
The risk of eye injury in squash is high	48.8% (44.6, 53.0)	56.3% (52.4, 60.2)	(-0.13, -0.02)
It is just as easy to use protective eyewear as it is to wear ordinary prescription glasses or sunglasses	33.4% (29.5, 37.3)	33.4% (29.7, 37.1)	(-0.05, 0.05)

**Table 18 continued.**

	<b>Strongly Agreed/Agreed 95% CI 2002 n=555</b>	<b>Strongly Agreed/Agreed 95% CI 2002 n=608</b>	<b>95% CI for difference</b>
It is important that I personally use protective eyewear when playing squash	21.8% (18.4, 25.2)	22.8% (19.5, 26.1)	(-0.06, 0.04)
Protective eyewear should be made compulsory for all players	20.0% (16.7, 23.3)	20.1% (16.9, 23.3)	(-0.05, 0.05)
	<b>% of sample who Strongly Disagreed/Disagreed</b>	<b>% of sample who Strongly Disagreed/Disagreed</b>	<b>95% CI for difference</b>
I would stop playing if protective eyewear was made compulsory	60.5% (56.4, 64.6)	66.6% (62.9, 70.3)	(-0.12, -0.01)
The benefits of using protective eyewear is low	57.0% (52.9, 61.1)	65.7% (61.9, 69.5)	(-0.14, -0.03)

## **7.7 Combined summary results of annual player surveys**

This Chapter has presented the descriptive statistics of player surveys that were conducted with the same questionnaires and almost identical methodology. The sample included players from the same population in 2001 and 2002. The survey methodology resulted in high response rates over the consecutive years.

In summary, there were no significant differences in the demographics of players such as age, gender, their playing standard or history of play. With respect to age, there was no difference to the reported age of survey participants (mean calculated) and the estimated age of non-participants.

There were also no significant differences in the frequency of eye injuries between the survey groups nor in the cause of these injuries, which were mainly the ball and racquet. The calf, ankle, knee and lower leg tended to be the most injured body region, consistently for both survey years, with significantly less 'strain' as cause of injury reported in 2002 compared to 2001 survey.

The proportion of self-reported protective eyewear use did not differ over the two year period. The stated reasons for players choosing to wear or not wear eyewear also did not vary. The only significant difference with respect to the use of protective eyewear was that participants were more likely to have correct knowledge that polycarbonate lens eyewear provided adequate protection, in 2002 than in 2001. However, this did not seem to alter player's eye safety behaviours.

Due to the similarities of the data over the two year period, it would seem appropriate to combine the data for further analyses. Defining specific predictors or influences of protective eyewear use would be beneficial. What is it that makes the few players wear appropriate eyewear? Why is it that players' do not

adequately protect their eyes? The answers to these questions are in Chapter Eight. Once the barriers and influences of eyewear use are understood, strategies can be developed to alter players' eye safety attitudes, knowledge and subsequent behaviours. From the results presented in this Chapter and the trends of eye safety as discussed in Chapter Four, there is no reason to expect that the use of appropriate eyewear will increase at large, without an intervention or promotion.

The predictors of appropriate protective eyewear use is presented in Chapter Eight. This is based on the combined results of the surveys results presented in Chapter Seven.

## Chapter 8: Factors relating to the use of protective eyewear

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The foundations of the descriptive data presented in the previous Chapters and in particular, the investigation of players' knowledge, attitudes and behaviours associated with protective eyewear in Chapter Six points out that further analysis and investigation to understand the behavioural aspect of protective eyewear use is warranted.

The predictors of appropriate eyewear use from data obtained during the player surveys are described and examined in this Chapter. The paper titled *Unprotected eyes in squash: Not seeing the risk of injury* by R Eime, C McCarty, C Finch and N Owen was accepted for publication in the Journal of Science and Medicine in Sport in July 2004.

The significant predictors of appropriate eyewear use were found to be, being a female player, previous experience of an eye injury, playing squash on average for more than two hours per week and having favourable eye safety attitudes.



**Declaration for Thesis Chapter Eight**

In the case of *Chapter Eight*: paper titled: "*Unprotected eyes in squash: Not seeing the risk of injury*", contributions to the work involved the following:

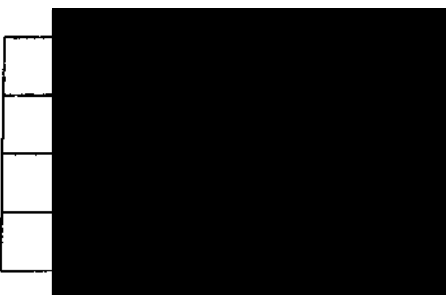
Name	% contribution	Nature of contribution
Rochelle Eime	70%	Design, analysis and writing of paper
Catherine McCarty	15%	Assistance with analysis and contribution to writing of paper
Caroline Finch	10%	Contribution to writing of paper
Neville Owen	5%	Contribution to writing of paper

**Declaration by co-authors**

The undersigned hereby certify that:

- (1) they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;
- (2) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;
- (3) there are no other authors of the publication according to these criteria;
- (4) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit; and
- (5) the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s) Injury Risk Management Research Centre, University of New South Wales, and Department of Epidemiology and Preventive Medicine, Monash University

		Date
Signature 1		16/1/04
Signature 2		19-Jan 2004
Signature 3		16/01/04
Signature 4		22/1/04

## **Unprotected eyes in squash:**

### **Not seeing the risk of injury**

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**Abstract**

The use of appropriate eyewear in squash can protect the eyes against injury. However, few adult squash players adequately protect their eyes against potential severe injuries. We describe the characteristics of non-users of protective eyewear and examine predictors of appropriate eyewear use. Self-report surveys of adult players were conducted in metropolitan Melbourne, Australia. Information on players' knowledge, behaviours and attitudes associated with protective eyewear use was collected, in addition to player demographic data. Appropriate eyewear was defined as Standards-approved polycarbonate lens eyewear. The majority 92.2% of players did not adequately protect their eyes whilst playing squash. Significant predictors of reported eyewear use were: previous eye injury; playing squash on average more than 2 hours per week; having played for more than 20 years; and having more favourable attitudes towards eye safety in squash. The significant predictors of appropriate eyewear use were: being female; previous eye injury; playing squash on average more than 2 hours per week; and having more favourable attitudes towards eye safety in squash. Understanding the characteristics of both users and non-users of appropriate eye protection in squash is essential for informing future prevention strategies.

## Introduction

In many sports, personal equipment designed to protect players against injury is a fundamental part of the game. In some sports, it is even compulsory for players to use protective equipment specific to the injury risks of the particular sport (1-3). In others, players may choose to use or not use the available protective equipment.

There is a plethora of reasons why a player would voluntarily choose to wear a particular type of protective equipment. Rehabilitation of an injury or stabilisation of an existing/recurring injury are two (4, 5). Another reason is previous injury experience either to, themselves or to another player (6). The actual design, comfort, cost, look and availability of the protective equipment and player group norms can also influence a person using such equipment (6-10). Other personal factors can also be associated with protective equipment use either in conjunction with these or by themselves. Such factors include knowledge of appropriate protective equipment, other protective equipment behaviours as well as specific attitudes towards the equipment (6-8). Heightened injury risk perception can also influence protective equipment use by acting as a moderator variable on these other factors.

In Australia, the use of protective eyewear is compulsory for all junior squash players; however adult players are not required to wear such protection (3). Debate remains as to whether or not certain levels of squash players are more at risk of sustaining an eye injury than are others (6, 11). However, any player regardless of age, gender, playing experience or expertise is at risk of sustaining an eye injury. This usually occurs through impact from the ball or an opponent's racquet (11). In a recent Australian study of hospital treated squash injuries, the overall eye injury rate was 19.0 per 100,000 registered players in the state of

Victoria (12). Whilst injury damage to the eye and surrounding structures can be as minor as slight bruising, the potential severity can be loss of an eye (11).

The occurrence of eye injuries in many sports, including squash, can potentially be eliminated through the use of appropriate protective eyewear (13). Despite this, very few adult Australian players wear appropriate protection (14). Recently, 18.8% of adult players reported wearing protective eyewear, but fewer than half of these actually wore Standards-approved, or appropriate protective eyewear (6). Types of eyewear reported to be worn, and believed to be protective, included prescription spectacles, open-eyeguards (lensless eyewear), industrial eyewear and contact lenses (14). These types of eyewear can actually exacerbate eye injuries (15, 16), and the only appropriate eyewear is Standards-approved polycarbonate eyewear (3, 15-17).

The descriptive data required to understand the many components relating to eye injuries in squash have been investigated and discussed recently (6, 12, 14, 18, 19). A study of squash venue personnel has also assisted in understanding the environmental influences of protective eyewear use (7). The current literature shows that squash eye injuries in squash are a problem, yet few adult players adequately protect their eyes. What are not yet understood are the specific characteristics of players who do not protect their eyes. The aim of this study, therefore, was specifically to identify players who do not wear appropriate protective eyewear and to describe their reasons for not doing so, as well as determining the significant predictors of protective eyewear use. It is the unprotected players who should be the focus of any injury prevention measures as they would benefit most from future behaviour change strategies.

## Methods

Half of all squash venues in metropolitan Melbourne that are associated with the Victorian Squash Federation, the governing body of squash in Victoria, were randomly selected for the study. A self-completion, anonymous survey was administered to all adult players present at the squash venues during randomly assigned data collection sessions on peak playing evenings over a seven week period. Players were directly approached either before or after a game of squash. The survey was conducted during the same months (April-June) in each of two consecutive years, 2001 and 2002. The recruitment of players included competition players as well as social/recreational and practising players.

The survey collected information about: basic player demographics; squash playing history; self-report previous injury; use of protective eyewear; related knowledge and attitudes associated with protective eyewear. Many of the survey items were derived from previous research (6). Player characteristics were described (Table 1). The responses presented in Table 2 identify the response items used in the survey form. Players were asked to indicate all options listed in the survey that applied to them, or they could specify a response not listed. Players were also able to provide opinions not listed, however these were not common and were subsequently listed under 'other'. Appropriate protective eyewear was defined as Standards-approved polycarbonate lens eyewear. All other eyewear was deemed inappropriate to provide adequate protection.

Survey data were double entered and transferred into the Statistical Package for Social Sciences (SPSS) Version 11.0 for statistical analysis. Preliminary analyses found no significant differences between the key responses from the 2001 and 2002 surveys. Therefore, the data sets were combined and analysed as one data

set. Descriptive statistics including proportions and associated 95% confidence intervals (95% CI) were calculated.

Based on the Likert scale responses to the attitudinal statements, two different analyses was performed. Firstly, to compare attitudes of users and non-users of appropriate protective eyewear, the strongly agree and agree responses were combined and analysed (Table 3). Secondly, a total attitude score was calculated for each individual player and is presented in Table 4. Responding in a positive safety manner to each statement was assigned the following scores: Strongly Agree=5; Agree=4; Uncertain=3; Disagree=2 and Strongly Disagree=1. This scoring system was reversed for the two statements where disagreeing with the statement actually indicated a positive safety attitude.

Chi-square analysis was used to examine the association between non-use of protective eyewear and categorical data. Multivariate logistic regression analysis, with the dependent variable being appropriate protective eyewear use (yes/no), and independent variables being demographic variables (age and gender) as well as playing habits (years of play, playing frequency), attitudes towards eye safety and previous eye injury experience, was used to determine the significant predictors of protective eyewear use and associated odds ratios. All variables listed in the Table 4 were entered in the multivariate logistic regression model. These variables were selected for the model because they were thought to potentially impact the use of protective eyewear and are factors that could potentially be used to subset the players in the future for more targeted interventions/education.

## Results

All randomly selected venues agreed for the survey to be conducted on their premises. The combined two-year survey sample consisted of 1163 adult players, with an associated response rate of 94.2% of all players approached. Table 1 summarises the player characteristics for the total sample.

Overall 1072 (92.2%; 95% CI:90.6, 93.7) adults reported that they did not wear appropriate protective eyewear. Hence, 91 players reported wearing appropriate eyewear when playing. Player survey sample demographics are summarised in Table 1.

*Insert Table 1 about here*

Table 1 relates only to the characteristics of the 1072 non-users. The mean age of players was 40 years, (range 18-73 years), and there were more males than females (75.4% versus 24.6%).

These non-user players were asked if they had sustained an eye injury whilst playing squash within the previous year. Only 2.7% of players reported an eye injury. Of these, the racquet (48.1%) was the most common mechanism of injury, followed by the ball (37.0%). Injuries to other regions of the body had been sustained by 34.3% (95% CI 31.4, 37.2) of players within the past year. Most commonly injured body regions included the calf muscle (11.7% of injuries), knee (11.4%), lower back (10.6%) and ankle (9.4%). Combined, injuries to the lower leg regions totalled 45.6% (95% CI 40.4, 50.8) of all injuries.

*Insert Table 2 about here*



Of the players reportedly wearing appropriate eyewear, 9.4% (95% CI 7.6, 11.2) wrongly thought that they were adequately protecting their eyes. The inappropriate eyewear included prescription glasses, open-eyeguards, industrial eyewear, and contact lenses. Separate from the question regarding the use of protective eyewear, was a question asking if players wore prescription glasses when playing. A total of 8.8% of the non-users reported doing so. Thus, in total, 14.1% (95% CI 12.0, 16.2) of the sample reported playing with prescription glasses, some believing they were protecting their eyes from injury, and others not.

When asked what eyewear they thought provided adequate protection against an eye injury, 28.9% (95% CI 26.1, 31.7) of non-users were uncertain. In addition, 63.2% (95% CI 60.3, 66.1) reported eyewear that is not appropriate such as industrial eyewear, open-eyeguards and contact lenses.

The non-users reasons for not wearing appropriate, polycarbonate protective eyewear were varied (Table 2). Simply, 'I do not want to' was the most common reason provided. Very few players (2.6%), indicated that their reason for not wearing protective eyewear was because it cost too much. Most of the non-user players, (72.5%; 95% CI 69.7, 75.3) indicated that they had never tried using appropriate, polycarbonate lens protective eyewear.

To further understand the characteristics of non-users of appropriate protective eyewear, their knowledge of where the eyewear could be obtained was investigated (Table 2). Many players, 39.6% (95% CI 36.6, 42.6) indicated 'uncertain' for this question. A sports store was also a frequent response (39.3% 95% CI 36.3, 42.3). The particular survey venue (32.0%; 95% CI 29.2, 34.8) and

squash venues other than the specific survey venue (35.0% 95% CI 32.1, 37.9) were also common.

*Insert Table 2 about here*

Players' specific attitudes and beliefs associated with eye injury risk and of protective eyewear were an important factor for analysis of the predictors of protective eyewear use. Even though these players did not wear protective eyewear when playing squash, nearly all believed that appropriate eyewear should be available for purchase (89.4%; 95% CI 87.5, 91.3) and hire (79.5%; 95% CI 77.0, 82.0) at squash venues.

The results of the analysis of players' beliefs and attitudes about eyewear are presented in Table 3. The results to the same statements by players who reportedly wore appropriate protective eyewear are provided for comparison purposes. Overall, players wearing appropriate eyewear had significantly more favourable attitudes to all eye safety opinions in all but two statements. In one case, the majority of both users and non-users stated that they would not stop playing squash if eyewear use was made compulsory. Non-users were also significantly more likely to report that benefits of wearing protective eyewear are low, than those players who wore adequate eye protection.

*Insert Table 3 about here*

The results of the multivariate logistic regression analysis in Table 4 show that the significant predictors of use of protective eyewear were previous eye injury, more favourable attitudes towards eye protection, 20 or more years of squash playing, and playing squash two or more times per week. Significant predictors of appropriate protective eyewear use included female gender, previous eye injury, more favourable attitudes towards eye protection, and playing squash two or more

times per week. Players' knowledge of what eyewear provides adequate protection (that is, polycarbonate lens eyewear) was also assessed. Those with correct knowledge were significantly more likely to wear appropriate protective eyewear (OR=3.7,  $X^2$   $p < 0.001$ ) than those who were uncertain or indicated an incorrect response.

*Insert Table 4 about here*

## **Discussion**

The descriptive epidemiology of eye injuries and the use of protective eyewear in squash has received research attention recently in Australia (6, 12, 14). This paper extends this initial research, by examining the specific characteristics of Australian adults who do not adequately protect their eyes when playing squash.

This study provides a large sample of community level squash players, which equated to 5% of the total number of registered players in metropolitan Melbourne during the time of this study. It is expected that the random selection of 50% of the squash venues in the study population separately in each of the two years, and the high survey response rate, has led to a sample of players that is representative of adult squash players throughout Melbourne. The demographics of the total sample did also not differ from the sample of non-users of protective eyewear. Only a small number of players reported having sustained a recent squash eye injury, which is consistent with previous published studies (14).

In an effort to increase the response rate of individuals, their identity was anonymous. A limitation of this study is that some players may have been surveyed both years.

The most common reasons reported by players for not wearing appropriate protective eyewear were associated with the design and comfort of the eyewear. However, few of these players had actually ever tried wearing such eyewear. Thus, some players were reporting anticipated barriers only. Inadequate knowledge of what eyewear is appropriate protective is one factor. Some players believe they are protecting their eyes when in fact they are not. Overall, the majority of players perceived eye injury risk on the squash court to be very low, and do not consider wearing any type of eyewear is necessary.

The main issue in the context of the prevention of eye injuries in squash is that the majority (92.2%) of adult players are not adequately protecting their eyes. Unlike some sports injuries, eye injuries in squash can be easily and quite cheaply protected, without essentially altering the nature of the sport. It seems that design and comfort are predominantly only perceived barriers, as most players have yet to try wearing protective eyewear. Appropriate eyewear is not readily available at squash venues for players to loan or purchase, and it is clear that this issue needs to be addressed as a priority (7). Giving players the opportunity to try different types of eyewear before purchasing, would be helpful in this regard.

We have identified several significant predictors of protective eyewear use and these suggest that younger, casual male players should be a major target of educational programs and behaviour change initiatives to improve their attitudes towards use of appropriate protective eyewear. Further research to more fully understand why they do not adopt this safety behaviour and what would motivate them to do so is warranted. Females' dominating the proportion of protective equipment users in sport is not an unfamiliar result. These results also confirm the strong interrelationships between individuals' knowledge, and attitudes and their

specific safety behaviours (8). The barriers, specifically for men to wear protective eyewear and their particular reasons for not choosing to wear this protection needs to be investigated further.

The fact that there are only a few predictors is relevant because it would seem that just a few factors need to be specifically targeted in future prevention strategies. It would seem that such interventions, whilst needing to incorporate the specific behaviour, knowledge and attitudes of these players can be sufficiently general so as to address players of different ages, experience and standards of play.

Given the results of this survey of players' behaviours and knowledge regarding protective eyewear, it is not surprising that their associated attitudes did not favour its use. The association between attitudes and behaviours in this context is made clearer through the comparison to the attitudes of the users of protective eyewear that are also presented. The users were significantly more likely to respond with positive safety attitudes compared to the nonusers. The exception to this was the question of stop playing squash if eyewear use was made compulsory for all players. Whilst not significantly different, the non-users were 2.45 times more likely to state that they would stop playing squash if eyewear use was made compulsory. The non-users were also more likely to state that the benefits of eyewear use was lower, than those who protected their eyes. These two results are again examples of the non-users having less favourable safety attitudes than those who wear eye protection.

This specific information on knowledge, behaviour and attitudes characteristic of players who do and do not wear protective eyewear provides a clear foundation for

the targeting of future injury prevention measures. Environmental influences that include squash venue safety policies and practices are also relevant.

### **Acknowledgements**

This study was funded by an NHMRC Translational Grant in Injury. Rochelle Eime was funded by an NHMRC Public Health Postgraduate Research Scholarship. Paul Vear from the Victorian Squash Federation is thanked for his contribution to this project.

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**Table 1: Player survey sample demographics**

Player characteristic	Total sample (n=1163)	Non-users of appropriate protective eyewear (n= 1072)
Age	Mean: 40 years	Mean: 40 years
	Median: 40 years	Median: 37 years
	(SD 10.8)	(SD 12.9)
	Range 18-73 years	Range 18-60 years
Gender	73.6% Male	75.4% Male
Average time of play per week	80.9% play between 1-5	81.4% play between 1-5
	hours	hours per week
Years of squash experience	72.4% played for 10 years or more	72.7% played for 10 years or more
	61.1% play between	60.6% play between State
Grade of play	State grade and grade 4	grade and grade 4
	competition	competition

Table 2: Reasons why players do not wear appropriate, polycarbonate lens protective eyewear

Reasons for not wearing appropriate protective eyewear	Percent of	
	responding players	95% CI
	n=974*	
I do not want to	31.2	28.3, 34.1
It restricts my vision whilst playing	20.8	18.0, 23.6
I have never thought about it	22.7	20.0, 25.4
It is too uncomfortable to wear	23.9	21.2, 26.6
I am not at risk of an eye injury due to my playing level	11.2	9.2, 13.2
It is not necessary, as the risks of eye injury are not that great	11.0	9.0, 13.0
I wear normal prescription glasses	10.4	8.5, 12.3
I do not like the look of them	2.6	1.5, 3.7
Other	14.4	12.2, 16.6

\*98 missing values

Table 3: Comparison of protective eyewear and injury risk attitudes and beliefs of players who reportedly wear appropriate

protective eyewear to those who do not

Statement	Non-users (n=1072)		Appropriate protective eyewear users (n = 91)		Comparison
	% of respondents who 'strongly agreed' or 'agreed'	95% confidence interval	% of respondents who 'strongly agreed' or 'agreed'	95% confidence interval	
Injury players	71.5	68.7, 74.3	89.0	85.6, 92.4	OR = 0.31 (0.12, 0.82) $\chi^2 = 13.06$ p < 0.001
I would stop playing if protective eyewear was made compulsory	13.4	11.3, 15.5	7.8	5.3, 13.3	OR = 2.45 (0.81, 7.49) $\chi^2 = 2.45$ p = 0.11
Protective eyewear should be made compulsory for all players	16.7	14.4, 19.0	27.8	24.7, 30.9	OR = 0.14 (0.03, 0.53) $\chi^2 = 30.66$ p < 0.001
More players should use protective eyewear	60.7	57.0, 63.0	97.8	94.8, 100.8	OR = 0.03 (0.01, 0.14) $\chi^2 = 49.8$ p < 0.001
Eye injuries are a particular problem for dusts players	59.2	56.2, 62.2	78.0	69.5, 86.5	OR = 0.41 (0.24, 0.70) $\chi^2 = 12.46$ p < 0.001
Chi-Square df=1	Odds Ratio				

Table 3 Continued	0.02	0.07	0.28, 2.80	0.07	0.02
The risk of eye injury in squash is high					OR = 0.34 (0.18, 0.25) $X^2 = 33.38$ $p < 0.001$
The benefits of using protective eyewear are LOW	15.1	4.4	0.5, 8.0	4.4	OR = 3.15 (1.08, 10.11) $X^2 = 20.0$ $p = 0.05$
It is just as easy to use protective eyewear as it is to wear ordinary prescription glasses or sunglasses	30.1	0.31	0.23, 8.13	0.31	$X^2 = 44.50$ $p < 0.001$ OR = 0.52 (0.10, 0.40)
It is important that I personally use protective eyewear when playing squash	0.01	0.48	0.50, 11.5	0.48	$X^2 = 555.0$ $p < 0.001$ OR = 0.004 (0.05, 0.01)
Protective eyewear would significantly reduce my risk of sustaining an eye injury whilst playing squash	0.00	0.70	0.001, 8.40	0.70	$X^2 = 33.50$ $p < 0.001$ OR = 0.02 (0.01, 0.51)

**Table 4: Predictors of use of protective eyewear**

Factor	Use of any protective eyewear Vs non-use OR (95% CI)	Use of appropriate protective eyewear Vs non-use OR (95% CI)
Age 40 years and older	1.13 (0.72, 1.77)	1.66 (0.90, 3.07)
Female gender	1.34 (0.91, 1.96)	2.80 (1.70, 4.59)*
Previous eye injury	2.24 (1.02, 4.91)*	4.20 (1.76, 10.03)*
More favourable attitude towards eye protection	7.59 (4.92, 11.73)*	11.15 (5.25, 23.67)*
20+ years of squash playing	1.97 (1.26, 3.08)*	1.12 (0.61, 2.08)
Play squash two or more times per week on average	1.75 (1.21, 2.54)*	2.26 (1.33, 3.83)*

Shaded boxes indicate statistically significant finding

## **Chapter 9:     Validity of self-reported appropriate                   protective eyewear use**

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A large amount of self-report data has been presented in the preceding Chapters Seven and Eight. Chapter Nine presents an analysis of the validity of players' self-reported use of protective eyewear. During the survey data collection sessions in 2002 and 2003, direct observations of players' wearing all types of eyewear was conducted. The observation information was compared to the self-reported survey data on eyewear behaviours.

