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SECONDARY PREVENTION OF ACCIDENTS IN SCHOOL SPORTS - DOES THE SPORT TEACHER'S FIRST AID EDUCATION MEET THE DEMANDS AT SCHOOL?

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Abstract

Objective: We investigated whether the actual knowledge of sport teachers in Germany was sufficient to deal with the reality of school sport accidents.

Material and methods: Based on an analysis of school sport accidents, a multiple-choice questionnaire was piloted. This questionnaire was answered by class 5-13 school sport teachers (n=25). These results were compared with a control group (n=25) who were mountaineers or ski instructors with similar age and sex distribution, but with a sports specific First Aid education.

Results: There was a general lack of knowledge in first aid procedures by both test groups, especially in basic techniques like bedding, the diagnosis of limb fractures, pain treatment, the problems of back injuries and hypothermia.

Conclusions: To improve safety in school sport we suggest a First Aid course specifically designed for sport teacher as an integral part of the teacher's education followed up by a refresher course every three years.

***Key words**: school sports, accidents, first aid, prevention, education*

Introduction

Sport is of increasing interest for the general publication to prevent diseases caused by civilization, e.g. metabolic syndrome. All aspects of sports and health cover regular dynamic aerobic endurance activity and the knowledge to perform the training safely. At the same time a mental development passes in. There is a general consensus that sports education should start in childhood to improve the factors mentioned above as well as factors like coordination, fitness, and social behaviour in a team. Unfortunately children have less sense of responsibility (1,2) - a competence which can be learned by sports as well - and therefore the teacher or the coach must take care of safety and must be prepared to handle the First Aid (FA) situation if accidents should happen. However sports education is still active in schools for about 2 hours per week, and it is important that a child's involvement in such school sporting activity is actively encouraged, and supervised by knowledgeable sports teachers who have sufficient first aid knowledge to deal with any accidents that may occur.

In North Rhine Westphalia, the most populated state of Germany with 18 million inhabitants (3) of which are 2.25 million school students (class 1–13) (4), 140,000 – 150,000 accidents happen during sport lessons at school annually (5). About 90% of them are not related to technical deficiencies of the gymnasium or the sports equipment, but were a consequence of mistakes by the teachers or their assistants, e.g. lack of supervision or discipline (of the pupils), insufficient arrangements for safety, and others (5). However classical attempts of safety research are limited in school sports and many statements about the factors causing the accidents, the conditions on-scene as well as personal factors are dominated by speculations (5). In consequence the knowledge of the factors causing accidents during school sport lessons are limited.

Main risk factors for school sport accidents are ball games which are responsible for about 2/3 of all accidents (6). It is suggested that the risk may be increased because these games are often performed at the beginning or the end of the lesson. At these parts of the lesson the pupils did not really warm-up or are already tired and therefore they perform all motions with less control (6). Most accidents of all ball games happen with contact sports such as soccer or hockey games (>25% each) while basketball, handball, and volleyball are less risky (14 - 17% of the accidents) (6). The risk in swimming or track-and-field sports is 3- to 5-times lower (6).

The school form - or the pupil's social status, respectively - is of major influence on the risk of sustaining a sporting injury or sporting accident. In extended elementary schools there were more accidents in soccer and basketball than in any other school (6). In conclusion pupils at extended elementary schools tended be engage in more venturesome sporting games. In contrast to other countries German schools normally do not favour any specific sport but give a general education in sports, which means that the pupils have to perform several disciplines. Therefore the differences of risk and injuries are not a consequence of local sport tradition, but of social factors.

In all schools most accidents happen in class 7 and 8 (age of 13-14 years) which may be a consequence of a higher risk tolerance of these age groups or an early confrontation with complex actions before adequate preparations of techniques and tactics were done (6). But risk tolerance is only one factor between others. For example the age group of class 7 and 8 is the age, where the final growth spurt occurs and it is known to be a period where an adolescent is statistically likely to experience more injuries, especially if they are very active (7). With increases in skeletal and muscle growth, the supporting connective tissue must be weaker to accommodate such growth and as a result injuries and fractures are more likely.

In total, male pupils suffer from more accidents than female (51.3% vs. 48.7%), but there is a reverse tendency with younger females showing more accidents than males and vice versa after the age of 15 (5). In female pupils most accidents happen during gymnastics, volleyball, and basketball (5). The trait of the pupil's character as subjectively determined by the teachers was "motivated" in 75%, "ambitious" in more than 50%, only 5% as "aggressive", 7.5% as fearful and only a small minority as "frolicsome"(5), Because of statistical reasons it was not possible to confirm by this study, that pupils judged as being "aggressive" suffer from more accidents than others. In disciplines with direct contact to the opponent as well as in those being most popular the risk of accidents is higher (5) . The details described above can be summed up that there are many interdependences of the psychological nature and the actual, spontaneous behaviour of the pupil (5). Therefore the effectiveness of primary prevention of accidents by the teacher is necessary but limited.

