Preface

The Second Joint Research Conference of the Universities of Gloucestershire and Chemnitz took place at the Chemnitz University of Technology from 09th to 11th of September 2009.

There were presenters from seven different nations in the lecture theatre. The very close partnership of the two institutions is characterised by a very active student exchange programme, joint teaching modules and some collaborative research which has been extended after the conference as well as several extracurricular guest lectures.

In 2007 our friends from Gloucester invited us to our first joint conference and set the standard. The topics of the 2009 Conference were Public health and Sports with three main areas of interest:

1. Physiology and Biomechanics,
2. Philosophy and Social Science,
3. Prevention, Rehabilitation and Health Promotion.

Many interesting and inspiring presentations were given by colleagues, PhD students and research students. One example of inspiration was the Clem Burke Drumming Project (S. Draper and M. Smith), which we were kindly invited to join. This is an example par excellence on how to conduct international research by simply using existing resources and talking to each other. It caused huge interest among colleagues across the whole university that Chemnitz did not only follow the example of our colleagues in Gloucester, but also widened the research interest into the application of different types of drumming as a means of therapy. This was the beginning of the DRUM BEAT Project (P. Wright of the Chair of Sports Medicine).

Furthermore, both universities - Chemnitz and Gloucester - are trying to establish outreaching programmes with local communities which have practical implications of research in the context of public health and/or health promotion. One of the presentations for instance referred to a concept called the Healthy Town Project Tewkesbury, a similar project is planned for Chemnitz called Healthy Community. These two outreaching
programmes and other research synergies could be part of an attempt of both universities to establish stronger international research links and in this context also submitting joint proposals to funding agencies, i.e. the EU. Since this conference a joint EU research proposal was submitted by colleagues in Gloucester.

Also, talks were held on the topic of establishing a joint international degree. Understandably a project of this scale will take more than a couple of conferences and work on both sides is necessary and last but not least is also depending on the political and funding situation. However, first small step was taken after the conference by conducting a joint teaching module in the Ore Mountains /Saxony. Students from both institutions and colleagues conducted a research project comparing physiological and cognitive parameters of cross-country skiing and running. Social and inter-cultural processes were just as important during this winter camp. Some of the data is presented in this book.

I trust that the colleagues of both universities do agree that this is an outstanding and very productive partnership with a lot of potential for future development and I am looking forward to many more joint schemes, projects and conferences to come - perhaps even an international degree.

Prof. Dr. Henry Schulz
## Content

### Prevention, Rehabilitation and Health Promotion


2. *Correlation of Exercise/Physical Activity and Physical and Mental health in Sport Science Students in Germany* (P R Wright, A Linke, H Schulz) .......................................................... 23

3. *Understanding the relationship between physical activity and self-esteem* (T Davenport) .......................................................... 35

4. *Comparison of physiological Parameters in Cross-country Skiing and Running in Consideration of Distance and Time* (P R Wright, J Clough, H Schulz) .................................................. 43

5. *Fitness assessment of primary School children in Saxony* (I Wolf, R Zetzsche, M Schwarze) .................................................. 54

6. *Correlates of clinically diagnosed anxiety and depression among higher education students in Libya* (K Abduallah, W El Ansari, D Crone) .................................................. 63

7. “Engaging children into a research project on the role of play and physical activity in improving physical literacy” (P De Rossi) .................................................. 72

8. *Childhood obesity – strategies for intervention* (U Müller et al.) .................................................. 80


10. *A mixed method evaluation of a community based art intervention – the story so far* (E O’Connell). ................................ 98
11. Questionnaires for Parents – Valid Instrument for Assessment of Physical Activity of Children in Pre-School Age? (R Roschmann, P Ehnold, K Adler) ............................................. 107

12. Sports leadership and its role in the development of community sport (H Mawson et al.) .......................................................... 116

Physiology and Biomechanics

13. Non-Contact ACL and hamstring injuries: eccentric hamstring training for injury prevention (M De Ste Croix et al.) ........................................................................... 124


15. The behaviour of lactate, ammonia and perceived exertion during exhaustive constant load exercise (H Schulz) .............. 141

16. Influence of Exercise Duration on the Maximum Lactate Production Rate (T Hauser, A Mäbert, H Schulz) ................. 149

17. Sex differences in the functional hamstring to quadriceps ratio and neuromuscular performance (Y Omran Elnagar, M De Ste Croix, D James) .................................................. 155

18. Effects of medical exercise therapy in neurological rehabilitation (N Nitzsche et al.) ......................................................... 164

Philosophy and Social Science

19. The notion of a science of sport: some conceptual considerations (E Ryall) .............................................................................. 171

20. Cyborgs, Spacemen and Metaphysical Sporting Value (C Thomen) ...................................................................................... 177

21. Choosing ill-health: aspects of a critical sociology of physical activity (M MacLean) ........................................................... 184
Today's university students are tomorrow's parents, role models, and patients. Hence, their current unhealthy practices and habits could impose health risks later in life and could be passed on to the next generation (Mikolajczyk et al. 2009). At university, the prospective important aspects of student life are not only related to their learning: being a university student may also comprise changes in terms of their social exchanges, connections, and relationships with their peers especially in the initial phase of being a student as adaptation processes take place (Dyson & Renk 2006). University students frequently have to change their residence to other cities or countries, away from family and friends. Such changes contribute to altered financial responsibilities and circumstances. Moreover, students at university represent a developmental shift to new responsibilities and freedoms, along with a dearth of well-established social support network/s (Fisher et al., 2007). Such transition could be accompanied by a range of health complaints, e.g. in the USA, about 8% of students described their general health status as either fair or poor (American College Health Association 2007). Two points stand out from the literature. Firstly, the levels of health complaints vary across different student populations e.g. common somatic symptoms and depression in Japanese and American college students showed that the Japanese had higher levels of somatic distress than American students (Arnault et al. 2006). Second, a broad range of physical symptoms, somatic sensations and psychological/psychosomatic complaints have been reported by university students. Below we outline some of these complaints.

**Mental health**: mental health issues are increasing in severity and are widespread on college campuses (Edberg & Elasowich 2006). Many young adults go through their first psychiatric episode during their university years, and a range of mental conditions could originate in young adulthood
Mental health services at university campuses encountered complaints that included depression, anxiety, and sleep disorders (Kadison 2004). Similarly, medical students at a university in Sweden had depressive symptoms that were about 13% higher than in the general population (Dahlin et al 2005). Likewise, in the USA, depression was reported in 16% of the students surveyed (American College Health Association 2007).

Lower back pain: the prevalence of lower back pain among young adult populations (e.g., university students) is significant and understudied (Kennedy et al 2008), inspite of being a common self-reported complaint (Brennan et al 2007). In a sample of undergraduate college students, the reported prevalence of lower back pain was 44% (one-month) and 28% (one-week), and the average age of onset was 16.4 years (Nyland & Grimmer 2003). In particular vocational training (where physical activity is part of the curriculum) (e.g., sport students) and in some professions (e.g., physical education teachers), the onset of lower back pain may be significant (Stergioulas et al 2004). Indeed lower back pain sufferers in physically demanding college academic programs were young (about 21.6 years old) (Brennan et al 2007). Lower back pain is not uncommon in younger populations, and has been observed from early teens and onwards (Hakala et al 2002).

Sleep difficulties: a study of 117 college and university campuses in the USA found that about 26% of the students surveyed reported sleep difficulties (American College Health Association 2007). Short sleep duration and insomnia have been found to impair youths’ daytime memory, to reduce cognitive and behavioral functioning (Maquet 2001). It has also been associated with poor health status (Chen et al 2006). Research examining the links among alcohol use, sleep, and academic performance in university students suggested that their alcohol use was related to sleep-wake patterns and grades (Singleton & Wolfson 2009). Modern civilization and new changes in lifestyle seem to be another factor affecting sleep duration (BaHammam et al 2006).

Headache: headache is a common complaint in university and college students. For instance, the prevalence of headache in medical students of the University of Lagos in Nigeria was 46.0% (Ojini et al 2009). In support, a
study of 104 university undergraduate students in the USA found that a majority of students surveyed reported experiencing headaches of moderate to severe intensity (Curry & Green 2007). Likewise, in medical students in the sultanate of Oman, the lifetime and last-year prevalence of headache was 98.3% and 96.8%, respectively (Deleu et al 2001).

Neck and shoulder pain: the advent of the wide use of computers and other electronic equipment at universities could be accompanied by a range of musculoskeletal complaints, suggesting the need for ergonomic training for college students and workstation assessments. Indeed computer-use-related musculoskeletal symptoms among college students are increasing. In the USA, a cross-sectional survey of undergraduate students found that 54% of the surveyed participants reported experiencing symptoms associated with computer usage (Jenkins et al 2007). More seriously, 62% of the surveyed students experienced functional limitations and neck and shoulder pain (Jenkins et al 2007). However, such complaints are not only due to computer and other electronic equipment-related causes. It could sometimes be related to the actual physical demands of the subject of study and curriculum. For instance, in the USA, a study of dental students found that 61% of the sample reported that during the past year they experienced musculoskeletal symptoms related to their work at the dental school (Thornton et al 2008). Of those students, the neck represented 48% and shoulder 31% of the musculoskeletal complaints (Thornton et al 2008).

Based on the published literature, we sought to explore the prevalence of eight complaints (headache; concentration difficulties; back pain; neck pain; stomach complaints; sleep disorders; depressive mood; and dizziness) in a sample of university students at a Faculty of Sport, Health and Social Care in the UK.

Study aim

The aim of the study was to explore the range and frequency of health complaints of university students. The specific objectives were: (1) to describe the prevalence of students’ self-reported health complaints at the study site; and 2) to compare the prevalence of students’ self-reported health complaints with those of similar university students from different countries.
Methods

Sample

The study received ethical approval from the University of Gloucestershire and data were collected at the University during the academic year 2008-09. Participant information sheets were provided, and all students were informed about the aims and objectives of the study. Participation in the survey was voluntary and anonymous, and students could withdraw from the study if they wished to do so. After permission from module leaders, questionnaires were distributed in the classes towards the end of any given lecture. Students who wished not to participate could either stay in the class or leave as they wished. The data employed in the present analysis pertains to students attending at the Faculty of Sport, Health and Social Care. Students represented a range of courses and disciplines that represented four broad areas of study: Sport & Exercise Degrees (e.g. Sports Education, Sports Coaching, Sports Therapy); Sport & Exercise Foundation Degrees (e.g. Applied Sport & Exercise Studies, Sports Development & Coaching); Health & Social Care Degrees (e.g. Social Work, Health, Community & Social Care, and Community Nursing Specialist Practice); and, Health and Social Care Foundation Degrees (e.g. Mental Health Practice, Health & Social Care Practice).

Questionnaire

We adopted the questionnaire that was employed by Stock et al (2007) in their survey of students’ health complaints in seven countries. The questionnaire assessed self-reported complaints (headache, nervousness, dizziness, stomach complaints, sleep disturbance, backache, neck/shoulder ache and depressive moods). Participants reported how often they experienced the given symptoms during the last year, scored on a 4-point response scale (1= ‘never’, 4= ‘very often’). For the purpose of the descriptive analyses, responses were dichotomised into low (never or not very often) and high (quite often or very often).

Statistical analysis

Data were analysed using SPSS version 16.1, with significance level set at $p<0.05$. Descriptive statistics were expressed in means and 95% confidence intervals. Chi-square test ($\chi^2$) was used to compare proportions. Best
practice requires the reporting of effect sizes rather than merely reporting p
values (Altman et al 2006), and we undertook that step by reporting the
95% confidence intervals.

Results

The sample comprised 380 undergraduate students with females making up
about half (48.8%) the sample. Mean age was 22.9 years (SD 7.5), but
females were older than males [24.6 years (SD 9.4); 21.2 years (SD 4.7)
respectively). Roughly 76% of the sample were from Sport and Exercise
Degrees; 7% from Sport and Exercise Foundation Degrees; 13% from
Health and Social Care Degrees; and remaining students (4%) were from
Health and Social Care Foundation Degrees.

As the sample comprised nearly equal males and females, we present the
prevalence of students’ health complaints unadjusted for gender (Table 1).
The prevalence of subjective health complaints varied from 11% to 43%.
Students reported headache as the most frequent complaint followed by
nervousness, concentration difficulties, backache and neck/shoulder ache.
This group of complaints were followed by stomach complaints, sleep
disturbances and depressive moods. The least frequent complaint was
dizziness.

As we had only a sample of students, one has to make some estimates of the
likely maximum and minimum preferences which would be observed in the
population from which the sample was drawn. Hence Table 1 also shows
that the 95% confidence intervals for each complaint were narrow.
Table 1. Prevalence of students’ self-reported health complaints by type of complaint

<table>
<thead>
<tr>
<th>Complaints</th>
<th>Prevalence (%)</th>
<th>95% C. I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>43</td>
<td>40.5 - 45.5</td>
</tr>
<tr>
<td>Nervousness</td>
<td>42</td>
<td>39.5 - 44.5</td>
</tr>
<tr>
<td>Concentration difficulties</td>
<td>41</td>
<td>38.5 – 43.5</td>
</tr>
<tr>
<td>Backache</td>
<td>38</td>
<td>35.5 - 40.5</td>
</tr>
<tr>
<td>Neck/shoulder ache</td>
<td>35</td>
<td>32.6 - 37.4</td>
</tr>
<tr>
<td>Stomach complaints</td>
<td>26</td>
<td>23.7 - 28.3</td>
</tr>
<tr>
<td>Sleep disturbances</td>
<td>22</td>
<td>19.9 - 24.1</td>
</tr>
<tr>
<td>Depressive moods</td>
<td>20</td>
<td>17.9 - 22.1</td>
</tr>
<tr>
<td>Dizziness</td>
<td>11</td>
<td>9.4 - 12</td>
</tr>
</tbody>
</table>

C.I.: Confidence intervals

The nature of self-reported complaints broken down by gender is depicted in Table 2. Six complaints were reported by more than 20% of the sample. For the female-male ratio, a ratio of 1 meant that there was no significant difference between the proportions of male and female students who reported the given complaint. Female-male ratio >1 indicates that women reported more complaints than males. There was a consistent difference between males and females, whereby females consistently reported more complaints than males, by between 13% (neck or shoulder ache) and 118% (dizziness). For headache, stomach complaints and concentration difficulties, the gender differences were statistically significant at the 95% level. However, the prevalence matters as well: e.g. although the women are over twice as likely to report dizziness as men, the generally low level of prevalence for both genders meant that we could not be very confident that the results would be repeated on other samples.
Table 2. Student self-reported health complaints by gender sorted in descending order of female-male-ratio

<table>
<thead>
<tr>
<th>Complaint</th>
<th>% of respondents</th>
<th>Total</th>
<th>Female-Male Ratio</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dizziness</td>
<td>15</td>
<td>7</td>
<td>11</td>
<td>2.18</td>
</tr>
<tr>
<td>Headache</td>
<td>57</td>
<td>31</td>
<td>43</td>
<td>1.85</td>
</tr>
<tr>
<td>Stomach complaints</td>
<td>32</td>
<td>20</td>
<td>26</td>
<td>1.63</td>
</tr>
<tr>
<td>Depressive mood</td>
<td>24</td>
<td>16</td>
<td>20</td>
<td>1.52</td>
</tr>
<tr>
<td>Sleep disturbances</td>
<td>26</td>
<td>19</td>
<td>22</td>
<td>1.33</td>
</tr>
<tr>
<td>Concentration difficulties</td>
<td>47</td>
<td>36</td>
<td>41</td>
<td>1.31</td>
</tr>
<tr>
<td>Back pain</td>
<td>42</td>
<td>33</td>
<td>38</td>
<td>1.28</td>
</tr>
<tr>
<td>Neck/ shoulder ache</td>
<td>37</td>
<td>33</td>
<td>35</td>
<td>1.13</td>
</tr>
</tbody>
</table>

