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1 Sport Injury Prevention In-School and Out-Of-School? A Qualitative Investigation of The Trans-
2 Contextual Model

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4 Alfred S. Y. Lee^{1¶}, Martyn Standage^{2¶}, Martin S. Hagger^{3¶}, Derwin K. C. Chan^{4, 1, 5*¶}

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6 ¹School of Public Health, The University of Hong Kong

7 ²Department for Health, University of Bath

8 ³University of California, Merced, United States

9 ⁴Faculty of Education and Human Development, The Education University of Hong Kong

10 ⁵School of Psychology, Curtin University, Australia

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12 *Correspondence author

13 Email: derwin@eduhk.hk.

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15 ¶These authors contributed equally to this work.

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Abstract

Objective: To investigate junior secondary school students' experiences and perspectives of in-school and out-of-school sport-safety, with a particular focus on the meaning and content that they applied to the motivational and social cognitive factors of sport injury prevention.

Design: Focus-group interview

Method: Participants were 128 junior secondary school students (Form 1 to Form 3) aged between 12 and 16 years from two secondary schools. We organised focus-group interviews by class (group size = six to nine students). Seventeen groups completed semi-structured interviews regarding their experience, beliefs, and motives for injury prevention in-school and out-of-school. We analysed data by thematic content analysis using a typological approach.

Results: Higher order themes (N = 7) including in-school and out-of-school motives and social cognitive factors and associated lower-order themes (N = 16), emerged from the analysis corresponding to constructs from trans-contextual model tenets.

Conclusions: The current study is the first qualitative study to explore junior secondary school students' experience and perspectives on sport injury prevention, using trans-contextual model as a framework for investigation. The findings contribute to a better understanding on their motivational and social cognitive factors in adopting sport injury prevention. The content of the theme behavior also indicated the inadequacy of students' knowledge of effective sport injury prevention techniques, and underscored the importance of sport safety education.

Keywords: Injury PE students; integrated behavioural change model; self-determination theory; theory of planned behaviour; health education; the trans-contextual model; qualitative approach

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41 Contextual Model

42 Sport injury is one of the leading causes of injury in young people [1-3]. Not only may
43 injury lead to temporary impairment of sport performance and absence from sport and school,
44 but it could also result in prolonged pain, higher risk of re-injury, early retirement from
45 competitive sport, and lower future commitment to physical activity for health [4-6]. Emery and
46 Tyreman [1] reported that over 60% junior high school students (aged 12-15 years) suffered at
47 least one sport injury in the past year. They also found that few injuries occurred during physical
48 education (PE) classes. Most occurred in a game (39.3%) or recreational setting (26.9%), such as
49 informal sport play in community parks. It therefore appears that sport injuries occur most often
50 in out-of-school contexts.

51 Sport injury prevention includes static stretching, warm-up before and cool down after
52 exercise, strength and conditioning [7], landing technique [8], and correct application of
53 protective equipment (e.g., helmet) [9]. Sport injury prevention programs are provided for youth
54 both in-school [10] and out-of-school [11]. Yet, the prevention of sport injury is a behavior that
55 requires motivation and perseverance to maintain [12-14], particularly when students are
56 unsupervised in out-of-school contexts (e.g., playing physically active games, leisure sport
57 events). It is therefore important to understand why and how students learn sport safety in-school
58 (PE lessons) and apply sport injury prevention in out-of-school contexts. In the current study, we
59 employed a qualitative investigation guided by the trans-contextual model (TCM) [15-17] to
60 explore and gain a rich understanding of the psychological processes underpinning students'
61 learning and application of sport safety principles. For the in-school context, we are referring to
62 the PE lesson; out-of-school refers to both supervised and unsupervised physical activities.

63 The TCM integrates three important social psychological theories: including self-
64 determination theory (SDT) [18, 19], the theory of planned behavior (TPB) [20], and the
65 hierarchical model of intrinsic and extrinsic motivation (HMIEM) [21]. The pattern of
66 motivation posited in TCM is classified generally by three forms of motivation and their sub-
67 types defined by SDT [18, 19]. Autonomous form of motivation is an inherent drive to engage
68 particular behaviors. Individuals are autonomously motivated when they are performing
69 behaviors under intrinsic (e.g., acting for fun and pleasure), integrated (e.g., acting for behavior
70 that is synthesis with own self) and identified (e.g., acting for achieving personally valued goal)
71 motivation. In contrast, behaviors driven by externally-referenced reasons are known as
72 controlled motivation which comprises introjected (e.g., acting to satisfy pride and ego, and
73 avoid shame and guilt) and external (e.g., acting for compliance and to avoid punishment)
74 regulation. Last but not least, amotivation refers to the absence of the motivation (e.g. acting for
75 behaviors without any reason). The fundamental premise within the TCM is that the quality and
76 quantity of motivation (i.e., autonomous, controlled motivation, and amotivation) based on tenets
77 within SDT can be transferred from one context (e.g., taking PE lesson) to another related
78 context (e.g., leisure-time physical activity), leading to changes in the social cognitive factors
79 (i.e., attitude, subjective norm, perceived behavioral control (PBC), and intention from the TPB)
80 that relate to intention, and actual behavioral participation. The proposition of TCM regarding
81 the transferability of motivation is built on the assumption derived from the HMIEM [21]. The
82 HMIEM proposes that forms of motivation from SDT operate at the three levels of generality
83 (i.e., specific, contextual, and global) and are hierarchically related to each other. The
84 motivational and behavioral patterns in one context are then expected to activate similar
85 motivational patterns in allied behaviors in related contexts [22].

86 The original application of the TCM lies within transferring motivation between PE and
87 leisure-time physical activity [15]. It was found that when students endorsed autonomous forms
88 of motivation (i.e., identified regulation, and intrinsic motivation) rather than controlled forms of
89 motivation (i.e., introjection and external regulation) in PE, they were more likely to be
90 autonomously motivated toward leisure-time physical activity. Autonomous forms of motivation
91 in leisure-time physical activity then predicted intention and self-reported physical activity via
92 the mediation of the social cognitive factors. This pattern of results has been shown to be
93 consistent across 12 countries, supporting the cross-cultural invariance of the original application
94 of the TCM in PE and physical activity contexts [16, 17]. Therefore, promoting autonomous
95 motivation of students in PE (e.g., PE teachers who support the psychological needs of students
96 and their volitional engagement with PE activities; [16, 17] might be meaningful not only to the
97 motivational pattern in an in-school context, but also to the motivational and social cognitive
98 process associated with the behaviors in an out-of-school context.

99 Researchers have extended the potential of the TCM model to other behaviors, including
100 rehabilitation [23], occupational injury prevention and rehabilitation [24], in-school and after-
101 school learning [25], anti-doping in sport [26] and elite athletes' sport injury prevention [27].
102 The trans-contextual process of motivation tested in these studies explains how motivation at
103 work, school, or sport can be transferred into motivational, social cognitive and behavioral
104 patterns of a related behavior in an allied context (e.g., rehabilitation for occupational injury,
105 learning in out-of-school, sport injury prevention). In support of the tenets within TCM in the
106 context of sport injury prevention, Chan and Hagger [27] found that elite athletes who possessed
107 high autonomous motivation in sport tended to hold higher autonomous motivation for sport
108 injury prevention. Autonomous motivation for sport injury prevention is a predictor of a wide

109 range of behavioral outcomes of sport safety or injury prevention, such as adherence and
110 commitment to injury prevention, prioritization and fatalism towards safety, and communication
111 barrier and worry towards sport injury [27, 28]. Aligned with TCM predictions, the relationship
112 between autonomous motivation for sport injury prevention and intention has been shown to be
113 mediated by social cognitive variables [28, 29]. The TCM has been used to explain motivation
114 and social cognitive process of human behaviors, including sport injury prevention, yet research
115 has predominantly used quantitative methods to test the model. To date, extant work has not
116 formally examined if the model is well-placed to explain students' learning and application of
117 sport safety in-school and out-of-school contexts. Somehow, it would not be comprehensive to
118 understand students' experience and perspectives in learning sport safety by using quantitative
119 data only [30]. Hence, we proposed to adopt qualitative methodology to supplement existing
120 research findings predominantly based on quantitative data.

121 **The Present Study**

122 In the present study, we employed qualitative methods to investigate junior secondary
123 school students' experiences and perspectives of in-school and out-of-school sport-safety, with a
124 particular focus on the meaning and content that they applied to the motivational and social
125 cognitive factors of sport injury prevention. The purpose of the present study was to explore the
126 applicability and provide a holistic view of the TCM in secondary school students learning sport
127 safety. Our study targeted junior secondary school students (Secondary 1 to Secondary 3,
128 typically aged 12 to 16 years) because it is the beginning stage of secondary school education, a
129 time in which sport safety is especially important for reducing the risk of sport injury in the later
130 stages of PE [31, 32]. We conducted semi-structured focus group interviews with students to
131 explore the content of the psychological variables in the TCM. We also examined number of

132 codes identified respectively for autonomous motivation, controlled motivation, and amotivation.
133 We were particularly interested to explore 1) the applicability of adopting TCM to explain
134 secondary school students' psychological factors underpinning sport safety; and 2) what are the
135 realistic psychological processes of students learning sport injury prevention (e.g. particular
136 reasons of adopting sport injury prevention, feelings or beliefs toward the prevention exercises)
137 in-school and out-of-school. These analyses led to the first qualitative investigation of the TCM
138 on sport safety in a junior secondary school setting. The results that obtained from the qualitative
139 study would be useful to advance the understanding of TCM constructs in the context of sport
140 safety for secondary school students, and the findings might inform the development of theory-
141 driven interventions for sport injury prevention in school settings.

142 **Method**

143 **Participants**

144 Upon ethical approval from the first author's institution [approval number =
145 EA1604014], we conducted 17 focus-group interviews (6 to 9 participants per group)
146 corresponding to a total number of 128 junior (Form 1 to Form 3 which are equivalent to 7th to
147 9th grade in US) secondary school students (69 males and 59 females; age = 12 to 16 years old;
148 mean-age = 13.76, *SD* = 1.50) from two secondary schools in Hong Kong. Participants attended
149 two mandatory PE lessons per teaching week. Most participants reported a history of sport injury
150 (52.80%) such as a scrapes, sprained ankle, strained muscle, ligament rupture, or bone fractures.
151 Some participants had experienced a sport injury in the last 6 months (18.75%). The variation in
152 participants' background in terms of age, gender, sport participation and injury experience

153 enabled diverse perspectives of sport safety for enriching interview conversation [33]. The
 154 characteristics of each focus group are shown in Table 1.

155 **Table 1**

156 *Focus Group Characteristics*

Groups	School	Form	Age	N	Gender
1	A	F1	Range = 12-13 ($M_{age} = 12.50$, $SD_{age} = .50$)	28	Male = 13 Female = 15
2					
3					
4					
5	A	F2	Range = 13-15 ($M_{age} = 13.69$, $SD_{age} = .54$)	28	Male = 14 Female = 14
6					
7					
8					
9	A	F3	Range = 14-15 ($M_{age} = 14.60$, $SD_{age} = .51$)	35	Male = 20 Female = 15
10					
11					
12					
13	B	F2	Range = 13-16 ($M_{age} = 13.94$, $SD_{age} = 1.89$)	18	Male = 10 Female = 8
14					
15	B	F3	Range = 14-15 ($M_{age} = 14.50$, $SD_{age} = .94$)	17	Male = 11 Female = 6
16					
17					

157 *Note.* The two local schools are marked as A and B to protect confidentiality and anonymity. M
 158 = mean; *SD* = standard deviation.

159

160 Procedure

161 Secondary school students (Form 1 to Form 3) aged between 12 to 16 who attend regular
 162 PE lessons were invited to the study. Eligible students and their parents/guardians provide
 163 informed consent before the study. Students were asked to complete a short demographic
 164 questionnaire (e.g., age, gender, sport and sport injury experience) before joining the focus group
 165 interview. To foster a friendly environment in which students would freely interact with their
 166 peers, each focus group interview was formed by students within the same class, used the mother

167 language of participants (i.e., Cantonese, the primary Chinese dialect in Hong Kong) as the
168 medium of communication, and was moderated by one of the five Cantonese-speaking
169 interviewers, including the first and second author, and three research assistants trained to follow
170 the study protocol and moderate the interview according to the interview schedules. To enhance
171 the quality and consistency of interview delivery, five interviewers ran 2 practice trials among
172 themselves before the data collection.

173 At the beginning of the focus groups, interviewers raised questions about sports
174 experience and motivation to play sports to establish rapport with the participants. Interviewers
175 then provided a clear definition of sport injury (i.e., ‘any unintentional or intentional damage to
176 the body resulting from participation in sport [34]’ and examples (e.g., abrasion, sprain,
177 dislocation, or bone fracture), before leading the main topic of discussion to sport injury.
178 Interviewers would then explore students’ sport safety knowledge by asking “What do you
179 normally do to prevent sport injury in-school/out-of-school?”. The main part of the interview
180 centered on questions about students’ motivation and social cognitive factors of sport injury
181 prevention in-school and out-of-school. Examples of questions included “Why do you prevent
182 sport injury in-school/out-of-school?”, “What are the pros and cons of doing sport injury
183 prevention?” and “Under what circumstances, is sport injury prevention more difficult/ easy?”.
184 The whole interview schedule is presented in S1 Appendix. The interviewers facilitated the
185 discussion by (1) encouraging every group member to be active in contributing to, but not
186 dominating, the interview, (2) asking for clarification and elaboration on certain points, (3)
187 providing probing questions (e.g., “How do you feel”, “What do you think?”) to stimulate
188 reflection of thoughts and feelings. At the end of the interview, participants were asked to
189 discuss any additional issues that came to their mind about safety and injury prevention in sport.

190 The focus group interviews lasted for 35 to 50 minutes with audio recordings transcribed
191 verbatim.

192 **Data Analysis**

193 We adopted and followed Keegan and colleagues' key analytical procedures [35, 36] in
194 our qualitative data analysis, including (1) transcribing of interview content into 65 pages of
195 single-lined text with 11 font size; (2) reading the transcript and listening to the interview
196 recordings multiple times to increase familiarity; (3) conducting a thematic content analysis with
197 typological approach [37] using ThematiCoder version 1.0 [38], and quotes could be coded into
198 multiple themes; (4) checking consistency of all the coding with agreement of 96% between two
199 coders; (5) paraphrasing and restating participants' responses to ensure correct understanding
200 and precise transcription of the data; (6) adopting a 'critical friend' approach to allow the two
201 coders to critically review and challenge each other's coding, categorization, organization,
202 reflection, and interpretation of qualitative findings [39, 40], and (7) conducting a peer debriefing
203 session among the research team members about the analysis. The essence of the thematic
204 content analysis in this study was to systematically organize the lower-order themes that
205 emerged inductively into higher order themes based on motivational and social cognitive factors
206 of the TCM, so deductive data analysis would progressively take place until theoretical
207 saturation was reached. Chi-square tests of independence examine if the frequency (i.e., the code
208 counts) of the three forms of motivations were consistent or different between in-school and out-
209 of-school contexts.

210 **Results**

211 The theoretical components within the TCM, including motivation in-school and out-of-
 212 school contexts, the three social cognitive factors (attitude, subjective norm, PBC), and intention,
 213 emerged as higher-order themes in the thematic analysis. In general, most of the students
 214 understood sport injury prevention as doing warm-up, such as running laps and stretching. Few
 215 students mentioned cool down as a preventive measure. The details and English translations of
 216 quotations of the higher-order themes and their corresponding lower-order themes are presented
 217 in Table 2. Where quotations are provided, the participants' reference is presented for gender (F
 218 = female and M = male) and group (G1-G17 = Group 1 - Group 17).

219 **Table 2**220 *Themes and Sub-Themes*

Main theme	Sub-themes	Examples of Quotations	Code Count
Motivation			
1. Motivation in-school	Autonomous	“I do it (warm-up) to prevent injury” (M, G7) “Lower the chance of getting injury” (F, G11)	40
	Controlled	“Only do it when teacher ask us to do it” (F, G13) “Warm-up, absolutely will not be self-initiated” (M, G8)	83
	Amotivation	“I just do it (warm-up) but never questioned why” (F, G1)	6
2. Motivation out-of-school	Autonomous	“To relax the muscle” (F, G17) “(I do warm-up) because If you are injured, you cannot play in competition” (M, G4)	44
	Controlled	“The coach outside (school) will ask me to do it” (M, G7) “If my father is not around, I don't need to do it” (F, G2)	20
	Amotivation	“When it comes to my mind/ attention I do it (warm-up)” (F, G2)	8
Social cognitive factors			
3. Attitude	Affective	Positive: “[interviewer: how do you feel about doing sport injury prevention?] It is	34

		quite okay... You feel comfortable after doing it” (F, G16) Negative: “(stretching) is painful, I don’t want to do it” (F, G17)	
	Instrumental	Positive: “To improve performance” (M, G9) Negative: “It is the same whether you do it (warm-up) or not” (F, G9)	125
4. Subjective norms	Injunctive norms	Positive: “(people think that you are) very cool and professional to do stretching” (M, G14) Negative: “If you do it outside, people will look at you” (F, G5) No idea: “No one care about doing warm-up” (F, G1)	241
	Descriptive norms	Positive: “Nothing special, people next to me also do it (warm-up)” (F, G10) Negative: “You go out to play, people will not do it (warm-up) as well” (M, G7)	53
5. PBC	Positive	“if we have more time, we can do more; less time, we cannot not do it” (M, G12)	84
	Negative	“No confidence, if no one does it together, it is difficult” (F, G10)	53
6. Intention	Intention	“Yes, I injured my arm before, so I will need to stretch it” (M, G16)	45
	No intention	“No, why will I do it?” (F, G8)	41
7. Behaviors	In-school	“Jog for two laps” (M, G7) “Yes, we stretch every single time before doing sports (PE lessons)” (F, G2)	94
	Out-of-school	Positive: “I do a warm-up in swimming pool” (F, G1) Negative: “I start to play right away” (M, G7)	104

221

222

223 **Motivation**

224 *Motivation In-School.* This theme refers to the motivation that students endorsed toward

225 in-school sport injury prevention measures. The three main emergent subthemes were

226 *autonomous motivation, controlled motivation, and amotivation.* Students reported being

227 autonomously motivated to prevent in-school sport injuries when they self-endorsed the values
228 or benefits of warm-up activities or exercises. They viewed warm-up exercises as preventing
229 muscle pain, stiffness, sprain, sport injury or enhancing sport performance: “I want to protect
230 myself” (M, G16), “(Why will you do sport injury prevention?) It is good to my body” (M,
231 G11). Controlled motivation refers to the external demands, pressure, and pride satisfaction of
232 doing sport injury prevention. Many students reported that they experienced controlled motivated
233 to carry out the preventive measures in-school: “I do it (warm-up) only when teachers ask us to
234 do it” (M, G9), “Sometimes it (warm-up) is compulsory, and so you need to do some to avoid
235 being scolded (by teachers)” (F, G1). Sometimes, students did not know the reasons they
236 engaged in sport injury prevention in-school. These quotes are under the themes of amotivation:
237 “(What are the reasons that you do injury prevention in PE lesson?) No reason we just do it” (M,
238 G17), “I do it (warm-up) because I have nothing else to do” (F, G4).

239 ***Motivation Out-Of-School.*** This theme specifically represents students’ motives to
240 prevent sport injury in out-of-school context. *Autonomous motivation, controlled motivation, and*
241 *amotivation* emerged as sub-themes. For the autonomous motivation, similar responses could be
242 found in-school and out-of-school contexts. “I really want to do better in the competition” (F,
243 G1), “(I want) to prevent cramping (in swimming)” (F, G5). Outside of school, students also
244 attempted to prevent sport injury because of external reasons (controlled motivated): “Yes, I will
245 do (preventive measures), I have training during summer, I do it when coach asks me to do it”
246 (M, G13), “When my father is around I definitely need to do (a warm-up)” (F, G2). For
247 amotivation, some of the students’ responses showed absence of motivation towards sport injury
248 prevention out-of-school: “(So do you know why you do sport injury prevention?) I really don’t
249 know” (M, G6).

250 **Social Cognitive Factors**

251 *Attitude.* Attitude refers to the personal evaluation of sport injury prevention. This theme
252 encompasses two sub-themes, *affective attitude* and *instrumental attitude*. Affective attitude
253 represents whether the students enjoy performing the preventive measures. It is further
254 subdivided into positive and negative affective attitude. Students used “Refreshing”, “Relaxing”
255 (M, G6) and “Comfortable” (M, G16) to describe the positive feelings of warming-up. However,
256 other students had different ideas: “(Doing a warm-up is) very boring” (M, G3), “That was very
257 annoying is doing leg split” (F, G1).

258 Instrumental attitude refers to students’ assessment of the benefits of doing sport injury
259 prevention. Many students did not consider preventive measures to be beneficial to them: “It is
260 the same whether you do it (warm-up) or not” (M, G15), other terms like “Waste of time”,
261 “Waste of energy” and “Useless” (M, G16) were also reported. In other cases, students believed
262 injury prevention can “Reduce (muscle) pain”, “Reduce the chance of injury” and “Relax your
263 muscle” (F, G5). A handful of students highlighted warm-up exercises can enhance their sport
264 performance: “You will be more concentrated after warming-up”, “Improve competition
265 performance” (M, G12).

266 *Subjective Norms.* This theme refers to the perception of social appropriateness of sport
267 injury prevention. *Injunctive norm* and *descriptive norm* emerged as lower-order themes.
268 Injunctive norms referred to the perception of others’ approval or encouragement on preventing
269 sport injury. Most students could not determine whether their significant others cared about their
270 injury preventive behaviors (i.e., “No idea”): “My family members have no opinion (on whether
271 I do warm-up)” (F, G2). Some felt that teachers, coaches and family members approved their

272 behaviors: “If you do a lot (of warm-up exercises), people think that you are professional” (F,
273 G9). Only a small number of students reported their social groups disapproved them to do sport
274 injury prevention. They perceived others viewed them as “Pretending to be professional”, “Very
275 weird” (M, G14), when they carried out the safety measures. Descriptive norms represented
276 whether students’ significant others prevented sport injury or not. Both positive and negative
277 descriptive norms were reported by the students: “Yes, they (parents) are the one to lead (the
278 warm-up)” (F, G2), “Family members don’t do (warm-up exercises)” (M, G11).

279 **PBC.** This theme refers to students’ perceived ease or difficulty of adopting sport injury
280 prevention. The two main emergent sub-themes were *positive PBC* and *negative PBC*. The
281 majority of the students were confident in doing preventive measures: “It (doing warm-up
282 exercises) is always easy” (M, G17). However, some students found it more difficult, “Very
283 difficult, we need to do leg split” (F, G1). Environment was also reported to be a determinant of
284 PBC, “It is easier to do if we have a mat”, “(It is easier to do), if we can turn on air conditioner”
285 (F, G1). Students had negative PBC on injury prevention when the “Weather is hot”, “Not
286 enough space” (M, G9).

287 **Intention.** Intention emerged as a higher order theme that refers to the students’ intention
288 to engage in sport injury prevention. This theme was further divided into *intention* and *no*
289 *intention*. Some students reported they are intended to participate in sport injury prevention:
290 “Yes I will do some stretching after exercises” (M, G12), “I will do it in the training session in
291 coming Thursday” (M, G5). For students who had no intention, they said “I will not do it” (F,
292 G1), “No, why will I do it?” (F, G8).

293 **Behavior**

294 Behavior was a higher-order theme that referred to the adoption of sport injury
295 prevention in-school and out-of-school. All of the groups reported they needed to do warm-up
296 exercises before PE class and a few students highlighted they do cool-down exercises. The
297 warm-up in-school normally consisted of “standard stretching” (F, G2) and “Jogging for few
298 laps” (M, G4). Besides doing warm-up exercises, PE teachers also taught “the correct
299 techniques” (F, G6) and asked students to use safety equipment: “Knee pad” (M, G13) and “Shin
300 guard” (M, G3). When students were out-of-school, approximately half of them said they would
301 engage in sport injury prevention: “I do it (stretching) before swimming” (F, G5) and “Bring
302 helmet and do warm-up before skating” (M, G6). The other half of the sample reported they
303 would not do injury prevention out-of-school: “I jump right into to the swimming pool to swim”
304 (M, G12), “I don’t think of putting on a helmet before cycling” (M, G4).

305 **Pattern of Motivation Between In-School and Out-of-School**

306 The code counts for in-school autonomous motivation, controlled motivation, and
307 amotivation were respectively 40, 83, and 6; that for out-of-school were respectively 44, 20, and
308 8 respectively. A 2 x 3 chi-square test of independence ($\chi^2 = 28.84, p < .01$) indicated that
309 patterns of motivation were different between the in-school and out-of-school contexts. Follow-
310 up 2x2 chi-square tests indicated that controlled motivation was mentioned more often regarding
311 in-school than out-of-school contexts (controlled and autonomous motivation x contexts: $\chi^2 =$
312 22.33, $p < .01$, odds ratio = 4.57; controlled motivation and amotivation x contexts: $\chi^2 = 9.64, p$
313 $< .01$, odd ratio = 5.53). However, the frequency of autonomous motivation and amotivation were
314 relatively consistent between the two contexts (autonomous motivation and amotivation x
315 contexts: $\chi^2 = .11, p = .74$, odds ratio = 1.21).

316

Discussion

317 The purpose of the current study was to explore junior secondary school students'
318 experience and perspectives of sport safety in-school and out-of-school context, with a particular
319 focus on the meaning and content they applied to the psychological factors of sport injury
320 prevention under the TCM [15-17]. The higher-order and lower-order themes emerged from
321 thematic content analysis generally aligned with the motivational and social cognitive constructs
322 of the model, but the pattern of motivation in-school and out-of-school context did not entirely
323 support the proposition of the TCM as the patterns of controlled motivation did not appear to be
324 consistent (or transferrable) between the two contexts. These results yet may provide information
325 about the mechanisms underlying the process of trans-contextual transfer of motivation [12, 27-
326 29].

327 Motivation

328 The current data are supportive the presence of autonomous and controlled motivation,
329 and amotivation for sport injury prevention among junior secondary school students [24, 27, 29].
330 However, when investigating the content of the quotes for autonomous motivation, we did not
331 observe intrinsic motivation for sport injury prevention in either in-school or out-of-school
332 contexts. This phenomenon may indicate that autonomously motivated students may participate
333 in sport injury prevention because they think that it is useful or beneficial, rather than because it
334 is fun. While "Having fun" has been regarded as an important factor that determines individuals'
335 adherence to sport injury prevention [14], and researchers also proposed that injury prevention
336 programs should be more game-like [41] our current data suggest that students are not
337 intrinsically motivated to participate in injury preventive measures. Although the absence of

338 intrinsic motives for sport injury prevention is somewhat in line with the operationalization of
339 autonomous motivation in the sport injury prevention version [24, 29] of treatment self-
340 regulation questionnaire [42], our findings may raise further questions about the necessity,
341 applicability, effectiveness, and practicality of promoting intrinsic motivation for sport injury
342 prevention. Nevertheless, workshops and interventions can be provided to PE teachers and
343 coaches, introducing ways to develop enjoyable sport injury prevention programme (e.g. jogging
344 with a football, rotating leadership in leading dynamic stretching). Another effective strategy
345 would be to enhance other autonomous forms of motivation, such as identified regulation. This
346 would mean a focus on identifying the internally valued outcomes of injury prevention (e.g.,
347 being able to continue participating in exercise, avoiding lengthy rehab or visits to the
348 physiotherapist), rather than promoting enjoyment of the exercises themselves.