About 2/3 of all injuries are overstraining and sprains, 38% contusions, 23% fractures, 14% ruptures, 8% dislocations, and 5% wounds (5). Males show more fractures, dislocations and ruptures than females who suffer more often from overstraining and sprains (5). Volleyball mainly causes overstraining and sprains (62%) while in soccer contusions predominate (35%) (5). In basketball 20% of all accidents cause a fracture (5). In about 50% the injury is located at the upper limbs (mainly the fingers), in 38% at the leg or the feet. In 12% there are head and / or brain injuries (5).

57% of the teachers are 35-44 years of age, 33% 45-54 years, and those being younger than 35 or older than 55 years represent 5% each (5). Persons with 20 or more years of teaching describe their education in accident prophylaxis as absolutely insufficient while the younger rate theirs somewhat better (5). Recently safety strategies during the teacher's education were mostly part of practical education in the different disciplines. Up to now accident prophylaxis and FA education is not an integral part of the education of sports teachers at most universities. In our actual investigation we describe the status of the teacher's knowledge and focus on recommendations for future education to improve safety in FA and school sports.

Material and Methods

The principal procedures were identical to those used and evaluated in earlier studies (8). 25 school sports teachers who taught classes 5-13 volunteered to answer the study's multi-choice questionnaire. This pilot questionnaire comprised of 11 questions with 5 written answers each (multiple choice). Because one question had only 4 answers there were 54 answers per questionnaire in total. The questions were orientated according to North Rhine Westphalia's official statistics of school sport accidents 1997-99, (8,9) and the answers described typical measures or mistakes. 25 persons engaged in mountaineering or skiing and with sports specific training in FA and comrade rescue techniques were used as controls. Additional data about age, sex, and education (especially any education in FA) were obtained to ensure homogeneity between both groups with respect to these items. Persons with professional education in FA like paramedics were excluded from the investigation. Both groups completed the same questionnaire.

In addition to the 11 questions on FA we asked the subjects for a self-assessment of their FA knowledge as well as any desires of further education in FA. Self-assessment had to be rated by a scale from 1 (excellent) to 5 (poor). The whole study was anonymous (single blind design). Statistics were performed using non-parametric tests (Mann-Whitney-U-test, x^2-test). $P<0.05$ was defined as significant.

Results

Both groups showed a similar structure in sex and age distribution: 13/12 vs. 11/14 females/males; 13 < 30y, 31 30-50y, 6>50y. 48.1% of the teachers had participated in a standard FA course of 8 lectures (2 hours each) during the last 5 years. 23.6% had an additional sports specific FA education, e.g. during their study at university, while 28.3% had no FA education at all. The investigation's design ensured all of the controls had a similar sports specific FA education. In their self-asses-

sment 16% of the teachers rated their FA knowledge as "relatively good or very good", 44% as "moderate", and 20% as "fragmentary". 20% refused to rate their knowledge. The controls rated their corresponding results as100% good or very good (P<0.001).

An average of 36.5 +/-4.7 (67.6%) of the 54 answers were answered correctly by the school sport teachers compared to 43.2 +/-5.4 (79.9%) in the controls (P<0.001). A detailed analysis of the answers showed the controls had a superior understanding in most of questions posed (P<0.05 - 0.001) with 12/54 answered 100% correctly by the controls, and another 12/54 of the questions were answered with more than 90%. correct. In contrast the teachers answered only 3/54 (5.6%) answers 100% correctly in the whole collective (P<0.05) and further 8/54 (14.8%) being correct in more than 90% of the collective. Specific questions where the answers were correct in less than 50% of the study group are concerned with the following topics: i. position of the victim (bedding), ii. fractures, iii. pain treatment, iv. back injury, and v. hypothermia.

The symptoms of hypovolaemic shock are well-known without any significant difference between the study group and the controls (20/25 vs. 25/25, P<0.1), the fact that a hypovolaemic shock can occur in cases without any external bleeding (17/25 vs. 25/25, n.s.), and the correct position for a patient in such a situation as well (21/25 vs. 15/25, n.s.). The latter is in contrast to all the other positions suitable for a patient in FA situations: Although more of the participants were able to diagnose thoracic trauma (13/25, controls 20/25, P<0.05) and rib fractures, only 2/25 knew that the patient should be laid on the injured side (controls 15/25, P<0.001). The results in head and cerebral trauma are similar: 11/25 did not know the recommendation of a slightly elevated position of the head (controls 23/25, P<0,001). The chance to minimize abdominal pain if the patient is lying on his back or his side with the legs bended was answered correctly by 18/25 volunteers (controls 17/25, n.s.). The statement, that the position which is most comfortable for the patient is the best one if there are no medical reasons which recommend an other position was answered correctly by 14/25 (controls 25/25, P<0.001). In contrast recovery position in case of unconsciousness was relatively well-known (22/25 vs. 23/25, n.s.).