The self-reported protective eyewear wearing rate 9.4% was significantly higher (1.6 times more) than the observed rate 5.9%. It was concluded that studies that rely on self-report protective equipment use data alone, need to take into account that this could lead to biased estimates.

The following paper *Do squash players accurately report use of appropriate protective eyewear use?* by R Eime, C Finch, N Owen and C McCarty was submitted to the Journal of Science and Medicine in Sport, June 2004.

## Monash University

Declaration for Thesis Chapter Nine

In the case of *Chapter Nine*: paper titled, "*Do squash players accurately report their protective eyewear use?*", contributions to the work involved the following:

Name	% contribution	Nature of contribution
Rochelle Eime	70%	Design, analysis and writing of paper
Caroline Finch	20%	Contribution to analysis and writing of paper
Neville Owen	5%	Contribution to writing of paper
Catherine McCarty	5%	Contribution to writing of paper

Declaration by co-authors

The undersigned hereby certify that:

- (1) they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;
- (2) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;
- (3) there are no other authors of the publication according to these criteria;
- (4) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit; and
- (5) the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s)

Injury Risk Management Research Centre, University of New South Wales, and Department of Epidemiology and Preventive Medicine, Monash University

Signature 1

Signature 2

Signature 3

Signature 4

Date

16/1/04

16/01/04

22/2/04

19 Jun 2004

## **Do squash players accurately report use of appropriate protective eyewear?**

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**Keywords:** protective equipment, observed behaviours, self-report, validity

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**Abstract**

Self-report surveys are a common method of collecting data on protective equipment use in sports. The aim of this study was to assess the validity of self-reported use of appropriate protective eyewear by squash players. Surveys of squash players' appropriate protective eyewear behaviours were conducted over two consecutive years (2002 and 2003) at randomly selected squash venues in Melbourne, Australia. Over the two years, 1219 adult players were surveyed (response rate of 92%). Trained observers also recorded the actual on-court appropriate protective eyewear behaviours of all players during the survey sessions. Eyewear use rates calculated from both data sources were compared. The self-reported appropriate protective eyewear use rate (9.4%; 95% CI 7.8, 11.0) was significantly higher (1.6 times more) than the observed rate (5.9%; 95%CI 4.6, 7.2). This suggests that players may over-report their use of appropriate protective equipment, though some may have incorrectly classified their eyewear as being appropriate or suitably protective. Studies that rely only on self-report data on protective equipment use need to take into account that this could lead to biased estimates.

## Introduction

Ensuring the validity of research measurement tools is a major consideration for high quality research projects. Self-report methodologies have frequently been used to determine the success of health promotion interventions aimed at behaviour change and are used commonly in injury surveillance studies <sup>(1)</sup>. Sports injury studies often rely on self-reports of protective equipment use and then attempt to relate these self-reported behaviours to injury occurrence. The value of such studies is only as good as the accuracy of the protective equipment use data. A more objective approach is direct observation of protective equipment behaviours <sup>(1, 2)</sup>.

Direct observations of the use of sporting protective equipment have been used to compare the use of such equipment in different exercise settings<sup>(2)</sup>. Few studies have validated self-reported sports safety behaviours against direct observations of these behaviours <sup>(3)</sup>. This means that the validity of self-reported protective equipment use in the sporting context is generally not known.

The aim of this study was to determine whether squash players accurately report their protective eyewear behaviours. We compared data derived from self-reported surveys with direct observations, in large sample of adult Australian squash players.

## Methods

Squash player surveys were conducted at a randomly selected sample of squash venues in metropolitan Melbourne in 2002 and 2003. This covered 22 venues over a total of 38 survey sessions in 2002; and, eight venues over a total of 24 survey sessions in 2003. The survey investigated players' knowledge, behaviours and

attitudes towards protective eyewear. In addition, it sought information on player demographics and injury data. The survey sessions were conducted during peak playing times on weeknights, over a seven week period, at the same time each year. All adult players who attended the squash venues during the survey sessions were personally approached to complete an anonymous survey about their knowledge, attitudes and behaviours associated with the use of protective eyewear in squash. No player was surveyed twice in any year. Participants included social/recreational players, as well as competition players.

Information about the specific type of eyewear worn during play was collected, along with the reasons for its use. Players who reported wearing protective eyewear were also asked to indicate the frequency and context (ie. competition, social play, and/or practice sessions) of use. Appropriate eyewear was defined as Squash Australia Standards Approved Polycarbonate eyewear. All other eyewear was classified as inappropriate because it offers inadequate or no protective benefits. Players' self-reported behaviours were classified as appropriate or not, on the basis of the type of eyewear they specified.

At the same time as the survey, trained observers directly observed the actual eyewear behaviours of all players at the venues. The observers viewed all squash courts at each venue every 30 minutes and noted the number of players wearing appropriate protective eyewear. The 30 minute interval was appropriate because a squash game generally lasts for at least 30 minutes. The observations were performed on all of those who completed the survey, as well as survey refusers and players not approached to be interviewed. Given the high survey response rate, however, the two groups were largely the same.

Appropriate protective eyewear use was calculated as the percentage of all players using it and 95% confidence intervals were calculated. Although they included the same players, it was not possible to directly match the two series of data because the surveys were completed anonymously and the names of the players on court at any one time were not known. Sensitivity analyses were therefore undertaken, with different assumptions about the wearing behaviours of the survey non-responders, to obtain some bounds for the comparisons of the two proportions.

## Results

Overall, a total of 1219 adult squash players completed the survey. The response rate was 92%. The self-reported rate of appropriate eyewear use (9.4%; 95%CI 7.8, 11.0) was significantly higher (1.6 times) than the on-court observed eyewear behaviour (5.9%; 95%CI 4.6, 7.2)

In the sensitivity analyses, it was first assumed that all survey non-responders were non-users of appropriate protective eyewear: the corresponding self-reported usage proportion was estimated at 8.7% (95%CI 7.2, 10.2). When an assumption was made that all non-responders were actually wearers, the self-reported proportion was estimated at 16.7% (95% CI 14.8, 18.6).

The frequency of players who self-reported 'always' wearing appropriate protective eyewear when playing, differed across different contexts of play. Of players reporting wearing protective eyewear, 56.5% reported 'always' wearing eyewear when participating in competition. Fewer players 'always' wore appropriate eyewear when practising (42.7%) or when playing socially (42.0%). Not all protective eyewear users reported using this equipment in all playing contexts.

## Discussion

This study provides unique data assessing the accuracy of self-report protective eyewear behaviours compared to direct observation. Very few Australian adult players wear appropriate eye protection when playing squash <sup>(4, 5)</sup>. Players' self-reported behaviours tended to over-estimate the actual observed behaviours of players in the same playing population. The findings are likely to be representative of what is the case for the general metropolitan Melbourne squash-playing population at the community level, given the high response rate and the random selection of squash venues.

Self-reported data are subjective in nature and may not agree with more objective, direct observations of health or safety behaviours <sup>(6)</sup>. For example, self-report methods tend to detect much higher levels of physical activity than those detected by direct observation <sup>(6)</sup>. In this present study, self-reported protective eyewear use was significantly more common than direct observations of this behaviour.

There are a number of possible reasons for this difference. Utilising other data from the same survey, we have shown that players have limited knowledge of what eyewear is appropriate to wear for protection. <sup>(4)</sup> It may have been that use of the term polycarbonate lens in the survey was confusing to some players. For example, some players may have worn prescription glasses made of polycarbonate lens, and incorrectly indicated this as protective eyewear on their surveys. The observers were trained not to record this as appropriate protective eyewear use.

Our previous studies have also indicated that players tend to wear protective eyewear for matches and not necessarily for practice and/or social play <sup>(5)</sup>. Some

players self-reported wearing protective eyewear only sometimes and their likelihood of always using it also varied across contexts of play. It may have been that the observations were made at a time when they chose not to wear it. In such a case, the observed rate could be expected to be lower than the self-reported rate.

The sensitivity analysis conducted in this paper shows that non-responders are unlikely to have biased our conclusions as the conclusions about over self-reporting of protective eyewear behaviours held true under the assumptions at both extremes.

A strength of this study is that all observers were formally trained at determining the differences between appropriate and inappropriate eyewear. The observational data are thus likely to be more accurate than the self-reported information, as the relevant distinctions may not have been fully clear to the survey respondents.

A limitation of our study is that the observed behaviours could not be directly matched to self-report data for individuals, because the surveys and observations were anonymous. Future studies in competition settings could obtain player details from match score sheets and ask players to give their name on the survey.

Although players' self-reported appropriate eyewear behaviours did not agree with those observed, we believe that the true rate of eyewear use would be closer to that of the observed rate. Studies that rely only on self-report data on protective equipment use need to take into account that this could lead to positively-biased estimates.

**Acknowledgements**

This study was funded by an NHMRC Translational Grant in Injury. Rochelle Eime was funded by an NHMRC Public Health Postgraduate Research Scholarship. Paul Vear, Executive Director of the Victorian Squash Federation is thanked for his valuable and ongoing supportive role in this squash eyewear research project.

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## **Chapter 10: The conceptual framework for the Protective Eyewear Promotion strategy**

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The problem of eye injuries in squash, the specific causes and a suitable preventive measure have been well established in the literature. It could be said that the foundation for eye injury prevention in squash is laid. Laboratory experiments have found appropriate protective eyewear to prevent eye injuries (Pashby 1992). Squash balls are mechanically fired in excess of speeds produced by players, at eyewear which is mounted on a head-form (Pashby 1992). The eyes on the head-form and the surrounding eye structures are not damaged. It is clear that certain brands of eyewear prevent eye injuries in squash, not just in the laboratory but in real-world experiences too. However, the theory and reality are quite dissimilar. Chapter Six presented the current standing of the eye safety practices and eyewear availability of the squash venues. In the field, it would seem that the eyewear is not on players heads, but instead still on the shelves, at least in venues that stock this protective eyewear. Worse still, many squash venues do not have eyewear readily available to players. Players' reasons for wearing and not wearing have also been investigated in Chapters Seven and Eight. Simply, in reality, the mechanical barrier is not preventing eye injuries in squash. There are multifactorial reasons for this, including factors relating to the squash environment as well as players themselves. These underlying factors need to be taken into account and a holistic project approach targeting change at each level through the application of behavioural change principles is required.

Given the status, it was thought appropriate to change this through a multifaceted ecological model health promotion strategy. Through combining the findings from the descriptive research it was found necessary to design and implement an injury prevention strategy in an attempt to change the environmental setting as well as players' knowledge, attitudes and behaviours with regards to protective eyewear use in their sport. This particular intervention was named the Protective Eyewear Promotion (PEP).

This Chapter Ten presents the theoretical behaviour change strategies that were adopted for the conceptual framework underpinning the prevention of eye injuries, using protective eyewear. Chapter Eleven describes the implementation and evaluation of PEP.

The PEP was a promotional strategy that was conducted throughout randomly selected squash venues in Metropolitan Melbourne. Four squash venues within one playing associated in Metropolitan Melbourne were randomly chosen to receive and implement PEP. Another four venues in another playing associated were the Control venues. In summary, the main components of PEP included the provision task specific behavioural information, in addition to addressing the availability problems of limited appropriate protective eyewear within squash venues.

The design of PEP is described in the following paper *Protective Eyewear Promotion: Applying principles of behaviour change in the design of a sports injury prevention program*, by R Eime, N Owen, C Finch. *Sports Medicine*, Accepted for publication March 2004.

## Monash University

Declaration for Thesis Chapter Ten

In the case of *Chapter Ten*: paper titled "*Protective Eyewear Promotion: Applying principles of behaviour change in the design of a sports injury prevention program*", contributions to the work involved the following:

Name	% contribution	Nature of contribution
Rochelle Eime	70%	Design and writing of paper
Neville Owen	20%	Methodology of the paper and contribution to writing of paper
Caroline Finch	10%	Contribution to writing of paper

Declaration by co-authors

The undersigned hereby certify that:

- (1) they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;
- (2) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;
- (3) there are no other authors of the publication according to these criteria;
- (4) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit; and
- (5) the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s)

Injury Risk Management Research Centre, University of New South Wales, and Department of Epidemiology and Preventive Medicine, Monash University

Signature 1

Signature 2

Signature 3

		Date
		16/1/04
		27/2/04
		16/01/04

**Protective Eyewear Promotion:**  
**Applying principles of behaviour change**  
**in the design of a sports injury prevention program**

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Running title: Health promotion strategies for injury prevention

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This study was funded by an NHMRC Translational Grant in Injury. Rochelle Eime was funded by an NHMRC Public Health Postgraduate Research Scholarship. The Victorian Metropolitan squash venues operators are thanked for their ongoing contribution to this research. Paul Vear from the Victorian Squash Federation is also thanked for his involvement in this project. Dunlop and IMAX Pty Ltd, are acknowledged for their partnership in this project.

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[REDACTED]

[REDACTED]

## Abstract

Eye injuries in squash have the potential to be severe. Although these injuries can be prevented through the use of protective eyewear, few players wear such eyewear. The aim of this paper is to outline the behavioural principles guiding the design of a squash eyewear promotion initiative, the Protective Eyewear Promotion (PEP). Principles from the Health Belief Model and ecological models of behaviour change were used to provide a comprehensive perspective on intrapersonal factors, policies and physical environmental influences of protective eyewear use. Results of baseline player surveys and venue manager interviews were used to provide relevant and specific intervention content. At baseline, protective eyewear was not found to be readily available, and players' behaviours, knowledge and attitudes did not favour its use. The main components of PEP involved informing and educating both players and squash venue operators of the risk of eye injury and of appropriate protective eyewear, as well as assisting with the availability of the eyewear and offering incentives for players to use it. A structural strength of PEP was the strong collaborative links with the researchers of different disciplines, squash governing body, eyewear manufacturers, squash venue personnel, as well as players. Attempts were made within the project structure to make provision for the future dissemination and sustainability of more widespread eye injury prevention measures in the sport of squash.

## 1.1 Introduction

The fast, high intensity, intermittent sport of squash is played on a small indoor court. This close proximity of moving players, in addition to racquets swinging, and a small ball being hit, contributes to a risk of head and eye injuries <sup>(1)</sup>. Eye injuries have been found to be the most frequent squash injury presenting for treatment at a Victorian Emergency Department <sup>(2)</sup>. Squash eye injuries can range from hyphaemas, lid haemorrhages, corneal abrasions, retinal detachments to the extreme of loss of an eye <sup>(1)</sup>. Whilst eye injuries are not the most common squash injury, their potential severity is a major concern, and such injuries pose considerable monetary costs to the player and the community <sup>(3, 4)</sup>. Squash eye injuries need not occur, as it is widely acknowledged that they are preventable through the use of appropriate protective eyewear <sup>(3, 5, 6, 7, 8, 9)</sup>.

The only eyewear approved by Squash Australia must meet frontal impact requirements and is made of polycarbonate <sup>(10, 11)</sup>. It has been known for some time that neither glass nor plastic lenses, nor lensless open eye guards, provide adequate protection to the eye; they can increase the risk and severity of injury <sup>(12, 13, 14)</sup>. Squash players in Australia wear many such types of eyewear, including many that offer no real protection <sup>(15)</sup>.

An examination of protective eyewear use in Australia found that only 9 to 19% of adult players reported using some form of protection <sup>(15)</sup>. However, less than half of these players actually wore appropriate eyewear, that is Standards Approved polycarbonate eyewear <sup>(16)</sup>. The World Squash Federation recommends that all players should wear protective eyewear <sup>(17)</sup>, however its use is not yet compulsory

for all. To date, Standards Approved protective eyewear is compulsory for junior players worldwide. It is also compulsory for players and coaches in the United States, and doubles players in Canada <sup>(18, 19)</sup>. In addition, Canadian senior players who compete in National Championships and provincial teams, as well as all doubles players are required to wear appropriate eyewear <sup>(19)</sup>. In Australia and England doubles players are also required to wear appropriate eyewear <sup>(10, 20)</sup>.

## **1.2 Pathways to Increasing Protective Eyewear Use**

Figure 1 shows two potential approaches for increasing protective eyewear use among adult squash players. One strategy is to apply a systematic behaviour change approach, in order to promote the voluntary use of appropriate protective eyewear. Another approach is to enforce compulsory protective eyewear use.

***INSERT FIGURE 1 ABOUT HERE***

Although Squash Australia, the peak squash body in the country, had discussions during the 1990's about the possibility of mandating protective eyewear use for all squash players by the end of 2001, this policy development did not eventuate (Paul Vear, Personal Communication). A staged process of regulation introduction was adopted, but the compulsory junior regulation introduced in 1997 did not result in the expected 'trickle-up effect' of these players continuing to use it as adults (Paul Vear, Personal Communication).



Implementing a protective equipment policy can be a protracted process. It requires initial strategies to increase players' knowledge regarding the equipment and to promote favourable attitudes towards its use, before compulsory regulation is a consideration. For example, the compulsory policy of bicycle helmet use in Australia followed more than a decade of research and promotion that included education, mass media publicity, support by professional associations and community groups, consultation with bicycle groups and financial incentives before the policy was implemented <sup>(21)</sup>. Experience with legislating bicycle helmets suggests that it is critical to have a high proportion of voluntary use of protective equipment before such a regulation can be effectively implemented and enforced <sup>(21)</sup>. As shown in Figure 1, the success of a protective equipment regulation will depend on the ability to enforce the regulation. Squash venue managers in Victoria, Australia have expressed concern about their ability to enforce a compulsory protective eyewear ruling for adult players, as well as about players' adverse reactions to such a regulation, should it be introduced <sup>(22)</sup>.

### 1.3 Ecological Models of Health Behaviour

Sallis and Owen argue for the need for multilevel preventive interventions based on ecological models of behaviour change <sup>(23)</sup>. Individual-based approaches do not alter the environmental factors that act to determine the initiation and maintenance of new behavioural choices <sup>(23)</sup>. Ecological models identify intrapersonal factors, sociocultural factors, policies and physical environments as levels of influence on health-related behaviours <sup>(23)</sup>. Ecological models recognise that many factors combine to influence an individuals' behavioural choices <sup>(24)</sup>. These influences are illustrated in column 1 and 2 of Figure 2. Figure 2 portrays how an individual will not engage in using protective equipment, unless they perceive themselves at risk

of injury; find barriers to its use to be minimal; receive cues to action; have confidence about adopting the behavioural change; and, perceive the benefits to be real <sup>(25, 26, 27)</sup>. It is however, recognised that other variables that address perceived risk can help to explain influences on behaviour change. Specifically in relation to injury prevention, it has been argued that past experience, perceived vulnerability, perceived severity, perceived effectiveness of existing preventive measures, awareness of preventive measures, perceived availability and cost, and social influences all contribute to protective behaviour changes <sup>(28)</sup>.

***INSERT FIGURE 2 ABOUT HERE***

Knowledge is an important factor influencing both attitudes and behaviours. Collectively, attitudes towards, and knowledge about safety protection can substantially influence safety behaviours <sup>(24, 29)</sup>. Geller argues that for a safety intervention to be successful, people need to progress through a sequential behaviour change process, as illustrated in column 3 of Figure 2 <sup>(24)</sup>. Furthermore safety behaviour can be predicted by past experiences of injury, either to themselves or knowledge of an eye injury occurrence <sup>(15, 22, 24, 30)</sup> as well as knowing others who perform certain safety behaviours <sup>(22, 31)</sup>. If individuals do not think that specific protective equipment is necessary, they will not use it <sup>(32)</sup>.

Education and information strategies have been widely used in a range of safety equipment promotion strategies <sup>(24, 33, 34, 35, 36)</sup>. Whilst education is necessary, it is not solely sufficient for safety behaviour change <sup>(34)</sup>. Educational strategies, together with a broader ecological approach to safety behaviours and incentives

for behaviour change, have been found to have a more positive effect<sup>(24, 33, 35, 37, 38)</sup>.

Safety research has demonstrated that significant incentives provided to people work as an effective motivator to the desired behaviour<sup>(24)</sup>. Attempts to persuade people to use seat belts or bicycle helmets, before the introduction of the respective regulations, were unsuccessful without incentives<sup>(21, 24)</sup>. However, when prizes were awarded for use of seat belts, and bicycle helmet use the proportion of people using these safety devices increased<sup>(21, 24)</sup>. Even relatively low-cost incentives have been shown to produce large increases in seat belt use, which demonstrates that many people are not opposed to seat belts<sup>(24)</sup>. The incentives assisted in the particular seat belt intervention because the risk of injury per trip is low and because drivers have unrealistic optimism regarding their own driving skills<sup>(24)</sup>.

#### **1.4 Applying Ecological Principles of Behaviour Change**

Two guiding principles that require consideration in the design and implementation of a safety behaviour intervention are the potential for direct environmental influences on behaviour and the adoption of a multilevel approach<sup>(23)</sup>.

In the immediate environment of squash venues, equipment such as racquets, balls and apparel is widely available for purchase and/or borrowing purposes. In this context, squash venue operators could potentially influence players' safety habits through specifically promoting the availability and use of appropriate

protective eyewear within the proximal venue environment <sup>(22)</sup>. The access to, and promotion of protective eyewear at squash venues is necessary for people to perceive the need for its use <sup>(22)</sup>. Sherker and Cassell, recommend that sports protective equipment be promoted at point of equipment sale or hire, preferably as a 'package deal' <sup>(39)</sup>. That is, that the provision of the equipment is included in the price of the sporting product <sup>(39)</sup>. The current practices and policies of squash venue operators are thus important, in order to fully address the environmental and social contexts in which the risk of squash-related eye injuries is greatest <sup>(22)</sup>. Squash venue operators can play a pivotal role in promoting and influencing the safety practices of players <sup>(22, 39, 40, 41)</sup>.

To comprehensively influence squash safety environments, sport governing body support and relevant industry support is crucial. The Victorian Squash Federation (VSF), the governing body of squash in the Australian state of Victoria, has been a collaborative partner in the development of eye injury prevention strategies. Its main role has been to act as an advocate for the squash environment and to disseminate project information. For the provision of appropriate protective eyewear readily available to venues and players, the two leading Australian eyewear manufacturers were approached, and are also project partners. In addition, their role is to assist in offering incentives to players who try and/or purchase eyewear. Squash venue operators were involved throughout the design and implementation of the project.

## 2. Relevant Venue Manager Survey Findings

In order to move from the underlying theoretical models to the development of a Protective Eyewear Promotion (PEP) strategy information about relevant knowledge, beliefs, behaviours and attitudes of players associated with protective eyewear was gathered. Information regarding the practices and policies of squash venues was also collected and systematised. Individual and environmental influences of protective eyewear use were examined through use of two baseline player surveys and venue manager interviews <sup>(22)</sup>.

An independent random sample of squash venue managers was selected in 2001 and 2002 for interviews. Methods and full results have been published elsewhere <sup>(22)</sup>. The content of the interviews covered five topics: overall injury risk perception; eye injury occurrence; knowledge, behaviours, attitudes and beliefs associated with protective eyewear; compulsory protective eyewear; and availability of protective eyewear at venues.

The availability of appropriate eyewear at these venues, for players to either borrow/hire and/or purchase was found to be inadequate <sup>(22)</sup>. The lack of sufficient availability of appropriate eyewear was partly influenced by venue managers' uncertainty about the type of suitable eyewear to have available and where to obtain it. This in turn made it difficult to adopt favourable protective eyewear behaviours. Most venue managers did not adopt an active role in promoting the use of protective eyewear, but increasing voluntary use was a much higher priority than making eyewear compulsory for all players. Notwithstanding this, they were favourable in being better informed about this safety issue and taking a more active safety role. There was concern expressed about their ability to enforce a

protective eyewear regulation and many anticipated negative reaction of players<sup>(22)</sup>. The main finding of the venue manager surveys was the need for protective eyewear to be readily available for players to be able to hire/borrow and purchase at venues<sup>(22)</sup>. There is an associated cost of protective eyewear, for both venues and players. There are different brands of eyewear that consider the diverse requirements of players.

For example, one Australian-made brand of eyewear is a visor style that can be worn over normal prescription glasses. This particular brand also covers a larger area of the face, which is desirable for some players. However, others prefer smaller eyewear that looks very similar to sports sunglasses. This adds confusion for both venue operators and players in making relevant decisions as to what is most suitable for them. Having multiple brands available also adds considerable cost to the venues. Involving the cooperation of eyewear manufacturers, venue managers and educating and informing venue operators and players alike would be a very positive step to increasing voluntary use amongst adult players.

### **3. Relevant Player Survey Findings**

A random sample of 50% of squash venues with at least two squash courts in metropolitan Melbourne, were selected for sampling at the same time in both 2001 and 2002. In 2001, the players were sampled from 25 venues and 22 venues were used in 2002. All adult players present during the data collection sessions were personally invited to participate in the anonymous self-report survey. The survey questionnaire collected information about: basic player demographics (e.g. age, sex); squash history (e.g. number of hours played per week, total years of squash played, participation level); self-report previous injury (e.g. eye or other injury, cause of injury); use of protective eyewear (e.g. frequency, type); related

knowledge and attitudes. In 2001, 555 players were surveyed corresponding to a response rate of 98%. The following year, 608 players were surveyed, with a response rate of 90%. Data from both surveys were combined.

A total of 3% of responding players indicated that they had sustained an eye injury within the past twelve months from squash. Of the 1163 players, 17% stated that they wore protective eyewear whilst playing squash; however the number of players that indicated that they wore appropriate protective eyewear, that is, polycarbonate lens eyewear, was only 8%. The most common reasons for use and non-user of protective eyewear are summarised in Table 1. All non-users of appropriate eyewear were asked if they had ever tried polycarbonate lens protective eyewear; most (74%) had never done so.

***INSERT TABLE 1 ABOUT HERE***

Incorrect knowledge or uncertainty amongst players regarding protective eyewear was clear within the survey findings. Some (13%) of the sample reportedly wore inappropriate, prescription glasses when playing. Whilst these players wore prescription glasses for reasons of vision, some of these players believed they were actually protecting their eyes from injury. Prescription glasses can be worn in addition with a brand of protective eyewear. Other inappropriate eyewear, worn by players who thought they were protecting their eyes included industrial eyewear, contact lenses, and open-eyeguards. Some players stated that they did not know what eyewear provided adequate protection against an eye injury. Many players (37%) stated that they did not know where they could obtain protective eyewear.

A high proportion of players, (57%) believed that all players, regardless of standard, were at an equal risk of sustaining an eye injury. However, 42% believed that casual or social players were more at risk than were higher-grade players.

Players were asked to indicate on a five point Likert Scale, their responses to ten attitudinal statements. The proportion of players who 'Strongly Agreed' or 'Agreed' with each statement is provided in Table 2.

***INSERT TABLE 2 ABOUT HERE***

It is clear from the player survey results that few players wore appropriate protective eyewear, and more wore inappropriate eyewear than the number of players adequately protecting their eyes. The current status of adult players' knowledge, behaviours, and attitudes towards protective eyewear does not favour the use (and therefore immediate regulation) of protective eyewear use in the sport of squash.

#### **4. Implementation of the Protective Eyewear Promotion Project**

Understanding the policies and physical environmental influences of protective eyewear use, and the analyses of the data reported here on, players' knowledge, behaviour and attitudes associated with the eyewear led to the development of PEP. Behaviour change principles were applied to develop a comprehensive strategy to increase the use of appropriate protective eyewear.



The process to the design and implementation of PEP is summarised in Figure 3. The main components of PEP involved informing and educating players and venue managers of the risk of eye injury and of appropriate protective eyewear, through the use of task specific posters, pamphlets and stickers displayed prominently at the project venues (Figure 3, Column 4).

The availability of different brands of appropriate eyewear for venue managers to be able to provide to their players to be able to borrow or purchase was also a major component. Players were able to try one or both of two brands of the eyewear, without being required to purchase the eyewear. Each of these players was asked to complete a player eyewear-feedback form. Incentives including meeting the current female world squash champion, winning a squash racquet or cash prizes and were offered to a random selection of players who choose to adopt the safety behaviour.

***INSERT FIGURE 3 ABOUT HERE***

The project was run and continually monitored at four squash venues over a four month period. Four control venues were also randomly chosen. This number of venues was determined by 90% power calculations of the main outcome measures. A clustered randomisation was performed with venues with at least seven courts. Larger venues were used for the study to capture as many players as possible. The project was continually monitored for four months. A final player survey was then conducted at the PEP and Control venues. Results of the project and control venues will be compared pre and post-PEP on an intention to treat

basis. The project material will continue to be displayed at the project venues after this time.

In summary the strong collaborative nature of this project involving the VSF as the relevant sport governing body, the venue managers and players, as well as the protective equipment manufactures in this project provides a model approach to sports injury prevention research. The high-level of engagement and input from all relevant groups in the sport should allow PEP to be disseminated throughout all squash venues if the PEP trial is successful. The potential for this sports injury prevention initiative to be sustained over time and adopted widely will be the true test of its worth.

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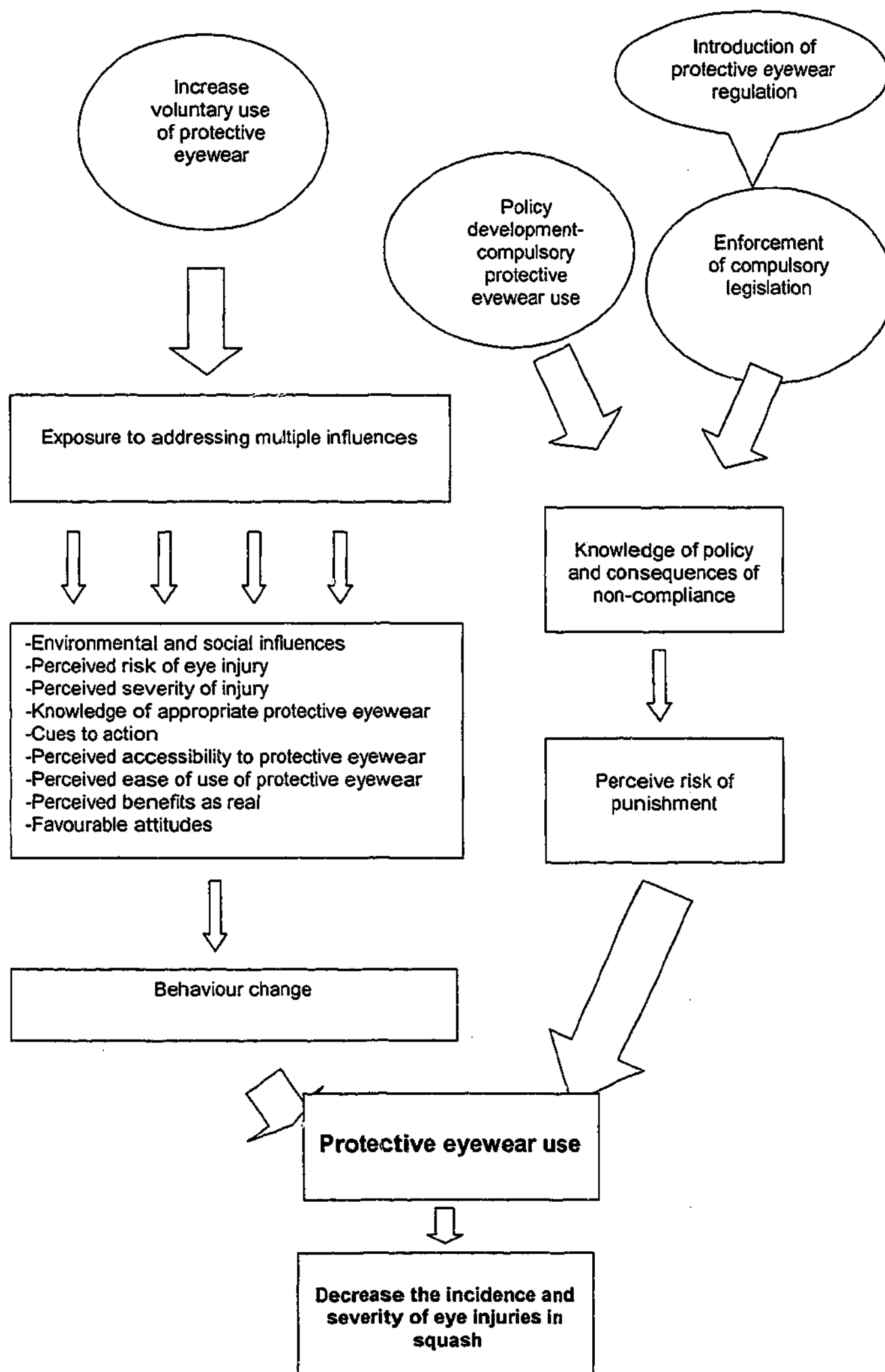
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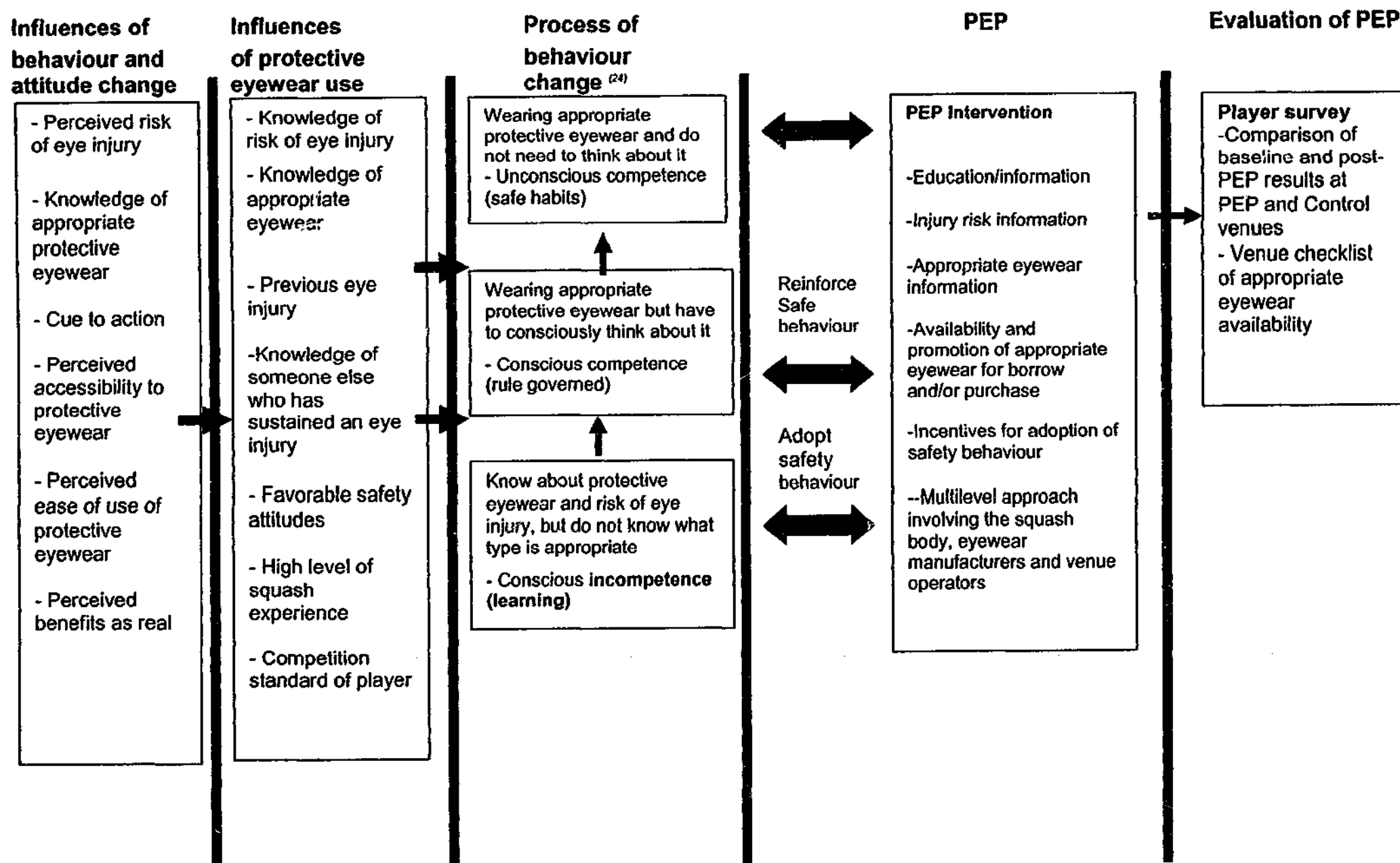
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**Figure 1: Models of protective eyewear adoption:** the left hand side illustrates a voluntary behaviour change model; the right hand side illustrates a regulatory model



**Figure 2: The conceptual framework of the Protective Eyewear Promotion**



**Figure 3: The application of relevant behavioural principles in developing the Protective Eyewear Promotion**

<b><u>CONCEPT</u></b>	<b><u>APPLICATION</u></b>	<b><u>BASELINE RESULTS</u></b>	<b><u>PROTECTIVE EYEWEAR PROMOTION</u></b>
<b>Perceived susceptibility</b>	Define population at risk	<ul style="list-style-type: none"> <li>• Random allocation of, PEP and Control venues</li> </ul>	<ul style="list-style-type: none"> <li>• Target population defined</li> </ul>
<b>Perceived severity</b>	Specify consequences of the risk	<ul style="list-style-type: none"> <li>• 3.4% of sample had eye injury in past year</li> <li>• 53% agreed risk of eye injury is high</li> <li>• 71.6% agreed protective eyewear decreased risk of injury</li> <li>• 60% agreed that eye injuries is a problem</li> </ul>	<ul style="list-style-type: none"> <li>• Injury risk clearly defined on 'risk' posters</li> <li>• Individuals at each stage of behaviour change are targeted through PEP</li> </ul>
<b>Perceived benefits</b>	Define action to take: how, where, when; clarify the positive effects to be expected	<ul style="list-style-type: none"> <li>• 62% agreed benefits of eyewear is high</li> <li>• 72% agreed eyewear would reduce their personal risk</li> </ul>	<ul style="list-style-type: none"> <li>• Action to take detailed on all four posters: 'Appropriate eyewear' poster (what); 'Risk' poster (why); Venue safety' poster (positive safety aspect); 'Incentive' poster (positive effects and incentive)</li> </ul>
<b>Perceived barriers</b>	Identify and reduce perceived barriers through reassurance, correction of misinformation, incentives, assistance	<ul style="list-style-type: none"> <li>• 31% don't want to wear eyewear</li> <li>• perceived comfort barriers</li> <li>• 26% never thought about it</li> <li>• wear incorrect eyewear</li> <li>• 77% of non-users never tried</li> <li>• 37% don't know where to buy</li> </ul>	<ul style="list-style-type: none"> <li>• Eliminate availability barrier for venue managers and players</li> <li>• Try eyewear opportunity</li> <li>• Decrease cost of eyewear</li> <li>• Poster make players aware of eyewear availability</li> </ul>
<b>Cues to action</b>	Provide how-to information, promote awareness, employ reminder systems		
<b>Self-efficacy</b>	Provide training, guidance in performing action	<ul style="list-style-type: none"> <li>• 27% state don't know what is appropriate</li> </ul>	<ul style="list-style-type: none"> <li>• Posters clear 'cues to action'</li> </ul>

**Table 1. Most common responses to the main player survey questions**

<b>Reasons for wearing appropriate protective eyewear</b>	<b>% of respondents</b>	<b>Reasons for not wearing appropriate eyewear</b>	<b>% of respondents</b>
<b>n = 91</b>		<b>n = 1072</b>	
Knowledge of the risk of eye injuries	53%	Protective eyewear is uncomfortable/restricts vision	51%
Previous eye injury	28%	Do not want to	31%
Know someone who has had an eye injury	37%	Never thought about it	26%
		Protective eyewear is not necessary	22%

\* Players were asked to indicate all options that applied to them

**Table 2. Player attitudes towards protective eyewear use (n=1163 players who did not wear appropriate protective eyewear)**

Attitudinal Statements	% of players who strongly agree/agree with each statement (95% CI)
Protective eyewear should be made compulsory for junior players	72.8 (70.2, 75.4)
Protective eyewear would significantly reduce my risk of sustaining an eye injury whilst playing squash	71.7% (69.1, 74.3)
More players should use protective eyewear	63.7% (60.9, 66.5)
Eye injuries are a particular problem for squash players	60.7% (57.9, 63.5)
The risk of eye injury in squash is high	52.7% (49.8, 55.6)
It is just as easy to use protective eyewear as it is to wear ordinary prescription glasses or sunglasses	33.4% (30.6, 36.2)
It is important that I personally use protective eyewear when playing squash	22.4% (20.0, 24.8)
Protective eyewear should be made compulsory for all players	20.0% (17.7, 22.3)

<i>Table 2 continued</i>	12.6%
I would stop playing if protective eyewear was made compulsory	(10.7, 14.5)
The benefits of using protective eyewear are low	12.1%
	(10.2, 14.0)

## **Chapter 11: Implementation and evaluation of the Protective Eyewear Promotion**

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As stated in Chapter Ten, the design and implementation of the Protective Eyewear Promotion (PEP) utilised an ecological model approach. As part of this promotion, the two leading Australian sports protective eyewear manufacturers were approached to be project partners, in addition to the continued collaborative support from the Victorian Squash Federation (VSF). The adoption of an ecological approach also recognises the importance of the environmental context of the intervention and influences, as well as individual or personal characteristics for behaviour change. In this case, squash venues were identified as environmental influences on the use of protective eyewear by players.

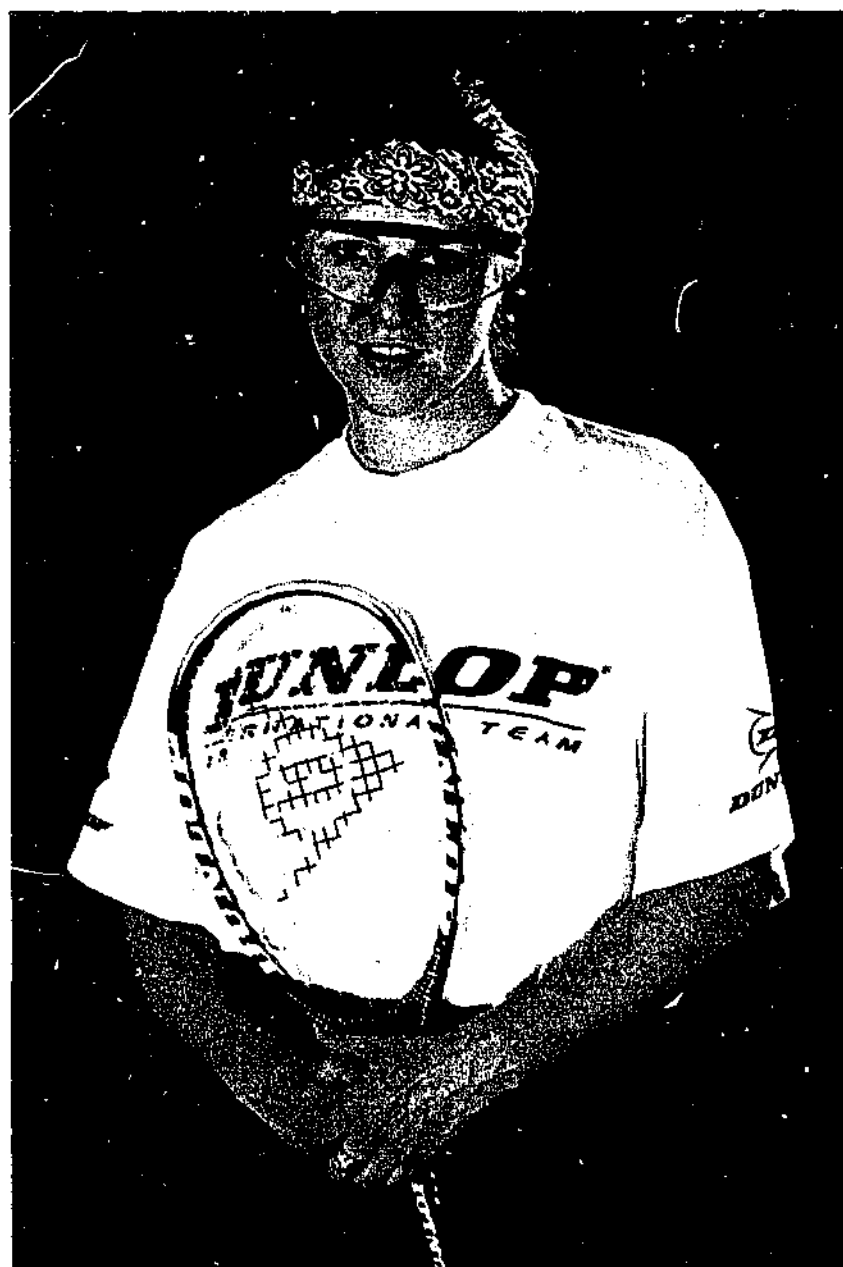
As stated in Chapter Ten, the definitive goal of PEP was to increase the number of players wearing appropriate eyewear when playing squash. To gain momentum towards this goal, PEP endeavoured to rectify the identified problems associated with the availability of appropriate eyewear, both at the venue and individual player level. Improving venue staff's<sup>7</sup> and players' knowledge of both injury risk and of appropriate eyewear was a key component of PEP.

### **11.1 The implementation of the Protective Eyewear Promotion**

In attempting to meet the aims of PEP, it was paramount to establish a connection with, and project support from, eyewear manufacturers. The two Australian eyewear manufacturers (IMAX Pty Ltd and Dunlop Sport) were approached to be PEP partners. Their main role was to provide subsidised eyewear as well as

incentives for players to try or purchase the eyewear during the four month promotional trial (Appendix Five). The two brands of eyewear used in PEP were both Squash Australia Standards Approved protective eyewear, yet represented quite different types of eyewear (Figure 6, 7). To an extent, this accommodated differences among players' tastes in design, look and comfort. Importantly, for the people who wear prescription glasses when playing, the IMAX brand was able to be worn with prescription glasses.

**Figure 6. Protective Eyewear Promotion eyewear, Dunlop brand (as worn by World Champion, Sarah Fitzgerald)**





**Figure 7. Protective Eyewear Promotion eyewear, IMAX brand (as worn by a PEP survey participant)**



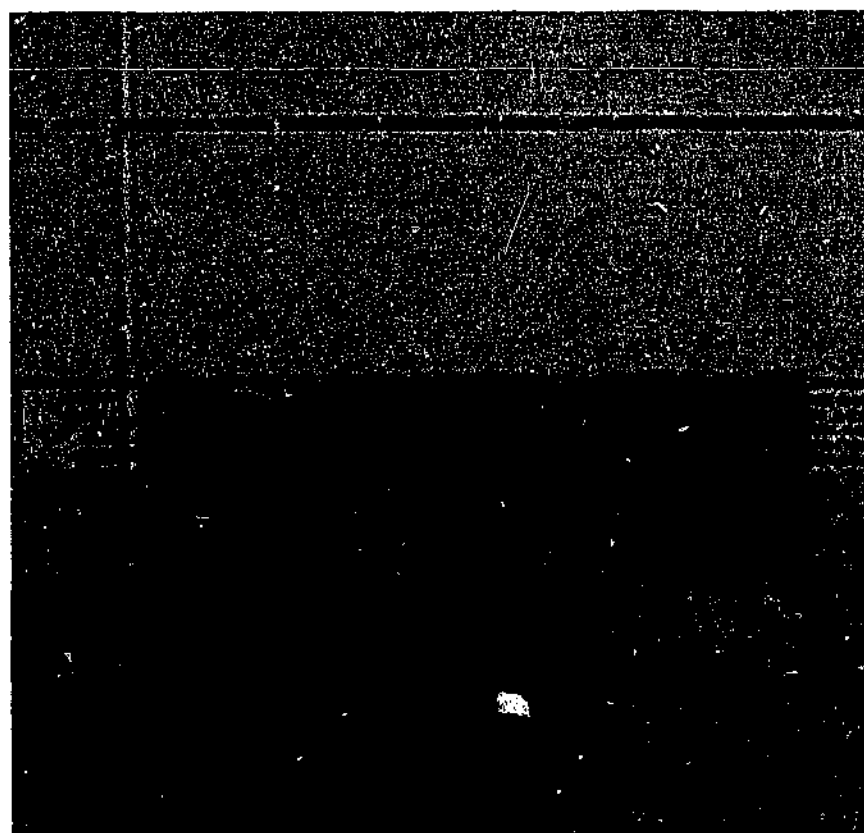
Once the two eyewear manufacturers agreed to be PEP partners, the PEP and control venues were randomly selected, and the corresponding venue managers approached to be involved with the project. The randomisation of the venues to receiving the promotion or control was explained to each participating venue manager. It was further explained that each control venue would be given the opportunity to be provided with the PEP materials and information at completion of the four month trial. A letter explaining the commitment of the PEP venues was sent to the managers for them to read and sign (Appendix Six). Accompanying this letter was a PEP plain language statement which outlined the details of the project further (Appendix Seven).