For the international comparisons, we based our comparison with the data presented in Stock et al (2007) of the different levels of complaints that university students reported in 7 European countries. Hence we constructed a rank order table for the complaints reported from each individual countries and further included the ranking of the complaints in our UK sample (8 countries, one university from each country) (Table 3). It shows how consistent the picture is from country to country, whether one takes the rank orders or the means.
Table 3. Rank order of students’ self-reported health complaints by country

<table>
<thead>
<tr>
<th>Complaints</th>
<th>Denmark</th>
<th>Lithuania</th>
<th>Poland</th>
<th>Bulgaria</th>
<th>Germany</th>
<th>Spain</th>
<th>Turkey</th>
<th>UK</th>
<th>Sum of</th>
<th>Mean for</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=</td>
<td>548</td>
<td>1,031</td>
<td>572</td>
<td>701</td>
<td>770</td>
<td>658</td>
<td>1,037</td>
<td>380</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nervousness</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>18</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Headache</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>22</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Backache</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>26</td>
<td>3</td>
</tr>
<tr>
<td>Neck/shoulder ache</td>
<td>1</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>32</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Sleep disturbances</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>4</td>
<td>5</td>
<td>7</td>
<td>2</td>
<td>6</td>
<td>46</td>
<td>5</td>
</tr>
<tr>
<td>Depressive moods</td>
<td>6</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>48</td>
<td>6</td>
</tr>
<tr>
<td>Stomach complaints</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>55</td>
<td>7</td>
</tr>
<tr>
<td>Dizziness</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>60</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

Note: the complaint ‘concentration difficulties’ was not included in this table as there was no data available for the other European countries which we compare the UK with (Stock et al 2007)

We further examined the rank-order correlations between the eight countries and the general picture was mixed, but with a strong tendency for countries to be in agreement with each other (Figure 1). Taking the countries two at a time, the vast majority of the pairs correlated in the range +0.3 to +0.9, with only 3 correlations being below that level, of which only 2 correlations were slightly negative (-0.11 and -0.27). As regards students’
subjective health complaints, taking Table 3 and Figure 1 together, the eight European countries presented a broadly similar picture, although their experiences were by no means identical. Lithuania was somewhat different. Overall, its median correlation with the other countries was the lowest of all. In addition, the two negative correlations mentioned above involved Lithuania (with Germany -0.11, with Denmark -0.27) and its correlation with Turkey was effectively zero (0.04). With that exception, the other 7 countries were broadly, but in general not precisely, similar in their student health complaints.

Figure 1. Rank-order correlations between 8 countries, taken two countries at a time: % of cases by level of their correlation

Discussion
The health of students is an increasing cause of concern. Such concerns are echoed in the number of published papers generated from different countries that report on some aspect of students’ health (e.g. Stock et al 2007; Mikolajczyk et al 2009). The current study assessed the prevalence of eight complaints (headache; concentration difficulties; back pain; neck pain; stomach complaints; sleep disorder; depressive mood; and dizziness) in a sample of university students in a UK university.
Below we discuss the prevalence levels of complaints reported by our UK sample, and we compare these levels with similar samples of university students from different European countries. Generally we note differences in the levels of reported health complaints between our sample and other university students in a range of western and eastern European countries. This might not be surprising, as others (e.g. Stock et al. 2007) have similarly found differences in health complaints in-between the different European countries that we compared our UK with. It is difficult to ascertain precisely why such differences exist. However such discrepancies could be either due to genuine differences in a range of possible risk factors, predisposing conditions, or particular characteristics that might be associated with headache (e.g. exposures, lifestyle, nutrition, climate, etc.) (e.g. Stock et al. 2007); or alternatively, due to differences in the individual experience of symptoms by people from different countries. For instance, there could be culturally related distinctions in the concepts and beliefs of what actually constitutes an illness or symptom; as well as country/ethnic dissimilarities in the willingness to report illness. The notion of cultural models of wellness and illness as cognitive guides for perception, emotion and behaviour has been described (Saint Arnault 2009). Indeed culture affects all aspects of health and illness, including the perception of it, the explanations for it, and the behavioural options to promote health (Saint Arnault 2009). Furthermore, the diversity in language and discrepancies in vocabulary may also be underlying reasons for some of the observed differences highlighted below.

About 44% of the surveyed students reported experiencing headache either quite often or very often. This is in agreement with a recent study of university students from Nigeria where the prevalence of headache was 46% (Ojini et al. 2009). It was also in agreement with levels reported by university students in Turkey (41%), Bulgaria (44%), and Poland (45%) (Stock et al. 2007). However, it was higher than levels reported in Denmark (27%), Germany (39%), and Lithuania (29%) (Stock et al. 2007).

As regards nervousness, although it was reported by 42% of our sample, it was still favourable when compared with levels reported from Turkey, Spain, Poland, Bulgaria, and Lithuania (Stock et al. 2007). Nevertheless, lower levels of nervousness have been described in Danish (20%) and German (36%) students (Stock et al. 2007).
In connection with backache, our sample’s level (38%) was favourable when compared with levels reported from Turkey, Spain, and Germany. It was close to Poland and Bulgaria, and higher than Denmark (28%) and Lithuania (21%) (Stock et al. 2007). Similarly, for neck/shoulder aches, the UK level (35%) were very close to Spain and Poland (33% and 34% respectively), but was higher than Lithuania (16%) and Bulgaria (29%) (Stock et al. 2007). Similarly, the annual prevalence of lower back pain among college students was 42.8%, and feeling very sad, exhausted, and overwhelmed were associated with the prevalence of lower back pain in students (Kennedy et al. 2008).

For two complaints (depressive moods and dizziness), the UK sample fared well in comparison to other European countries. The prevalence of depressive moods in the current UK sample (20%) compared favourably with many countries except for Denmark (13%). Likewise, for dizziness, our sample’s level (11%) was only superseded by Denmark (10%) (Stock et al. 2007).

Sleep disturbances were reported by 22% of our sample which compared favorably with many other European countries, except for Poland and Lithuania (17% and 19% respectively). Finally for stomach complaints, the UK was one of the highest countries (26%) only matched by Turkey (26%) (Stock et al. 2007).

**Conclusion**

The high prevalence of health complaints such as headache, nervousness, back pain and neck and shoulder aches calls for preventive actions at the university level. On campus, student health clinics and counseling services need to pay attention to such complaints and adopt preventive measures. Further studies will need to investigate whether these health and musculoskeletal complaints are associated with psychosocial stress and/or lack of physical activity (e.g. Stock et al. 2003) or alternatively with other causes such as computer-use-related and study (course) (Jenkins et al. 2007). Based on such findings more counselling, health-oriented courses, and/ or ergonomic awareness could be recommended.
References


CORRELATION OF EXERCISE/PHYSICAL ACTIVITY AND PHYSICAL AND MENTAL HEALTH IN SPORT SCIENCE STUDENTS IN GERMANY

– Interim Results –

Peter R. Wright, Anne Linke, Henry Schulz

Introduction

One of the major health challenges for nowadays society is a sedentary lifestyle in conjunction with obesity [1] as well as certain types of cancer and cardiovascular conditions [2, 3, 4]. One result of the lacking physical activity in combination with the before mentioned civilization disease is a reduced life expectancy [5]. In this context several European researchers including scientists of the University of Gloucestershire started to investigate lifestyle and therefore also the physical activity of students worldwide. The “Students Health Survey” analyses and compares the lifestyle of students internationally based on a questionnaire that uses items of other validated questionnaires addressing socio-demographic issues, nutrition, psychological aspects and physical activity. This study was conducted in collaboration with the University of Gloucestershire, namely Prof. Dr. Walid El Ansari and focused on the physical activity of sport science students of the Chemnitz University of Technology. This article presents one aspect of this study, looking at the correlation between reported physical activity and recorded physical activity. Future research will compare data from Egypt, the UK and Germany.

Numerous studies have investigated the physical activity (PA) of students. One found a significance difference between PA depending on gender and race by comparing data from six universities [6]. Stock et al. for instance investigated in a cross-sectional study the gender specific health behaviour and health conscience of first year students (19 – 33 years of age). In this context the interest of students in health promotion programmes was considered. Female students showed a significantly higher interest in these programmes than their male
counterparts, especially in health counselling sessions for psychological stress. The measurement of PA in this study was conducted using a questionnaire. The students proved to be extremely active as 40.8% of men and 33.7% of women showed to exercise more than 4 hours a week. 21.8% answered that they did not exercise at all. There was no significant gender specific difference in the latter group [7].

Loke and Lee (2005) investigated the health related behaviour as well as the psycho-social well-being in students of a university in Hong-Kong. Various topics were addressed again using a questionnaire, i.e. eating habits, personal relationships, stress coping and PA. Only a minority of students were physical active, men more often than women, which is probably related to gender specific differences as well as depending on culture determents. 38.8% of male students occasionally did sports in their leisure time compared to 25.7% of female students. Even greater differences were shown for vigorous exercise – 26.2% of men and 9.3% of women exercised at this level. For other areas such as stress coping, no gender specific differences could be shown [8].

According to the German Federal Department for Statistics the number of recorded mental health patients has doubled between 1990 and 2010. Hence, it appears relevant to identify possible health promotion strategies in future academics as these people will be in higher management positions and might be able to influence companies' health policies. In this context PA could play a major role and therefore is subject of this study.

Considering the presented evidence it seems necessary to investigate the difference between real time recorded PA and reported PA using a standardised questionnaire as well as identifying any correlation between different aspects of health and PA.
Methods
The participants in this study were all sport science students of the Chemnitz University of Technology. 15 males and females were included met the inclusion criteria (9♂, 6♀). All students performed a basic fitness assessment, carried an accelerometer for a week while keeping a daily PA log as well as filling out standardised questionnaire as part of the “Students’ Health Survey”. Their average age was 25.53 years with a BMI of 21.85. 6 subjects did recreational sports and 9 were involved in competitive sports. All students gave their written consent and had a thorough briefing on the use of the equipment.

Subjects
Anthropometric Data of the 15 Subjects

<table>
<thead>
<tr>
<th>Age [years]</th>
<th>Weight [kg]</th>
<th>Height [cm]</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>25,53</td>
<td>64,24</td>
<td>171,0</td>
<td>21,85</td>
</tr>
<tr>
<td>SD 2,066</td>
<td>12,02</td>
<td>9,043</td>
<td>2,55</td>
</tr>
<tr>
<td>min 19</td>
<td>46,0</td>
<td>155,0</td>
<td>17,30</td>
</tr>
<tr>
<td>max 27</td>
<td>87,2</td>
<td>188,0</td>
<td>26,30</td>
</tr>
</tbody>
</table>
Study Design

Equipment

Students’ Health Questionnaire
The questionnaire used items of the validated International Physical Activity Questionnaire, but also contained questions regarding mental health, diet and the general health status.

Exercise and PA Log
The exercise log used in this study was an open exercise diary with columns for time of day, type of exercise, duration, rate of perceived exertion (RPE) and heart rate (HR) where applicable. Data of 7 consecutive days was recorded.
Heart Rate Monitors
For heart rate data the Polar RS300X [POLAR, Kempele, Finland] was used. A beat to beat instrument with enough storage capacity for the duration of the study.

Accelerometer
For real time exercise/movement data collection the Running Sensor Polar S1 (accelerometer) [POLAR, Kempele, Finland] was used. The subjects attached it before leaving home in the morning and took it off before going to bed each day.

Statistics
Descriptive as well as inference statistical analysis was used with a significance threshold of alpha <0.05.

Results
In the following exercise/PA data recorded by using the questionnaire is compared to data from the heart rate monitors, the accelerometer (distance and time), RPE and the exercise/activity log. Each question of the Students’ Health Survey is presented at the start followed by real time recorded data and then correlated at the end each result section.
Q: In the past 7 days on how many days did you do exercises to strengthen or tone your muscles, such as push-ups, sit-ups, or weight lifting?

The subjects did 2.06 days less strength training during the real time recording [7 days] compared to the answers in the questionnaire.

Strength Training - Correlation after Pearson:
Days Strength Train. Questionnaire and Days Strength Train. Recorded = 0.381; Significance 2-sided 0.161

Q: During the last 7 days, on how many days did you do vigorous physical activities?
The subjects exercised 0.67 days less vigorously in the recorded measurement than in the questionnaire.

Vigorous Exercise - Correlation after Pearson:
Days Vigorous Exercise Questionnaire and Days Vigorous Exercise Recorded = 0.22; Significance 2-sided 0.937

Q: How much time did you usually spend doing vigorous physical activities on one of those days

The average time of vigorous exercise is 11.62 min longer in the questionnaire than recorded using HR, RPE and the activity log book.

Time Vigorous Exercise - Correlation after Pearson:
Time Vigorous Exercise Questionnaire and Time Vigorous Exercise Recorded = 0.477; Significance 2-sided 0.100
Q: During the last 7 days, on how many days did you do moderate physical activities

![Bar chart showing days of moderate exercise](chart1.png)

The actually recorded moderate p.a. is 0.46 days more than in the questionnaire.

Days Moderate Exercise - Correlation after Pearson:

Days Moderate Exercise Questionnaire and Days Moderate Exercise Recorded = 0.213; Significance 2-sided 0.445

Q: How much time did you usually spend doing moderate physical activities on one of those days?

![Bar chart showing minutes spent](chart2.png)
The recorded time of moderate activity over 7 days was 41.34 mins. less than in the questionnaire.

Time Moderate Exercise - Correlation after Pearson:
Time Moderate Exercise Questionnaire and Time Moderate Exercise Recorded = 0.265; Significance 2-sided 0.360

Q: During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

The recorded number of days in which the subjects walked more than 10 min. continuously is 3 days less than in the questionnaire.

Days Walking > 10 min. - Correlation after Pearson:
Days Walking Questionnaire and Days Walking Recorded = 0.248; Significance 2-sided 0.372
Q: How much time did you usually spend walking on one of those days?

The recorded time walking/day is 69.21 minutes less than in the questionnaire.

Time Walking - Correlation after Pearson:

Time Walking Questionnaire and Time Walking Recorded = 0.280;
Significance 2-sided 0.355

Conclusions

Using questionnaires to measure physical activity and/or exercise appears to be the most practical and cost efficient method at present for larger scale studies. There is sufficient evidence in the area of nutrition and dietary questionnaires to prove that subjects tend to under-report. This is probably due to the public awareness of a healthy lifestyle advocated by government agencies and the media. The same applies to exercise and physical activity. However, in this case we face the opposite problem a chronic over-reporting for the same reasons. This was also shown by the presented data - except for the question asking for days/week of moderate physical activity, there was an over-reporting of frequency and duration of all other physical activity and exercise.
This over-reporting plays the same role as the frequent under-reporting in nutrition/dietary related questionnaires and can therefore be considered a systematic error and needs to be investigated further. As the Students’ Health Survey used items of the widely accepted IPAQ this information should be considered in future studies. The next step in this project is to analyse the data referring to the health status of students and correlating it to their physical activity and exercise behaviour.