The diagnosis of a limb fracture seems to be relatively easy for the participants (e.g. femur fracture 17/25 vs. 25/25, P<0.01) as was their ability to distinguish a severe contusion from a fracture (24/25 vs. 23/25, n.s.) but there was poor knowledge that fixation and a moderate pull at the distal part of the limb could reduce pain significantly (6/25 vs. 11/25, n.s.). The advantage of a sterile covering of an open fracture (in our questionnaire the fracture of the tibia) was not known by some teachers (correct: 21/25 vs. 25/25, P<0.05).

A special problem are back injuries: While it is well-known that it should be avoided to move patients with vertebral fracture (21/25 vs. 16/25, n.s.) and that the diagnosis of a vertebral injury is difficult in many cases (22/25 vs. 20/25, n.s.), the teachers showed a lack of knowledge of the symptoms in such an injury (i.e. sensibility of the legs 12/25 vs. 20/25, P<0.01; enuresis 13/25 vs. 23/25, P<0.001). The increased risk of hypothermia in cases of spinal trauma is relatively unknown by the teachers as well (6/25 vs. 23/25, P<0.001). In contrast to the back injuries the answers which focus on cerebral trauma were answered relatively correct, for example: A fall on a smooth surface doesn't exclude a cerebral trauma (24/25 vs. 21/25, n.s.), the risk of additional injuries of the cervical spine (23/25 vs. 20/25, n.s.) and enlarged pupils being a sign of cerebral hypoxia (17/25 vs. 25/25, P<0.001).

The diagnosis of hypothermia was done quite well (21/25 vs. 23/25, n.s.), but not the consequences of such a situation. Only 10/25 knew that kneading, rubbing, and massage may improve the symptoms in mild hypothermia and only 6/25 knew that moving the patient with severe hypothermia could be harmful (controls 23/25, P<0.01 and 23/25, P<0.001, respectively). In both groups only 9/25 knew that the wind chill effect was often more dangerous for the victims than moisture alone. Most subjects made the correct diagnosis of heat stroke (19/25 vs. 25/25, P<0.001), knew the efficacy of cooling the victim (18/25 vs. 21/25, n.s.) and that heat stroke (systemic overheating) in contrast to sunstroke (heliosis) could not be prevented by a hat (20/25 vs. 19/25, n.s.). But both groups showed problems in the differentiation between heat stroke and a collapse induced by a cardiac problem - a very rare event in school children which should be an argument to distinguish both (correct 6/25 vs. 10/25, n.s.). The teachers more often treat blunt trauma with cold pack applications (24/25 vs. 20/25, P<0.05). Both groups tend to organize an examination by a physician even in cases where no injury is visible and pain decreases soon, but the controls did so more often than the teachers (14/25 vs. 25/25, P<0.001).

No correlation could be found between the self-assessment of the skills and the real knowledge (results of the questionnaire).

Discussion

Surprisingly 99% of all school injury accidents occurred in gyms (10). As sport teachers are the first responders in school sport accidents as they supervise such participation, we investigated whether their education in FA covered the demands of school sports accidents and if not, which themes should be emphasized more in FA training.

As already described there are about 150.000 accidents which happen annually during school sport lessons in North Rhine Westphalia (5), an area in Germany

with a total population of about 18 million inhabitants (3) and 2.25 million school students (4). There was an increased risk of accidents in girls aged 10 to 13 years, and in participation in ball sports (5,6,10). The latter, especially volleyball, basketball, handball, and soccer are responsible for 43.5% of all school sport accidents (10). 48% of all injuries are located at the arms with most of the injuries (about 80%) damaging the hand or wrist (10). Only 37% of injuries were located in the legs, with more than 50% located at the feet or ankles (10). Sprains and distortions were the most common injury (45%), followed by contusions in 23%, but more severe injuries like fractures in at least 11% (10). Obviously the risk is correlated with circadian rhythms: While only one of nine accidents causes severe injuries in the early morning the risk increases to 1:6 severe accidents at noon (10). Investigations in other countries show comparable results. KINGMA and TEN-DUIS report a comparable increase of the incidence with the age of 12 - 13 years (11). This age is typical and predictable to some degree – dependent on hrs of participation and sport - for injuries to occur as already stated in first pgs due to the growth spurt in adolescence. In their study 59% of the injuries involved the upper extremities, 35% of these were in the wrist region. 33.5% were of the lower extremities with 50% being of the feet and 36.4% of the ankle. The risk was statistically increased in ball sports. In Norway SCHULLER and KOPJAR report similar results as well (12). They point out that about 1% of all injuries were categorized as „severe", which means, the victim suffered from an injury which caused an acute health hazard or a possibly life-threatening situation. Actually there are no comparable data from Germany, but nevertheless at least the fractures (11% of all cases, see above) require correct FA treatment.