Task specific posters and a promotional sticker were developed, and displayed prominently throughout the PEP venues. The first of the posters (Appendix Eight) provided details of each of the brands (internationally) of eyewear (including the two PEP brands) that are 'appropriate', being Standards Approved by Squash Australia. Another poster (Appendix Nine) explained certain incentives that were being offered if players chose to try or purchase the project eyewear during the promotion. Facts about the risk of sustaining an eye injury was highlighted through another poster (Appendix Ten). In particular, the message that all players are at risk of sustaining an eye injury irrespective of playing experience was highlighted. The final poster (Appendix Eleven) was designed to express to players that the venue management and staff cared for the safety of their clientele. On the posters, the message, in different contexts, that appropriate protective eyewear is available at 'this' particular venue to borrow or purchase was prominent. A sticker with the words "Protective Eyewear Lets Get It On (Appendix Twelve) was also displayed throughout the PEP venues, most prominently on each of the squash court doors. This simple message was designed to be noticeable for players without them using a conscious effort to read text as was required with the posters. Figures 8, 9 and 10 are examples of how the promotional material was displayed at the PEP squash venues. Pamphlets (not unique to PEP) summarising eye injury risk associated with playing squash and of appropriate eyewear were also displayed on the reception desks of the PEP venues (Appendix Thirteen). PEP eyewear was displayed in clear view at squash venue reception desks.

**Figure 8.** Display of the Protective Eyewear Promotion posters and sticker at project squash venue reception desk



**Figure 9.** Protective Eyewear Promotion sticker displayed on squash court door



At the time when the PEP stickers, posters and pamphlets were set up at each of the PEP venues, the eyewear was also provided (Figure 10). At least one set of each brand of eyewear was displayed prominently on the reception desk next to the cash register where players were required to pay their court fee. The PEP venues were provided with the project eyewear, by the eyewear manufacturers. Some was free of charge so that the venues could lend it out to players at no cost, and other sets were provided at a discounted price that the venue could retail to players. When a player chose to try or purchase a set of eyewear, the brand of eyewear was noted by a member of staff, along with the date and time. The player was then provided with a sheet to provide their contact details so that they could be included in the incentive draw. The PEP squash venue staff were also asked to provide all players who tried or purchased the PEP eyewear at the venues during the trial, with an eyewear feedback sheet (Appendix Fourteen). In further attempts to advertise PEP, a note summarising the project were provided to the squash team captains to provide to their players (Appendix Fifteen).

**Figure 10. Protective Eyewear Promotion eyewear displayed prominently at the squash venue reception desk**



The venue manager of the PEP venues was visited personally bi-weekly. At each visit the incentive sheets and try/buy record sheets were collected. This also ensured that the venues were fully equipped with all promotional materials, and that the project was running smoothly.

A survey was used pre and post-intervention as a tool to evaluate the effectiveness of PEP. Players at the PEP and control venues were surveyed as per the methods explained in Chapter Seven, with the only exception of the number of survey sessions at these eight venues. The conduct of player surveys at PEP and control venues was performed three times each. This was to ensure a larger number of survey participants. The information from the 2002 PEP and Control survey represented the pre-intervention survey. The pre-intervention data was compared with the post-intervention survey data that was conducted in 2003 after four months from the commencement of PEP. The post-intervention survey was slightly different to the pre-intervention survey in that it included questions to assist with the formal evaluation of PEP (Appendix Sixteen).

## **11.2 The evaluation framework of the Protective Eyewear Promotion**

The descriptive analysis of the PEP player survey was performed as described in *Section 7.5*. The following *Section 11.3* describes the PEP and control player surveys results comparing the pre-intervention (2002) to the post-intervention (2003) survey results. To analyse differences between and within the two project groups, 95% confidence intervals were calculated. Linear regression models for the total attitude score, and logistic regression models for all other responses were

performed. Potential confounders were identified and adjusted for in multivariate analysis. Multivariate regression models were used to adjust for potential player-specific confounders. The potential confounders adjusted for were: years of squash experience; grade of play; average hours of play per week; and gender. The PEP impact and process evaluation is presented in *Section 11.4 and 11.5*.

### **11.3 Comparison of the Protective Eyewear Promotion and control group survey data pre and post intervention**

#### **11.3.1 The Protective Eyewear Promotion group survey response rates**

The following Table 19 shows the distribution of responding players surveyed at the PEP and Control venues. The response rate was lower at the Control venues compared to the PEP venues.

**Table 19. Pre and Post-intervention survey response rates**

	PEP	CONTROL	PEP	CONTROL
	Pre-intervention	Pre-intervention	Post-intervention	Post-intervention
Number of participants	266 61% of sample	170 39% of sample	379 62% of sample	232 38% of sample
Response rate	93.0%	89.0%	97.0%	90.0%

#### **11.3.2 Pre and post-intervention player demographics**

As shown in Table 20, the median age of players was similar between the PEP and Control groups pre and post-intervention.

**Table 20. Age of players**

	Pre- intervention		Post- intervention	
	Median	Range	Median	Range
PEP	38	19-68	39	18-72
Control	39	18-62	37	19-60

In 2002, there was no significant difference in the proportion of males versus females between the two groups (95%CI for difference -0.07, 0.11: PEP 65.9% V Control 60.2%). Post-intervention there was a significant difference in the proportion of males versus females between the PEP and Control groups (95% CI for difference -0.16, -0.01: PEP 71.9% V Control 80.3%).

Players' occupations were categorised as per the classifications in Table 21. Most players were employed in a professional field in both groups in both years. The spread of occupations of PEP players and Control players was similar. Players' classification of occupation did not differ considerably between the PEP and Control groups in either survey year.

**Table 21. Classification of players occupation, pre and post intervention**

	PEP	CONTROL	PEP	CONTROL
	Pre-	Pre-	Post-	Post-
Classification of occupations	intervention	intervention	intervention	intervention
	n= 262*	n= 170	n= 368*	n= 222*
	95% CI	95% CI	95% CI	95% CI
	19.9%	9.8%	14.9%	15.3%
Managers	(14.3, 23.9)	(5.3, 14.3)	(11.3, 18.5)	(10.6, 20.0)
	34.4%	30.7%	42.7%	26.6%
Professionals	(28.6, 40.2)	(23.9, 37.6)	(37.6, 47.8)	(20.8, 32.4)
	8.8%	11.7%	9.8%	8.1%
Associate professionals	(5.4, 12.2)	(6.9, 16.5)	(6.8, 12.8)	(4.5, 11.7)
	10.7%	14.7%	7.3%	15.3%
Tradespersons & related workers	(7.0, 14.4)	(9.4, 20.0)	(4.6, 10.0)	(10.6, 20.0)
	5.7%	7.4%	3.0%	3.2%
Advanced clerical & service workers	(2.9, 8.5)	(3.5, 11.3)	(1.3, 4.7)	(0.9, 5.5)
	6.9%	8.6%	9.8%	17.6%
Intermediate clerical, sales & service workers	(3.8, 10.0)	(4.4, 12.8)	(6.8, 12.8)	(12.6, 22.6)
	2.7%	3.1%	1.9%	5.9%
Intermediate production & transport workers	(0.7, 4.7)	(0.5, 5.7)	(0.5, 3.3)	(2.8, 9.0)



**Table 21 continued.**

	0.4%	0.0	0.5%	1.4%
Elementary clerical, sales & service workers	(0.0, 1.2)		(0.0, 1.2)	(0.0, 2.9)
	0.4%	2.5%	0.0	0.5%
Labourers & related workers	(0.0, 1.2)	(0.2, 4.8)		(0.0, 1.4)
	11.1%	11.7%	10.1%	6.3%
Other#	(7.3, 14.9)	(6.9, 16.5)	(7.0, 13.2)	(3.1, 9.5)

# includes students; self-employed persons not further specified, retired and unemployed persons and those performing home duties

\* PEP pre-intervention; 4 missing values, PEP post-intervention; 11 missing values, Control post-intervention; 10 missing values

### 11.3.3 Survey respondents playing habits and standards

The following Tables 22 and 23 display the playing habits of players, firstly on average per week and in total for the previous two weeks. The majority of players in both groups and in both years played, on average, between 1 and 5 hours per week. There were no significant differences between or within project groups in relation to years of squash play, or average squash participant per week, except that less PEP players post-intervention participated for 2 to <5 hours per week when compared to pre-intervention. When calculating the hours of play over the past two weeks before surveying PEP players post-intervention were slightly less likely to have played for a longer period of time post-intervention compared to pre-intervention. There were strong similarities for frequency of play for both PEP and Control group players.

Table 22. Playing frequency per week

	PEP	CONTROL	PEP	CONTROL
	Pre-	Pre-	Post-	Post-
Hours of play per week	intervention	intervention	intervention	intervention
	n= 264*	n= 170	n= 377*	n=231*
	95% CI	95% CI	95% CI	95% CI
<1 hr	8.0% (4.7, 11.3)	12.4% (7.4, 17.4)	17.2% (13.4, 21.0)	16.0% (11.3, 20.7)
1hr to <2hr	32.2% (26.6, 37.8)	40.0% (32.6, 47.4)	37.9% (33.0, 42.8)	48.5% (42.1, 54.9)
2hr to <5hr	49.2% (43.2, 55.2)	40.0% (32.6, 47.4)	34.5% (29.7, 39.3)	28.1% (22.3, 33.9)
5hr to <10hr	8.0% (4.7, 11.3)	7.1% (3.2, 11.0)	8.0% (5.3, 10.7)	6.1% (3.0, 9.2)
10hr or more	2.7% (0.7, 4.7)	0.6% (0.0, 1.8)	2.4% (0.9, 3.9)	1.3% (0.0, 2.8)

\*PEP pre-intervention; 2 missing values, PEP post-intervention; 2 missing values, Control post-intervention; 1 missing value

Table 23. Playing history of past two weeks

	PEP	CONTROL	PEP	CONTROL
	Pre-	Pre-	Post-	Post-
Hours of play in past two weeks	intervention	intervention	intervention	intervention
	n= 263*	n= 170	n= 376*	n= 231*
	95% CI	95% CI	95% CI	95% CI
<1 hr	12.5%	10.6%	18.9%	14.3%
	(8.5, 16.5)	(6.0, 15.2)	(14.9, 22.9)	(9.8, 18.8)
1hr to <2hr	20.2%	25.9%	31.1%	30.3%
	(15.3, 25.1)	(19.3, 32.5)	(26.4, 35.8)	(24.4, 36.2)
2hr to <5hr	43.3%	52.4%	34.6%	43.3%
	(37.3, 49.3)	(44.9, 59.9)	(29.8, 39.4)	(36.9, 49.7)
5hr to <10hr	19.0%	7.6%	10.9%	10.0%
	(14.3, 23.7)	(3.6, 11.6)	(7.7, 14.1)	(6.1, 13.9)
10hr or more	4.9%	3.5%	4.5%	2.2%
	(2.3, 7.5)	(0.7, 6.3)	(2.4, 6.6)	(0.3, 4.1)

\*PEP pre-intervention; 3 missing values, PEP post-intervention;; 3 missing values, Control post-intervention;; 1 missing value

The years of squash playing experience of the survey participants are summarised in Table 24. Most players had been playing squash for over 10 years. There were no significant differences within the PEP nor Control groups over the two years.

Table 24. Years of squash experience

Years of squash experience	PEP	CONTROL	PEP	CONTROL
	Pre-	Pre-	Post-	Post-
	intervention	intervention	intervention	intervention
	n= 266	n= 169*	n= 375*	n= 232
	95% CI	95% CI	95% CI	95% CI
<1yr	4.9% (2.3, 7.5)	3.6% (0.8, 6.4)	8.0% (5.3, 10.7)	11.2% (7.1, 15.3)
1yr to <5yr	11.3% (7.5, 15.1)	15.4% (10.0, 20.8)	18.4% (14.5, 22.3)	19.0% (14.0, 24.0)
5yr to <10yr	11.3% (7.5, 15.1)	16.6% (11.0, 22.2)	11.2% (8.0, 14.4)	15.9% (11.2, 20.6)
10yr to <20yr	30.5% (25.0, 36.0)	23.1% (16.7, 29.5)	26.1% (21.7, 30.5)	22.0% (16.7, 27.3)
20yr or more	42.1% (36.2, 48.0)	41.4% (34.0, 48.8)	36.3% (31.4, 41.2)	31.9% (25.9, 37.9)

\*Control pre-intervention;; 1 missing value, PEP post-intervention; 4 missing values

Whilst most players participated in competition and were high grade players (State grade- grade 4) significantly more players in both groups, post-intervention were social-recreational players post-intervention compared to pre-intervention (Table 25). A higher proportion of Control players participated in the highest form of competition (state grade) post-intervention compared to pre-intervention,, however no difference in the proportion of PEP players in this grade.

**Table 25. Standard of player**

	PEP	CONTROL	PEP	CONTROL
Highest grade participated in by player	Pre-intervention n= 266 95% CI	Pre-intervention n= 146* 95% CI	Post-intervention n= 360* 95% CI	Post-intervention n= 220* 95% CI
Grade 1-4	45.1% (39.1, 51.1)	51.4% (43.3, 59.5)	35.3% (30.4, 40.2)	39.5% (33.0, 46.0)
Grade 5>	25.2% (20.0, 30.4)	32.2% (24.6, 39.8)	17.2% (13.3, 21.1)	8.2% (4.6, 11.8)
Social-recreational	15.0% (10.7, 19.3)	11.6% (6.4, 16.8)	29.4% (24.7, 34.1)	31.8% (25.6, 38.0)
State Grade	14.6% (10.4, 18.8)	4.8% (1.3, 8.3)	18.% (14.1, 22.1)	20.5% (15.2, 25.8)

\* Control 2002; 24 missing values, PEP 2003; 19 missing values, Control 2003; 12 missing values

#### 11.3.4 Eye injury occurrence

As shown in Table 26, few players reported sustaining an eye injury within the past 12 months of play. The racquet and ball were the most common reported cause of injury.

Table 26. Eye injury occurrence

	% of sample	Causes	Type of injury
<b>Pre-intervention</b>			
	n= 2	Ball (n=1)	Bruising (n=1)
PEP	0.8%	Collision with court wall (n=1)	Eyelid injury (n=1)
	n= 7		
		Racquet (n=5)	Bruising (n=6)
Control	4.1%	Ball (n=2)	1 missing value
<b>Post-intervention</b>			
	n=12	Racquet (n=6)	Bruising (n=7)
	(3.2%)	Ball (n=4)	Eyelid injury (n=2)
PEP		Collision with wall (n=1)	Bleeding (n=1)
		Fall (n=1)	2 missing values
	n=6	Ball (n=3)	Bruising (n=2)
	(2.6%)	Racquet (n=2)	Corneal injury (n=2)
Control		1 missing value	2 missing values

### 11.3.5 Eyewear use in squash

There were no significant differences between or within groups of self-reported protective eyewear use (Table 27). Nonetheless, the reported use was higher post-intervention compared to pre-intervention in both the PEP and Control groups.

**Table 27. Self-reported protective eyewear use**

	Pre-intervention	Post-intervention
	% of sample	% of sample
	95% CI	95% CI
	n= 50	n=104
PEP	18.8%	27.4%
	(14.1, 23.5)	(22.9, 31.9)
	n=23	n= 58
Control	13.5%	25.0%
	(8.4, 18.6)	(19.4, 30.6)

Post-intervention, players that reported having previously worn or currently wearing protective eyewear were asked when they had first tried such eyewear. The results of this question are presented in the following Table 28. If a player indicated that they started trying/wearing protective eyewear during 2003, this would have been within the four month intervention period because of the timing of the survey. The results of whether or the player believing to wear protective eyewear tried and/or purchased the eyewear is summarised in Table 29. There was more consistency in the PEP group with an even spread of players reporting that they had 'tried', 'purchased' and 'tried and purchased' protective eyewear. Importantly, more Control players tried and purchased the eyewear compared to purchasing without trying the eyewear. These results present self-reported use of a type of protective eyewear, and may include players wearing inappropriate eyewear.

**Table 28. Players' reports of when they started wearing protective eyewear**

	Before Intervention	During intervention
	% of protective eyewear users	% of protective eyewear users
	95% CI	95% CI
PEP	73.6% (64.3, 82.9)	26.4% (17.1, 35.7)
Control	85.4% (75.4, 95.4)	14.6% (4.6, 24.6)

**Table 29. Indication of initial use of protective eyewear**

	Tried eyewear	Purchased eyewear	Tried and purchased eyewear
	% of protective eyewear users	% of protective eyewear users	% of protective eyewear users
	95% CI	95% CI	95% CI
2003			
PEP	32.7% (19.9, 45.5)	34.6% (21.7, 47.5)	32.7% (19.9, 45.5)
Control	42.9% (26.5, 59.3)	11.4% (0.9, 21.9)	45.7% (29.2, 62.2)

Post-intervention, players were asked what prompted them to initially try protective eyewear of any, that they believed was protective (Table 30). Reporting that the injury occurred by accident was a common response for players in both groups, as too was safety reasons and that it is compulsory for them to do so. A free trial was a reason given by 9% of both PEP and Control players.



**Table 30. Prompt to initially try protective eyewear (2003, post intervention sample only)**

	PEP n=82	Control n=45
Accident	39.0%	22.2%
Recommended	2.4%	0
Safety	24.4%	20.0%
Need to wear glasses to see	2.4%	8.8%
Common sense	0.0	2.2%
Compulsory	19.5%	24.4%
Fear of injury	1.2%	0.0
Free trial	8.5%	8.9%
Good idea	1.2%	0.0
Last years survey	1.2%	0.0
Game reasons	0.0	4.4%

Post-intervention, the type of eyewear that was tried and/or purchased was investigated. The results of this are presented in the following Table 31. All inappropriate brands were grouped together. Many players in both groups reported wearing the brand IMAX and Dunlop. A large proportion, especially in the Control group did not know what type of eyewear they wore or tried.

**Table 31. Brand of eyewear tried and/or purchased**

	PEP n=73	Control n=41
IMAX	35.6%	26.8%
Dunlop	16.4%	7.3%
Wilson	1.4%	0.0
Don't know	17.8%	41.5%
Sports	4.1%	4.8%
South African brand	1.4%	0.0
RAD	0.0	4.9%
Multiple	5.5%	0.0
Leader	1.4%	7.3%
Inappropriate eyewear	16.4%	7.3%

Table 32 presents the frequency of use of protective eyewear as reported by the players. Of the categories presented, there was only one significant difference between and within the two project groups. Significantly, more PEP players post-intervention indicated that they sometimes wore protective eyewear during competition compared to players in this group pre-intervention.

**Table 32. Frequency of self-reported protective eyewear use**

	PEP	CONTROL	PEP	CONTROL
Frequency of protective eyewear use	Pre-intervention n= 45* 95% CI	Pre-intervention n=21* 95% CI	Post-intervention n= 68* 95% CI	Post-intervention n=32* 95% CI
Always during competition	75.6% (63.1, 88.1)	81.0% (64.2, 97.8)	55.9% (44.1, 67.7)	53.1% (35.8, 70.4)
Sometimes during competition	8.9% (0.6, 17.2)	9.5% (0.0, 22.0)	29.4% (18.6, 40.2)	25.0% (10.0, 40.0)
Always during social play	42.2% (27.8, 56.6)	33.3% (13.1, 53.5)	42.6% (30.8, 54.4)	50.0% (32.7, 67.3)
Sometimes during social play	8.9% (0.6, 17.2)	9.5% (0.0, 22.0)	7.4% (1.2, 13.6)	6.3% (0.0, 14.7)
Always during practice	48.9% (34.3, 63.5)	42.9% (21.7, 64.1)	36.8% (25.3, 48.3)	43.8% (26.6, 61.0)
Sometimes during practice	8.9% (0.6, 17.2)	14.3% (0.0, 29.3)	5.9% (0.3, 11.5)	15.6% (3.0, 28.2)

\*n= PEP pre-intervention; 5 missing values, Control pre-intervention; 2 missing values, PEP post-intervention; 36 missing values, Control post-intervention;; 26 missing values

Players were informed to indicate all options that applied to them

Table 33 displays the type of eyewear worn by players who think that they are protecting their eyes through its use. Players in the PEP group were more likely to report wearing polycarbonate lens eyewear, and the Control group less likely to report this post-intervention than pre-intervention, however these differences were not significant. Of all types of eyewear reported as protective, significantly fewer PEP players post-intervention reported wearing prescription glasses compared to the pre-intervention survey. This suggests a positive change of knowledge of players, from using inappropriate eyewear to appropriate or no eyewear worn.

**Table 33. Type of eyewear worn by reported users of protective eyewear**

	PEP	CONTROL	PEP	CONTROL
	Pre-	Pre-	Post-	Post-
Type of protective eyewear worn	intervention	intervention	intervention	intervention
	n= 46*	n=22*	n=83	n= 44
	% of responders	% of responders	% of responders	% of responders
	95% CI	95% CI	95% CI	95% CI
Polycarbonate lens	45.7% (31.3, 60.1)	54.5% (33.7, 75.3)	57.8% (47.2, 68.4)	45.5% (30.8, 60.2)
Prescription glasses	41.3% (27.1, 55.5)	36.4% (16.3, 56.5)	12.0% (5.0, 19.0)	15.9% (5.1, 26.7)
Open-eyeguards	10.9% (1.9, 19.9)	4.5% (0.0, 13.2)	9.6% (3.3, 15.9)	13.6% (3.5, 23.7)
Industrial eyewear	4.3% (0.0, 10.2)	4.5% (0.0, 13.2)	10.8% (4.1, 17.5)	9.1% (0.6, 17.6)
Contact lenses	0.0	0.0	2.4% (0.0, 5.7)	6.8% (0.0, 14.2)

\*n= PEP pre-intervention;; 4 missing values, Control intervention;; 1 missing value

Players were informed to indicate all options that applied to them

Table 34 shows the breakdown of reported use of protective eyewear compared and those players who wore appropriate eye protection. Reported use of protective eyewear was higher for both groups post-intervention compared to pre-intervention; this finding was significantly different in the Control group. The use of appropriate eyewear rose slightly for each group post-intervention compared to pre-intervention.

**Table 34. Use of appropriate polycarbonate protective eyewear**

	PEP	CONTROL	PEP	CONTROL
	Pre-	Pre-	Post-	Post-
Use of appropriate eyewear	intervention	intervention	intervention	intervention
	n= 261*	n= 166	n=345	n= 213
	% of sample	% of sample	% of sample	% of sample
	95% CI	95% CI	95% CI	95% CI
Reported use of protective eyewear	18.8% (1.4, 23.5)	13.5% (8.4, 18.6)	27.4% (22.9, 31.9)	25.0% (19.4, 30.6)
Use of appropriate polycarbonate eyewear	8.6% (5.3, 12.0)	7.1% (3.2, 11.0)	12.7% (9.3, 16.1)	8.6% (5.0, 12.2)

\* n=PEP pre-intervention 5 missing values; Control pre-intervention 4 missing values; PEP post-intervention 34 missing values; Control post-intervention 19 missing values. There are some discrepancies in the percentages in this table compared to the percentages presented in the table p 271. This is due to a difference in the missing values indicated only.

As reported previously, some players reported wearing protective eyewear and believed it to be protective. Table 35 displays the breakdown of all players who reported wearing prescription glasses. The percentage of the survey sample that wore prescription glasses when playing did not differ significantly between groups or within groups. There was a declining trend, however, in the percentage of PEP

players who wore prescription glasses that thought they provided protection in post-intervention compared to pre-intervention.

**Table 35. Wearing of prescription glasses**

Use of prescription glasses	PEP	CONTROL	PEP	CONTROL
	Pre-	Pre-	Post-	Post-
	intervention	intervention	intervention	intervention
	% of sample	% of sample	% of sample	% of sample
	n= 266	n=170	n=379	n=232
	95% CI	95% CI	95% CI	95% CI
Reported wearing protective eyewear-wearing prescription glasses	7.1% (4.0, 10.2)	4.7% (1.5, 7.9)	2.6% (1.0, 4.2)	3.0% (0.8, 5.2)
Did not report wearing protective eyewear-wearing prescription glasses	6.8% (3.8, 9.8)	6.8% (3.0, 10.6)	11.1% (7.9, 14.3)	12.1% (7.9, 16.3)
Total % of sample wearing prescription glasses	13.9% (9.7, 18.1)	11.5% (6.7, 16.3)	13.7% (10.2, 17.2)	15.1% (10.5, 19.7)

### 11.3.6 Reasons for wearing polycarbonate lens/standards approved squash eyewear

All players who reported wearing appropriate protective eyewear were asked their reason for doing so. The results of this are summarised in Table 36. Having knowledge of the risks of injury was commonly reported for both groups pre-intervention and post-intervention. Players in both project groups had very similar reasons for wearing such protection, and these did not differ considerably post-intervention compared to pre-intervention.

**Table 36. Reasons for wearing polycarbonate lens/standards approved squash eyewear**

	PEP	CONTROL	PEP	CONTROL
	Pre-	Pre-	Post-	Post-
Reasons for wearing polycarbonate lens eyewear	intervention	intervention	intervention	intervention
	% of responders	% of responders	% of responders	% of responders
	n= 23	n=12	n= 45*	n= 18*
	95% CI	95% CI	95% CI	95% CI
I have knowledge of the risks of eye injury	60.9% (41.0, 80.8)	50.0% (21.7, 78.3)	44.4% (29.9, 58.9)	61.1% (38.6, 83.6)
I know someone who has had an eye injury and I do not want to get one myself	30.4% (11.6, 49.2)	33.3% (6.6, 60.0)	35.6% (21.6, 49.6)	33.3% (11.5, 55.1)
I have had an eye injury before and do not want to get another one	21.7% (4.9, 38.5)	25% (6.6, 60.0)	24.4% (11.9, 36.9)	16.7% (0.0, 33.9)
Protective eyewear use has been recommended to me	21.7% (4.9, 38.5)	25% (0.5, 49.5)	20.0% (8.3, 31.7)	44.4% (21.4, 67.4)
It is compulsory for me to wear protective eyewear	8.7% (0.0, 20.2)	33.3% (6.6, 60.0)	20.0% (8.3, 31.7)	22.2% (3.0, 41.4)
Other reasons	8.7% (0.0, 20.2)	0	11.1% (1.9, 20.1)	11.1% (1.9, 20.1)

\*n= PEP post-intervention; 3 missing values, Control post-intervention;; 2 missing values

Players were informed to indicate all options that applied to them



### 11.3.7 Reasons why non-users do not wear polycarbonate lens/standards approved squash eyewear

Similarly to those players who wore adequate protection, those that did not were asked their reasons for not wearing protective eyewear (Table 37). Pre-intervention, there were no significant differences between players' responses in the two project groups. Fewer people in the PEP group reported that protective eyewear restricts their vision whilst playing in post-intervention compared to pre-intervention. There were no significant differences of the Control group player responses between the two survey years.

**Table 37. Reasons why players do not wear polycarbonate lens/standards approved squash eyewear**

Reasons why players do not wear polycarbonate lens eyewear	PEP 2002 n= 242* 95% CI	CONTROL 2002 n=158 95% CI	PEP 2003 n=310* 95% CI	CONTROL 2003 n=197* 95% CI
I do not want to	32.1% (26.2, 38.0)	26.4% (19.5, 33.3)	32.3% (27.1, 37.5)	34.5% (27.9, 41.1)
It restricts my vision whilst playing	29.9% (24.1, 35.7)	20.8% (14.5, 27.1)	19.0% (14.6, 23.4)	19.8% (14.2, 25.4)
I have never thought about it	26.3% (20.8, 31.8)	35.4% (27.9, 42.9)	33.9% (28.6, 39.2)	31.0% (24.5, 37.5)
It is too uncomfortable to wear	25.4% (19.9, 30.9)	20.8% (14.5, 27.1)	17.7% (13.5, 21.9)	18.3% (12.9, 23.7)

I am not at risk of an eye injury because of my playing level	15.6% (11.0, 20.2)	5.6% (2.0, 9.2)	8.1% (5.1, 11.1)	5.6% (2.4, 8.8)
Because I wear normal prescription glasses when playing	10.3% (6.5, 14.1)	6.9% (2.9, 10.9)	11.6% (8.0, 15.2)	13.2% (8.5, 17.9)
It is not necessary, as the risks of eye injury are not that great	12.5% (8.3, 16.7)	6.9% (2.9, 10.9)	8.1% (5.1, 11.1)	8.1% (4.3, 11.9)
I do not like the look of protective eyewear	8.0% (4.6, 11.4)	6.3% (2.5, 10.1)	5.2% (2.7, 7.7)	4.1% (1.3, 6.9)
It costs too much	2.7% (0.7, 4.7)	2.8% (0.2, 5.4)	4.5% (2.2, 6.8)	3.6% (1.0, 6.2)
I do not know where to obtain protective eyewear	1.3% (0.0, 2.7)	3.5% (0.6, 6.4)	1.3% (0.0, 2.6)	2.5% (0.3, 4.7)
Other	7.6% (4.3, 10.9)	11.8% (6.8, 16.8)	11.0% (7.5, 14.5)	6.6% (3.1, 10.1)

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\*n= PEP pre-intervention; 1 missing value, PEP post-intervention; n=20 missing values, Control post-intervention;; n=15 missing values

Those players who did not wear appropriate eyewear were asked if they had every tried wearing such protection. As summarised in the following Table 38, the majority of non-users had never tried wearing protective eyewear. Of the non-users, significant more PEP players had tried using appropriate eyewear post-intervention compared to pre-intervention, and compared to Control at this time.

**Table 38. Association of non-users and them having tried to wear protective eyewear**

Proportion of players who do not wear polycarbonate eyewear but have tried in the past 95% CI			
2002			
PEP	n= 63	26%	(20.5, 31.5)
Control	n= 32	20.3%	(14.0, 26.6)
2003			
PEP	n= 42	13.0%	(9.3, 16.7)
Control	n= 32	14.9%	(10.1, 19.7)

### 11.3.8 General knowledge about protective eyewear

General knowledge about appropriate eyewear was investigated through players indicating what eyewear they thought would be protective against sustaining an eye injury (Table 39). The appropriate eyewear in the survey was defined as 'polycarbonate lens' and not as the brand names as indicated on the PEP posters. Knowledge that polycarbonate lens eyewear is protective was lower in post-intervention compared to pre-intervention for both the PEP and Control group players. Significantly more PEP players pre-intervention were wrong in their belief that open-eyeguards provided adequate protection compared to PEP players post-intervention.

Table 39. Type of eyewear thought to be protective

	PEP	CONTROL	PEP	CONTROL
	Pre-	Pre-	Post-	Post-
Eyewear thought to be protective	intervention	intervention	intervention	intervention
	n= 260*	n= 162*	n= 366*	n=227*
	95% CI	95% CI	95% CI	95% CI
	57.7%	48.1%	45.9%	42.7%
Polycarbonate lenses	(51.7, 63.7)	(40.5, 55.8)	(40.8, 51.0)	(36.3, 49.1)
	29.6%	21.0%	18.3%	20.3%
Open-eyeguards	(24.1, 35.1)	(14.7, 27.3)	(14.3, 22.3)	(15.1, 25.5)
	22.3%	29.0%	38.0%	35.7%
I don't know	(17.2, 27.4)	(22.0, 36.0)	(33.0, 43.0)	(29.5, 41.9)
	15.8%	17.9%	13.7%	16.3%
Industrial eyewear	(11.4, 20.2)	(12.0, 23.8)	(10.2, 17.2)	(11.5, 21.1)
	10.4%	6.8%	7.4%	6.6%
Normal prescription glasses	(6.7, 14.1)	(2.9, 10.7)	(4.7, 10.1)	(3.4, 9.8)
	3.5%	3.1%	1.4%	1.3%
Contact lenses	(1.3, 5.7)	(0.4, 5.8)	(0.2, 2.6)	(0.0, 2.8)
	7.3%	3.1%	1.6%	0.9%
Other	(4.1, 10.5)	(0.4, 5.8)	(0.3, 2.9)	(0.0, 2.0)

\*n= PEP pre-intervention; 6 missing values, Control pre-intervention; 8 missing values, PEP post-intervention; 13 missing values, Control post-intervention; 5 missing values

Players were asked to indicate all responses applicable to them

### 11.3.9 Squash venue membership and attendance

Table 40 indicates at which category of squash venue each of the surveyed players were a member at. Nearly all of the players surveyed at a PEP venue were members of a PEP venue or neither a PEP or Control venues. This finding was also true for those players surveyed at Control venues. This suggests very little contamination.

**Table 40. Squash venue membership**

	A PEP venue 95% CI	A Control venue 95% CI	No membership/ other venue 95% CI
PEP	66.0% (61.2, 70.8)	0.3% (0.0, 0.9)	33.7% (28.9, 38.5)
Control	1.7% (0.0, 3.4)	67.1% (61.0, 73.2)	31.1% (25.1, 37.1)

The attendance of all survey players at the four PEP venues throughout the PEP program is summarised in Table 41. Very few Control players had attended a PEP venue frequently during the project time. Most of the PEP players had visited the venue a multiple of times during the project, with many attending more than 10 times.

Table 41. Attendance at PEP venues post-intervention

	None 95% CI	1 time 95% CI	2-5 times 95% CI	6-10 times 95% CI	More than 10 times 95% CI
<b>Moorabbin</b>					
	42.6%	10.5%	20.6%	6.2%	20.1%
PEP	(37.6, 47.6)	(7.4, 13.6)	(16.5, 24.7)	(3.8, 8.6)	(16.0, 24.2)
<b>Control</b>					
	89.6%	4.1%	4.1%	1.8%	0.5%
	(85.6, 93.6)	(1.5, 6.7)	(1.5, 6.7)	(0.1, 3.5)	(0.0, 1.4)
<b>Gardenvale</b>					
	52.8%	9.0%	17.8%	5.0%	15.4%
PEP	(47.8, 57.8)	(6.1, 11.9)	(13.9, 21.7)	(2.8, 7.2)	(11.8, 19.0)
<b>Control</b>					
	95.5%	1.8%	2.3%	0.0	0.5%
	(92.8, 98.2)	(0.1, 3.5)	(0.3, 4.3)		(0.0, 1.4)
<b>Knox</b>					
	62.9%	7.0%	13.0%	2.4%	14.6%
PEP	(58.0, 67.8)	(4.4, 9.6)	(9.6, 16.4)	(0.8, 4.0)	(11.0, 18.2)
<b>Control</b>					
	91.5%	3.1%	2.7%	0.4%	2.2%
	(87.8, 95.2)	(0.8, 5.4)	(0.6, 4.8)	(0.0, 1.2)	(0.3, 4.1)
<b>MSAC</b>					
	41.0%	14.2%	19.8%	5.1%	19.8%
PEP	(36.0, 46.0)	(10.7, 17.7)	(15.8, 23.8)	(2.9, 7.3)	(15.8, 23.8)
<b>Control</b>					
	77.9%	5.4%	10.4%	3.2%	3.2%
	(72.4, 83.4)	(2.4, 8.4)	(6.4, 14.4)	(0.9, 5.5)	(0.9, 5.5)

### 11.3.10 Knowledge of the Protective Eyewear Promotion

Post-intervention, all surveyed players that had attended a PEP venue at least once in 2003 (during the intervention period) were asked whether or not they had noticed any eyewear promotion. The responses to this question are provided in Table 42. Most players in both the PEP and Control groups, who had attended a PEP venue during the project, had noticed a particular component of the promotion. The particular component of PEP that the player noticed is provided in Table 43. Of all responses, players were more often to report noticing the promotional posters. Players also reported often that they had noticed promotional eyewear and that protective eyewear was available for them to borrow at the PEP venues. The summary of any particular project message that players could remember is displayed in Table 44. The sticker message of 'Protective Eyewear Lets Get It On' was the most prominent response.

**Table 42. Protective Eyewear Promotion**

	<b>PEP</b>	<b>Control</b>
<b>Players noticing eyewear promotion</b>	<b>n= 372</b>	<b>n=72</b>
	<b>95% CI</b>	<b>95% CI</b>
Yes	65.3%	58.3%

**Table 43. Particular components of PEP that players noticed**

	PEP	Control
	n= 239*	n=42
	95% CI	95% CI
	80.3%	83.3%
Posters	(75.3, 85.3)	(72.0, 94.6)
	20.5%	21.4%
Pamphlets	(15.4, 25.6)	(9.0, 33.8)
	28.9%	26.2%
Stickers	(23.2, 34.6)	(12.9, 39.5)
	26.4%	28.6%
Eyewear available for borrow	(20.8, 32.0)	(14.9, 42.3)
	7.1%	7.1%
Cheaper eyewear	(3.8, 10.4)	(0.0, 14.9)
	10.1%	2.4%
Incentives to try/purchase eyewear	(6.3, 13.9)	(0.0, 7.0)

\*PEP = 4 missing values

Players were asked to indicate all responses applicable to them



**Table 44. Reported protective eyewear promotion message remembered**

	PEP	Control
	n= 42	n=3
Forgot	5	2
Wear protective eyewear	4	0
Try protective eyewear	2	0
Try before you buy	1	0
This venue cares for your safety	1	0
Safety	7	0
Protective eyewear lets get it on	18	0
Open-eyeguards don't work	1	0
Money can't buy another eye	2	1
Imax and Dunlop	1	0

### **11.3.11 Attitudes towards protective eyewear use**

Players' responses to protective eyewear safety statements are given in Table 45.

There were no significant differences either between or within the project groups.

The responses were generally favourable towards protective eyewear safety.

**Table 45. Players responses to Likert scale attitudinal statements**

	PEP 2002 n= 266 95% CI	CONTROL 2002 n=170 95% CI	PEP 2003 n= 379 95% CI	CONTROL 2003 n=232 95% CI
Protective eyewear should be made compulsory for junior players	72.6% (67.2, 78.0)	78.0% (71.8, 84.2)	70.2% (65.6, 74.8)	71.3% (65.5, 77.1)
Protective eyewear would significantly reduce my risk of sustaining an eye injury whilst playing squash	70.1% (64.6, 75.6)	78.0% (71.8, 84.2)	73.9% (69.5, 78.3)	70.3% (64.4, 76.2)
More players should use protective eyewear	63.5% (57.7, 69.3)	67.4% (60.9, 74.9)	64.1% (59.3, 68.9)	59.9% (53.6, 66.2)
Eye injuries are a particular problem for squash players	62.4% (56.6, 68.2)	55.8% (48.3, 63.3)	63.0% (58.1, 67.9)	60.4% (54.1, 66.7)
The risk of eye injury in squash is high	55.4% (49.4, 61.4)	54.6% (47.1, 62.1)	50.7% (45.7, 55.7)	46.6% (40.2, 53.0)
It is just as easy to use protective eyewear as it is to wear ordinary prescription glasses or sunglasses	37.7% (31.9, 43.5)	25.8% (19.2, 32.4)	30.6% (26.0, 35.2)	31.8% (25.8, 37.8)

It is important that I personally use protective eyewear when playing squash	22.8% (17.8, 27.8)	20.1% (14.1, 26.1)	25.7% (21.3, 30.1)	23.0% (17.6, 28.4)
Protective eyewear should be made compulsory for all players	18.8% (14.1, 23.5)	19.9% (13.9, 25.9)	23.0% (18.8, 27.2)	18.4% (13.4, 23.4)
I would stop playing if protective eyewear was made compulsory	11.0% (7.8, 14.2)	14.0% (9.5, 18.5)	10.8% (7.7, 13.9)	17.0% (12.2, 21.8)
The benefits of using protective eyewear is low	7.5% (4.8, 10.2)	13.6% (9.2, 18.0)	8.7% (5.9, 11.5)	11.5% (7.4, 15.6)

## 11.4 Impact and process evaluation of the Protective Eyewear Promotion

### 11.4.1 Impact evaluation of the Protective Eyewear Promotion

The following presents the analysis specific to the delivery and uptake of specific components of PEP. The data therefore represents that of the post-intervention survey only. The results of univariate and multivariate analysis are presented in the following Tables. Subsequently, a paper describing the evaluation of PEP is included in *Section 11.5*.

### 11.4.2 Self-reported protective eyewear use

Table 46 displays a breakdown of appropriate and inappropriate eyewear for those players who indicated that they wore protective eyewear. Further analysis could not be performed due to small numbers. Fewer PEP players reportedly wore inappropriate eyewear and more wore appropriate eyewear than the Control group players.

**Table 46. Use of protective eyewear**

Type of eyewear	Control	PEP
Inappropriate	25.0%	16.7%
Appropriate	75.0%	83.3%

Table 47 summarises the reasons why players did not wear appropriate protection. There were no significant differences between the two groups, with one exception. The PEP players were more likely than Control players to state that they had never thought about wearing protective eyewear when compared to the differences pre-intervention compared to post-intervention. The PEP players were also more inclined, than Control players to report that protective eyewear costs too much. The PEP players were less inclined than Control players to report that they were not at risk of an eye injury due to their skill level and that protective eyewear was not necessary. However, these differences were not significant.

**Table 47. Reasons for not wearing appropriate eyewear**

Reason provided	Univariate	Multivariate
	analysis	analysis
	OR (95%CI) p-value	OR (95%CI) p-value
It costs too much	1.30 (0.29, 6.03) 0.71	OR 1.26 (0.25, 6.25) 0.78
It is not necessary, as the risks of eye injury are not that great	0.52 (0.19, 1.41) 0.20	0.51 (1.93, 1.35) 0.17
I am not at risk of an eye injury because of my playing level	0.47 (0.15, 1.47) 0.20	0.46 (0.14, 1.47) 0.19
I do not know where to obtain protective eyewear	1.33 (0.29, 6.04) 0.71	1.27 (0.28, 5.88) 0.76
I do not want to	0.68 (0.40, 1.17) 0.17	0.68 (0.41, 1.12) 0.13
I do not like the look of protective eyewear	0.98 (0.56, 1.70) 0.95	0.92 (0.49, 1.70) 0.78

**Table 47 continued.**

	0.74 (0.24, 2.28)	0.79 (0.27, 2.37)
It is too uncomfortable to wear	0.60	0.68
	0.59 (0.29, 1.17)	0.64 (0.29, 1.43)
It restricts me vision whilst playing	0.59	0.28
	1.75 (1.06, 2.90)	1.8 (1.01, 3.36)
I have never thought about it	0.03	0.05
	0.56 (0.31, 1.01)	0.57 (0.32, 1.02)
Because I wear normal prescription glasses	0.56	0.06

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*OR>1 = PEP players were at greater odds than the Control players*

### 11.4.3 Attitude score

An total attitude score was calculated for each individual player. Responding in a positive manner to each attitude statement was assigned the following: Strongly Agree=5; Agree=4; Uncertain=3; Disagree=2 and Strongly Disagree=1. This scoring system was reversed for the two statements where disagreeing with the statement actually indicated a positive eye safety attitude.

There was no evidence of a difference between PEP and control in the mean attitude score from pre-intervention compared to post-intervention. Univariate analysis ( $p=0.77$  95%CI -1.66, 1.22). Multivariate analysis PEP v Control of differences of pre v post means ( $p=1.05$  95%CI -0.19, 1.98).

### 11.4.4 Knowledge of appropriate eyewear

There was only one response of what players thought would protect their eyes from injury that was significantly different between the PEP and Control groups when compared to the difference between pre and post-intervention. PEP players

were significantly more likely to know that open-eyeguards do not provide adequate protection once adjusting for confounders. A Table summarising these results is provided in the paper in *Section 11.5*.

### **11.5 A controlled evaluation of a squash protective eyewear promotion strategy**

The following paper presents findings of the evaluation of PEP that were not presented in 10.3 Further evaluation of PEP. In particular it addresses the delivery of PEP. The paper titled *A controlled evaluation of a squash protective eyewear promotion strategy* by R Eime, C Finch, R Wolfe, N Owen, was submitted to the the journal *Injury Prevention* July 2004.



## Monash University

Declaration for Thesis Chapter Eleven

In the case of *Chapter Eleven*: paper titled "*A controlled evaluation of a squash eyewear promotion strategy*", contributions to the work involved the following:

Name	% contribution	Nature of contribution
Rochelle Eime	60%	Design, analysis and writing of paper
Caroline Finch	15%	Assistance with design, analysis and contribution to writing of paper
Rory Wolfe	15%	Assistance with analysis and contribution to writing of paper
Neville Owen	5%	Assistance with design and contribution to writing of paper
Catherine McCarty	5%	Contribution to writing of paper

Declaration by co-authors

The undersigned hereby certify that:

- (1) they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;
- (2) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;
- (3) there are no other authors of the publication according to these criteria;
- (4) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit; and
- (5) the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s)

Injury Risk Management Research Centre, University of New South Wales, and Department of Epidemiology and Preventive Medicine, Monash University

Signature 1

Signature 2

Signature 3

Signature 4

Signature 5

Date

16/1/04

16/01/04

19/3/04

22/2/04

14 Jan 2004

## **A controlled evaluation of a squash eyewear promotion strategy**

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**Key Words:** Squash, eye, controlled evaluation

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## Abstract

**Design:** A trial of a squash protective eyewear promotion initiative the Protective Eyewear Promotion (PEP) was conducted in Victoria, Australia in 2003. The PEP was a comprehensive educational strategy to increase the use of appropriate protective eyewear in squash based on applied behaviour change principles, in combination with pre-intervention player survey results. This paper presents the results of the evaluation of this sports injury prevention intervention. **Methods:** The evaluation was a controlled trial at squash venues with a cross-sectional survey of players pre- and post-intervention. Four squash venues in one playing association were randomly chosen to receive PEP and four in another association maintained usual practice and hence formed a control group. The primary evaluation measurement was pre- and post-intervention surveys of cross-sectional samples of players. The surveys investigated players' knowledge, behaviours and attitudes associated with the use of protective eyewear. In addition, the post-intervention survey determined players' exposure to PEP. Univariate and multivariate analyses were performed to describe differences at PEP venues from pre- to post-intervention and to compare these to the control venues. **Results:** The PEP players had 2.4 times the odds (95% confidence interval for odds ratio 1.3, 4.2) of wearing appropriate eyewear compared to control group players' post-intervention, relative to the groups' pre-intervention baselines. Components of PEP, such as stickers and posters and the availability and prominent positioning of the project eyewear, were found to be a contributing factor towards players adopting favourable eyewear behaviours. **Conclusion:** The true success will be the sustainability and dissemination of the project and favourable eyewear behaviours, as well as evidence of the prevention of eye injuries long into the future.

## Introduction

Associated with participation in sport and physical activity is a risk of sustaining an injury <sup>[12]</sup>. Nonetheless, sports injuries are not inevitable and many injuries can be prevented. Most sports injury research to date has focussed solely on injury surveillance activities <sup>[3]</sup>. Although data gathered from surveillance systems has been shown to be useful for guiding sports injury prevention strategies <sup>[245]</sup>, surveillance alone does not prevent injuries from occurring.

In order to prevent sports injuries, both the extent of the problem and the preceding aetiology and causal mechanisms need to be established <sup>[2]</sup>. These steps are essential before the design and implementation of any prevention strategy. We have previously applied this framework for the prevention of eye injuries in squash. The specific injury incidence and severity, as well as the mechanisms of, eye injuries in squash have been identified <sup>[678]</sup>. A rate of 19 eye injuries per 100,000 squash players has been calculated from Emergency Departments and Hospitals throughout Victoria, Australia <sup>[8]</sup>.

It has been long established that squash eye injuries can be prevented by the use of appropriate eyewear, that is, Standards Approved protective eyewear of polycarbonate lenses <sup>[91011121314]</sup>. However, fewer than 10% of Australian adult players adequately protect their eyes <sup>[6]</sup>.

The aim of this study was to implement a health education and eyewear promotion strategy, named the Protective Eyewear Promotion (PEP), aimed specifically at squash players. The design of this eye injury prevention strategy has been described in detail previously <sup>[15]</sup>. In summary, behaviour change principles, in

combination with player survey results, were applied to develop a comprehensive strategy to increase the use of appropriate eyewear in squash. The main components of PEP involved informing and educating both players and squash venue operators of the risk of eye injury and of appropriate protective eyewear, as well as assisting with the availability of the eyewear and offering incentives for players to use it. This involved the provision of eyewear for players to try and or purchase, as well as displaying educational pamphlets, task specific posters and stickers displayed at venues.

This paper reports the formal evaluation of PEP. The aim of the controlled evaluation was to compare outcomes such as players' eyewear behaviour characteristics pre and post-intervention to see if there was any benefit associated with PEP.

## **Methods**

Two squash associations of different geographical locations, one in the North-West region of Melbourne and the other in the South-East region, were randomly allocated to one of two groups: PEP (to receive the intervention) and control (without the intervention). The geographic separation of the two groups minimised contamination of players between them. Four PEP and four control venues were randomly selected from the list of public squash venues in the two separate playing associations. The managers of the eight venues were contacted and all agreed to be involved in the project.

Both pre-intervention and post-intervention player survey were conducted, to gather information on player personal profiles (age, gender, playing history, etc) as well as their knowledge, behaviour and attitudes towards protective eyewear. The post-intervention survey also investigated players' knowledge and exposure to the PEP. Occupation was categorised as per the Australian Bureau of Statistics classification scheme. The sampling procedures for the two player surveys were the same. Data collection sessions were randomly chosen during peak playing times at each of the venues. Each adult player present at the selected venues during the sampling times was approached to complete an anonymous survey. Players' squash participation was not interrupted. Any players not wishing to participate, as well as any unreturned surveys, were noted as a non-response. No player completed more than one survey in either the pre- or post-surveys.

The project provision of eyewear and educational materials was delivered and set-up at the PEP squash venues. These venues were visited weekly for monitoring purposes. The PEP venues were equipped with record forms to report the borrowing/loan and sales of eyewear during the trial. At the end of the four-month project trial period, the PEP components remained in place at the venues, and the venues continued to conduct the PEP eye safety practices.

Usual safety practices were undertaken at the control venues during the project period. The managers of these venues were informed that upon completion of the project they would have the opportunity to be provided with the promotional information and materials, as per the PEP venues.

Appropriate eyewear was defined as Standards Approved polycarbonate eyewear<sup>[16]</sup>. All other types of eyewear were considered to be inappropriate, that is not providing adequate eye protection. For each survey participant a total attitudinal score was calculated by summing their responses to ten Likert-scale safety

statements. A lower total score indicated a more favourable safety attitude. Subtle wording differences between the 2002 and 2003 questionnaires may account for changes observed from pre- to post-intervention. For example, we analysed the response "Ever worn protective eyewear for squash" where in 2002 the question was "Do you wear protective eyewear when playing" and in 2003 the question was "Have you ever worn protective eyewear when playing".

The number of venues was determined through power calculations based on expected rates of appropriate and inappropriate protective eyewear use, attitudes towards protective eyewear use, and knowledge of appropriate protective eyewear. The expected difference at PEP venues in appropriate eyewear usage was a pre- to post-intervention increase from 7% to 15%, and a decrease in the use of inappropriate eyewear from 19% to 9%. With nQUERY Advisor Release 4.0 it was determined that complete surveys were required from 261 players at PEP and control venues pre- and post-intervention for 90% power and 189 for 80% power. Previous surveying in the same population estimated a mean of 30 players participating per venue on a typical competition night <sup>[17]</sup>. It was therefore determined most appropriate to visit the PEP and control venues 3 times each, with an expected conservative number of 25 survey respondents at each session. Therefore, to potentially gain excess of 261 players in each group, four venues were chosen for both the PEP and control groups. No adjustment was made for the clustering of players by squash venue or data collection session since previous experience indicated that such design effects would be minimal <sup>[18]</sup>.

Where data was available only from post-intervention questionnaires, e.g. "When did you try or first start wearing protective eyewear for squash? We compared responses between players at PEP and control venues. Where relevant responses were available from pre-intervention and post-intervention questionnaires, we

analysed the difference between pre- and post-intervention responses, specifically whether these differences differed between PEP and control venues. We used a linear regression model for total attitude score, and logistic regression models for all other responses. We estimated model parameters using maximum likelihood and calculated robust standard errors using the information sandwich formula to take account of the clustering of players by squash venue <sup>[19]</sup>.

Multivariate regression models were used to adjust for potential player-specific confounders. Where sufficient data was available, we adjusted for years played, grade of competition, and hours usually played per week (all with 4 categories), and gender (male/female). These adjustments were made for the analysis of total attitude score which had 10 responses per model parameter, and the analysis of "ever worn protective eyewear for squash" (which had at least 10 positive and 10 negative responses per parameter). For all other responses, we adjusted for years played and hours usually played per week (assuming dose-response relationships across the 4 categories) and gender. Grade of play was not included because there was no evidence of a difference between PEP and control venues in the changing distribution of grades despite there being differences in both groups between 2002 and 2003 and differences between PEP and control in the proportion of State grade players; hence this factor would not have acted as a confounder in comparisons of PEP changes to control changes.



## Results

At the PEP venues, 266 players pre-intervention (response rate 93%), and 379 players post-intervention (response rate 97%) completed the survey. Pre-intervention, 170 players (response rate 89%) were surveyed at control venues and 232 players (response rate 90%) in the post-intervention survey.

Table 1 shows the median age and gender of survey participants. The difference in median age across the four groups was not significant ( $p=0.35$ ). Pre-intervention, there was no significant difference in the proportion of males versus females between the two groups (PEP 65.9% vs. control 60.2%, 95%CI for difference -0.07, 0.11). However, post-intervention, there was a significant difference in the proportion of males versus females between the PEP and control groups (71.9% vs. 80.3%, respectively, 95% CI for difference -0.16, -0.01).

*Insert Table 1 about here*

Players' classification of occupation did not differ considerably between the PEP and control groups in either survey year. The majority of both groups of players in both surveys were employed in a professional field.

Table 1 also provides a summary of the playing standard of participants. The majority of players participated in competition, and were high grade players (State grade - grade 4). Some factors were imbalanced across the samples and we adjusted for these in multivariate analyses.

There was no difference between PEP and control groups in the pre to post intervention change in the proportion of players reportedly wearing protective eyewear (Univariate OR 0.77, 95%CI 0.41, 1.45). (The effect of clustering on the standard error of this odds ratio [on the log scale] was minimal, with adjustment for

clustering reducing the standard error by 3%.) The conclusion on PEP versus control differences was unchanged by multivariate analysis. However, this analysis included all types of eyewear worn by any player, who believed that they were protecting their eyes through using that eyewear.

Table 2 summarises the pre-post differences in the type of eyewear worn for the PEP and control groups separately. In the PEP group, the proportion of players using appropriate eyewear increased, whilst the use of inappropriate eyewear decreased from pre- to post-intervention. In the control group, the use of appropriate eyewear increased slightly, as did the use of inappropriate eyewear.

*Insert Table 2 about here*

The PEP players had 2.4 times greater odds (Univariate OR 95%CI 1.3, 4.2) than control players of wearing appropriate eyewear (rather than all other types of eyewear), compared to control players, over and above the PEP v control difference pre-intervention. This finding was partly explained by adjusting for confounders (multivariate OR 1.8 95%CI 0.9, 3.5).

In the post-intervention survey, players who reported wearing protective eyewear were asked to report when they first started using it. A response of 'this year' would indicate during PEP, because PEP ran from Jan to April inclusive. Players at PEP venues were 2.1 times more likely than control players to commence wearing protective eyewear 'this year' ( $p=0.04$ , 95%CI 1.1, 4.2), and this finding was not explained by confounding with other factors (multivariate OR 3.0,  $p=0.03$ , 95%CI 1.1, 8.2).

There was one significant difference between PEP and control venues in the change in players' belief of which eyewear provided adequate protection, from pre- to post-intervention (Table 3). The PEP group had a greater increase in knowledge that open-eyeguards do not provide adequate protection (multivariate analysis,  $p=0.05$ ).

*Insert Table 3 about here*

The above analyses were performed on an "intention to treat" basis and we investigated group crossover and the extent of exposure to PEP. Nearly all of the players surveyed at a PEP venue were either members of a PEP venue (66.0%) or neither a member at a PEP or control venue (33.7%). This trend was similar for those players surveyed at a Control venue; 67.1% were members of a control venue, and 31.1% were neither a member at PEP or Control venue. The number of times each player visited a PEP venue is presented in Table 4. The PEP players' surveyed post-intervention had made more visits to a PEP venue than control players.

*Insert Table 4 about here*

Post-intervention, all surveyed players that had attended a PEP venue at least once during the intervention period 2003 were asked whether or not they had noticed any eyewear promotion. Most players at both PEP (65%) and control (58%) venues, who had attended a PEP venue during the project, remembered seeing PEP. Of the players who had visited a PEP venue only once, 54% remembered PEP and half (52%) of players who had visited a PEP venue 2-10 times had noticed the promotion. Players who had visited a particular PEP venue more than 10 times were significantly more likely to have noticed the promotion (76%) than those who had visited less than 10 times ( $p<0.001$ ).

The actual component of the promotion that was noticed, according to the maximum number of times a player had visited a PEP venue, is summarised in Table 5. A correlation was found whereby the more visits that players had made to PEP venues the more likely they were to remember components of PEP. The single most commonly remembered PEP message (by 40% of exposed players) was the slogan on the sticker: 'Protective Eyewear, Let's Get It On'.

*Insert Table 5 about here*

The attitudinal scores were approximately normally distributed. Overall, the responses to the attitudinal statements displayed favouritism towards protective eyewear safety. However, there was no evidence of a difference between the PEP and control groups in the mean attitude score change from pre to post-intervention. (multivariate difference in mean score change = 0.9 95%CI -0.2, 2.0).

In a post-PEP review, all control venue managers stated that they had appropriate protective eyewear available for players to purchase. During the four month trial, PEP venues recorded 65 sales of project eyewear and 161 occasions of players borrowing eyewear. The control venues collectively had 5 sales over the same period of time.

## **Discussion**

It is well supported that collectively, attitudes towards, and knowledge about, safety protection can substantially influence safety behaviours<sup>[202122]</sup>. Strategies to achieve behaviour change need to be based on ecological models<sup>[23]</sup>. Such models identify intrapersonal factors, sociocultural factors, policies and physical environments as levels of influence on health-related behaviours<sup>[23]</sup>. Importantly, they recognise that many factors combine to influence an individual's behavioural choices<sup>[22]</sup>.

At the onset of this project, the amount of exposure needed for players to notice or be influenced by an education and program promotion such as PEP was unknown. In this instance, it would seem that visiting a PEP venue 10 times or more, significantly correlates to recognising at least one component of PEP, but not necessarily to specific eyewear behaviour change. It was encouraging that even the proportion of players who had only visited a PEP venue once and had noticed PEP was high. Results showed many players that were exposed to PEP did adopt favourable eyewear behaviour during the four month period.

An important aspect in any controlled trial is the contamination of individuals in the control and intervention groups with regards to their group allocation. In the context of a community study such as PEP this is difficult to ensure. Only a small proportion of players surveyed at a PEP venue were a member of a control venue, and vice versa. The random allocation of PEP and control venues within two different playing association helped to minimise contamination of study groups.

It was positive, but not unexpected, that there would be very few differences in the groups' demographics and playing habits and standards both survey years. Those factors found to vary were controlled for in the analyses. This shows that the two groups were relatively well balanced at baseline.

At first sight, it would seem that overall the PEP players had lower favourable eyewear behaviours compared to control players, post- compared to pre-intervention. However, this was measured on the basis of self-reported eyewear use of any type. More control players 'believed' they were wearing protective eyewear, when in fact they were not wearing adequate protection. When

assessing only appropriate protective eyewear use, the PEP players were significantly more likely to wear appropriate eyewear compared to other types. This suggests a positive behaviour change in the population of players exposed to PEP that is likely to have been associated with the intervention. Analysis of when players started wearing protective eyewear showed that PEP players were influenced by PEP rather than external factors.

Fewer PEP players reported knowledge that polycarbonate lens eyewear is appropriate than did controls. This finding could be a limitation or error in the survey design. This difference does not seem to be reflected in their behaviours, because significantly more PEP players wore appropriate eyewear compared to controls, post compared to pre-intervention. The knowledge-specific messages on the posters stated "wear Approved Protective eyewear" and listed the brands. They did not specifically mention Polycarbonate lens. The high frequency of players noticing the promotional posters was a positive finding. Open-eyeguards do not provide adequate protection <sup>[24]</sup>, and PEP players were more likely to know this after the intervention compared to the control group.

The study had some limitations. The number of surveyed players was lower than needed for 90% power, nonetheless, the statistical power was still above 70%. Importantly, the response rates pre- and post-intervention were high. The personal approach to each survey participant, whilst time costly, contributed to the high response rate.

This study did not follow up individual players; rather independent samples were used pre and post intervention. To achieve follow up of individuals would have been logistically difficult and costly. It would seem from the low contamination of

players between the project groups that this study design is robust enough to detect a difference when one is present. Our design is common in community trials where the community (corresponding to a squash venue in our study) is followed up rather than individuals within the community.

The results showed no significant difference in players' eye safety attitudes after PEP. Player's attitudes were favourable at baseline, and perhaps there does not need to be a significant change in attitudes for behaviour change, as long as attitudes are favourable to begin with.

At the community squash level, including the Victorian Squash Federation (VSF), squash venues and players, results of eyewear sales was very important. This was a marker providing evidence for this success of PEP. All control venues opted to be equipped with the project material after the trial and the promotion is ongoing at the time of writing. The pro-active stance taken by the venue staff contributed to the successful running of PEP. From the favourable results, the VSF is seeking to have all Victorian squash venues set up with the project material. Squash venues need to include protective eyewear as a priority for their safety practices and policies. This, supported with task-specific behaviour-change promotional materials, is most likely the best strategy for widespread use of protective equipment in squash.

In the broader context, sports injury prevention and health promotion research based on specific behaviour change should design and apply ecological models in controlled and randomised trials. It is imperative that this research field builds a strong evidence base for intervention and does not rely solely on education efforts without evaluation. Behaviour change is a process, and much further research is

required to understand this as it applies to the sports injury prevention domain. Our PEP was successful from the point of view of the researchers and the local squash community in that players exposed to PEP were seen to change their behaviours, and the sales of eyewear during the trial was very high. The true success will be the sustainability and dissemination of the project and favourable eyewear behaviours, as well as evidence of the prevention of eye injuries long into the future. This project was also recognised by Sport and Recreation Victoria as significantly contributing to the safety of sport at the community level, and was awarded a state wide award.



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## **Key Points**

- The use of protective eyewear in squash in Australia is low
- Survey results investigated players eyewear knowledge, behaviours and attitudes
- Behaviour changes strategies based on ecological models were applied in a controlled trial
- The protective eyewear promotion was successful in increasing protective eyewear use

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**Table 1: Comparison of player demographics and standard of players in PEP and control groups pre and post-intervention**

	Pre-intervention		Post-intervention	
	PEP	CONTROL	PEP	CONTROL
<b>Demographic variable</b>	<b>2002</b>	<b>2002</b>	<b>2003</b>	<b>2003</b>
	<b>n= 266</b>	<b>n= 146*</b>	<b>n= 360*</b>	<b>n= 220*</b>
	<b>95% CI</b>	<b>95% CI</b>	<b>95% CI</b>	<b>95% CI</b>
Median age (years)	38	39	39	37
Gender (% males)	66	60	72	80
<b>Highest grade participated in by player</b>				
Grade 1-4	45.1%	51.4%	35.3%	39.5%
	(39.1, 51.1)	(43.3, 59.5)	(30.4, 40.2)	(33.0, 46.0)
Grade 5>	25.2%	32.2%	17.2%	8.2%
	(20.0, 30.4)	(24.6, 39.8)	(13.3, 21.1)	(4.6, 11.8)
Social-recreational	15.0%	11.6%	29.4%	31.8%
	(10.7, 19.3)	(6.4, 16.8)	(24.7, 34.1)	(25.6, 38.0)
State Grade	14.6%	4.8%	18.0%	20.5%
	(10.4, 18.8)	(1.3, 8.3)	(14.1, 22.1)	(15.2, 25.8)

\* Control 2002; 24 missing values, PEP 2003; 19 missing values, Control 2003; 12 missing values

Table 2: Differences in eyewear use for PEP and Control groups

	Did not use eyewear		Used eyewear				
	No eyewear		Appropriate eyewear		Inappropriate eyewear		Chi-Square
	n	%	n	%	n	%	2002 V 2003
PEP 2002*	216	82.4	21	8.0	25	9.5	
PEP 2003*	275	78.8	48	13.8	26	7.4	PEP
							p=0.67
Control 2002*	147	87.0	12	7.1	10	5.9	
Control 2003*	173	82.8	20	9.6	16	7.7	Control
							p=0.53

\*PEP 2002 4 missing values; PEP 2003 30 missing values; Control 2002 1 missing values; Control 2003 23 missing values

**Table 3: Change in knowledge of eyewear that provide adequate protection: PEP players compared to control players, pre- compared to post-intervention**

Eyewear thought to be protective	Univariate analysis	Multivariate analysis
	Odds Ratio (95%CI) p-value	Odds Ratio (95%CI) p-value
	0.77 (0.45, 1.35)	0.74 (0.39, 1.36)
Polycarbonate lens	0.37	0.32
	0.56 (0.29, 1.07)	0.51 (0.26, 1.1)
Open-eyeguards	0.08	0.05
	1.57 (0.91, 2.7)	1.72 (0.89, 3.30)
Don't know	0.10	0.10
	0.95 (0.45, 1.97)	1.00 (0.46, 2.21)
Industrial eyewear	0.88	0.99
	0.71 (0.20, 2.50)	0.70 (0.18, 2.71)
Prescription glasses	0.59	0.61
	0.92 (0.33, 2.59)	0.89 (0.30, 2.66)
Contact lenses	0.88	0.84

*Odds ratios are for PEP group 2003 versus 2002 relative to a ratio of 1 for control group 2003 versus 2002; 95% CI's give 2002 to 2003 change in PEP population odds that is over and above the change in control population.*

**Table 4: Frequency of visits to players' most visited PEP venue during the intervention period**

	PEP group	Control group
Number of visits to a PEP venue	n= 377*	n= 223*
	%	%
None	2.1	73.1
1 time	5.8	6.3
2-5 times	21.8	11.2
6-10 times	10.3	3.6
10+ times	60.0	5.8

\*n PEP= 2 missing values; Control= 9 missing values



**Table 5: Player recall of intervention components in relation to the number of visits they made to the PEP venues**

Yes noticed component of promotion*	<2 visits		2-10 visits		10+ visits	
	n	%	n	%	n	%
Posters	21	77.8	61	79.2	144	81.8
Pamphlets	3	11.1	6	7.8	49	27.8
Stickers	8	29.6	12	15.6	60	34.1
Eyewear available to borrow	4	14.8	13	16.9	58	33.0
Cheaper eyewear	0	0	7	9.1	20	7.1
Incentive to try and purchase eyewear	0	0	7	9.1	18	10.1

\* Players could respond with more than one option

## **Chapter 12: Conclusion and recommendations**

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This Thesis has moved through a cycle, involving multiple avenues of investigation and studies for the long term aim, of preventing eye injuries in squash players. This progression has included initial developmental research, followed by the design and implementation of the Protective Eyewear Promotion, and concludes with the evaluation of this intervention.

The following sections summarise the findings and conclusions from each Chapter through the progression of the injury prevention cycle. This PhD project is then summarised as a whole, with recommendations provided.

### **Chapter Three: The epidemiology of squash injuries requiring hospital treatment**

The calculation of injury rates per player numbers is useful above and beyond simply reporting the cause and mechanism of injuries. The hospital based injury data surveillance presented in this Chapter assisted with understanding the epidemiology of squash injuries in general in Victoria, Australia.

#### **Summary**

- The hospital admission injury rate was 35.5 injured players per 100,000 squash players over a 12 month period.
- There were 58.5 injured players per 100,000 squash players presenting to Emergency Departments for treatment per annum over a four year period.

- The lower extremities were the most frequently injured body region, accounting for 34.7 injuries per 100,000 players.
- The overall (emergency department and hospital) eye injury rate was 19.0 per 100,000 players.
- Eye injuries were the most common squash injury requiring treatment at an Emergency Department and accounted for almost a third of all cases.
- Males were over represented in both hospital admitted cases (90%) and Emergency Department presented cases (80%) relative to participation.
- The majority of injured squash players were over 30 years of age.
- The most common cause of injury was defined as overexertion or being struck.

#### **Strengths/Limitations**

- The information on the cause, mechanism and injury site of injury from this injury surveillance database are very general and not specific enough to inform prevention strategies.
- A limitation of this study is that it only covers severe injuries, defined as those warranting medical treatment at a hospital setting.
- A strength of this study was the large capture rate of injuries presenting for treatment at the two treatment settings.

#### **Conclusions**

- The injury rates reported in this Chapter are an underestimate of the true problem of squash injuries in this population, as they represent only those severe enough to warrant medical attention.
- Eye injuries are a considerable problem to squash players in terms of injury incidence and potential severity.
- It was recommended that causal mechanisms of eye injuries need to be further investigated.

## **Chapter Four: Nine-year retrospective injury surveillance utilising insurance claim records**

This Chapter presented additional squash injury surveillance data. Instead of relying solely on information at one time-point, this Chapter investigated trends in squash injuries retrospectively over a nine year period. Injury rates per player numbers as well as injury costs are summarised.

### **Summary**

- The average annual injury rate was 13.5/1000 insured players.
- The rate of injury declined significantly over the nine year period, even after adjusting for the decline in the number of insured players.
- Males represented almost two-thirds of squash injury claimants.
- The mean age of claimants was 40 years.
- The most common cause of injury was unspecified acute overexertion.
- The most frequent injury was a strain or a sprain.
- The average cost of injuries was \$500. The highest cost of an injury was to the eye (AUS\$5000).

### **Strengths/Limitations**

- A strength of this injury surveillance was the ability to provide detailed information of the body region injured, the cause and nature of injury and review this over a nine year period.
- As with the data from injuries presenting for treatment at hospital in Victoria, utilising insurance records to investigate injury trends also underestimates the true extent of injuries. Only those injuries severe enough to warrant making an insurance claim through the VSF are captured in this surveillance tool.

- The inability to further clearly define causal mechanisms is a limitation of this method of injury surveillance.
- A further limitation is the lack of exposure information from the injury surveillance method.

### **Conclusion**

- The decline in the injury rate is likely to be due to changes in the trends in health insurance cover over this time, rather than a true decline in injury risk.
- Further research is required to investigate the relationship between age, gender, risk factors and injury.
- The potential severity of eye injuries, including loss of vision substantiates implementing eye injury prevention strategies in squash.

## **Chapter Five: Australian trends in players' attitudes towards protective eyewear**

Three Australian adult player surveys had been conducted previously in Australia. This Chapter reviewed this information on eyewear use and assessed trends in players' eye safety attitudes over the past decade.

### **Summary**

- The use of appropriate eyewear was consistently low.
- More people reportedly wore inappropriate eyewear than appropriate eyewear when playing squash.
- Players' were generally supportive of compulsory use of protective eyewear for juniors, however not for adult players.

**Strengths/Limitations**

- A limitation of this comparison, is that the studies did not all have consistent methodology.
- The 1995 player survey relied on a volunteer sample of players, which may have led to a bias sample, as players that wore protective eyewear may have been more inclined to participate in the survey.

**Conclusion**

- The use of eyewear had only slightly increased over the past decade.
- More favourable attitudes towards eye safety in squash were evident in the most recent squash survey.
- A transition of positive eye safety attitudes to favourable behaviours is required in this sport. Increasing the proportion of voluntary protective eyewear use amongst adults is essential before an eyewear compulsory ruling for all players is made.
- Strategies aimed at increasing the use of appropriate protective eyewear, and decreasing the use of inappropriate eyewear are required.

**Chapter Six: Eye injury safety practices of squash venues**

Many factors contribute to a person choosing to wear protective eyewear in squash. Apart from personal factors, environmental factors can largely influence a person's safety behaviour. Although never investigated before, squash venues are in a position to potentially influence the safety practices of their clientele. Venue manager interviews were conducted with the following findings.

**Summary**

- Squash venue managers were concerned with the potential severity of eye injuries but not necessarily the incidence of these injuries occurring.
- Most venue managers believed that wearing any type of eyewear on court was more beneficial for safety than wearing no eyewear at all.
- There was a general belief that lower standard players were at an increased risk of injury than more competent players.
- Few squash venues were equipped with protective eyewear for loaning or sales purposes.

### **Strengths/Limitations**

- The main strength of this study was the ability to define and describe the squash venue environment in relation to eye safety in this sport.

### **Conclusion**

- It was concluded that appropriate eyewear was not readily available at squash venues across Metropolitan Melbourne. Addressing this issue would be a positive move towards increasing protective eyewear use amongst players.

## **Chapter Seven: Players' eyewear behaviours, knowledge and attitudes**

Understanding the current situation of players' knowledge regarding eye injury risk and protective eyewear, as well as their associated attitudes and behaviours was an important aspect of this PhD project.

### **Summary**

- Two annual player surveys were conducted. The analysis of the two surveys found that the differences across player characteristics, responses to survey questions and topics did not differ significantly.

### **Strengths/Limitations**

- The larger sample size through the combining of the data enabled investigation into the specific predictors and barriers of protective eyewear use.

### **Conclusion**

- It was therefore concluded that it would be appropriate to combine the data for further analysis.
- Without a specific intervention targeting the increase of protective eyewear use it is unlikely that the situation of eyewear use would differ largely across time.

## **Chapter Eight: Factors relating to the use of protective eyewear**

Further analysis of the player surveys identified specific factors associated with appropriate eyewear use.

### **Summary**

- Factors associated with increased use of appropriate eyewear were: being female, having had an eye injury in the past, playing squash on average for more than 2 hours per week and having more favourable attitudes towards eye safety in squash.

### **Strengths/limitations**

- This study moved forward from the large descriptive nature of squash injury information to investigate specific predictors of the use of protective equipment.



- The random selection of 50% of squash venues in the study population, and the high response rate led to a sample of players representative of the adult squash population of Melbourne.

### **Conclusion**

- The barriers, specifically for men to wear protective eyewear, or their particular reasons for choosing not to wear this protection need to be investigated further.
- Understanding the characteristics of both users and non-users of eyewear is essential for the development of future eye injury prevention strategies in squash.

## **Chapter Nine: Validity of self-reported appropriate protective eyewear use**

Few studies have examined the validity of self-reported protective equipment use by comparison with direct observations of the specific protective behaviours. In this Chapter, the data derived from self-reported protective eyewear use was compared with direct observation data.

### **Summary**

- The self-reported protective eyewear use rate was 1.6 times higher than the observed rate
- There are a number of possible reasons for this difference, including a lack of correct knowledge regarding appropriate protective eyewear. Also, some players indicated in the survey that they only sometimes wore protective eyewear. It may have been that the observations were made at a time when they chose not to wear it.

**Strengths/Limitations**

- A strength of this study is that all observers were formally trained at determining the differences between appropriate and inappropriate eyewear.
- A limitation is that the observed behaviours could not be directly matched to self-report data for individuals, because the surveys were anonymous.

**Conclusion**

- Squash players are likely to over-report their use of appropriate protective eyewear.
- Direct observation of protective equipment use is recommended, particularly if such observations can be linked to other data at the individual level. However, this is a time consuming and labour-intensive approach to measurement.

**Chapter Ten: The conceptual framework for the Protective Eyewear Promotion strategy**

The results of the previous Chapters laid the developmental foundation for the injury prevention cycle. Alone, this descriptive data would not and cannot prevent injuries. This Chapter described the conceptual framework for the Protective Eyewear Promotion strategy.

**Summary**

- In addition to considering the context described by the findings of previous chapters, behaviour change principles were applied for the development and implementation of PEP.

- The PEP utilised the strong influences of the squash venues and altered their eye safety practices, as well as being aimed at changing players' eye safety knowledge, attitudes and subsequent behaviours.

### **Strengths/Limitations**

- A strength of this study was the collaborative nature of the project involving the VSF, venue managers and players, as well as the protective eyewear manufactures.

### **Conclusion**

- Attempts were made within the project structure to be able to sustain the project over time. This was important for long-term adoption of eyewear use and for future prevention of eye injuries past the scope of the initial four month trial of PEP.

## **Chapter Eleven: Implementation and evaluation of the Protective Eyewear Promotion**

The PEP was evaluated through comparing pre and post-intervention survey data amongst players in the PEP and Control groups. Without formally evaluating PEP, little could be learnt from the design and implementation of PEP.

### **Summary**

- The PEP players were significantly more likely (OR 2.4) to wear appropriate eyewear than were Control players, when compared to the pre-intervention survey results.
- Certain components of PEP, including the task specific stickers and posters were found to be a significant contributing factor to players adopting favourable eye safety behaviours.

- Visiting a PEP venue 10 times or more significantly correlated with recognising a particular component of PEP.
- Sales of protective eyewear at PEP venues far outweighed the few sales of eyewear at Control venues of the intervention period.

### **Strengths/Limitations**

- The random allocation of the PEP and Control venues within two different playing associations assisted with very little contamination.
- A limitation of the study was the difference by explaining appropriate eyewear by the brand name on the PEP posters and by the material composition on the player survey.

### **Conclusion**

- Sports injury prevention research aimed at specific behaviour change should apply and evaluate ecological models in controlled and randomised trials.
- The PEP was effective in changing players eyewear behaviours.
- Behaviour change is a process, and much further research is required to understand this in the sports injury prevention domain.

Squash injuries began receiving research attention internationally, back in the 1980's. Until recently, this information was obtained mainly from single treatment facilities and was presented in a descriptive manner. Whilst there are limitations with research as a single, treatment facility as highlighted in Chapter One, it does assist in identifying key areas, particularly the severe nature of eye injuries in squash. Protective eyewear was developed, and later evaluated on its abilities to prevent injuries to the eye and surrounding structures. Unfortunately, the results of the open-eyeguard experiments that they did not provide adequate protection did not transcend to squash at the community level. Eyewear protective standards

were set, and 'appropriate eyewear' was designed and manufactured. As explained in this Thesis, this information did not filter out to the community squash player, nor did it impact heavily on the eye safety practices and policies of most squash venues in Melbourne.

The extent of squash injury data to date in Australia lies with three player surveys, and one descriptive hospital based eye injury study. This Thesis provides the first comprehensive research information of this sport in Australia. In doing so, it was necessary to build a new foundation of knowledge through research activities. This Thesis presents an extensive picture of eye injury prevention in squash in Australia for the first time. For the prevention of injuries, it is paramount that research 'develops', 'implements' and 'evaluates', and does not pause after merely describing injury statistics. For widespread prevention of injuries, research must be based at, and involve the community level.

Descriptive statistics are the foundation for any injury prevention research. This data can be used more productively than merely describing differences in injury frequencies across body regions. By including player demographics such as age and gender, analysis of certain predictors of injury and use of protective equipment can easily be made. For example, this research was able to ascertain that the significant predictors of appropriate eyewear use were: being female; previous eye injury; playing squash on average for more than two hours per week; and having favourable attitudes towards eye safety in squash.

Various injury surveillance methods were used in the developmental or descriptive stage of this research project. There was a consensus from the results of the injury surveillance, player surveys and venue manager interviews that eye injuries are a

problem. Whilst players and venue managers alike, only believed it was the severity of these injuries that was a major concern, the injury surveillance methods identified that they are also associated with a relatively high incidence rate and monetary costs. A limitation of the injury surveillance methods presented in this Thesis was that indirect costs associated with injuries were not able to be identified.

There are specific limitations with each type of injury surveillance methods, including the preciseness and detail of certain injury information. However, by conducting various injury surveillance methods can complement each method and fill the void in information. Whilst the causes of eye injuries as presented in this Thesis are clearly defined, the specific injury mechanisms and body region for other squash injuries are not.

Within the body of descriptive information, the calculation of general squash injury rates per player numbers were presented for the first time in Australia. This is valuable to be able to assess trends in injury over time, especially in accordance to injury prevention measures, game/rule changes etc. In addition, priorities in injury prevention research can be established by comparing injury rates across specific injuries and sports. Research utilising hospital-based injury surveillance should be conducted with a comprehensive range of facilities, preferable across one year to cover seasonal changes in environmental conditions as well as sports participation.

Understanding personal factors, as well as injury surveillance facts and figures, was a main component of this project. A similarity between the players and squash venue managers was their belief that only players of a high standard were at

particular risk of an eye injury. Another fallacy, believed by both players and venue managers was that the wearing of 'any' type of eyewear is better than none at all. Filling this void in correct knowledge of injury risk and of appropriate eyewear was a major aim of the Protective Eyewear Promotion

In moving from the descriptive stages into the prevention of eye injuries in squash, protective eyewear was recognised as a suitable injury prevention measure. Some brands of eyewear are effective in preventing eye injuries, however some that was found to be available to players at squash venues is not. It may seem from the outside that devising a prevention strategy against eye injuries in squash is straightforward. There is an appropriate preventive measure, a mechanical barrier. However, there is an abundance of factors contributing to the low use of this eyewear. Without initially understanding these factors, and then developing and implementing an intervention, there was no reason to expect the low use to change. In this case, and for other injury prevention strategies, it is essential that every avenue is investigated and strategies are not limited to education. As well as personal reasons, the environmental links of the squash venues were identified as an important factor in this situation.

Several factors were found to be significantly related to both injury status, and to the use of appropriate protective eyewear. Males were identified as being the most frequently injured gender on the squash court through various injury surveillance methods. Whilst the reason for this is not known, there could be many plausible explanations including rate of exposure, age, intensity of play, or fitness. In relation to eye injuries only, females were significantly more likely than males to wear appropriate protection. This is most likely to be linked with the habit of other safety behaviours and individuals' risky behaviour habits. Further investigations are

required to understand why males are more prone to injury, yet are significantly less likely to wear protective eyewear than females.

There are some general limitations associated with PEP. It was important to have a Control group in this project for evaluation purposes. The cross-over of PEP players surveyed at Control venues and vice versa was not able to be controlled fully. However, having PEP and Control implemented in different playing associations resulted in few players being surveyed at a venue from the opposite group to which they were a member of.

A main reason for the success of PEP lies with the holistic approach of directly involving people from different research disciplines, the VSF, venue managers and staff as well as players. Another valuable aspect of this project is that the initial investigations were not limited to one source of data.

Sports injury prevention research is slowly being recognised in Australia as a key research priority. However, without substantial funding for large, long term studies that take into account the whole injury prevention cycle, and which does not stop short of evaluation, we are going to be stagnated at the 'descriptive' stage. This project was fortunate to have been funded through a Translational Grant in Injury from the NHMRC. Without this substantial funding this research project would not have been able to be conducted.

It is recommended from the research conducted as part of this PhD, that for the widespread prevention of eye injuries in squash in Australia, Squash Australia and all State governing bodies need to have consensus on this issue. I hope that some of the information in this research project can be utilised to pronounce the issue



and prevention principles further. Future recommendations from this research include the further dissemination of the PEP material and principles. It is fortunate that these recommendations are not just that, but steps are in place to make this a reality

In 2003, the PEP project was awarded a keenly contested \$5000 Victorian Sport and Recreation Industry Award- Safety Initiatives Award, for recognition of the safety promotional efforts of PEP at the community level of squash in Victoria. Since then, a research team led by the author of this Thesis also received a grant from The Sport and Recreation Victoria Sports Injury Prevention Research Committee for the future dissemination and sustainment of PEP throughout Metropolitan, Country and Regional Victoria. From a personal point of view it is both very rewarding and exciting to see PEP not crumble with the end of this PhD studies. Scientific research must be translated into practice into the wider community. By involving the sport at all levels (sport governing body, sporting clubs and associations, and players), mainly at the community level the future sustainability of a project such as PEP is possible. Mr Paul Vear, the Executive Director of the VSF has been a crucial part of all stages of this research and will continue to be a critical component in the dissemination efforts. The random allocation of eight squash venues was enough scientifically, to detect various changes. However, this alone would not prevent many eye injuries. It is envisaged that PEP will continue to grow and become self-funded and self-sustained.

This Thesis has laid the foundation for the successful prevention of eye injuries in squash in Australia. The continuing efforts of sustaining the existing PEP and continuing to broaden across Victoria is valuable for long standing eye injury prevention in Squash.

*"We ourselves feel that what we are doing is just a drop in the ocean,  
but the ocean would be less because of that missing drop"- Mother Teresa*

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## **Appendix One: Venue manager contact letter**

Dear,

Researchers from Deakin University and the University of Wollongong, in conjunction with the Victorian Squash Federation (VSF), are conducting a study to determine factors associated with protective eyewear use by squash players.

Research has shown that eye injuries in squash and racquetball can be totally eliminated through the use of appropriate eye protection.

It is now compulsory for all players 19 years and under to wear protective eye-wear, which meets the Australian or American standards.

The VSF fully supports this survey, which also wants to find out what adult players think about protective eyewear.

On behalf of the VSF, I would like to thank you for your valuable support and involvement in the Squash Eyewear Research Project (SQERP).

A researcher will contact you to discuss a suitable time for them to visit your squash venue and survey adult players.

For further information contact Associate Professor Caroline Finch (Phone: 9251 7084, Fax: 9244 6017, email: cfinch@deakin.edu.au) or Ms Rochelle Eime [REDACTED]  
[REDACTED]

Best Regards,

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**Paul Vear**  
Executive Director

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**A/Prof Caroline Finch**  
Chief Investigator

## **Appendix Two: Player survey plain language statement**



Dear Squash player

Researchers from Deakin University and the University of Wollongong, in conjunction with the Victorian Squash Federation, are conducting a study to determine factors associated with protective eyewear use by squash players. We also want to find out what adult players think about protective eyewear. This project is being conducted by A/Prof Caroline Finch, Mr Paul Vear, Prof Neville Owen, A/Prof Catherine McCarty and Ms Rochelle Eime.

We would like to invite you to participate in this important research project. If you agree, you will be required to complete a short anonymous questionnaire that will take you about 2-5 minutes to complete. The questionnaire will ask you about your squash playing habits and history, previous eye injury, use of protective eyewear, and your knowledge and attitudes associated with the use of protective eyewear. There are no right or wrong answers. When you have completed the questionnaire return it to the box at the reception desk or hand it to the project officer on site.

The responses you give on your questionnaire will be used for research purposes only and entered onto a computer database. You will not be able to be identified on the computer database. Only the investigators named above, and the appointed research assistants will have access to the data. You are free to withdraw at any time and/or omit answers to questions.

The results of this study will be made available to squash players through their squash venues. If you have any further queries regarding the study, please contact A/Prof Caroline Finch on [REDACTED]

Should you have any concerns about the conduct of this research project, please contact the Secretary, Ethics Committee, Research Services, Deakin University, 221 Burwood Highway, BURWOOD VIC 3125. Tel (03) 9251 7123 (International +61 3 9251 7123).

## Appendix Three: Player survey project summary



Squash is a popular competitive sport with over 15 million players worldwide. Throughout Australia each year, 1.1 million players participate on 5000 courts. Squash is played on a confined indoor court with players swinging racquets and hitting a small ball. These factors contribute to a risk of eye injuries for squash players. Although eye injuries are not the most common squash injury, the potential severity of these injuries is a major concern. Injuries range from cut eyebrows, to bruised eyes or even total loss of sight.

Appropriate protective eyewear is a proven and effective way to prevent eye injuries in squash. However, few players choose to wear eyewear and often the eyewear they choose to wear does not provide suitable protection. The reasons why squash players do or do not wear this eyewear is of importance. SQERP (Squash Eyewear Research Project) will explore the factors that promote and support the use of protective eyewear when playing squash. The goal of SQERP is to decrease the incidence of eye injuries in squash by increasing the use of proper protective eyewear.

Squash players' injury rates, playing habits, protective eyewear wearing behaviours, attitudes and safety knowledge will be measured through the use of a player survey. Squash venue policies and practices will also be assessed in detail.

This two-year study is funded by a research grant from the National Health and Medical Research Council (NHMRC). The chief investigators are: A/Prof Caroline Finch, Monash University; Mr Paul Vear, Victorian Squash Federation; Prof Neville Owen, The University of Queensland; Dr Catherine McCarty, Marshfield Medical Research Foundation; Ms Rochelle Eime, Monash University.

For further information contact Associate Professor Caroline Finch

Fax: +61 3 9903 0576, email:



## **Appendix Four: Player survey (2001 and 2002)**

Please answer all questions by written and/or the relevant tick boxes.

## PERSONAL INFORMATION

- 1 How old were you on your last birthday? \_\_\_\_\_ years
- 2 Are you        male        or        female Tick one response
- 3 What is your occupation?

## SQUASH HISTORY

- 4 On average how many hours of squash do you play per week?

less than 1 hour	1 hour to less than 2 hours	2 hours to less than 5 hours
5 hours to less than 10 hours	10 hours or more	

- 5 How many hours of squash did you play in the previous two weeks?

less than 1 hour	1 hour to less than 2 hours	2 hours to less than 5 hours
5 hours to less than 10 hours	10 hours or more	

- 6 How many years have you been playing squash?

Less than 1 year	1 to less than 5 years	5 to less than 10 years
10 to less than 20 years	20 years or more	

- 7 What level of squash do you play? Tick all options that apply

*If not playing competition at present, but have done so in the past, please specify the grade you last played and in what year that was.*

Competition (Inter-club/Pennant) *please specify competition and grade*

In-House *please specify competition and grade*

Social/Recreational/Casual

## INJURY OCCURRENCE

- 8 Have you had an eye injury in the past 12 months whilst playing squash?

*An eye injury is defined as one to the eye itself or its surrounding structures, including the eyelids, eyebrows and cheek or socket bones.*

Yes *please specify how many eye injuries in the past 12 months*

No (go to Q11)

- 9 What was the cause of the most recent eye injury, within the past 12 months?

Racquet	Ball
Fall	Collision with opponent
Collision with court wall	Other <i>specify</i>

**10 Did the most recent eye injury, within the past 12 months require medical attention?**

Yes No

*please specify what sort of injury you received:*

Cut or other injury to eyelid	Bruising around the eye (Black eye)	Retinal detachment/tear
Corneal abrasion/Laceration	Orbital fracture	Bleeding within the eye/Hyphaema
Permanent visual impairment	Other <i>specify</i>	

Please give details of treating doctor or ophthalmologist

**11 Have you had an injury to a part of the body (excluding the eye) in the past 12 months whilst playing squash?**

Yes No (go to Q14)

**12 If yes, what caused the most recent injury?**

Racquet	Ball
Fall	Collision with opponent
Collision with court wall	Other <i>specify</i>

**13 What part of your body was injured in the most recent squash injury, within the past 12 months?**

## EYEWEAR USE IN SQUASH

**14 Do you wear protective eyewear when playing squash?**

Yes No (go to Q17)

**15 How often do you wear protective eyewear? One or more responses may be given**

Always during competition	Sometimes during competition	Always during social play
Sometimes during social play	Always during practice sessions	Sometimes during practice sessions

**16 What type of protective eyewear do you currently use?**

Industrial eyewear	Polycarbonate lenses (eg IMAX, Leader) <i>Please specify type</i>
Contact lenses	
Open-eyeguards	
Normal prescription glasses	Other <i>specify (go to Q18)</i>

**17 Do you wear normal prescription glasses when playing squash?**

Yes No

**18 What eyewear do you think would be protective against eye injuries in squash? Tick all options that apply**

I do not know	Industrial eyewear	Polycarbonate lenses
Normal prescription glasses	Contact lenses	Open-eyeguards
Other <i>specify</i>		

**19 If you DO WEAR polycarbonate lens/standards approved squash eyewear (eg IMAX, Leader) why do you wear it? Tick all options that apply**

I have had an eye injury before and do not want to get another one	
I know someone else who has had an eye injury and I do not want to get one myself	
Protective eyewear use has been recommended to me by	
I have knowledge of the risks of eye injury	<i>please specify e.g. Doctor, player</i>
It is compulsory for me to wear protective eyewear	
Other <i>specify (go to Q22)</i>	

**20 If you DO NOT wear polycarbonate lens/standards approved squash eyewear (eg IMAX, Leader) when playing squash, why don't you wear it? Tick all options that apply**

- It costs too much
- It is not necessary, as the risks of eye injury are not that great
- I am not at risk of an eye injury because of my playing level
- I do not know where to obtain protective eyewear
- I do not want to
- I do not like the look of protective eyewear
- It is too uncomfortable to wear
- It restricts my vision whilst playing
- I have never thought about it
- Because I wear normal prescription glasses when playing
- Other *specify*

**21 Have you ever tried using polycarbonate lens/standards approved squash eyewear (eg IMAX, Leader)?**

- Yes                      No

**22 From where can polycarbonate lens/standards approved squash eyewear be bought? Tick all options that apply**

- I do not know                      This squash venue                      Other squash venues
- Sport store                      Hardware store                      Optometrist
- Other *specify*

**23 Do you think polycarbonate lens/standards approved squash eyewear should be made available for PURCHASE at this squash venue?**

- Yes                      No

**24 Do you think polycarbonate lens/standards approved squash eyewear should be made available for HIRE at this squash venue?**

- Yes                      No

**25 Who do you believe is more at risk of an eye injury in squash?**

- State grade/area interclub competition player                      Inhouse player
- Casual/Social player                      There is an equal risk to all players

**26 Are you aware of any regulation to implement compulsory use of protective eyewear in squash?**

- Yes *please specify*
- No

**27 Please circle the appropriate number for each item below**

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
Eye injuries are a particular problem for squash players	1	2	3	4	5
More players should use protective eyewear	1	2	3	4	5
Protective eyewear should be made compulsory for all players	1	2	3	4	5
I would stop playing if protective eyewear was made compulsory	1	2	3	4	5
Protective eyewear should be made compulsory for junior players	1	2	3	4	5
The risk of eye injury in squash is high	1	2	3	4	5
The benefits of using protective eyewear is low	1	2	3	4	5
It is just as easy to use protective eyewear as it is to wear ordinary prescription glasses or sunglasses	1	2	3	4	5
It is important that I personally use protective eyewear when playing squash	1	2	3	4	5
Protective eyewear would significantly reduce my risk of sustaining an eye injury whilst playing squash	1	2	3	4	5

**Appendix Five: Eyewear company letter**



Mr Bob Crome,  
Promotions Manager  
Dunlop Sport  
PO Box 337  
Regents Park, NSW, 2143  
Hospital  
Ph: 02 9738 4300  
Fax: 02 9738 4399

A/Prof Caroline Finch,  
SQERP Chief Investigator  
Dept of Epidemiology and  
Preventive Medicine  
Monash University, Alfred

Prahran, Vic, 3181

Fax: 03 9903 0576

Email

Caroline.Finch@med.monash.edu.au

May 16<sup>th</sup>, 2002

Dear Mr Crome,

**Re: Partnership for Preventing Eye Injuries in Squash Players**

I am writing to you to tell you about an important initiative relating to protective eyewear for all squash players. This is a joint project between the Victorian Squash Federation (VSF) and university researchers. We believe that this project, and a broader partnership involving eyewear manufacturers, will have a significant impact on the delivery of safe squash at the community level of participation, both for recreational and competitive players.

The National Health and Medical Research Council (NHMRC) has awarded Monash University research funding of approximately \$182,000 to investigate the role of protective eyewear regulation in squash over a 3 year period. This research project is being led by Associate Professor Caroline Finch and Ms Rochelle Eime from Monash University and the research team includes Mr Paul Vear from the VSF, Professor Neville Owen from The University of Queensland, and Dr Catherine McCarty from the Marshfield Medical Research Foundation in the USA.

The results of our work to date have shown that very few players wear any protective eyewear, and that much of the eyewear worn does not provide suitable protection. For example, players wear prescription glasses and believe them to be protective. The majority of players lack sufficient knowledge of the risk of sustaining an eye injury, and think that it will never happen to them. Many players are also unaware of where proper eyewear can be obtained. This is often a barrier to its use. In addition, few squash venues have suitable eyewear available for players to purchase or borrow. Some venues, have inappropriate eyewear (eg lensless eyeguards), available to players. There is an excellent opportunity to influence the uptake of protective eyewear at squash venues by formalizing a partnership between ourselves (the research team) and a leading eyewear manufacturer. We would value the opportunity to discuss this with you in detail.

As Chief Investigator of SQERP (Squash Eyewear Research Project) I would like to formally invite Dunlop to join as a partner in this important initiative.

We believe that the benefits to Dunlop Sport from joining in this initiative would include:

- A partnership with Australia's leading sports injury prevention research (i.e. public health and epidemiology) team
- Formal acknowledgement as a partner in all written documents and oral presentations arising from this project, including final project reports, peer-review medical/scientific journal articles, and conference presentations
- Formal acknowledgement as a partner in all media and press releases relating to this project.
- Inclusion of the Dunlop logo on all relevant documents associated with the project
- Information about the outcomes of this study specifically targeted at your organisation's interests and in a form suitable for inclusion in your organisation's publications. This may help to inform future marketing plans for protective eyewear.

If you would consider joining our partnership, we would be pleased to discuss this with you further. Please contact A/Prof Caroline Finch on 9903 0581 or at the email or office address at the top of this letterhead, if you would like further information about this project.

I am attaching a brief summary of the SQERP project for your information. We look forward to hearing from you soon and working with you to enhance the delivery of safe squash to the broad community.

Kind Regards

A/Prof Caroline Finch

**Appendix Six: PEP venue manager letter**





Mr Phil Larmer  
120 Martin Street  
Gardenvale  
3185

Rochelle Eime  
DEPM  
Monash University  
Alfred Hospital  
Commercial Road  
Melbourne 3004

4<sup>th</sup> November 2002,

Dear Phil,

Thank you for the opportunity to discuss the forthcoming Protective Eye Promotion (PEP) with you. We believe that this is a great opportunity to increase the safety of squash through the collaborative efforts of injury prevention researchers, the Victorian Squash Federation (VSF), two leading eyewear manufacturers, squash venue managers as well as squash players. The PEP information pack which was provided to you contains all relevant background project information.

Should your squash venue agree to participate in this promotion, you will be required to:

- prominently display all PEP posters, stickers and pamphlets (which will be provided free of charge)
- encouraging all of your players to use or try approved protective eyewear;
- disseminate information sheets to all players during the promotion;
- keep a record of players who buy or purchase protective eyewear during the promotion (we will provide you with sheets for this)
- purchase twelve sets of both IMAX and Dunlop brands of protective eyewear at the PEP heavily discounted prices. You will be invoiced for this eyewear through the VSF.

You will also be provided with six sets of both IMAX and Dunlop eyewear free of charge for you to provide to players for borrow or hire. Any further purchase of eyewear will be via the eyewear companies directly, or your normal purchasing practices.

I will be contacting you soon to let you know when we will be starting this project. I will also hand deliver all of the information, eyewear, posters etc before the commencement of PEP.

To formally acknowledge the participation of Gardenvale Squash Centre in the eyewear promotion, and to agree to the formal project requirements, could you please sign below and return it to me in the accompanying reply-paid envelope within the next 2 weeks.

If you require any further details about this project, please feel free to contact me on:  
Phone 9903 0052; or Email [Rochelle.Eime@med.monash.edu.au](mailto:Rochelle.Eime@med.monash.edu.au)

Yours Sincerely,

Mr Phil Larmer,

Rochelle Eime  
SQERP Project Officer

*please sign*

## **Appendix Seven: PEP player survey plain language statement**



## Squash Eyewear Research Project

Dear Squash player

Researchers from Monash University and the University of Queensland, in conjunction with the Victorian Squash Federation, are conducting a study to determine factors associated with protective eyewear use by squash players. We also want to find out what adult players think about protective eyewear. This project is being conducted by A/Prof Caroline Finch, Mr Paul Vear, Prof Neville Owen, A/Prof Catherine McCarty and Ms Rochelle Eime.

We would like to invite you to participate in this important research project. If you agree, you will be required to complete a short anonymous questionnaire that will take you about 2-5 minutes to complete. The questionnaire will ask you about your squash playing habits and history, previous eye injury, use of protective eyewear, and your knowledge and attitudes associated with the use of protective eyewear. There are no right or wrong answers. When you have completed the questionnaire return it to the box at the reception desk or hand it to the project officer on site.

The responses you give on your questionnaire will be used for research purposes only and entered onto a computer database. You will not be able to be identified on the computer database. Only the investigators named above, and the appointed research assistants will have access to the data. It is intended that the results of this research will be published in a peer review journal, with anonymity of participants guaranteed. You are free to withdraw at any time and/or omit answers to questions. The results of the player survey will be used to analyse factors associated with protective eyewear use. The results will also be used as part of an evaluation of a protective eyewear promotion.

The results of this study will be made available to squash players through their squash venues. If you have any further queries regarding the study, please contact A/Prof Caroline Finch on 9903 0581 or Ms Rochelle Eime on 9903 0052.

*You can complain about the study if you don't like something about it. To complain about the study, you need to phone 9905 2052. You can then ask to speak to the secretary of the Human Ethics Committee and tell him or her that the number of the project is 2001/605. You could also write to the secretary. That person's address is:*

*The Secretary*

*The Standing Committee on Ethics in Research, Involving Humans  
PO Box 3A, Monash University, Victoria 3800*

**Appendix Eight: Poster displaying appropriate protective eyewear brands**



# SQERP

SQUASH EYEWEAR RESEARCH PROJECT

## Do Wear Approved Protective Eyewear

I-MAX P/L: I-MASK and I-MAX protective eyewear

Dunlop: Protective eyewear

Leader: Albany, Champion, Yorker, Vision II

R.A.D: Feather (+ Junior), Turbo & Turbo LX

HEAD: I-X Pro Talbot, I-X Speed Pro &

I-X Power Pro Baron: Champ, Elite

# Are you protecting your eyes?

## Don't Wear

Prescription glasses by themselves

Plastic lensed glasses

Industrial eyewear

Open-eyeguards

**This venue has approved protective eyewear  
available for YOU to purchase or borrow**

**Appendix Nine: Poster explaining intervention incentives**



**SQER**

SQUASH EYEWEAR RESEARCH PROJECT

## Protective Eyewear Promotion

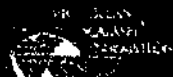
If you buy protective eyewear

# Chance to win!

- Framed picture of you and Sarah Fitzgerald, signed for you personally (from Dunlop/VSF)
- \$100 cash prize for a male (from I-MAX P/L)
- \$100 cash prize for a female (from I-MAX P/L)

Approved protective eyewear is  
available here for you to try or buy today

MONASH



**DUNLOP**

**I-MASK**

## **Appendix Ten: Poster explaining the risk of sustaining an eye injury**



**SQERP**

SQUASH EYEWEAR RESEARCH PROJECT

In 2001, 4% of 555 sampled  
Melbourne adult squash players  
sustained an eye injury whilst playing  
squash within the past 12 months



## It is hard to play squash with one eye

**Eye injury- It could happen to you**

**Wear approved protective eyewear to prevent an eye injury**

**All players are at risk of sustaining an eye injury**

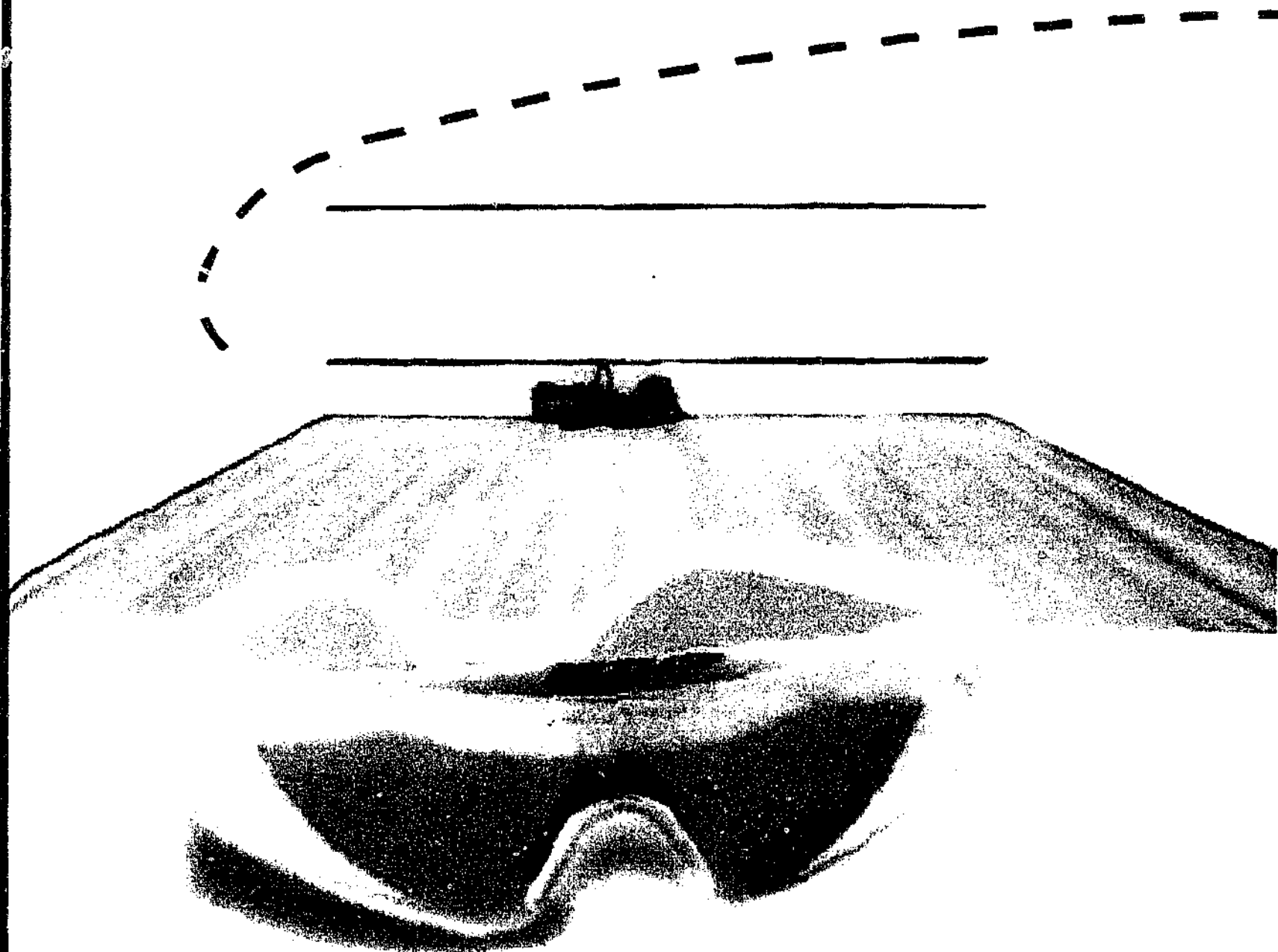
**irrespective of playing experience**

**Try or buy some approved protective eyewear today**

**Appendix Eleven: Eye injury safety poster**

# SQERP

SQUASH EYEWEAR RESEARCH PROJECT



**This squash venue cares for your safety**

**Ask us about trying or buying  
approved protective eyewear today**

## **Appendix Twelve: Protective Eyewear Promotion Sticker**

# Protective Eyewear Let's Get It On



**Appendix Thirteen: Protective Eyewear Promotion Pamphlet**

## **Safety for middle-aged players**

### **What are the problems?**

- ▶ A high proportion of squash players are aged over 40 years
- ▶ Injuries to players over 40 years are more common and often more severe than those to younger participants.
- ▶ Older players in the older age groups are also at higher risk of cardiovascular injuries.
- ▶ Injuries often result from the fact that older players are often in poor physical condition before play.

### **Safety tips**

- ▶ Older players should not take-up squash to get fit, particularly if they have been inactive for a while. A certain level of general physical fitness is required to play the game.
- ▶ Older players should undergo a comprehensive medical assessment from a doctor before participating in squash, particularly if they do not have a good level of fitness and do not participate regularly.
- ▶ When starting to play squash, players are advised to begin with a slower game (e.g. racquetball) to develop fitness and skills.
- ▶ Players should stop playing as soon as they experience symptoms of serious injury (e.g. heart condition). Prompt medical treatment should be sought if these symptoms are experienced.

### **For further information contact:**

Smartplay Program Manager  
Sports Medicine Australia - Victorian Branch  
Level 1, 120 Jolimont Road  
Jolimont Victoria 3002  
Phone: (03) 9654 7733  
Email: [smartplay@vic.sma.org.au](mailto:smartplay@vic.sma.org.au)  
<http://www.smartplay.net>

Deakin University -  
School of Health Sciences  
221 Burwood Highway  
Burwood Victoria 3125  
Telephone: 03 9251 7777.  
Email: [cfinch@deakin.edu.au](mailto:cfinch@deakin.edu.au)  
<http://www.hbs.deakin.edu.au/>

Victorian Squash Federation  
Telephone: 03 9682 2199  
<http://www.victoriansquash.com.au>

Sport and Recreation Victoria  
Tel: 03 9666 4267  
<http://www.sport.vic.gov.au>

### **Reference**

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Research Report No. 98002  
Faculty of Health and Behavioural Sciences  
Deakin University, July 1998.

### **Acknowledgments**

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Prepared by Deakin University, July 1998.  
The Victorian Squash Federation is thanked for providing information.

## Facts on Squash

### The game of squash

- ▶ Squash is a popular sport in Australia.
- ▶ Players require a high level of fitness because they are active 50-70% of the playing time.
- ▶ Players need to move quickly around the court, whilst maintaining control over ball placement and being aware of the position of the ball, racquets and other players.
- ▶ 75% of the players are older than 25 years of age and the majority are men. Victorian squash players enjoy both social sessions and competitive games.

### Common injuries during squash

- ▶ The overall risk of injury in squash is small when compared with other sports. However, the injuries that do occur can be quite severe.
- ▶ The majority of injuries in squash are due to acute or traumatic events (e.g. fall on court, strike from a racquet). Only a small proportion are overuse injuries.
- ▶ Injuries to the musculoskeletal system (e.g. strains/sprains) are common. Such injuries typically occur to the lower and upper limbs, as well as the lower back. These injuries are often not severe but can limit game performance.
- ▶ More severe injuries that can occur are eye and head injuries (e.g. eye injury from a ball or racquet strike), cardiac injury (e.g. discomfort in the chest) and heat injury (e.g. dehydration, dizziness).

### Players at risk of injury

- ▶ Mainly older males, aged over 40 years of age.
- ▶ Inexperienced players with poor technique.
- ▶ Players with poor general fitness.
- ▶ Players not wearing protective eyewear, irrespective of experience.
- ▶ High level players are at risk of overuse injuries due to the duration and nature of their participation.

## On court squash safety

There are a number of safety precautions that should be followed during a squash match.

- ▶ Never enter a squash court while play is in progress. Knock and wait for the players to acknowledge you.
- ▶ Always keep the court doors fully closed and handles flush with the walls whilst play is in progress.
- ▶ If players take belongings to the court, they should store them in the front corners of the court only.
- ▶ Players should drink plenty of fluids before, during and after a match.
- ▶ All players should exercise well within their limits, especially during hot and humid conditions.
- ▶ Players should wear appropriate clothing that allows for the evaporation of sweat.

## Safety for players

320

The following tips apply to all players, irrespective of the level at which they play.

- ▶ All players should undertake proper and adequate warm-up procedures before each game. This should include low intensity exercises, such as light jogging or walking, and stretching.
- ▶ All players should maintain their fitness levels through aerobic (e.g. walking, jogging) and anaerobic activities (e.g. sprinting). Activities that simulate the nature and movements of the game are of most benefit.
- ▶ All players should take squash lessons from a qualified coach to develop adequate skills and good game technique.
- ▶ Every player should always wear eye protection which satisfies Australian standards during all social, competition and practice games.
- ▶ All squash equipment should be maintained in good condition. Racquets should be kept in good repair and grips should be changed regularly.
- ▶ Players should wear shoes that are specifically designed for squash and professionally fitted.
- ▶ All players should cool down after their game by performing stretches and light walking.
- ▶ Players should stop playing immediately if they are injured and seek immediate first aid or medical treatment.
- ▶ Players should not return to play until their injury has fully healed.
- ▶ Players with a history of joint injury (e.g. ankle) should seek professional advice about taping or bracing of their joint before playing squash.



## **Appendix Fourteen: Protective eyewear feedback sheet**



### PROTECTIVE EYEWEAR USE- PLAYER FEEDBACK

We are interested in your assessment of the eyewear you have chosen to use today. We appreciate if you could complete this simple questionnaire and return to the labeled box at the reception area.

Please respond in the space provided or tick the appropriate box

What is your age? 18-25yrs ☐ 26-45yrs ☐ 46+yrs ☐

What is your gender? Male ☐ Female ☐

How many years have you been playing squash?

less than 1 ☐ 1 to less than 10 ☐ 10 to less than 20 ☐

20 or more ☐

What grade/level of player are you?

Pennant/club player Yes ☐ specify grade \_\_\_\_\_

And/Or Social/Recreational player Yes ☐ specify grade \_\_\_\_\_

What was your reason for trying or wearing protective eyewear? \_\_\_\_\_

Did you try and/or buy the protective eyewear? Try ☐ Buy ☐

What brand of eyewear did you buy or are you trying? \_\_\_\_\_

How often did you use the eyewear on court?

1<sup>st</sup> time ☐ Seldom ☐ Sometimes ☐ Often ☐ Always ☐

Will you continue to wear protective eyewear?

Never ☐ Seldom ☐ Sometimes ☐ Often ☐ Always ☐

Please rate the protective eyewear you use or are trying  
Please circle appropriate (whereby number 1 is the lowest score,  
10 the highest)

	Very poor							Excellent		
How do you like the eyewear overall?	1	2	3	4	5	6	7	8	9	10
How do you rate its comfort?	1	2	3	4	5	6	7	8	9	10
How do you rate full peripheral vision?	1	2	3	4	5	6	7	8	9	10
If you wear with prescription glasses, how do you rate its use with glasses?	1	2	3	4	5	6	7	8	9	10
How do you rate the quality?	1	2	3	4	5	6	7	8	9	10
How do you rate the temperature control?	1	2	3	4	5	6	7	8	9	10

Any other comments on the eyewear? \_\_\_\_\_

\_\_\_\_\_

**Appendix Fifteen: Intervention summary for squash team  
captains**



Dear Team Captain,

The Squash Eyewear Research Project is a joint initiative of the Victorian Squash Federation and university sports injury researchers. A brief summary of this project is attached. As team captain we would appreciate if you could please mention this initiative to your team members.

The project aims to understand squash players thoughts about the use of protective eyewear in an effort to increase the number of players who use it. Accordingly, a Protective Eyewear Promotion has been developed and is to be implemented at your venue. As a part of this promotion, protective eyewear educational posters explaining appropriate and inappropriate eyewear will be displayed at this venue. Appropriate protective eyewear will also be available for players to try and/or buy. Players who try and/or buy appropriate protective eyewear may be eligible for a number of incentives.

Thank you for your assistance with this important program.

For further information contact

Ms Rochelle Eime



Dear Team Captain,

The Squash Eyewear Research Project is a joint initiative of the Victorian Squash Federation and university sports injury researchers. A brief summary of this project is attached. As team captain we would appreciate if you could please mention this initiative to your team members.

The project aims to understand squash players thoughts about the use of protective eyewear in an effort to increase the number of players who use it. Accordingly, a Protective Eyewear Promotion has been developed and is to be implemented at your venue. As a part of this promotion, protective eyewear educational posters explaining appropriate and inappropriate eyewear will be displayed at this venue. Appropriate protective eyewear will also be available for players to try and/or buy. Players who try and/or buy appropriate protective eyewear may be eligible for a number of incentives.

Thank you for your assistance with this important program.

For further information contact

Ms Rochelle Eime

## Appendix Sixteen: Protective Eyewear Promotion survey

## PERSONAL INFORMATION

- 1 How old were you on your last birthday?  Years
- 2 Are you ☐ male or ☐ female *Tick one response*
- 3 What is your occupation?

## SQUASH HISTORY

- 4 On average how many hours of squash do you play per week?
- ☐ less than 1 hour ☐ 1 hour to less than 2 hours ☐ 2 hours to less than 5 hours
- ☐ 5 hours to less than 10 hours ☐ 10 hours or more
- 5 How many hours of squash did you play in the previous two weeks?
- ☐ less than 1 hour ☐ 1 hour to less than 2 hours ☐ 2 hours to less than 5 hours
- ☐ 5 hours to less than 10 hours ☐ 10 hours or more
- 6 How many years have you been playing squash?
- ☐ less than 1 year ☐ 1 to less than 5 years ☐ 5 to less than 10 years
- ☐ 10 to less than 20 years ☐ 20 years or more
- 7 What level of squash do you play? *Tick all options that apply*  
*If not playing competition at present, but have done so in the past, please specify the grade you last played and in what year that was.*
- ☐ Competition (Inter-club/Pennant) please specify grade
- ☐ In-House please specify competition and grade
- ☐ Social/Recreational/Casual
- 8 How many times have you visited one or more of the following squash venues this year?
- |   |                               |                                 |                                    |                                     |                                   |
|---|-------------------------------|---------------------------------|------------------------------------|-------------------------------------|-----------------------------------|
| Knox Squash Centre                            | <input type="checkbox"/> None | <input type="checkbox"/> 1 time | <input type="checkbox"/> 2-5 times | <input type="checkbox"/> 6-10 times | <input type="checkbox"/> 10+times |
| Melbourne Sports & Aquatic Centre Squash Club | <input type="checkbox"/> None | <input type="checkbox"/> 1 time | <input type="checkbox"/> 2-5 times | <input type="checkbox"/> 6-10 times | <input type="checkbox"/> 10+times |
| Moorabbin Squash Centre                       | <input type="checkbox"/> None | <input type="checkbox"/> 1 time | <input type="checkbox"/> 2-5 times | <input type="checkbox"/> 6-10 times | <input type="checkbox"/> 10+times |
| Gardenvale Squash Centre                      | <input type="checkbox"/> None | <input type="checkbox"/> 1 time | <input type="checkbox"/> 2-5 times | <input type="checkbox"/> 6-10 times | <input type="checkbox"/> 10+times |
- 9 What squash venue are you a member of, or play regularly at?

## INJURY OCCURRENCE

- 10 Have you had an eye injury in the past 12 months whilst playing squash?
- An eye injury is defined as one to the eye itself or its surrounding structures, including the eyelids, eyebrows and cheek or socket bones.*
- ☐ Yes please specify how many eye injuries in the past 12 months
- ☐ No (Go to Q13)

11 What was the cause of the most recent eye injury, within the past 12 months?

- ☐ Racquet      ☐ Ball      ☐ Fall  
☐ Collision with opponent      ☐ Collision with court wall      ☐ Other specify

12 Did the most recent eye injury, within the past 12 months require medical attention?

- ☐ Yes      ☐ No

Please specify what sort of injury you received:

- ☐ Cut or other injury to eyelid      ☐ Bruising around the eye (Black eye)      ☐ Retinal detachment/tear  
☐ Corneal abrasion/Laceration      ☐ Bleeding within the eye/Hyphaema      ☐ Orbital fracture  
☐ Permanent visual impairment      ☐ Other specify

#### EYEWEAR USE IN SQUASH

13 Have you ever worn protective eyewear when playing squash?      ☐ Yes      ☐ No (Go to Q17)

14 When did you try or first start wearing protective eyewear for squash?

- ☐ This year      please specify if you      ☐ Tried      or      ☐ Purchased      or      ☐ Tried and Purchased  
☐ Before this year      please specify if you      ☐ Tried      or      ☐ Purchased      or      ☐ Tried and Purchased

What prompted you to wear it?

Please specify brand of eyewear tried and/or purchased

15 How often do you wear projective eyewear? One or more responses may be given

- ☐ Always during competition      ☐ Sometimes during competition      ☐ Always during social play  
☐ Sometimes during social play      ☐ Always during practice sessions      ☐ Sometimes during practice sessions

16 What type of protective eyewear have you used or do you use currently?

- ☐ Industrial eyewear      ☐ Polycarbonate lenses (eg IMAX, Dunlop) Please specify type   
☐ Contact lenses  
☐ Open-eye guards  
☐ Normal prescription glasses      ☐ Other specify (go to Q18)

17 Do you wear normal prescription glasses when playing squash?      ☐ Yes      ☐ No

18 What eyewear do you think would be protective against eye injuries in squash? Tick all options that apply

- ☐ I do not know      ☐ Industrial eyewear      ☐ Polycarbonate lenses      ☐ Open-eyeguards  
☐ Normal prescription glasses      ☐ Contact lenses      ☐ Other specify

19 If you **HAVE EVER** worn polycarbonate lens/standards approved squash eyewear (eg IMAX, Dunlop) why did/do you wear it? Tick all options that apply

- ☐ I have had an eye injury before and do not want to get another one  
☐ I know someone else who has had an eye injury and I do not want to get one myself  
☐ Protective eyewear use has been recommended to me by  please specify e.g. player, venue staff.  
☐ I have knowledge of the risks of eye injury  
☐ It is compulsory for me to wear protective eyewear  
☐ I have been influenced by safety poster/stickers describing risk of injury and what eyewear is appropriate  
☐ I have been influenced by incentives that have been offered this year  
☐ Other specify



20 Have you noticed any eyewear promotion at either Knox, Moorabbin, Melbourne Sports & Aquatic Centre Squash Club or Gardenvale squash venue this year?

☐ Yes

*Tick all options that apply*

☐ Posters

☐ Pamphlets

☐ Stickers

☐ Eyewear available to borrow

☐ Cheaper eyewear

☐ Incentives to try/purchase eyewear

Do you remember any particular message?

☐ No

21 If you **DO NOT** wear polycarbonate lens/standards approved squash eyewear (eg IMAX, Dunlop) when playing squash, why don't you wear it? *Tick all options that apply*

☐ It costs too much

☐ It is not necessary, as the risks of eye injury are not that great

☐ I am not at risk of an eye injury because of my playing level

☐ I do not know where to obtain protective eyewear

☐ I do not want to

☐ I do not like the look of protective eyewear

☐ It is too uncomfortable to wear

☐ It restricts my vision whilst playing

☐ I have never thought about it

☐ Because I wear normal prescription glasses when playing

☐ Other specify

22 Have you ever tried using polycarbonate lens/standards approved squash eyewear (eg IMAX, Dunlop)?

☐ Yes

☐ No

23 Please circle the appropriate number for each item below

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
Eye injuries are a particular problem for squash players	1	2	3	4	5
More players should use protective eyewear	1	2	3	4	5
Protective eyewear should be made compulsory for all players	1	2	3	4	5
I would stop playing if protective eyewear was made compulsory	1	2	3	4	5
Protective eyewear should be made compulsory for junior players	1	2	3	4	5
The risk of eye injury in squash is high	1	2	3	4	5
The benefits of using protective eyewear is low	1	2	3	4	5
It is just as easy to use protective eyewear as it is to wear ordinary prescription glasses or sunglasses	1	2	3	4	5
It is important that I personally use protective eyewear when playing squash	1	2	3	4	5
Protective eyewear would significantly reduce my risk of sustaining an eye injury whilst playing squash	1	2	3	4	5

**Thank you for your valuable contribution. Enjoy your squash!**

SQERP

Small text below SQERP, possibly a subtitle or description.



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