349 Another noteworthy finding in this study concerns about content of amotivation for sport
350 injury prevention. Amotivation, compared to autonomous and controlled motivation, was a
351 theme that received less mention (expressed via codes), but its expressions in the quotations did
352 not always appear to be maladaptive as it was described within SDT [19]. In this study,
353 amotivated students were not aware of the reasons behind why they sported injury prevention,
354 and they did not feel pressured to do so. However, follow-up questions about why indicated that
355 (1) some students believed that it was easier to follow what it was told or what everyone else was
356 doing, (2) or they just did it automatically or habitually when time allowed. The former case was
357 more prevalent for in-school amotivation, and might reflect lack of true intention towards sport
358 injury prevention, thus more vulnerable to dropout and low-awareness to sport injury prevention
359 in some circumstances (e.g., unsupervised out-of-school conditions). It might also explain why
360 the latter case (i.e., automaticity and habit) was more commonly found out-of-school

361 amotivation. Such content related to amotivation might somewhat reflect concepts such as
362 implicit attitude, implicit motivation, and habit, that growing amount of research have used them
363 for the explanation of health behaviors [43-46]. Existing literature regarding the role of
364 amotivation on sport injury prevention has been scarce, so it would be worthwhile for future
365 studies to incorporate amotivation, and even other related factors (e.g., habit, implicit attitude)
366 into the TCM [47].

367 The role of controlled motivation is another interesting observation. Our data indicated
368 that students felt obliged to participate in safety measures, and felt that sport injury prevention
369 was compulsory because they had to follow significant others' (e.g., PE teachers in-school
370 context, and coaches and parents in out-of-school context) instructions or comply with safety
371 regulations. It seemed that students may not necessarily know the rationale behind performing
372 sport injury prevention activities. Such a scenario is not ideal for behavioral adherence because
373 in the absence of external demands or social pressure, individuals driven by controlled
374 motivation are less likely than autonomous motivated individuals to adhere to sport injury
375 prevention [19, 48], making them more vulnerable to behavioral dropout in out-of-school
376 context. In the focus-group interview, there were several students who possessed in-school
377 controlled motivation, but not out-of-school controlled motivation, and they also reported
378 behavioral non-compliance in out-of-school context "I don't do warm-up [outside school]". This
379 might be why the students were less likely to report controlled motivation for out-of-school
380 injury prevention compared to in-school injury prevention.

381 Rates of autonomous motivation and amotivation (but not controlled motivation) for
382 injury prevention were highly comparable between in-school and out-of-school contexts. These
383 findings were in line with the tenets of TCM [15-17], it might provide implications for the trans-

384 contextual transfer of motivation in the injury prevention context [23, 27, 28, 49]. Autonomous
385 motivation and amotivation appeared to be more prevalent by participants than controlled
386 motivation in the out-of-school context, so that might suggest that the transferability of
387 autonomous motivation and amotivation is more effective than controlled motivation. Our data
388 might, therefore, offer an explanation as to why some previous studies adopting the TCM
389 reported non-significant [26] or relatively weaker association between controlled forms of
390 motivation across contexts, as compared to that of autonomous forms of motivation [15, 50].
391 Yet, the answer has not been fully revealed as majority of the studies applying the TCM often
392 use a composite score for motivation types from SDT (e.g., the relative autonomy index) rather
393 than differentiated constructs [16, 51]. It might be important for future studies to examine the
394 independent transferability of each type of motivation from SDT.

395 Our findings were consistent with previous studies examining the TCM in injury
396 prevention regarding the transferability of autonomous motivation across contexts [23, 27].
397 According to SDT [18, 19] and prior studies in injury management [23, 27], autonomous
398 motivation could be facilitated by satisfying individuals' psychological needs of autonomy
399 (feeling of choices and freedom), competence (feeling of being able to do what you want) and
400 relatedness (feeling of being accepted, connected and cared for) [28, 52, 53]. However, questions
401 remain on how PE teachers can provide the best support for satisfying students' psychological
402 needs in the injury prevention contexts, and answering this question require further analysis of
403 PE teachers' behaviors.

404 **Social Cognitive factors**

405 The current study provided evidence on students' beliefs in sport injury prevention with
406 themes consistent with the theoretical concepts of the social cognitive variables from the TCM,
407 including attitude, subjective norms, and PBC [24, 29]. The sub-themes indicated there were
408 positive and negative beliefs that governed students' decision-making process for sport injury
409 prevention. Our findings may be useful for understanding or even modifying the salient beliefs
410 associated with students' commitment to sport safety guidelines. Researchers and sport medicine
411 practitioners should try to alter negative beliefs, such as affective (e.g., "painful feeling") and
412 instrumental (e.g., "waste of time") attitudes, injunctive (e.g., "it makes me look weird in front of
413 others"), descriptive norms (e.g., "None of my friends do it"), and PBC (e.g., "no time and
414 space") to try to draw students' attention to the positive ones. For example, one common
415 negative instrumental attitude is about the effectiveness of sport injury prevention. It refers to a
416 misconception that sport injury is inevitable regardless of prevention, and previous studies have
417 reported this belief was negatively related to self-determined (i.e., more autonomous, less
418 controlled) motivation of injury prevention [27, 28]. Resolve this maladaptive belief by restating
419 the evidence about the effectiveness of sport injury prevention on reducing the risk and severity
420 of sport injuries [54]. A prior study in promoting helmet use among school-aged cyclists
421 disseminated leaflets with persuasive messages constructed based on the TPB [20] successfully
422 enhanced future helmet use by promoting change in the social cognitive variables [55]. Besides
423 the three social cognitive variables, intention emerged as an independent theme in the present
424 study, but the content regarding students' future engagement in sport injury prevention rarely
425 specified specific injury preventive behaviors, and when and how they would be performed. This
426 finding might be due to the well-documented intention-behavior 'gap' in which intentions cannot
427 fully predict behaviors because people do not act according to their intentions [56, 57]. Our data

428 may imply that enriching the specification of intention that students formed for sport injury
429 prevention might bridge the intention-behavior gap, and this could be done by fostering better
430 action control, implementation planning, action/recovery self-efficacy [56-59]. Several
431 behavioral change strategies have been proposed by the literature to tackle these variables, for
432 example the “if, then” approach proposed by Chapman, Armitage [60]. Future studies could
433 investigate the feasibility of applying these evidence-based behavioral change strategies in sport
434 injury prevention contexts.

435 **Behaviors**

436 Injury preventive behavior reported by junior secondary school students reported many
437 strategies related to sport safety. However, pre-exercise warm-up and stretching dominated the
438 content of this theme. Stretching during pre-exercise warm-up might not necessarily be the most
439 appropriate method for sport injury prevention [61]. Some studies even suggested stretching
440 could have negative effects on performance [62], and might have a non-significant impact on
441 injury prevention [63]. Other types of preventive methods, such as neuromuscular training (e.g.
442 FIFA 11+, iSPRINT) [54, 64, 65], eccentric strength training [66], resistance training [67]
443 received increasing amount of evidence in supportive to their effectiveness on sport injury
444 prevention. Our findings may imply that besides fostering better behavioral adherence,
445 enhancing the knowledge of sport injury prevention among students and PE teachers (e.g., sport
446 safety workshop, education seminar) might be critical to reducing the risk of sport injury,
447 particularly in out-of-school unsupervised situations [10, 68].

448 **Limitations and Future Directions**

449 A few limitations of the current study should be addressed to identify the boundaries of
450 the study and stimulate further research. Our study adopted a qualitative approach focusing on
451 the content of the psychological factors of TCM, and the frequency salient themes [69]. The
452 cross-sectional nature of the study and qualitative data mean that we cannot draw causal
453 inference on transfer of motivation, and the change in psychological variables within the TCM.
454 A longitudinal study with cross-lagged panel design could examine the temporal relationship by
455 testing the changes of TCM variables over time [70]. Another noteworthy limitation is related to
456 the study sample. Although our study sample was recruited from only two local secondary
457 schools in Hong Kong, the variation of participants' personal backgrounds, school environment,
458 sport culture, and region of residence could be restricted, so it might affect the generalizability of
459 the findings to other populations. Future studies should replicate this line of work with diverse
460 samples with participants from different backgrounds, and more importantly, in other behavioral
461 contexts (e.g., physical activity, occupational injury prevention, rehabilitation, and education)
462 where qualitative studies of the TCM have yet to be employed.

463 **Conclusion**

464 The current study is the first qualitative study to explore junior secondary school
465 students' experience and perspectives on sport injury prevention, using TCM as a framework for
466 investigation. Themes emerged from 17 focus group interviews were consonant with the
467 constructs of the TCM, including in-school motivations, and out-of-school motivations, social
468 cognitive factors, intention, and behavior regarding sport injury prevention. The frequency of
469 codes for motivation could be explained by the tenets of the TCM's regarding the transferability
470 of motivation across contexts. The frequency of autonomous motivation and amotivation was
471 highly consistent across the two contexts, but that of controlled motivation was significantly

472 reduced in out-of-school context. The content of behavior also indicated the inadequacy of
473 students' knowledge of effective sport injury prevention techniques, and underscored the
474 importance of sport safety education. Based on the findings of prior studies on the TCM in other
475 behavioral contexts (e.g., occupational injury prevention), making goal-oriented safety
476 objectives, promoting the pros of preventing sport injury, encouraging everyone to participate in
477 injury prevention (including students' family) and removing students' barriers to do sport injury
478 prevention (e.g. uneven surface, hot weather and time limit), might be possible solutions to
479 enhance students' adherence to engage in sport injury prevention [12, 28]. Future quantitative
480 research is warrant to test the effectiveness of these strategies on students' behavioral adherence
481 towards sport injury prevention.

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667

Insert S1 Appendix here. Interview Schedule

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