Our study demonstrated that the school sport teachers showed a lack of knowledge in FA in our data, a finding consistent with other investigators [e.g. (5)]. For example, in more of 50% of the severe accidents at school no FA at all was performed, that includes the lack of simple procedures like cooling, compression, and bedding (5). Our results confirm this statement: with correct answers about the patient's best position between 8% (thoracic trauma) and 72% (abdominal pain) one can not expect correct FA performed by the collective. In minor injuries the damage can be limited by cooling, elevated bedding, and compression as well, but - although simple - these techniques are performed in less than 40% of these cases (5).

These problems are well-known also in other attempts to educate people in FA with various psychological barriers being most important (8,13-15). Even persons with individual higher risk do not tend to be more interested in FA education than others – although they should have a personal interest (15). But it is possible to give people – lay persons in a medical sense - an effective education in FA as we could show in a study performed with members of Swiss ski patrols: 77.5% of their „on-scene" diagnoses were correct, additionally 12% mainly correct (16). Breivik et al. showed that some FA skills were present in lay people without any formal first aid training, and even without professional assistance (17). In this investigation the most important factor of in seeking FA training was the positive influence of the mass media that encouraged such training. Facing this, the results of our present study could be improved e.g. by the media which may induce an improvement of the awareness of a lack in FA knowledge. Additionally Breivik's good results were derived from better basic knowledge obtained in primary school and military services as established in Norway. This indicates the importance of the concept of general and systematic education in FA for all people including school children where such basic FA should be part of normal school curriculum.

Most FA education courses focus urban or traffic emergencies [e.g.:(18,19)], situations, which differ from those in school sports. For FA in school sports specific themes are necessary (20) and these must be adapted regularly to actual tendencies, because injury patterns change with new kinds of sports or changing techniques in the disciplines. For example we could show in a previous study that the injury pattern in downhill skiing is significantly changing within the last 20 years with a cranial shift of severe injuries (16,21). These aspects should be an integral part of the education at university as well as in teachers refreshing courses.

A comparison of our collective's knowledge with those of other investigations was difficult, mainly because of methodical differences (22,23), but in general there are two major tendencies: i. The knowledge of the population in FA in general is poor and ii. It is principally easy to educate a population in effective FA - if they enter any training at all. Less than 50% of the general population are able to detect the Carotid artery pulse within less than 5 seconds (24). Poor results were also obtained in other FA skills (17). But these skills could be optimized to more than 90% correctness with adequate, group-oriented training (17,20).

Additional there are many teachers – although already active, but who lack of any FA training – who should be educated in FA specific for school sports. In order to reach as many of them as possible their course should not last for more than 2 days, e.g. a weekend. Actually there are no data available, when a refreshing course should be recommended. Roth et al. showed a remarkable decrease of skills in resuscitation during 1 year, Safar's group obtained similar results as well as Spitzer (25-27). In paramedics this loss was only a little less dramatic (28). Based on these studies and taking into account the problems to motivate people to join a course, we would recommend a refreshing for teachers at least every third year.

The problem to reach the target group becomes more complicated because our data show self-assessment of skills being an inadequate mechanism to indicate the necessity of FA education or refreshing of the knowledge. This is in accordance with a previous study which focused on FA knowledge of mountaineer (8). The acceptance of teaching „safety regimes" could be increased via promotion by the societies and the government in combination with an integration of these themes as an integral part of any sports education. But FA as a part of a safety regime needs an adequate infrastructure to be realized. Mirbach (6) demonstrated that there were no possibilities to send an emergency call from more than 25% of the places where school sports were performed, and this is absolutely unacceptable. However, the proliferation of celluar phone use now should help correct this situation (6). An other problem pointed out by Mirbach is the lack of first-aid boxes in 5.1% of the places where school sport takes place and that the boxes found were complete filled in only 22.8% (9.6% were completely empty!) (6). Therefore in about 30% of all school sport accidents the infrastructure is insufficient for a good emergency management by the teacher. In consequence any improvement of safety in school sports should include educational as well as technical steps.

A more recent tendency in Germany is the education of first responder teams of pupils. Anecdotal reports suggest those children who participate in these FA groups are very enthusiastic – though a systematic investigation was not yet performed. These children were able to deal with most of the basic first aid treatments that were not severe in nature. But at least some incidences were very severe, e.g. the FA for a teacher who fell down the stair case of the school. As the emergency physician reported later, the unconscious patient received perfect FA treatment from three pupils of the 6th to 8th class.

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A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection