1. Introduction

Sports activity during adolescent stage can enhance cardiopulmonary function, and relieve emotional stress; moreover, it can lower morbidity and prolong life expectancy when entering adulthood (Huang, Chi, & Chong, 1993). Sports activity is also an inseparable part of life for many. However, without the basic and correct knowledge for Prevention and Management of Sports Injury techniques, sports injury will likely to abate the original benefits associated with sports activity. Therefore, it is especially critical to instruct knowledge related to "Prevention and Management of Sports Injury" through proper education.

In an investigation on incidence of sports injuries among 8,700 Massachusetts children and adolescents conducted by Gallagher, et al., (1984), the result indicated that 3.4% of the schoolchildren still required hospital observation after sports injury. Miller & Spicer (1998) pointed out that in US, one fourth of the students aged 5-17 suffered from sports injuries, which require medical care or lead to temporary disability, on school premises annually, and resulted in $3.2 billion in medical expenses and $115 billion in health loss. Various related studies all pointed out that prevalence of school sports injuries were over 30% for students in different educational system, age and gender (Briscoe, 1985; Chang & Huang, 1996; Chou, 1988; Feldman, et al., 1983; Gallagher, et al., 1984; Huang, et al., 1993; Kraus & Conroy, 1984; Tsuang, et al., 2001), indicating that prevalence of school sports injuries among students is a problem too important to overlook.

The efficacy of "Prevention and Management of Sports Injury" courses in reducing the prevalence of school sporty injuries has been demonstrated by numerous studies (Demorest, 2003; Flynn, Lou, & Ganley, 2002; Hergenroeder, 1998; Parkkari, Kujala, & Kannus, 2001), which established the importance of "Prevention and Management of Sports Injury" knowledge for students. A study conducted by...
Backous, Friedl, Smith (1988) showed that 14-17 years old is the high risk group for sports injury, while de Loes (1990) also pointed out that aged 15-19 is the population most likely to experience sports injury. Bijur, et al. (1995) had demonstrated in a study with 11,840 students aged 5-17 that, irrespective of gender of the students, aged 14-17 is the high risk group for sports injury. Abernethy, MacAuley, McNally, & McCann (2003) had pointed out that majority of the students who experience school sports injury in Northern Ireland were within the age group of 11-18, which was consistent with the studies conducted in Europe and North America. Summarizing the results mentioned above, it is apparent that high/vocational school students are the population most susceptible for sports injury.

Huang, et al. (1993) conducted a study on knowledge of "Prevention and Management of Sports Injury" among 1,152 junior college students who aged 15-20 years old in Taiwan. They showed that despite knowing the importance of preventing sports injury, majority of the students did not possess correct knowledge for sports injury management. Yang & Huang (1996) investigated "Prevention and Management of Sports Injury" knowledge among 200 graduating students of Department of Physical Education from three different universities in Taiwan, and the result showed that the average scores of the subjects were located in the low level. One of the possible explanations for this disturbing outcome was that the universities did not include "Prevention and Management of Sports Injury" in the required curriculum or even it did, students did not have opportunity for practical training session that in the current era of student-oriented education, understanding the needs of students is an important index for successful course planning and teaching. In other words, the first step towards effective teaching lies in truly understanding the present needs of the students and providing appropriate teaching material for these questions.

For the past five years, no publications investigating the knowledge and needs for "Prevention and Management of Sports Injury" have been submitted in Taiwan. This study integrated study designs for prevention and management associated with sports injury from works of numerous domestic and international researchers. Analysis and recommendations of knowledge and needs for "Prevention and Management of Sports Injury" have been proposed by focusing on high/vocational school students in Taoyuan area of Taiwan, hoping the study results will serve as a reference in teaching material selection and lecturing method for teachers in relating subject, so as to achieve effective teaching which also fulfills the needs of students. Thus, the objectives of this study are to examine the effect of demographic factors, including gender, type of school, educational system, study group, grade, education level of parents, type of sports extra curriculum participated, past sports injury experience, on knowledge and needs of "Prevention and Management of Sports Injury", and the correlation between knowledge and needs, so as to improve recognition of knowledge properly, and to fulfill the needs of students.

2. Method

2.1. Participants

Study population consisted of high/vocational school students from Taoyuan area of Taiwan. Stratified cluster sampling method was adopted with type of school, educational system, grade and study group as strata; whereas class as cluster sampling unit. A total of twenty-one public/private high schools and nine public/private vocational schools located in Taoyuan area. One high school from public and private system each, along with one vocational school from public and private system each, a total of four schools, were sampled in this study. Three classes from each sampled school were selected, in which the high school consisted of all different study group; while the vocational school consisted of students from Business Administration, Accounting and International Business programs. All students from the thirty-six classes sampled were included as study subjects in the investigation of knowledge and needs of "Prevention and Management of Sports Injury". A total of 1,720 questionnaires were sent and all of the questionnaires were returned. Aside from the invalid questionnaires, there were 1,649 valid questionnaires, with an effective response rate of 98.3%.

2.2. Study Tool

The study questionnaire is divided into three parts: demographic information, tests for knowledge and needs of "Prevention and Management of Sports
Table 1 Questionnaire of Knowledge of “Prevention and Management of Sports Injuries” (“▲” stands for correct answer.)

1. Sports protective devices are helpful to stabilize joints. They are used:
   ▼ When engaging in intense exercise  □ When suffering injuries  □ After exercise  □ During any and all types of exercise.
2. What do we call a sports injury that displaces a bone due to collision with external force:
   □ Sprain  □ Dislocation  □ Strain  □ Contusion
3. What do we call a sports injury that damages the muscles and tendons:
   □ Fracture  □ Sprain  □ Strain  □ Contusion
4. What do we call a sports injury that damages the ligaments:
   □ Fracture  □ Sprain  □ Strain  □ Contusion
5. The purpose of learning correct sports injury management principles is not to:
   □ Reduce post-recovery after-effects  □ Help yourself and help others  □ Reduce the possibility of injury  □ Improve sports skills
6. What is the first-aid method for strains?
   □ Treat the site of injury with hot compress immediately  □ Stabilize the site of injury and rest immediately  □ Massage the site of injury immediately  □ Lower the site of injury immediately to relieve pain
7. The standard procedure to treat a sports injury does not include:
   □ Cold compresses  □ Pressure  □ Fracture test  □ Elevation
8. After injury what should you do to hasten your return to the sports field?
   □ Continue to exercise as long as the pain is bearable  □ Exercise as much as possible to avoid loss of muscle strength  □ Do not exercise without the permission of a doctor  □ Pull and tug the site of injury to accelerate the rehabilitation
9. How to use a limb supports correctly?
   □ Keep it loose to allow free movement of the injured limb  □ Keep it tight but not too tight if it affects circulation  □ Keep it tight and apply pressure directly on the injured limb  □ Keep it loose for ease of movement
10. Which one of the following is the wrong way to support a limb?
    □ The limb can be well supported using appropriate devices  □ The support must be mounted across the injured limb  □ The joint must be repositioned before medical professionals arrive to avoid deformation  □ Avoid pressing on the injured limb directly
11. What is the correct way to use a bandage?
    □ Wrap from the near end of the injured limb  □ Wrap from the extremity of the injured limb  □ Wrap the site of injury directly  □ As tight as possible no matter which method is used
12. What is the cardiac massage frequency per minute when applying CPR to teenagers?
    □ 50-70  □ 100-120  □ 120-140  □ 140-160
13. What is the ratio of cardiac massage to breathing per minute when applying CPR to adults?
    □ 1:1  □ 2:1  □ 2:1  □ 3:1  □ 4:1
14. How long should a hot or cold compress be applied for a sports injury?
    □ 1-5 minutes  □ 5-15 minutes  □ 15-20 minutes  □ 25-30 minutes  □ As long as possible
15. What is the interval between hot/cold compresses?
    □ 1-5 minutes  □ 5-10 minutes  □ 2-3 hours  □ No interval
16. What is the reason for heatstroke?
    □ Insufficient salt content in the blood  □ Too much carbohydrates  □ Insufficient fluids  □ Too much fluids
17. What is the best preventive action to avoid heatstroke?
    □ Limit absorption of salt  □ Limit rest time  □ Drink adequate quantities of water  □ Prevention from heatstroke is not possible. It is better to let nature take its course
18. What action should not be followed when someone suffers overheating during exercise?
    □ Give sufficient fluids  □ Move the victim to a cool place  □ Let the victim rest till the symptoms of overheating disappear  □ Cover the victim with a heavy and thick blanket to avoid temperature loss
19. What is heatstroke?
    □ It is commonly seen and special care of the victim is not required  □ It can be prevented  □ It is not life-threatening  □ It rarely occurs at sports grounds
20. Which one of the following is not a symptom of heatstroke?
    □ Shortness of breath  □ Profuse sweating  □ Inability to sweat  □ Consulted pupils
21. What is the purpose of dressing a bleeding wound?
    □ Relieve pain  □ Make the wound beautiful  □ Control bleeding and prevent infection  □ To enable transportation of the victim
22. Which one of the following is the wrong way to treat a bleeding wound?
    □ If any foreign matter is on or in the wound, remove it immediately  □ The hemostatic gauges for the wound must be clean  □ Raise the injured limb to the level of the heart  □ Don’t take any hemostatic drugs before medical treatment
23. What should be done to treat a severely bleeding wound?
    □ Let it bleed thus allowing the blood to clean the wound and avoid infection  □ Dress the wound with a tourniquet or apply pressure directly on the wound to stop bleeding  □ Do nothing and wait for the bleeding to stop  □ Raise the injured limb even if the victim has suffered a fracture; otherwise, the wound might become untreatable
24. What is shock?
    □ It is not life-threatening  □ It may accompany any injuries  □ It only accompanies injuries to the head or heat-related illnesses  □ It only accompanies chronic injuries
25. Which one of the following methods is the wrong way to treat shock?
    □ Elevate the lower limbs if there is no bone injury  □ Enforced intake of solids and liquids are required to maintain the life of the victim  □ Maintaining good air circulation is required  □ Maintain coolness of the area

1) Demographic information: including gender of students, education level of parents, type of school, educational system, grade, study group, type of sports extra curriculum participated, sports injury experience in the past year, source of sports injury prevention knowledge, whether or not think sports injury related courses can reduce the prevalence of sports injury.

2) Knowledge: Since none of the questionnaires have been designed focusing on "Prevention and Management of Sports Injury" among high/vocational school students in Taiwan, the Knowledge section of the questionnaire was prepared by this study team by consulting with literatures related to "Prevention and Management of Sports Injury". The questionnaire of Knowledge (Table 1) consisted of 25 items in subjects like "Principles of preventing sports injury types", "Identification of sports injury types", "Management principles of sports injury", "Limb supporting methods", "Skills of Cardiopulmonary Resuscitation (CPR)", "Guideline for Hot or Cold Compress", "Management of Heat-related Illnesses in Sports", "Management of Bleeding Wounds" and "Management of Sports-related Shock".

3) Needs: Compiled by the study team by referring to concepts in literatures related to "Prevention and Management of Sports Injury" and consulting the opinion of 20 nursing teachers from high/vocational schools in northern, center and southern regions of Taiwan through questionnaire. The Needs section of the "Prevention and Management of Sports Injury" questionnaire consisted of 16 items were rated on a 4-point Likert scale, rating from "have no needs at all" to "have full needs", the scale point of each item corresponds to 1 score, i.e. from 1 through 4,
and the higher score, the greater the needs of students, including: Principles of preventing sports injuries, Identification of sports injury types, Management principles of sports injury, and so on. (Table 2)

2.3. Verification of Validity and Reliability of Study Tool

2.3.1. Pre-test
A total of 100 questionnaires were given to two classes from a vocational school which was not included in study population. All of the questionnaires were returned and 80 valid questionnaires were obtained.

2.3.2. Validity
The content validity of the study tool was tested by content validity, in which six experts from the field of incident injury, school health, nursing and physical education were asked to evaluate the study tool in terms of "importance of the content", "suitability of the content" and "clarity of the wording". The evaluation method was based on Content Validity Index (CVI), of which each item was scored on a 4-point scale, where 1= not relevant, 2= unable to assess relevance with item revision, 3=relevant but needs minor revision and 4=very relevant with clear and simple description (Burns & Grove, 2001; Polit & Hungler, 1999). Items were revised or deleted according to the response of the experts. The CVI for the entire scale was calculated with each item’s total score from the six experts as numerator and divided by denominator (24 points). For item with CVI larger than or equal to .80, it was considered as high content validity and therefore kept in the questionnaire (Polit & Hungler, 1999).

2.3.3. Reliability
The Knowledge section of the study tool consisted of multiple choices; thus, item analysis (difficulty level and discrimination of each item) and internal consistency (Kuder-Richardson reliability K-R20) of items were needed. As for the Needs section of the scale, internal consistency (Cronbach α) was adopted to determine the reliability. Items with difficulty level between 0.30~0.81 and discrimination level larger than 0.2 were kept. After the Kuder-Richardson reliability analysis, the K-R20 was determined to be 0.73; whereas the Cronbach α of Needs scale was 0.96.

2.3.4. Data analysis
After the data was collected, encoded and decoded, SPSS 12.0 statistical software was used for statistical analysis. Data was analyzed with statistical methods, including frequency distribution, mean, standard deviation, percentage, one-way ANOVA, and Pearson's product moment correlation.
3. Results

3.1. Demographic Information

As for the gender distribution among the study subjects, male students accounted for 46.6% while female students accounted for 53.4%. As for the type of school, 50.4% of the study subjects attended public school; while 49.6% attended private school. As for the educational system, 48.2% were high school students and 51.8% were vocational school students. As for the grade, 31.9% were Grade 10, 33.9% were Grade 11 and 34.2% were Grade 12. For the study groups, the educational system of senior high schools in Taiwan: No groups are decided at Grade 10, but students can select one of three groups from Grade 11 to 12 based on their wishes (interests) to prepare themselves for college entrance examination. These groups are Social Sciences Group (Group 1), Science and Engineering Group (Group 2), and Natural Sciences Group (Group 3). 14.5% of the high school students have not decided study group, 11.2% were Group 1, 11.3% were Group 2 and 11.2% were Group 3. For the vocational school students, 17.2% were in Business Administration program, six classes or 17.4% were in Accounting program and six classes or 17.4% were in International Business program.

Type of sports extra curriculum participated in school: 83.5% did not participate in any sports extra curriculum, while ball sports accounted for 13.5% and non-ball sports accounted for 3%. Main source of "Prevention and Management of Sports Injury" knowledge: 36.3% of the students obtained their knowledge from Health Education course in junior high school, 29.5% of the female students acquired the knowledge from military training/nursing course while 8.8% of the male students acquired their knowledge from military training course. High school Physical Education course and public media each accounted for 6.4%; while 5.8% of the students acquired their knowledge through discussions with their classmates, family and friends. Physical Education course in junior high school accounted for 3.9%; 1.4% who participated in first-aid training by themselves and 1.0% of the study population indicated that they never came into contact with any relevant information. Education level of parents: Graduated school (including) or above accounted for 41.6%, junior high school graduates or attended high/vocational school accounted for 24.0% and 4.2% were primary school graduates (including) or below. Sports injury experience in the past year: 43.3% of the study population experienced sports-related injury in the past year and 56.7% had not experienced sport injury. Whether or not think sports injury related courses can reduce the prevalence of sports injury: Up to 91.1% of the study population expressed positive attitude for the effectiveness of the education, while 8.9% held negative opinion.

3.2. Knowledge of "Prevention and Management of Sports Injury"

The knowledge section consisted of 25 items and each item was given 4 points when the answer was correct, and given zero points when the answer was incorrect. Thus, 100 points were a full score for correctly answering 25 items. Subjects who correctly answered more than or equal to 15 items (60 points), were considered as having reasonable understanding of knowledge for "Prevention and Management of Sports Injury". Through this study, it was found that 15.1% of the students answered 16 items correctly and 78.3% of the study population correctly answered 15 items or more, the correctly rate and data interpretation shows in Table 3. Items in the order of percentage of incorrect answer were: standard management of sprains, timing for hot or cold compress, identification of types of sports injury, management of bleeding wounds, techniques of cardiopulmonary resuscitation (CPR), signs of heat stroke and principle of bandaging, which were mostly items related with techniques of "Prevention and Management of Sports Injury", indicating that all students lack required on these knowledge.

3.3. Needs for "Prevention and Management of Sports Injury"

In the Needs section of the "Prevention and Management of Sports Injury" questionnaire, the 16 items were rated on a 4-point Likert scale, rating from "have no needs at all" to "have full needs", and the higher score, the greater the needs of students. On average, each item scored above 3 points, Table 2 indicating that students had high needs for "Prevention and Management of Sports
Knowledge and Needs for Prevention of Sports Injury

Distribution of the Correct Rate Regarding the Test of Knowledge on Prevention and Management of Sports Injuries (n=1694)

<table>
<thead>
<tr>
<th>Question No.</th>
<th>Correct rate (%)</th>
<th>Male n=790 Correct rate (%)</th>
<th>Female n=904 Correct rate (%)</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>59.1</td>
<td>57.8</td>
<td>60.3</td>
<td>Indicating that majority of male students don't understand the correct time for use of sports protective devices.</td>
</tr>
<tr>
<td>2</td>
<td>74.9</td>
<td>72.0</td>
<td>77.3</td>
<td>Indicating that all students lack required knowledge on identification of sports injury types.</td>
</tr>
<tr>
<td>3</td>
<td>54.3</td>
<td>54.3</td>
<td>54.3</td>
<td>Indicating that all students lack required knowledge on identification of sports injury types.</td>
</tr>
<tr>
<td>4</td>
<td>33.6</td>
<td>35.4</td>
<td>32.0</td>
<td>Indicating that all students lack required knowledge on the first-aid method in management sports injuries, which may affect the rehabilitation of the injury.</td>
</tr>
<tr>
<td>5</td>
<td>84.2</td>
<td>81.1</td>
<td>86.8</td>
<td>Indicating that all students lack required knowledge on management sports injuries, which may affect the treatment of the injury and rehabilitation time.</td>
</tr>
<tr>
<td>6</td>
<td>44.2</td>
<td>38.7</td>
<td>48.9</td>
<td>Indicating that all students lack required knowledge on and skill in dressing wounds brought about by sports injuries.</td>
</tr>
<tr>
<td>7</td>
<td>22.3</td>
<td>22.7</td>
<td>22.0</td>
<td>No matter what temperature treatment is carried out in tissue, damage may occur if the wound is treated for too long.</td>
</tr>
<tr>
<td>8</td>
<td>93.4</td>
<td>92.0</td>
<td>94.7</td>
<td>Indicating that all students lack required knowledge on and skill in dressing wounds brought about by sports injuries.</td>
</tr>
<tr>
<td>9</td>
<td>93.2</td>
<td>91.1</td>
<td>94.9</td>
<td>Indicating that all students lack required knowledge on and skill in dressing wounds brought about by sports injuries.</td>
</tr>
<tr>
<td>10</td>
<td>68.8</td>
<td>63.4</td>
<td>73.6</td>
<td>Indicating that all students lack required knowledge on and skill in dressing wounds brought about by sports injuries.</td>
</tr>
<tr>
<td>11</td>
<td>47.6</td>
<td>46.3</td>
<td>48.7</td>
<td>Indicating that all students lack required knowledge on and skill in dressing wounds brought about by sports injuries.</td>
</tr>
<tr>
<td>12</td>
<td>35.7</td>
<td>34.2</td>
<td>36.9</td>
<td>Indicating that all students lack required CPR knowledge and skills.</td>
</tr>
<tr>
<td>13</td>
<td>75.3</td>
<td>70.3</td>
<td>79.6</td>
<td>Indicating that all students lack required knowledge on hot and cold compress for sports injuries.</td>
</tr>
<tr>
<td>14</td>
<td>57.9</td>
<td>56.2</td>
<td>59.3</td>
<td>No matter what temperature treatment is carried out in tissue, damage may occur if the wound is treated for too long.</td>
</tr>
<tr>
<td>15</td>
<td>33.5</td>
<td>33.6</td>
<td>33.2</td>
<td>Indicating that all students lack required knowledge on heatstroke and are not capable of preventing or management heatstroke effectively.</td>
</tr>
<tr>
<td>16</td>
<td>75.3</td>
<td>73.9</td>
<td>76.5</td>
<td>Indicating that all students lack required knowledge on heatstroke and are not capable of preventing or management heatstroke effectively.</td>
</tr>
<tr>
<td>17</td>
<td>93.1</td>
<td>89.6</td>
<td>96.1</td>
<td>Indicating that all students lack required knowledge on and skill in dressing wounds brought about by sports injuries.</td>
</tr>
<tr>
<td>18</td>
<td>90.0</td>
<td>86.5</td>
<td>93.0</td>
<td>Indicating that all students lack required knowledge on and skill in dressing wounds brought about by sports injuries.</td>
</tr>
<tr>
<td>19</td>
<td>95.7</td>
<td>93.4</td>
<td>97.7</td>
<td>Indicating that all students lack required knowledge on and skill in dressing wounds brought about by sports injuries.</td>
</tr>
<tr>
<td>20</td>
<td>38.7</td>
<td>38.2</td>
<td>39.2</td>
<td>Indicating that all students lack required knowledge on and skill in dressing wounds brought about by sports injuries.</td>
</tr>
<tr>
<td>21</td>
<td>86.2</td>
<td>82.5</td>
<td>89.4</td>
<td>Indicating that all students lack required knowledge on and skill in dressing wounds brought about by sports injuries.</td>
</tr>
<tr>
<td>22</td>
<td>34.9</td>
<td>33.5</td>
<td>36.2</td>
<td>Indicating that all students lack required knowledge on and skill in dressing wounds brought about by sports injuries.</td>
</tr>
<tr>
<td>23</td>
<td>92.6</td>
<td>90.5</td>
<td>94.5</td>
<td>Indicating that majority of male students don't understand the principles of treatment of shock.</td>
</tr>
<tr>
<td>24</td>
<td>87.8</td>
<td>84.2</td>
<td>91.0</td>
<td>Indicating that majority of male students don't understand the principles of treatment of shock.</td>
</tr>
<tr>
<td>25</td>
<td>56.6</td>
<td>51.3</td>
<td>61.2</td>
<td>Indicating that majority of male students don't understand the principles of treatment of shock.</td>
</tr>
</tbody>
</table>

§ adding explanation for the correct rate less than 60%.

Injury". Based on the choice of the students, the items in the order of needs were: emergency care and management of sports-related shock, identification of types of sports injury, timing and method for hot compress, principle for prevention of various sports injuries and management of sports injury, which were mostly technical items.

3.4. Effect of demographic factors on knowledge of "Prevention and Management of Sports Injury"

Based on the result of analysis, it was found that gender, type of school, educational system, grade, study group and source of knowledge all demonstrated significant difference in knowledge of "Prevention and Management of Sports Injury" (Table 4). As shown in the result, female performed better than male students, public school students performed better than vocational school students, Grade 12 students performed better than Grade 11 and Grade 10, students from Group 1, 2 and 3 performed better than students from Business Administration, Accounting and International Business programs. Students whose main source of knowledge was high school military training/nursing course performed better in knowledge of "Prevention and Management of Sports Injury" than those who
Table 4: Effect of Students’ Demographic Factors on Knowledge of “Sports Injury Prevention and Management” (n=1694)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>F value</th>
<th>Tukey’s post hoc comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>790</td>
<td>15.73</td>
<td>3.14</td>
<td>3.19***</td>
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<td></td>
<td>Female</td>
<td>940</td>
<td>16.78</td>
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<td>16.80</td>
<td>2.74</td>
<td>4.78**</td>
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<td>Private</td>
<td>840</td>
<td>15.77</td>
<td>3.07</td>
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<td>Educational System</td>
<td>High school</td>
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<td>16.84</td>
<td>2.77</td>
<td>4.25**</td>
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<td></td>
<td>Vocational school</td>
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<td>15.77</td>
<td>3.03</td>
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<td>Injury Experience</td>
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<td>16.30</td>
<td>3.08</td>
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<tr>
<td></td>
<td>No</td>
<td>961</td>
<td>16.28</td>
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<tr>
<td>Grade</td>
<td>(1) 10</td>
<td>540</td>
<td>15.86</td>
<td>2.99</td>
<td>11.96***</td>
<td>(3)&gt;(1)</td>
</tr>
<tr>
<td></td>
<td>(2) 11</td>
<td>574</td>
<td>16.25</td>
<td>3.19</td>
<td></td>
<td>(3)&gt;(2)</td>
</tr>
<tr>
<td></td>
<td>(3) 12</td>
<td>580</td>
<td>16.72</td>
<td>2.61</td>
<td></td>
<td></td>
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<tr>
<td>Study Group</td>
<td>(1) Group 1</td>
<td>190</td>
<td>17.28</td>
<td>2.31</td>
<td>10.72**</td>
<td>(1)&gt;(2)</td>
</tr>
<tr>
<td></td>
<td>(2) Group 2</td>
<td>192</td>
<td>16.70</td>
<td>2.94</td>
<td></td>
<td>(2)&gt;(5)</td>
</tr>
<tr>
<td></td>
<td>(3) Group 3</td>
<td>189</td>
<td>16.55</td>
<td>3.04</td>
<td></td>
<td>(2)&gt;(6)</td>
</tr>
<tr>
<td></td>
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<td>(5) Business Adm.</td>
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<td>(7) Int. Business</td>
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<td>2.93</td>
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</tr>
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<td>2.51</td>
<td>1.55</td>
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<tr>
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<td>University or college graduates</td>
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<td>16.57</td>
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<td>High/vocational school graduates or attended university</td>
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<td>16.14</td>
<td>2.96</td>
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<td></td>
<td>Junior high school graduates or attended high/vocational school</td>
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<td>16.23</td>
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<td></td>
<td>Primary school graduates (including) or below</td>
<td>71</td>
<td>16.30</td>
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</tbody>
</table>

**p<.001 $§$ undecided is the grade 10 students of high school that have not decide study group yet

acquired knowledge from other sources.

3.5 Effect of Students’ Demographic Factors on Needs for "Prevention and Management of Sports Injury"

Based on the result of analysis, it was found that gender and knowledge source demonstrated significant difference in needs for "Prevention and Management of Sports Injury" (Table 5). As shown in the result, female students had high needs than male students; while students whose main source of knowledge was high school military training/nursing course s expressed high needs for "Prevention and Management of Sports Injury" than those acquired from other sources.

3.6. Relevant Analysis on Knowledge and Needs for "Prevention and Management of Sports Injury"

An overall positive correlation between knowledge and needs for "Prevention and Management of Sports Injury" was observed (r = .12, p<.001), indicating that in general, students who more acquainted with knowledge of "Prevention and Management of Sports Injury" tend to have higher needs.
**Table 5** Effect of Students' Demographic Factors on Needs for “Sports Injury Prevention and Management” (n=1694)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>F value</th>
<th>Tukey’s post hoc comparison</th>
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<td>49.49</td>
<td>8.56</td>
<td>2.66**</td>
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<td>500</td>
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<td>(3) Military training course in high school (male)</td>
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<td>(4) Physical Education course in junior high school</td>
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<td>9.48</td>
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<td></td>
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<tr>
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<td>(5) Physical Education course in high school</td>
<td>109</td>
<td>50.11</td>
<td>8.02</td>
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<tr>
<td></td>
<td>(6) Discussion with classmates</td>
<td>99</td>
<td>48.19</td>
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<tr>
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<tr>
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<td>Primary school graduates (including) or below</td>
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<td>49.75</td>
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</tbody>
</table>

***p<.001
§ undecided is the grade 10 students of high school that have not decide study group yet

4. Discussion

4.1. Knowledge of "Prevention and Management of Sports Injury"

For the 25 knowledge items in this study, the average number of correct answers was 16.29±2.96, meaning the students, in general, had "reasonable" understanding of the knowledge of "Prevention and Management of Sports Injury". As for the effect of demographic factors on knowledge of "Prevention and Management of Sports Injury", gender, type of school, educational system, grade, study group and source of knowledge all demonstrated significant statistical difference in the level of knowledge for "Prevention and Management of Sports Injury". Female students were evidently better than male students in terms of knowledge, which was similar to the outcome of "First-aid Knowledge" tests for university, high/vocational students in Chang (1982), Chou (1988) and Lan’s (1985) studies.

As for the type of school, students from pubic schools performed significantly better in knowledge of "Prevention and Management of Sports Injury" than those from private schools, meaning pubic school students had better understanding in "Prevention and Management of Sports Injury" than those in private schools. As for the educational
high school students performed considerably better than those in vocational schools, which was consistent with the results of Lan’s (1985) study on "Health Knowledge and Need" among high/vocational school students. Lan (1985) had pointed out that different type of school and educational system could reflect the learning capability and motivation in students.

Grade, study group and main source of knowledge all significantly affected the level of knowledge in "Prevention and Management of Sports Injury". Grade 12 students performed better than Grade 11 and 10 students in term of knowledge of "Prevention and Management of Sports Injury", indicated that the level of knowledge tend to improve with advancement of grades (course arrangement). Group 1 high school students performed better than those in Group 2 and International Business program students in vocational school. Group 2 high school students performed better than those in Business Administration, Accounting and International Business programs in vocational school. Grade 10 students performed better than these in Business Administration, Accounting and International Business programs. These outcomes reaffirmed the finding that high school students were better than vocational school in terms of knowledge. One observation to note was that vocational school students from different programs did not show significant difference in their level of knowledge for "Prevention and Management of Sports Injury"; while Group 1 high school students performed better than those in Group 2. This outcome was consistent with the result of health knowledge test for first year university students in Kuo’s (1990) study. In Kuo’s study, it was found that first year university students who were in Group 1 back in high school scored the highest in the health knowledge test; while first year university students who attended vocational school scored the lowest. Upon further investigation, it was discovered that key reason for high scores in Group 1 was due to the fact that majority of them were female students; thus, the test performance was better than students from other groups.

Students who acquired their knowledge of "Prevention and Management of Sports Injury" from high school military training/nursing course performed better than those from junior high school health education course, high school military training course, high school physical education course and through pubic media. This outcome indicated that military training/nursing course provided the most comprehensive knowledge for "Prevention and Management of Sports Injury", which was consistent with the findings that female students performed better than their male counterparts (Chang, 1982; Lan, 1985; Yeh, 1983). After checking the current military training course outline for high/vocational schools in Taiwan, it was found that female students were required to learn nursing-related courses for the three years in high school; whereas the male students only had opportunity to learn about prevention and management of accidents in the first year of high school, which had explained the difference in the source of knowledge for sports injury.

No significant difference in the level of knowledge for "Prevention and Management of Sports Injury" was observed for other factors like sports injury experience, participation of sports extra curriculum and education level of parents. In a study on first-aid knowledge among high/vocational school students in Kinmen region, Chou (1988) pointed out that no significant difference was observed between sports injury experience and first-aid knowledge. Chou (1988) suggested that rather than amount of injury experience, the level of first-aid knowledge was depended on learning status, which is consistent with the finding in this study.

Kuo (1991) and Lan (1985) both conducted studies on health knowledge and need among students and both found that the education level of parents would significantly affect the level of health knowledge in students, which is inconsistent with the finding in this study. After further investigation, it was discovered that the definition of health knowledge in the studies mentioned above included: personal hygiene, smoking/drinking and drug, food and nutrients, mental health, safety and first-aid, understanding of illness and community health. These eight items are inseparable part of family education and family live; thus, the education level of parents can considerably affect the health knowledge of students. The relationship between knowledge of "Prevention and Management of Sports Injury" and demographic factors of students in this study was similar to Chou’s (1998) concept that quality of knowledge depended on learning status of students; thus, there is no significant difference between the education level of parents and the knowledge of "Prevention and Management of Sports Injury" in students.
4.2. Needs for "Prevention and Management of Sports Injury"

Needs section of "Prevention and Management of Sports Injury" questionnaire consisted of 16 items with a total score of 64 point and the average score was 49.99±8.20 points, meaning students, in general, had high needs for "Prevention and Management of Sports Injury". This finding of high needs for sports injury knowledge was consistent with Chou's (1998) study on first-aid needs among high/vocational school male and female students, Lan's (1985) study on health needs among high/vocational school male and female students, indicating that students had tremendously needs for "Prevention and Management of Sports Injury".

Lan (1985) suggested that high/vocational school students are at puberty and tend to be more autonomous in their needs for knowledge; therefore, the education level of parents will not exert a direct effect on learning needs in students. Since the subjects in this study constituted of high/vocational school students, Lan's suggestion had explained this discrepancy. Relevant studies and publications on this topic seemed to be limited. The factors influencing the needs for "Prevention and Management of Sports Injury" in students might be clarified if more studies were conducted to investigate this finding.

After summarizing the analysis of this study, it was discovered that the prevalence of sports injury was higher in male students than female students. Even though male students were less acquainted with the knowledge of "Prevention and Management of Sports Injury", the needs for "Prevention and Management of Sports Injury" was lower than female students. Students who primarily acquired their knowledge of "Prevention and Management of Sports Injury" from military training/nursing course showed higher levels of knowledge and needs for "Prevention and Management of Sports Injury". One thing to note is that female students was the only student population whose main source of knowledge was military training/nursing course, and higher percentage of female students thought courses relevant to sports injury can reduce the prevalence of sports injury than their male counterparts. Students who received military training/nursing course had higher needs for "Prevention and Management of Sports Injury" than other students.

Although the prevalence of sports injury was higher in male than female students, most of the male students still use health education course back in junior high school as their main source of knowledge for "Prevention and Management of Sports Injury". Therefore, the knowledge and needs for "Prevention and Management of Sports Injury" in male students, as well as percentage of students who think relevant courses can reduce the prevalence of sports injury were considerably lower than female students. Chou (1988) indicated that most male students in high/vocational school still use health education course in junior high school as their main source of first-aid knowledge. This had highlighted the fact that male students lack appropriate learning channels for relevant knowledge and male students tend to overlook the importance of first-aid knowledge due to incomplete understanding.

4.3. Correlation between Knowledge and Needs for "Prevention and Management of Sports Injury"

A positive correlation was observed between knowledge and needs for "Prevention and Management of Sports Injury", meaning students who were more acquainted with the knowledge of "Prevention and Management of Sports Injury" were more likely to have higher needs. This finding of students who had higher scores in the knowledge test would have higher needs for such knowledge was similar to Chang (1982) and Yeh's (1983) studies on first-aid knowledge in students, Lan (1985) and Kuo's (1990) studies on health knowledge in students. This outcome confirmed that when students become more acquainted with the knowledge and recognize the importance of the knowledge, they would have higher needs for such knowledge.

5. Conclusion & Recommendation

5.1. Conclusion

The primary knowledge source of "Prevention and Management of Sports Injury" for all male students was still the health education course from junior high school and complemented with high school military training course. On the other hand, female students mainly acquired their knowledge from high school military training/nursing course and complemented...
with health education course from junior high school.
This outcome suggested that male students were
less acquainted with knowledge of "Prevention and
Management of Sports Injury" than their female
counterparts. In addition, as high as 91.1% of the
students believed that prevalence of sports injury
on school campus can be reduced effectively if
"Prevention and Management of Sports Injury"
course were part of education.

For all students, the items in the order of
percentage of incorrect answer were: principle of
bandaging, immediate management of pulled muscle,
signs of heat stroke, frequency of cardiac massage
during CPR, management of bleeding wounds,
types of sports injury, time interval for hot or cold
compress, standard management for sprained joints.
In general, students need more training for the
knowledge mentioned above.

All students had immediate need for "Prevention
and Management of Sports Injury" and the
precedence was: first-aid and management of
sports-related shock, identification of different types
of sports injury, timing and method of hot compress,
principle for various kinds of sports injury and
management of sports injury.

5.2. Recommendation

Acknowledge the difference in source and level
of knowledge for "Prevention and Management of
Sports Injury", as well as the needs for such
knowledge among male and female students.
Supplement and enhance the teaching material to
compensate the difference in course content and
improve the level of knowledge in students.
Establish the correct concept for injury prevention
and management based on student’s point of view in
order to fulfill student’s needs for "Prevention and
Management of Sports Injury" and improve teaching
effectiveness.

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National Chunghua University of Education, 2: 235-257. (in
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• Health & Exercise Association R.O.C