References

UNDERSTANDING THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND SELF-ESTEEM.

Thomas Davenport, University of Gloucestershire.

Introduction

The rationale for encouraging young people to participate in regular physical activity (PA) is evident when the many documented health benefits are considered (DoH, 2004). Despite these advantages, the Chief Medical Officer for the Department of Health identified that the current recommendation for children and young people, at least 60 minutes of moderate intensity activity per day, is not being met and that children and young people should be more active (DoH, 2004). The Health Survey for England (Craig & Shelton, 2008) found that the majority of children and young people participate in some kind of PA five days a week, 28% of boys and 37% of girls fail to meet the recommendations. This insufficient level of PA puts more emphasis on the importance of school physical education (PE). The British government recognised this and introduced the PE and Sports Strategy for Young People (Youth Sport Trust, 2009), which aims to provide 5 hour hours of high quality PA for all young people. This provision for PE and PA is an excellent step but does not ensure participation, therefore it is essential that the PA motivates and engages young people to participate in regular and long term PA.

Physical activity (PA) has been linked consistently with enhanced self-esteem (SE) in children and adolescents (Altinas & Asci, 2008; Ekeland et al., 2005; Schmalz et al., 2007). However, less attention has been paid to the mechanisms behind this influence; research has predominantly described the relationship rather than explaining it. Questions are raised within the research literature about how PA interventions relate to the specific participant group (Cale & Harris, 2006). Therefore, any programme designed to increase PA and adherence must be designed specifically for the target group and their particular needs. This project investigated the effect of a targeted programme of PA on the SE of a group of year 10 pupils who are disengaged from PE?
Methods

An action research methodology, a ‘participative method of research that both seeks to gain more knowledge and aims to change people’s lives and circumstances for the better’ (Waterman, 2007, p.133), was considered most appropriate. Action research is. This approach was adopted because it is concerned with stimulating change in the lives of the participants, rather than accounting for states of affairs as they exist currently; it was considered important in this project to attempt to influence the participants’ attitudes towards PA and their SE, rather than simply measure them. Action research can be explained as a cyclical process, involving evaluation, action and reflection (Gilbourne & Richardson, 2005).

This project was part of on-going research and builds on previous findings (Law, Hill & Matthews, 2008). In the preceding study, a cohort of year nine pupils from Heywood Community School completed inventories administered by the PE staff to establish self-esteem and physical activity levels. The inventories were a combination of the Physical Self-Description Questionnaire (PDSQ) (Marsh, 1996) and the Global Self-Esteem Scale (Rosenberg, 1965). These have both been validated and tested for generalisability for use with adolescents (Hagborg, 2006; Marsh, 1997). From these tests, 20 pupils were purposively selected on the basis of their low levels of reported SE and PA. Of these 20, thirteen agreed to take part ($n=13$, $m=4$, $f=9$). On the morning of the first

<table>
<thead>
<tr>
<th>Week</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity Day</td>
<td>Mon 0930-1230</td>
<td>Canoeing</td>
</tr>
<tr>
<td></td>
<td>1330-1630</td>
<td>Climbing</td>
</tr>
<tr>
<td>Week 1</td>
<td>Mon 0840-0940</td>
<td>Touch Rugby</td>
</tr>
<tr>
<td></td>
<td>1300-1340</td>
<td>Dance</td>
</tr>
<tr>
<td></td>
<td>Weekend</td>
<td>Walking</td>
</tr>
<tr>
<td>Week 2</td>
<td>Mon 0840-0940</td>
<td>Body Combat</td>
</tr>
<tr>
<td></td>
<td>1300-1340</td>
<td>Dance</td>
</tr>
<tr>
<td></td>
<td>Weekend</td>
<td>Walking</td>
</tr>
<tr>
<td>Week 3</td>
<td>Mon 0840-0940</td>
<td>Walking</td>
</tr>
<tr>
<td></td>
<td>1300-1340</td>
<td>Dance</td>
</tr>
<tr>
<td></td>
<td>Weekend</td>
<td>Walking</td>
</tr>
<tr>
<td>Week 4</td>
<td>Mon 0840-0940</td>
<td>Body Combat</td>
</tr>
<tr>
<td></td>
<td>1300-1340</td>
<td>Dance</td>
</tr>
<tr>
<td></td>
<td>Weekend</td>
<td>Walking</td>
</tr>
<tr>
<td>Week 5</td>
<td>Mon 0840-0940</td>
<td>Trampolining</td>
</tr>
<tr>
<td></td>
<td>1300-1340</td>
<td>Dance</td>
</tr>
<tr>
<td></td>
<td>Weekend</td>
<td>Walking</td>
</tr>
<tr>
<td>Week 6</td>
<td>Mon 0840-0940</td>
<td>Badminton</td>
</tr>
<tr>
<td></td>
<td>1300-1340</td>
<td>Dance</td>
</tr>
<tr>
<td></td>
<td>Weekend</td>
<td>Walking</td>
</tr>
</tbody>
</table>

Figure 1: The targeted PA programme
session four of the participants decided to opt out of the project, which left a
participant group of nine ($n=1$, $f=8$) who remained for the entirety of the
project.

The PA programme was designed as a result of an informal discussion with
the participant group. This involved discussion regarding what the
participants expected of the programme, the type of activities they wanted to
see in the programme and the type of activities they did not want to take part
in. The information and opinions collected were used to directly inform the
design of the programme.

The programme was designed to take place over a seven week period during
an hour long timetabled PE lesson and one lunch time (See figure 1). Each
participant was also given a pedometer, with a goal of 10,000 steps, to
encourage walking over the weekend. There was also a day trip to an outdoor
education centre incorporated into the programme.

The sessions in the PA programme were delivered in a simple manner, with
skills being broken down into small parts and with positive feedback given to
each participant throughout each session. For example, the rugby session
included a variety of basic skills delivered very simply by the coach. Once the
participants had grasped the skill and succeeded, the coach moved on to a new
skill, and by the end of the session the group had performed successfully at
least four new skills. This was to promote a perception of success,
competence and mastery throughout the programme in an attempt to impact
the SE of the participants.

Data was collected from a number of different sources during the research
process. Following each session the researcher completed a short evaluation
with the participants. This was ensured that the programme remained targeted
to the specific needs of the participants throughout. A number of small
changes were made to the programme as a result of these discussions, for
example, the trampolining session was replaced by boxing and the
participants enjoyed this session so the badminton session was also replaced
with boxing.

During the programme all participants were asked to fill out a log of the PA
they perform each week in a PA diary, which was an adaptation of the PAR
(Previous Day Physical Activity Recall) (Ward et al., 2007, pp. 235-238). The
lead researcher attended all sessions and completed a research diary containing any information deemed appropriate. Notes were taken during the session evaluations, which will also contribute to the data set.

Following the completion of the programme, individual interviews were conducted with each participant to assess their attitudes and experiences to PA, PE, and their SE. These interviews lasted between eight and twenty minutes and took place within two weeks of the PA programme finishing. The individual interviews enabled participants to reflect on their experiences of the programme, but also to share their thoughts, on a more personal level, on their general perceptions of PA and their SE. The interviews raised led to detailed conversation with some of the participants, while with others the interviews were very short with little discussion of important topics. As a result, a follow up focus group was undertaken three weeks following the completion of the PA programme. The interviews and focus group were recorded using a digital voice recorder and transcribed verbatim. Inductive content analysis was used to analyse the variety of data sets. The computer package NVivo 8 was used to assist the analysis of the qualitative data.

Results
The results showed that the targeted programme of PA had a positive impact on the SE of the participant group. The participants suggested that the intervention had made them evaluate themselves more positively. For example, participant 5 reported that the programme made her “feel good about myself”, participant 4 explained that, “I feel happier about myself” and participant 1 discussed that the programme has made her “feel proud, like I’d achieved something”. SE is an evaluation of oneself; therefore, this increase in positive evaluations demonstrates an increase in SE.

This positive impact on SE was thought to occur because the PA programme influenced their feelings of competence and self-worth. The programme was designed to maximise perceptions of competence and the participants reported experiencing competence repeatedly during the PA programme; they often referred to this as “being able to do it. Participant 5 explained that, “I always felt like I was really able to do it, there was never any reason why I couldn’t”. Participant 1 discussed how the sessions gave her a perception of competence,
We could do it, it was just doing it...when we did it we found out that we could do it...it makes me think that I shouldn’t say no to it anymore, I should just go for it.

Following the programme, the participants suggested that their feelings of self-worth had increased, and as a consequence their SE increased. Participant 9 explained that during the PA programme sessions he did not think about what he looked like, “I didn’t worry as much, I just got stuck in, I didn’t worry about being fat or what I was wearing” and participant 1 explained that during the sessions she “didn’t feel ugly”. The participants also reported that the experiences of success during the PA programme gave them reasons to feel proud and therefore place more value on themselves, “you felt like you’d achieved something...made me proud.” The participants also discussed that the activities made them feel good about themselves, which made them happier and evaluated themselves in a more positive way, “when we did that skipping it felt really good...we all came together and did it, afterwards I felt great, we left feeling better!”

Discussion

The influence on SE appeared to have been due to an increase in the participants’ feelings of competence. These feelings of competence made the participants perceive themselves as successful and as a result brought positive self-evaluations. Self-evaluations are a defining element of SE, so an increase in one’s self-evaluation will bring an increase in SE. This relationship between feelings of competence during the project and SE levels is the strongest theme in the data and is supported by a wide base of research (Crocker et al., 2003; Eidelman and Biernat, 2007; Fox, 2000; Mruk, 2006). This supports the findings of Eidelman and Biernat (2007:p759) who found that increased success brought increased SE by “augmenting” perceptions of competence. These findings also support Mruk (2006: p14), who examined the evidence behind competence as an influential component of SE, suggesting that mastery of tasks brings feelings of effectiveness and “a sense of self-respect”, leading to positive SE.

As a result of the PA programme the participants’ feelings of self-worth were found to increase, which had a positive impact on their self-esteem. Their
self-worth increased because they were in a positive, supportive environment, unlike the environment they were in previously. The programme sessions were more informal than their normal PE lessons and this environment made them feel valued and worthwhile, which increased their feelings of self-worth, which therefore can be used to explain the positive impact upon SE. This has been reported elsewhere in the literature, Chionh and Fraser (2009) found that SE was more positive in adolescents who experienced more supportive school environments and Mruk (2006) confirmed that the way individuals value themselves influences their self-esteem. Having said this however, further research is needed to explain fully the influence of the environment upon self-worth and the influence of self-worth on SE. Further research is also required to investigate the causality of the relationship, it is unclear whether the it is the PA or the positive environment which brought the change, the changes may have occurred in other positive settings.

Conclusion

The PA programme was found to impact the participants’ SE. This was thought to occur through the participants experiencing success and mastery and therefore their perceptions of competence increased. The supportive and informal environment combined with their experiences of success made them feel comfortable and increased the value they place on themselves, increasing their self-worth.

These findings have a number of implications for practise. The influence of perceptions of competence, mastery and success has significant implications for PE teachers, PA deliverers, and those in the wider education system, as this study has demonstrated the importance to promote situations in which pupils will experience mastery and success, and feel competent in order to bolster and maintain SE. Teachers should attempt to promote a positive, supportive environment in school in order to enhance the self-worth and SE of all their adolescent pupils.

References


**Comparison of Physiological Parameters in Cross-Country Skiing and Running in Consideration of Distance and Time**

Peter R. Wright, Jim Clough, Henry Schulz

**Introduction**

This study was a result of the Second Joint Research Conference in Chemnitz in 2009. Representatives of both institutions – the University of Gloucestershire and the Chemnitz University of Technology agreed to offer a teaching module in the following winter term that was research based and used the facilities specific to the universities. It was decided to use a research module for this purpose investigating the physiological and cognitive responses to cross-country skiing and running. This so called winter sport project was held in Oberwiesenthal/Ore Mountains (Saxony, Germany) in January 2010 and consisted of students and staff of both institutions.

Cross-country skiing is one of the biggest winter sports in many countries across the globe and has evolved rapidly in recent years. In spite of changes in technique and equipment in competitive sports, the fact that elite cross-country ski racers have some of the highest aerobic power values reported for endurance athletes has not changed and are competing in this parameter against other athletes, i.e. runners. Cross-country skiers are also comparably lean as long distance runners. The absolute bodyweight of the ski racer, however, is much more variable than that of distance runners (EISENMAN PA et al., 1989). An advantage for the heavy skier was indicated by BERGH and FORSBERG (1992) who found that heavy skiers are favoured, besides that other factors are more important than body mass for cross-country ski racing performance.

Therefore, it seems that there are similarities between running and cross-country skiing on the one hand, but also significant differences on the other hand. This is also reflected in the testing of skiing athletes who are still very often being assessed by their treadmill running performance. In this context LARSSON (2002) investigated which parameter corresponds best to performance during cross-country skiing and tested seven male and nine female cross-country skiers with treadmill running tests. This study
concluded that treadmill tests can be used for the prediction of performance in cross-country skiing. Further, various parameters from treadmill tests in men and women are best used as predictors of performance in cross-country skiing, especially blood lactate levels, especially the performance at 4 mmol/l. However, considering the expertise and/or opinion of some leading coaches and athletes these findings are strongly contradicted as running uses less muscle mass at a lower work intensity than cross-country skiing and doesn’t account for the relatively complex technique.

This study therefore investigated the different physiological and cognitive effects of cross-country skiing (Classic style) vs. running in beginners and experienced skiers - specifically considering heart rate (HR), blood lactate levels (Lac), perceived exertion (RPE) and spirometry data as well as concentration and awareness performance pre and post the specific type of exercise. This article only presents HR, Lac and RPE data.

**Methods**

**COHORT**

18 students and staff of the University of Gloucestershire (GL) and the Chemnitz University of Technology (CUT) were included in the study. The cohort consisted of 3 female and 15 male subjects of whom 2 did not participate in the incremental running test. These drop outs were due to illness. Hence, the presented data only refers to 16 subjects. The average age was 24 with a minimum of 20 and a maximum of 39. The number of beginners and experienced skiers was evenly distributed, but still the cohort must be characterised as a heterogeneous group.
Table 1: Characteristics of the subjects

<table>
<thead>
<tr>
<th></th>
<th>Age [Years]</th>
<th>Body Weight [kg]</th>
<th>Height [cm]</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean value</td>
<td>24</td>
<td>71,18</td>
<td>175,26</td>
<td>23,09</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>5,34</td>
<td>11,05</td>
<td>7,45</td>
<td>2,53</td>
</tr>
<tr>
<td>Min.</td>
<td>20</td>
<td>50,00</td>
<td>161</td>
<td>18,37</td>
</tr>
<tr>
<td>Max.</td>
<td>39</td>
<td>96,00</td>
<td>187</td>
<td>27,73</td>
</tr>
</tbody>
</table>

STUDY DESIGN

Fig. 1: Schematic study design
The following tests were conducted: an anamneses questionnaire, a sports specific questionnaire, an incremental cross-country skiing test (Oberwiesenthal, Ore Mountains, Germany) in the Centre of Excellence stadium and an incremental running test (Chemnitz, Germany) in the sports halls of the CUT.

EXPERIMENTAL PROCEDURES

Questionnaires

The health questionnaire was a general anamneses identifying any health related aspects which could possibly put the subjects at risk and/or influence their performance. The sports specific questionnaire covered aspects of main sports, training frequency and duration, performance levels and a self assessment of the cross-country experience and performance level. It also asked for the subjects’ experience in any related sports such as roller skating, Nordic blading, Nordic walking etc.

Cross-Country Skiing Incremental Test

The incremental cross-country skiing test was conducted in Oberwiesenthal during the period of 11.01.2010 to 15.01.2010. All subjects had to cover two days of cross-country skiing instructions and/or a skiing accustoming phase over the same duration if they were already experienced skiers. The subjects were instructed to use the classic style - although at higher speed levels, when it is almost impossible to keep up the pace using this technique, they were allowed to perform the double pole technique.

The test location was the stadium of the Centre of Excellence Chemitz/Dresden in Oberwiesenthal on a 200m track with pylons as markers every 25 meters (see Fig. 2) and an acoustic signal pacing the subjects. The test started at 2 m/s and was increase by 0.4 m/s every 5 minutes until exertion and/or not being able to keep up with the acoustic signals for whatever reason. Heart rate data was monitored throughout the test, blood lactate and RPE values were taken during a 30 seconds break between each stage.
Fig. 2: Cross-country skiing course with pylons and testing station in Oberwiesenthal/Ore Mountains

Incremental Running Test
This test was conducted in the sports hall facilities of the TUC in Chemnitz on 16.01.2010. on a 100m round track and therefore offered similar challenges as the 200m track on skis considering the curves. This was necessary to produce comparable results. The same test specifications were applied as in the skiing test: stage duration 5 minutes, speed increase per stage 0.4 m/s and 30 second breaks in between stages allowing for taking RPE values and blood lactate.

EQUIPMENT

Skis
The same types of skis were used in all skiing tests – FISCHER fish scale skis.

Heart Rate Monitors
The Polar Rs 400 heart rate monitor (POLAR, 90440 Kempele, Finland) continuously collecting HR data as beats per minute.

Lactate Diagnostics
For analysing the 20µl capillary blood samples for lactate levels the BIOSEN C- Line lactate analyser (EKF- diagnostic, 39179 Barleben/ Magdeburg, Deutschland) was used.
Rate of Perceived Exertion (RPE) Scale
The BORG 6 to 20 RPE scale was used to measure the perceived exertion of the subjects after each stage in both tests. A familiarisation with the RPE scale took place during the previous skiing sessions.

STATISTICS
The data was analysed using Microsoft Office Excel 2007 for descriptive analysis and SPSS for inference statistical analysis with a significance threshold of alpha <0.05.

Results
Comparison of Blood Lactate Concentrations in Cross-country Skiing and Running
Both graphs show the continuous increase of blood lactate in cross-country skiing (x skiing) and running. The maximal values in x-skiing are slightly higher than in running, but not significantly (p> 0.05). However, the speed at these lactate levels is significantly different: 2,82 m/s with a lactate concentration of 8,97 mmol/l in X-skiing vs. 3,81 m/s at 8,81 mmol/l lactate in running. This is 0.9 m/s faster than in x-skiing.

Fig. 3: Comparison of lactate concentrations in cross-country skiing and running at the same speed
Comparison of RPE Values in the Incremental Cross-country Skiing vs. Running Test

The RPE values show that there is a more rapid increase in perceived exertion in x-skiing than in running, i.e. at a speed of 2.82 m/s a value of 19 is found while in running there is a more linear increase and the same RPE value is found at a speed of 3.81 m/s. Also, comparing the perceived exertion at the same speed of 2.5 m/s a significant difference is found with 16 during x-skiing vs. 11 during running in the same subjects. Fig. 3: Comparison of lactate concentrations in cross-country skiing and running at the same speed.

Fig. 4: Comparison of RPE values in the incremental cross-country skiing test vs. running at the same speed
Comparison of Heart Rate values in Cross-Country Skiing vs. Running

In x-skiing a temporary drop of HR can be seen from 167 down to 159 before increasing again. The maximal HR achieved in both types of exercise are the same with 190 in x-skiing and 191 in running. There is a significant difference in speed though with 3.81 in the last stage of the running test vs. 2.82 in the skiing test. There are significant differences considering the HR at different speed stages throughout the two tests, i.e. at a speed of 2.5 m/s a difference of 24bpm is demonstrated (151 running vs. 175 x-skiing).

Fig. 5: Comparison of Heart Rate values in Cross-Country Skiing vs. Running at the same Speed
Blood Lactate Concentration in Relation to Heart Rate in Cross-country Skiing and Running

In x-skiing the blood lactate levels increase more rapidly than in running, i.e. at a HR of 170 the lactate concentration is ca. 3.5 mmol/l, at 185 already 7.2 mmol/l. However, the overall difference is not significant and at a HR of 160 the subjects show the same blood lactate levels. An exception is the lactate concentration at a HR of 179 where a significantly higher lactate level is found with 5.5 mmol/l vs. only 4.28 mmol/l in running. Towards the end similar blood lactate concentration are seen.

Fig. 6: Blood Lactate concentration in relation to heart rate in cross-country skiing vs. running
Conclusions

Before deriving any conclusions it needs to be emphasised that the environmental temperatures under which the incremental cross-country skiing tests and the running tests were conducted differed significantly and are specific to the type of exercise, but this obviously must have had an effect on some physiological parameters i.e. blood lactate. The average temperature during the skiing tests was between -10°C and -15°C while during the running tests in the sports hall it was +16°C – a difference of up to 31°C.

In conclusion, the perceived exertion in x-skiing was significantly higher than in running. The most likely reasons for this is the higher muscular work intensity of the upper body and the severe environmental conditions as a higher respiratory stress caused by the cold and dry air. The difference from one stage to the next during the x-skiing test was up to 5 points on the RPE scale. Although at maximal speed in both exercises the same values were achieved. The heart rate showed a significant difference in both exercises at the same speed with higher values in x-skiing. However, peak values were the same. Also, the maximal speed achieved was significantly higher in running with 3.81 m/s vs. 2.82 m/s in x-skiing. This might not only be due to the type of exercise, but also the heterogeneous cohort with a high number of beginners who struggled with the skiing technique at higher speed levels. The fact that the classic style technique was used also contributes to this result as it is comparatively slower than the widely used skating technique. This also applies to the blood lactate concentrations that were similarly high in both types of exercise with >8mmol/l at maximal level. However, higher levels in x-skiing could be expected as 80-90% of body musculature is actively used during this exercise compared to 60% in running (HEMMERSBACH A & FRANKE S, 2008). This is confirmed by other studies that tested competitive cross-country (ZORY R et al., 2009; STÖGGL TL., MÜLLER E, 2009).

The presented data with respect to findings of other studies (VERGES S, 2006) emphasises the importance of exercise specific testing in order to...
assess the effect of specific training programmes, but also proves that cross-country skiing is a physiologically effective and health oriented type of exercise for most populations – the only exception might be beginners with cardiac and/or respiratory conditions as cross-country skiing seems to cause significantly higher cardio-respiratory stress at slower speeds compared to running.

References

Introduction

The Project “Entdecke deine Stärken”¹ (EDS) was initiated by the DFB (German Football Association) the DOSB (German Olympic Sports Confederation) and the government of the free state of Saxony. The Main goal of this project is an implementation of additional physical activity in primary school which is realized by a so called ‘Bewegungstrainer’², ³. The University of Technology of Chemnitz was assigned for scientific accompaniment to examine the possible effects caused by additional lessons in physical activity and to evaluate the trainers’ procedure. Finally conclusion should be drawn from the results concerning a possible benefiting of the children's physical activity level from an extra training and regarding a derivation of specific (maybe updated) recommendations for designing effective sport lessons.

The following Important requirements in order to carry out this study are:

Recommendation for primary schools of integrating the additional physical activity program.

Supporting the education of more than 150 trainers.

Development of a trainers’ guideline concerning the implementation of extra physical activity lessons within school.

¹This term can be translated as “Discover your strengths”.

² ‘Bewegungstrainer’ can decide on their own what kind of physical activity they realize within their extra lessons. In addition to that the implementation of extra training differs from school to school. So either it is up to the pupil's decision whether they want to take part in or the head of school implement the extra lesson within their schedule, so all pupils have to participate.

³ In this article the terms ‘Bewegungstrainer’ and trainer are used synonymously.
This article will mainly focus on the presentation of the results concerning the effectiveness of additional physical activity. Therefore the subjects and methods of this study will be outlined in the next chapter, followed by the presentation of the results (chapter 3). The last chapter implies a discussion and conclusion of the study's results as well as an exposition of future research possibilities.

**Subjects and methods**

Fundamentally, the study is based on the following four main research questions:

- How is the physical ability level of primary school pupils in Saxony in general?
- How do the schools and the trainers realize recommendations for the additional physical activity lessons?
- How do pupils develop their motor skills with and without additional physical activity within EDS program?
- What role plays the social setting in regard to the physical activity of primary school children?

The data base consists of 15 schools applied as stratified random sample (Tenenbaum/Driscoll 2005). Then, within the schools the whole population was surveyed. The german motor skills test (DMT developed by Bös et al. 2009) was used as measuring instrument for examining physical activity. As the study was applied as a panel design the first measuring took place in September 2008 at the beginning and the second in June 2009 at the end of the school year. During this period of time the trainers gave their physical activity lesson. For comparative analysing, the program was implemented in 14 schools as one school functions as control group. The test battery of the DMT consists of the following eight exercises examining the essential dimensions of physical activity such as speed, strength, flexibility, coordination and endurance:

- 20-meter sprint (speed)

---

4 The stratification depends on the existence of a trainer (except one school) at the school, the five regions based on the five regional school offices in Saxony which were still current at this time and the dimension of the township.
- press-ups in 40 sec. (strength endurance)
- sit-ups in 40 sec. (strength endurance)
- standing long jump (speed-strength)
- side hopping for 15 sec. (coordination under time pressure)
- balancing backwards (coordination under precision pressure)
- stand and reach (flexibility)
- 20m shuttle run for testing the maximal aerobic power replaced the 6 minutes run used in the DMT because of an economically and practicably appliance in the coliseums (Mechelen et al. 1986).

In addition to that constitutional parameters like height, weight, body mass index (BMI), gender and age were determined, too.

Table 1: Sample

<table>
<thead>
<tr>
<th>Sample</th>
<th>School year 1</th>
<th>School year 2</th>
<th>School year 3</th>
<th>School year 4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
</tr>
<tr>
<td>APA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>59 11,3</td>
<td>73 14,0</td>
<td>63 12,1</td>
<td>58 11,1</td>
<td>253 48,5</td>
</tr>
<tr>
<td>F</td>
<td>69 13,2</td>
<td>77 14,8</td>
<td>64 12,3</td>
<td>59 11,3</td>
<td>269 51,5</td>
</tr>
<tr>
<td>Total</td>
<td>128 24,5</td>
<td>150 28,7</td>
<td>127 24,3</td>
<td>117 22,4</td>
<td>522 100</td>
</tr>
<tr>
<td>No APA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>68 12,1</td>
<td>73 12,9</td>
<td>71 12,6</td>
<td>69 12,2</td>
<td>276 48,9</td>
</tr>
<tr>
<td>F</td>
<td>63 11,2</td>
<td>73 12,9</td>
<td>71 12,6</td>
<td>69 12,2</td>
<td>276 48,9</td>
</tr>
<tr>
<td>Total</td>
<td>131 23,2</td>
<td>155 27,5</td>
<td>141 25,0</td>
<td>137 24,3</td>
<td>564 100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>APA</th>
<th>Additional Physical Activity</th>
<th>M</th>
<th>Male</th>
<th>F</th>
<th>Female</th>
</tr>
</thead>
</table>

5 The classification of the pupils into the school year category is not an empirical one. Furthermore it depends on their date of birth and the school year they’re supposed to be in because of their age. This step was necessary for comparing both times of measurement because the time period between both tests was not exactly twelve months, so some pupils didn’t reach the next age level and had the same age in both times of measurement. An advantage for using the school year category is an easier understandable presentation of this topic.
For examining the effects of additional physical activity it was necessary to identify whether a pupil belongs to the intervention or control group. For this reason the original data set had to be reduced to nine schools (N=1086), because only in these schools the pupils could certainly be allocated either to the intervention (N=522) or control group (N=564). Reasons for excluding cases from the data set were e.g. a voluntarily and changing participation every week, a lack of information concerning a clearly allocation to one group or the schools couldn't offer an extra lesson throughout the whole school year. An overview of the sample's structure is shown in table 1.

Another essential part of this study in order to evaluate the effectiveness of additional physical activity is the identification of general conditions for an implementation as well as the lessons' contents. Basically only general recommendations were given and so the realization of the extra lessons differs from trainer to trainer. Therefore interviews about contents and general conditions of their training had to be conducted. Content analysis was used as science method for analysing these interviews (Mayring 2003).

Results

The main goal of this study is the examination of effectiveness of additional physical activity. Therefore a separately analyse of each exercise enables a closer view over the work of the trainer's which makes it possible to explore if the extra training have only effects on certain factors of physical activity or even on the motor skills level in general. In order to examine the effectiveness the development in each exercise between intervention and control group was compared. Values representing the development are expressed by the difference of the testing results from the second to the first time of measurement. Thereby a distinction between pupils with abilities and disabilities in physical activity can be disregarded, because the development already relates the testing results in both times of measurements. Accordingly the extent of change throughout the year is the dependent variable. But basically it has to be assumed, too, that all children

6In the following pupils who took part in extra additional physical activity lessons will be regarded as intervention group, while the other pupils are considered as the control group.
– independently from their general motor skills level – have equal potentials in developing their abilities.

In order to prevent statistical bias caused by age or gender, both variables were tested in regard to group differences. As a result from this, each school year have to be examined separately for all exercises. For additional significant differences between gender groups, the development was separately analysed, too.

Table 2: Exercises’ development in reference to school year and gender

<table>
<thead>
<tr>
<th>Development</th>
<th>School year 1</th>
<th>School year 2</th>
<th>School year 3</th>
<th>School year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>APA</td>
<td>APA</td>
<td>APA</td>
<td>APA</td>
</tr>
<tr>
<td>Press- ups</td>
<td>3.75</td>
<td>2.15</td>
<td>1.77</td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td>No APA</td>
<td>3.25</td>
<td>2.45</td>
<td>0.99</td>
</tr>
<tr>
<td>Sit-ups</td>
<td>4.21*</td>
<td>4.51</td>
<td>2.37</td>
<td>1.66</td>
</tr>
<tr>
<td></td>
<td>No APA</td>
<td>6.28*</td>
<td>3.93</td>
<td>2.29</td>
</tr>
<tr>
<td>Side hopping</td>
<td>0.60</td>
<td>1.22*</td>
<td>1.04</td>
<td>M 1.23</td>
</tr>
<tr>
<td></td>
<td>No APA</td>
<td>1.18</td>
<td>0.67*</td>
<td>M 0.92</td>
</tr>
<tr>
<td>Balancing backwards</td>
<td>7.47</td>
<td>8.07*</td>
<td>6.22*</td>
<td>6.53*</td>
</tr>
<tr>
<td></td>
<td>No APA</td>
<td>7.59</td>
<td>5.40*</td>
<td>4.27*</td>
</tr>
<tr>
<td>Stand &amp;</td>
<td>1.63*</td>
<td>-0.01</td>
<td>0.40*</td>
<td>-0.17</td>
</tr>
</tbody>
</table>
Table 2 shows the results of group differences for the intervention group in comparison to the control group. Table fields on a white background represent no significant differences between both groups, as a light-grey background symbolizes a significant advantage for the intervention group and the ones in dark-grey show a significant higher development of the control group. On the whole no general conclusions can be drawn in regard to the motor skills level from these results. Therefore a closer look on the single results is necessary. Considering the exercises press-ups and shuttlerun no significant mean differences between both groups are detected. So it can be concluded that the additional physical activity has no effects on these exercises. Results for balancing backwards, 20-meter sprint, stand and reach and side hopping are different from the ones before. A definitely effect of additional physical activity is remarkable for balancing backwards throughout all school years except the first one (school

<table>
<thead>
<tr>
<th>Exercise</th>
<th>No APA</th>
<th>APA</th>
<th>M</th>
<th>5,23</th>
<th>6,38</th>
<th>6,75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reach</td>
<td></td>
<td>0,14*</td>
<td>-0,53</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing long jump</td>
<td>No APA</td>
<td>M 11,96</td>
<td>13,06</td>
<td>7,68</td>
<td>3,26</td>
<td>6,73</td>
</tr>
<tr>
<td></td>
<td>APA</td>
<td>F 4,90*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No APA</td>
<td>F 11,83*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shuttlrun</td>
<td>No APA</td>
<td>0,49</td>
<td>0,25</td>
<td>0,43</td>
<td>0,27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>APA</td>
<td>0,44</td>
<td>0,09</td>
<td>0,25</td>
<td>-0,11</td>
<td></td>
</tr>
<tr>
<td>20-meter sprint</td>
<td>No APA</td>
<td>M 0,39</td>
<td>0,24</td>
<td>0,24*</td>
<td>0,20*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>APA</td>
<td>F 0,31</td>
<td>0,20</td>
<td>0,13*</td>
<td>0,13*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No APA</td>
<td>M 0,35</td>
<td>0,20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F 0,26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0,05
year 2: p=0.006; d=0.31; school year 3: p=0.038; d=0.25; school year 4: p=0.006; d=0.34). Besides this, significant changes within 20-meter sprint in the third (p=0.001; d=0.43) and fourth school year (p=0.047; d=0.25) can be observed in the way that pupils taking part in extra sport lessons improve their skills on a higher level than the pupils of the control group. In side hopping intervention and control group differ only significantly in the second school year (p=0.042; d=0.24) as the remaining age groups show no significant differences.

A descriptive comparison of the mean values for the development in stand and reach mainly shows advantages for the intervention group. Although there are significant differences detected for the first (p=0.006; d=0.34) and third school year (p=0.002; d=0.38), it isn't accompanied by consequently achieving higher testing results. Indeed the children especially in the control group (except for the first school year) show negative developments. Apparently, additional sport lesson can at least prevent a greater decrease in performance, although it hasn’t clearly positive effects on the development. The results in standing long jump and sit-ups for the first school year have opposite effects. As children without additional physical activity can significantly increase their performance (p=0.001; d=0.51) only the girls of the intervention group have significant disadvantages within their development in standing long jump (p=0.005; d=0.51). But an explanation for these results - especially the girls' poor development for standing long jump in the intervention group - can't be given at the moment.

In conclusion, the results in this study show that additional physical activity has significant effect on the development over this period of time only for specific exercises (especially balancing backwards, stand and reach and 20-meter sprint). Nevertheless conclusion in reference to the general level of physical activity can't be drawn, because additional physical activity has no effects (press-ups; shuttlerun) or even negative ones (sit-ups; standing long jump) on several performance developments.

\(^7\) In addition to the significance level the effect size is given, too. Values up to 0.20 represent small, values up to 0.50 average effects and values above 0.8 huge affects (Bortz/Döring 2006:606).
Discussion and conclusion

Results of this study show that continuous positive effect of additional physical activity throughout all age groups and testing exercises can't be detected. But if extra training causes a significantly better development the testing exercises are mainly determined by coordinative-dominated aspects. An explanation for this can either be seen in the education of the trainer, which was focused on training the children's coordinative skills, or otherwise a possible reason can be seen in the assumption of a faster adaptation reaction of the coordinative system in comparison to the endurance dimension. Accordingly, a further investigation should provide more precise information on this issue. In addition to that some critical and problematic aspects concerning the selection of the children as intervention group and the implementation of the extra lessons have to be considered. So it has to be pointed out that the children are not randomly allocated to the intervention group because this depends on the possibilities the schools had in implementing the program. On the one hand schools could offer extra training for all pupils in the kind of an official extra sport lesson or on the other hand only a part of the schools' population could take part whereby the decision for participation lies either with the children themselves or with the parents/teacher. Another critical fact besides the different conditions of participation is the different timeframe for realizing extra lessons, e.g. children had the possibilities to train once per week or it could only be offered once in every two weeks. An additional fact which has to be considered is the setting of priorities by the trainers on specific aspects of physical activity within their lessons which are based on the abilities and disabilities of the children. So it can be assumed that the training itself differs from school to school.

Due to the fact that general conclusions upon the effects of additional physical activity on the motor skills level can't be drawn and the identification of confounding variables a further research is planned. Therefore the sample should be reduced in order to ensure equal general conditions for implementing the additional physical activity.
References

Students of higher education institutions (HEIs) do not only have to deal with the stress of academia, they must also contend with various life stress such as developing their independence, and separation from parents (Oxington, 2005). Students’ health is an important issue, because they are a significant proportion of young adults and more research is needed on effective health education and health promotion programmes for HEIs (WHO Regional Office of Europe, 1998). Musaiger (2004) indicated that there is a lack of quantitative and qualitative research and recommended that effective action be developed. It is necessary to research more fully factors contributing to the occurrence of student’s health problems in the Eastern Mediterranean Region.

Mental health disorders are common and can significantly affect people in their relationships, work, and quality of life (University of De Montfort, 2007). Mental health is linked to retention and academic performance, therefore university and college life can be stressful for many students and this stress can cause symptoms to develop or worsen (Ashton & Kamali, 1995; Backels & Wheeler, 2001). Coping with university work, working independently, exams, housing and money worries, can all impact on how people feel mentally, and lead to increased anxiety and depression (Benefield, 2006). Anxiety and depression are common challenges to students’ mental health (Inam et al., 2003; Wardle et al, 2004; Benefield, 2006; Rab et al, 2008). The UK Royal College of Psychiatrists suggested that students are 1.6 times more likely to experience symptoms of mental ill health than other young people (Harrison, 1999). In England one in four students will experience a mental health problem during their studies (National Statistics 2001). Also in Pakistan 43.7% of students reported anxiety and 19.5% depression (Rab et al., 2006). The proposed reasons for this include the pressure of work, assessment, relationship problems, money worries, drinking and drug use.
Previous studies found gender differences regarding anxiety and depression prevalence (Abdel-Khalek & Al-Ansari, 2004; Mackinaw-Koons & Vasey, 2000). However, to our knowledge, there is no study that has examined this in Libya. The purpose of this study is to assess the prevalence and investigate gender differences of anxiety and depression among HEI students in Libya, and their association with social factors such as accommodation during the semester, social support and monthly income.

**Methods**

The use of surveys among students has increased (Cheung et al., 2007; Malinauska et al., 2006; Stock et al., 2003), and questionnaires have been widely used for data collection. Anonymous questionnaires produce higher response rates among students, presumably because they find them impersonal and confidential (Oppenheim, 1992).

This study used a questionnaire which was designed in English and developed from previously published tools [e.g., the Social Support Questionnaire (Sarason et al., 1983); American College Health Association Survey 2005; National Health Interview Survey (USA) 2007; Students Health Survey WHO-2005]. The questionnaire was translated into Arabic; the translation was performed twice independently to check for inconsistencies.

**Data collection and analysis:** Based on previous studies (e.g. Chmara et al., 2007; Cheung et al., 2007; Abolfotouh et al., 2008), a random sample of volunteer undergraduate students from six universities (Al-Fateh, Garyounis, Omar El-Muktar, Sebha, Tahaddi and Seventh of October University) and three colleges (Higher Medical Technology Institute, Higher Industrial Technology Institute and Higher Computer Technology Institute) in Libya, from both urban and rural areas. Participants were also studying different disciplines (e.g. engineering, medicine, science and literature). The study was anonymous and data were collected over a period of 4 months (October 2008 -February 2009). Data were analysed using the SPSS version 16 software (e.g. descriptive statistics and logistical regression).
Results

Study Respondents: Out of 2100 distributed questionnaires, 1567 were returned from those students who attended lectures on the days of collection (74% response rate). 267 respondents were excluded because they had missing demographic data, analysis used data from 1300 completed questionnaires [males 439 (33.8%); 861 females (66.2%)]. The researcher speculates three main reasons for this: firstly, there has been an increase in the number of women wanting to follow careers outside the home. Secondly, educated women have better marriage prospects and thirdly, in the Arabic culture in Libya today, men are more likely to want to find employment than to continue their education. To date, however we are not able to substantiate these explanations. Respondents were aged between 18 -34 (mean = 20.9, SD = 2.37). Females were concentrated in the humanities and males in science, engineering and business faculties.

Accommodation during semester: Respondents were asked about their accommodation during THE semester. The majority of respondents (85%) reported living with their parents, whereas 13% lived in university/college accommodation, and just 2% were living alone.

Social support: About 66% of the whole sample reported being very satisfied with social support, 22% reported being somewhat satisfied, and only 12% of the total sample were dissatisfied with social support. There were no statistically significant differences with respect to gender.

Monthly income: About 75% of all students reported having sufficient income. However, there was a significant gender difference ($P = .000$) with more female students (77%) reporting sufficient income than males (65%).

Source of funding of studies: Three-quarters of students reported that they finance their studies by parental support, whereas just 9.2% of students reported having a job during the semester. Most students who supported their studies by a job during the semester were males.

Anxiety and depression: Overall, 8.8% of respondents reported anxiety and 4.3% depression. The prevalence of anxiety was higher among female than male students (9.5% and 7%, respectively), whereas for depression, the prevalence was higher among male students (4% and 5% respectively).

Table 2: Distribution of anxiety by gender.
### Anxiety

<table>
<thead>
<tr>
<th>Gender</th>
<th>Female-%</th>
<th>Male-%</th>
<th>Total-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>90.5</td>
<td>92.7</td>
<td>91.2</td>
</tr>
<tr>
<td>Yes</td>
<td>9.5</td>
<td>7.3</td>
<td>8.8</td>
</tr>
<tr>
<td>Total</td>
<td>861(100%)</td>
<td>439(100%)</td>
<td>1300 (100%)</td>
</tr>
</tbody>
</table>

### Depression

<table>
<thead>
<tr>
<th>Gender</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>96</td>
</tr>
<tr>
<td>Yes</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>861(100%)</td>
</tr>
</tbody>
</table>

Tables 3 & 4 show the effect of each independent variable on anxiety and depression. Only satisfaction with social support had a significant negative effect on anxiety and depression. None of the other independent variables show any significant effect.

**Table 3: Association between independent variables and anxiety.**

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>B</th>
<th>S.E</th>
<th>Wald</th>
<th>df</th>
<th>Sig</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>.167</td>
<td>.287</td>
<td>.339</td>
<td>1</td>
<td>NS</td>
<td>1.182</td>
</tr>
<tr>
<td>Age</td>
<td>.082</td>
<td>.060</td>
<td>1.898</td>
<td>1</td>
<td>NS</td>
<td>1.086</td>
</tr>
<tr>
<td>Year of study</td>
<td>-.007</td>
<td>.097</td>
<td>.005</td>
<td>1</td>
<td>NS</td>
<td>.993</td>
</tr>
<tr>
<td>Accommodation during semester</td>
<td>.083</td>
<td>.277</td>
<td>.090</td>
<td>1</td>
<td>NS</td>
<td>1.087</td>
</tr>
<tr>
<td>Monthly income</td>
<td>-.019</td>
<td>.150</td>
<td>.016</td>
<td>1</td>
<td>NS</td>
<td>.981</td>
</tr>
<tr>
<td>Satisfied with social support</td>
<td>-.516</td>
<td>.102</td>
<td>25.707</td>
<td>1</td>
<td>.000</td>
<td>.597</td>
</tr>
</tbody>
</table>

B = the coefficients. S.E = standard errors. Wald = the wald chi-square statistic. Sig = associated P-value. Exp (B) = odds ratio
Table 4: Association between independent variables and depression.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>B</th>
<th>S.E</th>
<th>Wald</th>
<th>df</th>
<th>Sig</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>-.362</td>
<td>.220</td>
<td>2.702</td>
<td>1</td>
<td>NS</td>
<td>.696</td>
</tr>
<tr>
<td>Age</td>
<td>.079</td>
<td>.044</td>
<td>3.183</td>
<td>1</td>
<td>NS</td>
<td>1.082</td>
</tr>
<tr>
<td>Year of study</td>
<td>-.046</td>
<td>.132</td>
<td>.119</td>
<td>1</td>
<td>NS</td>
<td>.993</td>
</tr>
<tr>
<td>Accommodation during semester</td>
<td>.013</td>
<td>.205</td>
<td>.004</td>
<td>1</td>
<td>NS</td>
<td>1.013</td>
</tr>
<tr>
<td>Monthly income</td>
<td>-.061</td>
<td>.108</td>
<td>.321</td>
<td>1</td>
<td>NS</td>
<td>.941</td>
</tr>
<tr>
<td>Satisfied with social support</td>
<td>-.226</td>
<td>.077</td>
<td>8.538</td>
<td>1</td>
<td>.003</td>
<td>.798</td>
</tr>
</tbody>
</table>

Discussion

The aim of these analyses was to assess the correlates of clinically diagnosed anxiety and depression among higher education students in Libya. The results showed that overall 8.8% of students reported anxiety and 4.3% depression. Our study also found a gender difference where female students on average had higher anxiety than male students (9.5% compared to 7%), but lower rates of depression (4% compared to 5%). These rates of anxiety and depression among HEI students in Libya are low when compared with students from England or USA (Stewart, 2001; Benefield, 2006; Inam et al., 2003). In England a Mental Health Foundation survey reported that 50% of university students in England showed signs of clinical anxiety and more than one in 10 suffered from clinical depression (Stewart 2001). Moreover, the results (Tables 3 & 4) showed that only satisfaction with social support had significant negative effect on anxiety and depression. These findings support those by Mikolajczyk et al (2007) and Takakura et al (2005). Therefore, the low rates of anxiety and depression might be explained by the high levels of social support which were reported by students who participated in this study (66% of students reported having more than three people supporting them and they were very satisfied with their social support). Previous studies (Mikolajczyk et al., 2007; Takakura et al., 2005) suggested that students with adequate social support have greater protection from major life stressors and also adjust better to those stressful situations. A reduction in social support
may thus explain part of the rise in depression, because insufficient social support has been found to be a major risk factor in mental disorder, especially when faced with major stress. When students’ social support was lacking, their risk for health complaints greatly increased (Faculty Advisory Council and the Student Advisory Committee 2007). Likewise, lack of social support in Japanese students was significantly related to more stress responses, such as anxiety and depression (Okayasu et al., 1992).

In this present study, findings show that the prevalence of anxiety is higher among female students than male students, which is reflected from research in other Arabic countries, e.g. Kuwait, Saudi Arabia, Emirates, Oman, Egypt, Syria and Lebanon (Abdel-Khalek & Alansari, 2004). Inam et al (2003) suggest that females experience higher levels of mental problems compared to males, they found 60% of students at University of Ziauddin in Pakistan had anxiety and depression, among them 60% were females. Also Silverman (2004) confirmed that female students were more likely than males to experience depression. The possible explanation of our finding of a low percentage of students (females and males) who reported being diagnosed with anxiety and depression is that, in our sample, most students were living with their families (85%). Rab and Nasir (2008) found this to be the most important reason which alleviates depression among university students in Pakistan. In supporting this they found the significantly higher rate of depression were among students living in college dormitories compared with those living at home, and there was a tendency for more students residing in dormitories to report anxiety than those living at home.

Another possible factor for the low rate of anxiety and depression among HEI students in Libya is the sufficient income (73% of students reported sufficient income), especially with free higher education in Libya. Also, most of our students reported financing their studies by parents’ financial support, so there is no need for students to devote additional time to working while studying. This is in contrast with students from European countries, where students have to deal with tuition fees, and general high costs of living. As a result, some students in European countries devote additional time to working while studying. According to Mikolajczyk et al (2007), there was an association between income perceived as insufficient and a higher prevalence of depressive symptoms among European university students.
There are limitations in this research: This study showed that there is no statistically significant relationship between mental health indicators such as anxiety and depression and some independent variables such as ‘gender’, ‘age’, ‘year of study’, ‘accommodation during semester’ and ‘monthly income’. However, previous studies (Abdel-Khalek & Alansari, 2004; Mikolajczyk et al, 2007; Rab & Nasri, 2008) showed that these variables do have a significant relationship with mental health disorders such as anxiety and depression. As these results refute past findings, possible reasons may be due to the limited data collected. The results showed that the cases of ‘no’ (96%) are the overwhelming majority, whereas for group ‘yes’ (4%), the statistical size is close to zero. The overall percentage of students answering ‘no’ for depression is 95.7%. The same conclusion can be made for anxiety. In conclusion, our study found a low rate of anxiety and depression among HEI students in Libya compared with students from other countries. It must be recognised that the specific question about anxiety and depression in this study asked about a medical diagnosis of these conditions. This leaves open the possibility that some respondents were suffering from one or both of these conditions without being aware of it, without having been diagnosed or not wishing to acknowledge it. Therefore, our findings suggest that social and cultural factors, such as gender, social support, and income seem to play a major role in influencing self-reported health, especially mental health in HEI students in Libya.

References


There seems to be general consensus, both in the research literature and among the public, that physical activity is good for one’s psychological and physical health (World Health Organisation, 2003). Physical activity is defined as “any bodily movement produced by skeletal muscles, that results in energy expenditure above the resting level” (Casperson et al., 1985, cited in Armstrong & Welsman, 1997 p.3). This definition includes various contexts of physical activity: leisure-time physical activity (including most sporting activities and dancing), physical activity at or near the home, and physical activity connected with transport.

According to the Council of Europe, children and young people is the group that should be targeted in order to raise physical activity levels and participation amongst the population. Policies and programmes focus on their needs (Council of Europe, 2003). It adds, “children and young people must be consulted and it is essential to involve them in the decision-making processes and the development of the programme” (Council of Europe, 2003, II.2). In the UK, the National Institute of Health and Clinical Excellence guidance suggested that children should not only be consulted but also involved in research in order to determine the most effective message and the appropriate language to promote physical activity among peers (NICE, 2009).

Aims and Objectives

This research explores the relationship between play and physical literacy and to gain a critical understanding of the role of play and physical activity in promoting physical literacy from the children’s perspective. A children's perspective could challenge adult standpoints, they are likely to have something to say that is different from what adults will say on the same subject (Dockett, 2008). The issues that the research addresses are: to analyse if and how physical active play can raise physical literacy; to examine the influence of physical and cultural environments on play; to evaluate through the children’s experience and their perspective the impact of play and physical activity on the development of physical literacy.
This research focuses on *active play*. For the purpose of this research, active play is any play that includes some element of physically active movement. This is a deliberately broad definition with no threshold for energy expenditure, meaning that active play might range from games with small, infrequent movements (such as playing marbles) through to activities expending large amounts of energy such as running games or climbing trees. It is hoped that the outcomes will provide an opportunity to support and implement free play policy provision, throughout the Physical Education National Curriculum, after school and sports clubs practice.

Physical literacy is a concept that puts children at the centre of the learning process. Physical literacy is a person’s ability and motivation to fully realise his/her own movement potential, their perception in “reading” all aspects of the physical environment, and their ability to anticipate movement needs and respond appropriately to these with intelligence and imagination (Whitehead, 2007).

In order to achieve an active relationship with the environment it is important to engage learners in problem solving practices. Bernstein (1967, p. 134), a Russian neurophysiologist, states:

> The process of practice towards the achievement of new motor habits essentially consists in the gradual success of a search for optimal motor solutions to the appropriate problems. Because of this, practice, when properly undertaken, does not consist in repeating the means of solution of a motor problem time after time, but in the process of solving this problem again and again by techniques which we changed and perfected from repetition to repetition.

Meinel argues that there are three different phases in the learning process of motor skills. These are: a phase of unrefined coordination, where the learner is engaged in understanding the task; a phase of refined coordination, where the learner reaches a higher level of coordination; a phase of reinforcement of refined coordination and variable receptiveness, where the motor skill is used and adapted in difficult and uncommon conditions (Meiner & Schnabel, 2000). The third phase of the learning process corresponds to the capacity of a physically literate individual to be creative, imaginative, competent, efficient, inventive, versatile, and skilful in a wide range of movement. A physically literate individual has a secure sense of self as embodied in the world which will sustain positive self esteem and self confidence (Whitehead, 2007).
One of the main concepts of physical literacy is to consider the holistic or monistic nature of the individual, the unity of mind and body, as opposed to the dualist nature of body and mind with the latter being more important in order to attain knowledge, an idea that influenced Western philosophy and pedagogy for centuries (Whitehead, 2007).

Play is possibly the most important feature of a child’s life on which the child bases (build) his/her own identity; the vast majority of the children’s daily free activity is devoted to play (Farnè, 2005). Various authors define play in different ways. Some characteristics on which most of the authors who have studied play are in agreement are the fact that it is connected with active engagement from the player, that it is a free activity and that the end result of play is the play itself (Garvey, 1977, Huizinga, 1970). Huizinga’s (1970) concept of Homo Ludens, helps to identify a natural feature of mankind, where play is not limited to the childhood period but is a continuous process within the individual development. There is not an age that should be considered exempt from play experience, and play activity could be considered as “long-life playing”, that could become an important part in life-long education (Farnè, 2005) with a life-long positive attitude towards physical activity.

Play is a means to express oneself freely in a creative, original and imaginative way. During play children can “know through movement, about movement, and because of movement” (Kentel & Dobson, 2007 p159.) It is a safe environment because children feel more free to experiment with new behaviours without any real consequences which might occur in real life. Play follows a continual transformation and even when we play the same game, the way of playing it is never the same.

Play in this perspective seems in resonance with the main concepts of physical literacy: unity of body and mind in an individual, the role of movement in cognitive development and in developing a sense of self (Whitehead, 2007). Physical literacy can be developed through natural active play, especially when the play is determined by the children themselves. Children’s play is considered a phenomenon that can be described by children based on their own experiences and subjectivity by representing their diverse perspectives. This means that by studying different children's experiences and perspectives, a unified picture of the essences of child's play can be achieved (Tekin & Tekin, 2007).
The history of the study of childhood in the social sciences has been marked not by an absence of interest in children, but by their silence (Kelly-Byrne, 1989). For a long time in research on children, adults have been considered experts on children’s lives rather than the children themselves. Play, as one of the most important children’s activities is a good example. Different theories of play have tried to define its instrumental value, its positive effect in shaping a “good” adult and its purpose but it has been much less studied for its autotelic value (Meire, 2007).

Methods and methodologies

The acknowledgement of children’s rights to participate in research contained in the 1989 United Nations Convention on the Rights of the Child (UNCRC) has provided an important basis for the development of participatory approaches to research with children (Einarsdottir, 2005). Since then, a “new sociology of childhood” has developed which is focused on children’s perspectives and puts great significance on children as individuals in their own right, as social and cultural actors, who can form and express opinions, participate in decision-making processes and influence solutions (Boyden & Ennew, 1997, Clark & Moss, 2001, Einarsdottir, 2005). Authors using research with children consider quantitative methods an incomplete manner of conducting research. This is because it is a practice which maintains adult power and excludes the possibility of taking children’s own views and language into account by failing to examine the detail of their lived experiences (Boyden & Ennew, 1997, Burke, 2005). For the purpose of a participatory child-centred research project aimed at gaining a critical understanding of the influence of play and exploring its relationship with physical literacy from the children’s perspective, multiple methods are considered appropriate. This is in order to generate data that best capture children’s own experiences and opinions.

The project is a case study design, working with children aged 8-14 in school and out-of-school settings. The methods that will be employed are underpinned by ethnographic and phenomenological methodologies. The ethnographic approach as suggested by Pole and Morrison (2003) presents two particular characteristics: it is focused on understanding social behaviour “in a discrete location, event or setting” (p.3), using methods that are able to reflect “the complexities of the discrete event, location or setting” (p.3). These characteristics provide a sound foundation in researching a complex event like children’s play.
The phenomenological approach aims to describe the meaning of the lived experiences for the research participants without transforming their meaning, with the recognition in the analysis of data that every statement has equal value (Grover, 2004). The research perspective is grounded on the understanding that children are the specialists in telling adults about their everyday experiences (Clark & Moss, 2001). Children are able communicators, the challenge is to find, as adults, the way to listen to the verbal and non-verbal ways through which they express their experiences and their views (Clark & Moss, 2001). Einarsdottir (2005) adds that a child-centred research method should be based upon children’s preferred ways of communication.

The methods considered in this project are visual methods and focus groups. Photography is a method used in a number of research projects with children and has many positive characteristics (Einarsdottir, 2005). It has been adopted widely in research on children’s play (Meire, 2007). In this project, the investigation on the landscape for play is focused on Gibson’s theory of affordances (1979, p. 127 in Fjortoft, 2004, p. 36) which states that: “The affordances of the environment are what it offers the animal (or the child), what it provides or furnishes, either for good or for evil.” The link between the active relationship with the environment, the perception in reading all the aspects of the physical environment and responding appropriately to them and physical literacy are strong (Whitehead, 2007).

The child participants in this project are responsible for collecting data, using a disposable camera for a week, documenting their play spaces and constructing a photo diary. The resulting photographs will be discussed with the researcher. Photo elicitation, described as “an interaction between words and images” (Burke, 2005, p.32), is the moment of critical reflection. It stimulates participants in expressing their own world, and usually more detailed data emerge from the children’s stories drawn out by the photographs (Burke 2005).

During the focus groups the questions will be about children’s perception of play including what play is, what they like or dislike about play, which kinds of play they like more, and their views about the difference between play and physical education lessons in schools. They will also be asked about the influence of the environment, including where and when they like to play (e.g. school, playground, sports club) and the reason for their decision, the choice between free
or adult and peer-directed play activities, and how they choose who they like to play with.

An analysis of audiotapes and verbatim transcriptions of interviews, photo elicitation, and the focus group sessions will be reviewed and examined for patterns and themes through inductive content analysis. Inductive content analysis is used “when there is not enough former knowledge about the phenomenon” (Elo & Kyngäs, 2008, p109). This analysis will include indicators that relate to different aspects of physical literacy such as positive attitudes towards physical activity or self-esteem.

Physical literacy is a concept that aims to put the child, as a unity of body and mind, at the centre of the education process. The child-centred approach has its roots in the definition of the word “education” itself. “Educe” means to bring out (The Concise Oxford Dictionary of English Etymology); the child is not a “sponge” - an object to fill with notions and knowledge, but a subject that can bring out her or his physical potential and capacity. During play, when there are less constraints and pressures, the child is more free to do this.

References

all European countries”<https://wcd.coe.int/ViewDoc.jsp?id=21055&BackColorInternet=9999CC&BackColorIntranet=FFBB55&BackColorLogged=FFAC75> [Accessed 28th November 2009]


perspectives on children’s play scientific reflections for practitioners
Antwerp:Garant 29-78

19. NICE (2009). Promoting physical activity, active play and sport for pre-
school and school-age children and young people in family, pre-school,
school and community settings. NICE (National Institute for Health and
Clinical Excellence) public health guidance 17

Maidenhead: Open University Press

Turkish early childhood educators: a phenomenological study. Journal
of Instructional Psychology 34,4,pp.207-213

developing a sense of self, universality and propositional knowledge.<
[Accessed 28th November 2009]

Physical Activity and Sport Geneva: World Health Organisation
November 2009]
CHILDHOOD OBESITY – STRATEGIES FOR INTERVENTION
Ulrike Müller, Sandra Erbs, Gerhard Schuler, Claudia Walther
University of Leipzig – Heart Center, Department of Internal Medicine/Cardiology, Strümpellstraße 39, 04289 Leipzig;

Background
Childhood obesity is the hallmark of an accelerating process which started in the affluent western societies decades ago. Meanwhile it has established itself firmly even in other “threshold” countries such as China and India (1). In Europe, overweight in childhood is defined as gender- and age-specific body mass index (BMI) above the 90th percentile according to the growth charts and obesity is defined as a BMI above the 97th percentile (2). The prevalence of obesity in childhood and adolescents increases faster than anticipated some years ago (3). Up to 25% of European school students are overweight or obese (3, 4). Very recently the prevalence of overweight and obese children in Germany was investigated in a large cross sectional study (“Kinder- und Jugendgesundheits-Survey KiGGS; children and adolescents health survey”, 5). 17.641 children and adolescents with the age between 0 to 17 years took part in this survey. In comparison to the reference data from 1985 to 1999 (2) with 10% overweight and 3% obese children the authors detected a significant increase in the prevalence of overweight and obesity to 21% (15% overweight, 6.3% obese children), meaning that there live 1.9 million overweight and about 800.000 obese children in Germany (5). According to the raising prevalence of childhood obesity, the 97th percentile (used to quantify obesity) had to be readjusted (6-8).

The dramatic increase in the prevalence of childhood overweight and obesity is related to co-morbidities such as metabolic syndrome, diabetes and other chronic diseases including early atherosclerosis (9-15). Almost inevitably clinical manifestations of cardiovascular disease may follow in the majority of the obese children later during adulthood (16). Children who are obese are more likely to have weight and health problems in adulthood (17). Around 80% of obese teens suffer from obesity in adulthood (16). Children born in the US in 2000 are estimated to have a 35% chance to develop diabetes. That’s why it is estimated, that they become the first
generation in US history to have life expectancy shorter than their parents (18).

Several factors like low socio-economic status, genetic predisposition, and environmental factors play a role in the development of overweight and obesity in children and adolescents leading to regional, social and ethnic differences. However, the increase in obesity has been too rapid to consider genetic factors as the primary cause. Therefore changes in young people’s lifestyles have to be discussed. According to data from selected countries in Europe (19, 20) energy intake of children and adolescents remained stable over the past 15 to 20 years. In parallel, an increase of sedentary behaviour and concomitant decline of physical activity was documented (21).

Programs

The consequence of obesity in children and adolescents is known for several years and a lot of programs to fight obesity were developed. These programs differ with respect to duration of intervention, ranging from weeks to years, as well as varying intervention strategies such as diet, exercise, lifestyle and social support (22-27, table 1). The current evidence suggests that many of these diet and exercise interventions to prevent obesity in children are not effective in preventing weight gain, but can be effective in promoting a healthy diet and increasing physical activity levels (28-33). A recent meta-analysis found a positive trend for increase in duration of physical activity and VO2max as well as a decrease for TV consumption and cholesterol levels favouring intervention programs albeit there was no statistical significance (34). Conflicting results are available with regard to blood pressure, BMI or heart rate. However, the authors of this meta-analysis conclude: „Given that there are no harmful effects and that there is some evidence of positive effects on lifestyle behaviours and physical health status measures, ongoing physical activity promotion in schools is recommended at this time.“ (34).
The Leipzig-Chemnitz “school-project”

With this background we initiated a school program with the aim to investigate the effect of daily school exercise on physical fitness, motor skills, and body composition in school children through a randomized, prospective trial. Since 2005 about 500 children of several schools in Leipzig and Chemnitz took part. The children were randomized class-wise into the intervention group (IG) with daily school exercise lessons (with a minimum of 15 minutes of endurance training) or the control group (CG) with two exercise lessons per week, which is standard in Germany. In addition lessons on healthy lifestyle were included in the regular schedule once monthly for all pupils. Measurements were performed at baseline and after one year.

Tests included

(1) Anthropometry with measurement of age and gender specific body mass index (BMI)-percentiles and BMI – standard deviation score (BMI-SDS)

(2) Assessment of maximal oxygen consumption (VO₂max) via a maximal treadmill exercise test with spirometry using the modified Bruce protocol for children

(3) Body coordination test for children resulting in the motor quotient (MQ)

(4) Body composition using bio impedance analysis.

The results of a subgroup of this large ongoing trial were published very recently (35). A total of 182 students from seven classes (89 boys, 93 girls, and mean age 11.1±0.7 years) at three different schools were investigated in this subanalysis, with 109 and 73 children in the IG and CG, respectively. At baseline, the prevalence of overweight / obese children was “only” 12.1% (≥ 90th percentile), of the entire group prior to randomization which is much lower when compared to published demographic data.

Regarding the BMI-percentiles and the prevalence of obesity there were no significant differences between IG and CG at begin and after one year of intervention. After 1 year, remission from overweight to normal-weight in four students of IG and an incidence of overweight/obesity in two normal-weight children of CG was observed. After adjusting for intra-class correlation no significant effect on BMI-standard deviation score (BMI-}
SDS) was detected. Fat free mass showed also a slight decrease in both groups, but also no statistical significance. Physical fitness (expressed by VO2max) increased significantly and to a higher extent in children of IG compared to children of the CG. Motor abilities improved in both groups and stronger in IG, but formal significance of the treatment effect were not achieved after adjustment for intra-class correlation. With respect to total cholesterol levels, LDL- and HDL-cholesterol and triglycerides no effects of the additional physical exercise were measured.

Conclusion

The results of this trial go well in line with other published data, who demonstrate that already in childhood an increase in regular exercise and physical activity have positive effects on exercise capacity and may improve cardiovascular health for children. However, studies to assess long-term effects of these programs on physical activity level and fitness in adulthood as well as the impact on the development of cardiovascular diseases are warranted.
Table 1: Randomized controlled interventional programs over more than 12 months (adapted from Summerbell et al. (35))

<table>
<thead>
<tr>
<th>Author</th>
<th>Participants/ Controls</th>
<th>Mean age</th>
<th>Interventions</th>
<th>Outcomes</th>
<th>Main results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caballero</td>
<td>1704 children (41 schools)</td>
<td>8 – 11 years</td>
<td>Dietary, PA</td>
<td>BMI</td>
<td>-</td>
</tr>
<tr>
<td>Donnelly</td>
<td>338 children</td>
<td>8 – 11 years</td>
<td>Dietary, PA</td>
<td>BMI and PA</td>
<td>-</td>
</tr>
<tr>
<td>Epstein</td>
<td>26 children with parents</td>
<td>6 – 11 years</td>
<td>Dietary</td>
<td>Percentage of overweight</td>
<td>-</td>
</tr>
<tr>
<td>Gortmaker</td>
<td>1295 children (10 US schools)</td>
<td>11 - 12 years</td>
<td>PLANET HEALTH – PA and dietary in.</td>
<td>BMI</td>
<td>obesity was reduced in intervention girls (but not boys)</td>
</tr>
<tr>
<td>James</td>
<td>644 children (29 classes)</td>
<td>7 – 11 years</td>
<td>CHOPPS</td>
<td>BMI</td>
<td>-</td>
</tr>
<tr>
<td>Mo-Suwan</td>
<td>292 children (kindergarten)</td>
<td>4.5±0.4 years</td>
<td>Physical activity</td>
<td>BMI</td>
<td>-</td>
</tr>
<tr>
<td>Mueller</td>
<td>1640 children</td>
<td>5 - 7 years</td>
<td>KOPS (Kiel Obesity Prevention Study)</td>
<td>BMI, triceps skinfold thickness</td>
<td>-</td>
</tr>
<tr>
<td>Sahota</td>
<td>643 children</td>
<td>7 - 11 years</td>
<td>APPLES (England)</td>
<td>BMI, triceps skinfold thickness</td>
<td>-<em>INSTANCE_1__BMI</em>↓_↓<em>in_IG</em></td>
</tr>
<tr>
<td>Sallis</td>
<td>549 children</td>
<td>9.25±0.5 years</td>
<td>SPARK – physical activity</td>
<td>BMI, skinfold thickness</td>
<td>small changes</td>
</tr>
<tr>
<td>Warren</td>
<td>218 children</td>
<td>5 - 7 years</td>
<td>Be SMART</td>
<td>BMI</td>
<td>-</td>
</tr>
</tbody>
</table>

PA= physical activity, BMI= body mass index, WC= waist circumference, FFM= fat free mass, IG= intervention group
References

23. Kiel-Obesity-Prevention Study (KOPS).
24. CHILT –Study of German Sporthochschule Cologne.


TRANSITION TO A HEALTHY LIFE? A MIXED METHOD EVALUATION OF A ‘HEALTHY TOWN’ IN THE U.K.

Noreen O’Connell- Gallagher. PHD student, Faculty of Sport Health and Social care, University of Gloucestershire.

Contextualisation of the Study

The concept of ‘healthy communities’ has grown from initial health promotion work carried out by the World Health Organisation (WHO). WHO has defined a healthy city as:

one that is continually creating and improving those physical and social environments and expanding those community resources that enable people to mutually support each other in performing all the functions of life and in developing to their maximum potential.

(WHO, 1986, p17)

In this type of health promotion activity, several different strategies are planned and implemented, in order to improve the health and/or well being of people living within a defined geographical area (WHO, 1986).

These community level health strategies have come to be known as Complex Community-based Initiatives, (CCIs) (Judge and Bauld, 2001). CCIs are recognised as instrumental in creating healthy communities, through a combination of the development of built environments and multi-agency programmes encouraging healthier lifestyles. In order to implement CCIs, agencies are called upon to work collaboratively at a local level. Programme or project boards are recruited usually from existing bodies responsible for community health programmes and political representatives, together with other agencies, with responsibilities for, or interest in, the themes of the initiatives.

The initial work from WHO (1986) developed and as a consequence Healthy Cities have been evaluated in Australia, (Baum and Brown, 1989), in Canada, (Feather and Mathur, 1990) and in the United States of America, (Twiss et al., 2000). Contemporaneously, the
concept and subsequent research continued to develop through the eighties and nineties in the UK. For example in 1994, Liverpool became a Healthy Cities and work started on the Healthy City Plan. In this phase of the Healthy Cities movement, researchers defined an important difference between ‘networking’ and ‘joint working’ with regard to partnership practices, emphasising that joint working is important to healthy towns as it is the ‘process by which the outcome has been achieved’ (Costongs and Springett, 1997, p11). These authors go on to discuss the importance of a ‘Healthy City Unit’ as a separate entity autonomously providing the ‘glue’ which holds the work together. Sheffield, Newcastle and Belfast were also named as Healthy Cities at this time. As differing geographical areas became involved the terms ‘healthy communities’ and ‘healthy towns’ also came into regular usage.

These initiatives were developed further in the UK following the election of the Labour government in 1997, with the formation of ‘Health Action Zones’ (HAZs). These zones incorporated the values of the WHO Ottawa Charter for Health Promotion, emphasising that it was people from ‘all walks of life’ that were key to the implementation of healthy communities, (WHO/HPR, 1986 p.2). Initially 15 HAZs were identified in 1998 and in the following year another 11 areas were added. These pilot projects had the aim of finding mechanisms for overcoming organisational boundaries to tackle inequalities and improve service delivery. The zones ranged from large conurbations such as Tyne and Wear to mainly rural areas such as Cornwall. Within each HAZ a range of tailored initiatives and partnerships were implemented over a fixed period of time. Areas were initially planned to have a seven year funding span with broad objectives centred on three subjects; (1) identifying local health priorities, (2) increasing the efficiency and response rates of local services and (3) the development of partnership working. Definite examples of good practice have been identified and disseminated. For example, the HAZs in the East and West Midlands published ‘top tips for ensuring effective evaluation’ (HDA, 2005, p2). However, a reduction in the funding periods, combined with the tendency to set over-ambitious goals, resulted in the finding that
HAZs had little impact that could be measured (Judge and Bauld, 2001).

A significant tension observed by evaluators of CCIs is the balance between making visible concrete changes quickly in order to galvanise the community, contrasted with the longer more invisible process of building community cohesion and partnership working practices from the community and local agencies and professionals (Baum and Cooke, 1992). Given the complex nature of these initiatives and the challenges that arose from establishing their value, evaluators in the US concluded that ‘...adaptable evaluation tools are urgently needed given the diversity of participants and disciplines’ (Twiss et al, 2003, p.4). These authors concurred with Baum and Cooke (1989) that the challenge of the work remained the involvement of the whole community and the development of tools and methods to capture the essence of different interpretations of progress, within the concept of a CCI.

Over the lifetime of the Healthy Cities and Communities movement, it is clear that there have been emerging changes in emphasis of the health messages, as social and public health issues have grown in prevalence. For example, currently global concern is growing in relation to the twin effects of poor diet and physical inactivity within certain communities. By 2006 a global pandemic of obesity was identified which has served to focus health promotion agendas on the relationships between healthy lifestyles, physical activity levels and food. Particular concern was raised with regard to childhood obesity (WHO, 2006). In the United Kingdom, the Foresight Report (2007) argued that understanding obesity was complex, involving a multiple of environmental, social and biological factors, hence the concept of the ‘obesogenic environment’ was born. Without action Foresight predicted that by 2050, nine out of ten adults and two-thirds of children in England would be overweight or obese.

In order to maximise the effect of community based initiatives, the UK government has employed several strategies. One of these is to develop the role of social marketing campaigns as instruments within community health programmes. Today WHO’s 2009 research
themes of Healthy Communities and Childhood obesity are represented in the UK Government’s Change4Life (C4L) campaign. This campaign also stems directly from the recommendations of the Foresight Report and the UK government’s white paper Healthy Weight, Healthy Lives (DoH, 2008). In these documents the government announced how a social marketing campaign (C4L) planned to play a key part in reducing obesity in the U.K. The influence of the modern society on individual choices on food and physical activity is acknowledged. The C4L campaign was launched emphasising two particular themes, (1) reducing childhood obesity and (2) an emphasis on the ‘family’ as the main unit of influence in children’s and parent’s health. Today, the original Healthy Cities and Communities themes from previous years, are expressed clearly in the C4L messages, emphasising a ‘society wide movement that aims to prevent people from becoming overweight by encouraging them to eat better and move more’ (DoH, 2009, p2).

It is the emphasis on the family unit which the government considers the vehicle of influence and change in the current health policy, (DoH, 2009). A recent study suggests that ‘parents are often key to the development of a home environment that fosters healthful eating and participation in physical activity, their role is likely critical to most solutions to combating obesity’ (Gruber and Haldeman, 2009, pg 5). This present study aims to add to this existing research base specifically by examining the influence of the ‘healthy towns’ framework for residents in the targeted area, (the town of Tewkesbury). The town of Tewkesbury was recently selected, after a bidding process, to be one of the nine pilot ‘healthy towns’ in the UK. It is the only designated healthy town in the south west of England identified through the Healthy Communities funding scheme (DOH, 2009) and as such provides a unique opportunity to study the community level interventions on a population of this size. The ‘town’, was defined in the successful bid, as the five geographical wards of Ashchurch with Walton Cardiff, Northway, Tewkesbury Newtown, Tewkesbury Prior’s Park, and Tewkesbury Town with Mitton.

Particular groups such as the elderly and those with underlying medical conditions will be included but assessed only by
demographic and self-reported health data. Research Question 1 (RQ1) concentrates on adults self-reported health status before and after the Healthy Town interventions, whilst Research Question 2, (RQ2) follows the journey of children, young people and families through the process. The influence of the family unit is integral to the social marketing of the C4L campaign and this research aims to investigate this influence through the qualitative strand. In Research Question 3 (RQ3) these two strands will be drawn together to combine findings to fully understand the impact of ‘healthy town’ status

Proposed Methods

This research adopts a mixed methods approach, utilising both quantitative and qualitative methods (Teddlie and Tashakkori, 2008; Onwuegbuzie and Collins, 2007). Using this approach will allow a research strategy that enables both analysis of large data sets and further exploratory investigations into experiences and perceptions of ‘healthy town’ inhabitants. It incorporates longitudinal aspects both in the qualitative and quantitative phases.

In order to answer RQ1, all adults in households in the intervention area will be offered the opportunity to complete a survey, at three time points. The survey will be directed at all residents of Tewkesbury over the age of 18 and distribution will be at three phases of the intervention, July 2009, April 2010 and April 2011. Self-reported data on knowledge, behaviour and attitude towards the themes of food, environment and physical activity will be assessed alongside questions from the Personal Wellbeing Index (PWI, 2006). The survey is being applied within the five geographical wards identified as making up the Tewkesbury healthy town.

In order to answer RQ2 focus groups with eight discrete communities will be undertaken. These communities will include:

- one community, involving young people (aged 14-19) at the local youth club
• two further communities, involving a group of year 6 pupils and group of year 7 pupils at local schools in Tewkesbury town, and (aged 10-12)
• five families with children, one from each of the geographical wards detailed above

Two focus groups will be conducted with each of the eight contributing forums. All participants will access the groups using already established networks or if necessary from opportunistic samples. The focus groups will represent the population as they will include full range of geographical wards by including a family from each of the five wards.

In order to answer RQ3, a combination of a range of data will be used to investigate the extent to which the status ‘healthy town’ impacts on the experiences, attitudes and health behaviours of this specific community. This will be undertaken by drawing on qualitative and quantitative data from RQs 1 and 2, and other routinely collected data from the ‘healthy town’ initiative to integrate findings to fully understand the overall impact of this complex community intervention on the town of Tewkesbury.

Future Developments

In this paper I have outlined the development of the ‘healthy communities’ story. I have discussed the planned research questions and the proposed methods to be used. The next phase of the work will involve the nine pilot ‘healthy towns’ being evaluated at national level, by the Department of Health in the UK. It is expected that this will lay out the direction of the next phase of developing the theory to practice developments in the field of community health. The challenges of reducing childhood obesity and improving the ‘health’ of our communities at a local level will continue. The partnerships which are central to the success of these processes are often unique to individual areas; however the techniques for the formal evaluation of these interventions will aim to become more established in their methodologies.
References


A MIXED METHOD EVALUATION OF A COMMUNITY BASED ART INTERVENTION – THE STORY SO FAR.

Elaine O’Connell, University of Gloucestershire.

Context

Primary Care is the first point of contact, interaction and opportunity to help people with mental health needs (Barry and Jenkins, 2007), so being able to deliver effective services at this level is vital. Changes in national policy, and reform within the NHS, places more emphasis on primary care, leading to the development of opportunities such as new working partnerships and allowing front line staff to respond to the needs of their local communities and design and deliver appropriate services (DoH, 2002). Many contemporary and innovative schemes have been developed in primary care in recent years, for example exercise referral schemes, healthy food initiatives, and arts for health interventions (DoH, 2002; DoH 2006). In terms of the relationship between arts and health there is a growing awareness of its potential role for health improvement (Arts Council, 2004). Some of the research on art and health is well supported by evidence, however some is less well supported and does not utilise the best methods (such as, not enough use of formal instruments of measurement) (Angus, 2002; Staricoff, 2004). The Arts Council are committed to strengthening and promoting current evidence, which shows that art and health projects have been used to help reduce feelings of isolation, broaden participants’ horizons, improve the mental well-being, self-esteem, confidence and social networks of participants (for example Daykin et al., 2008., Secker et al., 2007., Staricoff, 2004).

Due to the development of evidence and backing from the Arts Council, arts and health projects are becoming more prominent. In the south west there are arts and health projects in primary care settings in Bristol, Cornwall and Devon (Arts and Health South West, 2009). The arts and health intervention, Art Lift, a partnership project between Gloucestershire County Council and Gloucestershire NHS, aims to improve the health and well-being of patients through referral for 10 sessions with an artist, where the sessions are delivered within the GP’s surgery. The artists offer a variety of activities including poetry,
music, ceramics, drawing, mosaic, and painting. The artists are resident within 8 GP surgeries across the county.

White (2003) identifies differences between art therapy and art for health; art therapy tends to deal with patients with diagnosed health problems and involves specialist training, whereas art for health tends to deal with people with less severe undiagnosed health needs and is considered to be more versatile (Argyle and Bolton, 2005). Art Lift targets individuals who have less severe health problems. For example, the referral criteria includes low mood, recent bereavement and stress/anxiety issues: it therefore falls within the art for health intervention definition. It is vital to evaluate all those participating in the process, either through the delivery or receipt of this programme, and doing so the programme will provide valuable context specific evidence to further develop practice and assess the effectiveness of this programme in Gloucestershire. The development of context specific evidence is recommended by Geanellos (2004). The present research extends a previous evaluation (Daykin et al., 2008). Staricoff (2004) states the two main areas that still need exploration and review: the emerging evidence around the use of arts interventions in community settings to improve health, and the first hand engagement of artists with patients and staff in healthcare settings. The findings from this research may result in practice-related recommendations to assist in the future planning of arts and health interventions within the county and beyond. As a response to this benefit, this research engages with artists who deliver, patients who receive and engage, and health professionals who refer into the programme. This approach will go some way to understanding more about process and outcomes of such interventions in primary care settings. The project will investigate the impact of the art intervention on the mental well-being of patients, the associations between patient characteristics and their progress through the art intervention, and the experiences, opinions and perceptions of the art intervention for the patients, health professionals and artists involved.
Methodology and Methods

Mixed methods research embraces multiple viewpoints and allows qualitative and quantitative methods to be combined so that they complement each other (Johnson et al., 2007). Mixed methods research has become increasingly popular, especially when being used for evaluations, since it provides a deeper understanding of the phenomenon and allows more divergent ways of thinking (Titter, 2007). Some mixed methods designs can be hard to conduct by a single researcher and as a consequence Teddlie and Tashakkori (2003) state that the researcher may have to adapt or develop a new research design to best fit their individual research constraints.

In the case of the present research, concurrent and sequential design aspects can be utilised to make the research easier to conduct by a solo researcher. Each strand of the data will be collected and analysed independently, however the strands will be conducted in a pre-determined order, with the quantitative data being collected and analysed throughout the time period and qualitative data being collected and analysed in the latter part only. This gives the opportunity for the quantitative data to influence the qualitative strand. The quantitative aspects allow direct measurement of pre-defined outcomes, whilst the qualitative aspect allows issues to be discussed directly and participants’ perspectives to be explored and understood. The findings of each strand will be triangulated, integrated, compared and contrasted (Teddlie and Tashakkori, 2003). Mixed methods allow the broad range of research objectives to be met, providing stronger evidence for a conclusion through convergence of the findings. This in turn allows theory and practice to be informed (Johnson et al, 2007).

The quantitative aspect of this study has approval from NHS Gloucestershire and the qualitative aspect received a favourable judgement by the Wiltshire NHS Ethics committee when reviewed at a meeting on 01/10/09.

Quantitative

This mixed methods approach will gather data from two key strands, one of which is quantitative. The study design for the quantitative
strand is longitudinal, including a simple pre-post design (Mental Well-being outcomes) and a follow-up design (Attendance outcomes). The quantitative data will be anonymous as patients will be assigned with a unique number. Data will be obtained from completed referral forms, Warwick-Edinburgh Mental Well-being Scale and patient satisfaction questionnaires. The Warwick-Edinburgh Mental Well-being Scale will allow data to be gathered on changes in well-being for patients’ pre and post intervention. The scales has proved highly reliable (Cronbach’s alpha = 0.93) in previous studies (Lindsay et al., 2008), and normative data on the scale is available from Tennant et al., (2007). Data on patient demographics (age, sex, postcode, referral reason, referring health professional, artist, art type and surgery) will be collected from the referral forms and attendance data (number of weeks attended out of a total of 10) will be collected via an artist check list. In total, this data will allow an analysis of change over time and factors associated with any change (for instance, whether a change in well-being was associated with age, or whether attendance levels were associated with referral from different health professionals). The anticipated number of patients to be referred onto the scheme during the data collection period is anticipated to be between 200 and 250, thereby allowing conventional bivariate analyses.

Responses from the patient satisfaction questionnaire will be analysed for content using NVivo 8 as a management tool. SPSS will be used to analyse the quantitative data to determine change over time, and factors associated with any change. For example, data obtained from the Warwick–Edinburgh Mental Well-Being Scale will be subjected to analysis using both descriptive and inferential methods. Scores obtained from the scale at the pre and post intervention period will allow initial consideration of any well-being changes which may have occurred during the study period. Inferentially, the Wilcoxon test (a non-parametric within-group test) will be used to see if there are statistically significant differences between participant’s ratings of well being between the pre and post intervention period. Associations between demographic factors and changes in well-being will also be considered using between group inferential statistics (Mann Whitney U test) and correlation statistics where possible. These methods of analysis were chosen as they have been used in similar studies. For
example Patterson et al (2002) used the Wilcoxon and Mann Whitney U tests to analyse data on parents (n=116) scores on a self esteem scale pre and post a 10 week parenting programme and making comparisons with a control group who did not complete the parenting programme. Similar approaches have been used by Crone et al (2008).

**Qualitative**

At the end of the 10 week period, during the final session of the programme, patients will be asked to complete the patient satisfaction questionnaire and attached slip allowing patients to nominate themselves for the qualitative aspect of the study. These slips will be detached from the questionnaire, collated by the artist, and sent back independently of the patient's pack to ensure anonymity. The rest of the data is anonymous and identified through the use of patient identification number stated on all forms, rather than by name. It is therefore only the artist who can associate the number with the patients’ true identity. Patients who provided their contact details (name and telephone number) will be invited to the focus groups (2 focus groups, with approximately 8 patients in each) or interviews for those who cannot attend focus groups. Consent will be gained and then focus groups will take place at the venue of the art intervention.

The focus groups and interviews allow an opportunity for the researcher to interact and converse directly with the main users of the art intervention. Participants in the focus groups and interviews will be given the opportunity to use their own words to express their opinions, experiences, attitudes and perceived roles of the art intervention. The focus groups will allow valuable interaction between groups of patients and groups of artists, allowing them to discuss, probe and ask questions of each other. The qualitative aspect also involves the referring health professionals involved in the art intervention. Referral forms include the name of the referring health professionals, so these referring health professionals (n=8) will be invited through an invitation letter, to take part in a telephone interview. If they respond positively to the invitation, an appropriate time for the telephone interview will be arranged. Artists (n=8) are employed by the art intervention and will be invited through an invitation letter to attend a
focus group, scheduled to take place following an artist’s update meeting. Focus groups and interviews will be recorded using a digital voice recorder and transcribed verbatim. Data will then be analysed for content, and the NVIVO 8 computerised software package will be used to manage, store and organise the data. Content analysis will be used to analyse the data. Krippendorff (2004) characterises content analysis as a systematic, rigorous approach to analysing documents obtained or generated in the course of research. It provides new insights, increases a researchers understanding of a phenomena and can inform practical actions.

Results to date

The project has been collecting quantitative data for 12 months, from which some observations can be made. To date there have been 106 referrals onto the scheme, 75% are female and the average age of all referrals is 55 years (SD 17.7). Of these referrals 66 (62%) have fully completed the intervention. To compare the means of the pre and post Warwick-Edinburgh scores of those who completed the intervention, a t-test was completed. It shows a statistically significant (p=0.00) improvement in wellbeing after completing 10 sessions of art with an artist. With pre mean scores being 36.3 and post mean of scores being 44.12.

Conclusions

Initial findings suggest that the intervention appears to be improving wellbeing and targeting the people it was designed for. The main reasons for referral include to improve self esteem/confidence; to reduce stress/anxiety/depression and, to improve overall wellbeing. The protocol used by the artists to collect the quantitative data appears to be an efficient system that does not place an inappropriate burden on busy practitioners. The project steering group, with partners from different professional and geographic areas, has provided valuable expertise when helping to devise an optimal evaluation protocol. Also ensuring the project runs effectively and promoting arts and health benefits within the county infrastructure.
References


3. Arts Council (2004). The impact of the arts: some research evidence. Arts Council [online], [cited 31-08-09]. Available from URL:


5. Arts and Health South West (2009). Arts in Primary care. Arts and Health

6. South West [online], [cited 22-09-09]. Available from URL:


QUESTIONNAIRES FOR PARENTS – VALID INSTRUMENT FOR ASSESSMENT OF PHYSICAL ACTIVITY OF CHILDREN IN PRE-SCHOOL AGE?

Roschmann, R., Ehnold, P. & Adler, K.

Introduction

Alarming trends such as rising numbers of obese children or muscular dysbalanced children (cf. Campbell & Hesketh 2007, p. 327) brought scientists from medicine, sports sciences or Public Health to focus more and more on physical activity (PA) of children. Numerous studies indicate that physical activity in childhood has sustainable impact on physical activity in further course of live (cf. Bates 2006, p. 10). Also, direct effects of PA on physical health is for adolescence and adulthood yet well documented. However, there is a lack of documentation about physical activity in childhood (cf. Sallis et al. 2000, p. 963; Timmons et al. 2007, p. 122). This seems not to be because there is no relation between these parameters (cf. Rowlands et al. 1999, p. 1428; Sallis et al. 2000, p. 970) but rather because there are methodical problems in measuring physical activity of children. In this regard questionnaires are of particular relevance. Literature assumes that about 90% of empirical social research uses surveys (cf. Bortz & Döring 2006, p. 236) which are, however, accompanied by certain disadvantages.

Based on this the article’s aim is to test the validity of a parent’s questionnaire about physical activity of children. Therefore, initially the questionnaire for parents as an instrument to measure physical activity of children is theoretically reflected. Then, the measurement approach for testing its validity will be outlined before the results are presented. The article ends with a conclusion and a discussion of limitations of the study.

---

8 Physical Activity is defined as “...any bodily movement produced by skeletal muscle that substantially increases energy expenditure over the resting level” (Bouchard & Shepard 1994, p. 77). That means it includes activity in day to day life as well as activity that is organized (e.g. PA in a sports club, school or kindergarten).
There are several approaches to measure physical activity in general. Following Beneke & Leithäuser (cf. 2008, p. 216) three groups of measurement methods according to the level of validation they reach can be found. On the first and therefore best level of validation methods like direct observation, indirect calorimetry or double labeled water can be found. The second level of validation includes heart rate measurement, accelerometry and pedometry. And the third level of validation consists of subjective measurement instruments like activity diaries, structured interviews, or questionnaires respectively for the case of children also questionnaires for parents. Focusing the last-mentioned an overview over advantages and disadvantages is given in the following table.

Table 3 Advantages and Disadvantages of Questionnaires (following Trost 2005, p. 39)

<table>
<thead>
<tr>
<th>Method: Questionnaire</th>
<th>Child</th>
<th>Parents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validity</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Costs</td>
<td>***</td>
<td>****</td>
</tr>
<tr>
<td>Objectivity</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Economy</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Registration of modality and dimension of physical activity</td>
<td>***</td>
<td>**</td>
</tr>
<tr>
<td>No interaction between activity and measurement</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Applicability in large studies</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Applicability with children &lt; 10 y</td>
<td>X</td>
<td>**</td>
</tr>
<tr>
<td>Applicability with children &gt; 10 y</td>
<td>***</td>
<td>*</td>
</tr>
</tbody>
</table>
As can be seen, in many aspects a questionnaire is a good or even excellent instrument. Accordingly, it is not astonishing that questionnaires are so frequently used (cp. introduction). However, for this study it is necessary to focus on two of the disadvantages. Number one: a questionnaire is said to be not applicable with children younger than 10 years, amongst others because they are not able to recall their level of PA accurately (cf. Hands et al. 2002, p. 3). So it might be necessary to use questionnaires for parents. Problem number two is that both kinds of questionnaires have relatively low validity. Above it is labeled “acceptable” but this should be further examined. A special problem enforces this problem: most of the physical activity of young children does not take place in organized manner like in a sports club or as organized sports hour in kindergarten but rather in an informal way. So it might be especially hard to assess.

Thus, the question is: How valid is a questionnaire for parents in regard to physical activity of children in pre-school age?

**Methods**

To examine this question data from a large study about physical activity of pre-school children were taken. For our purpose a sample of 24 children (12 female, 12 male) aged 5 to 7 years could be used. The mean age was 5 years and 7 month. The data concerning this article were collected in Chemnitz (Saxony) in July 2008. As instruments a questionnaire for parents and heart rate measurement was employed.

The questionnaire divided physical activity into five categories: PA in Kindergarten (organized), PA in a sports club, PA outdoors (sports club was explicitly excluded), PA inside the house, and PA walk to/from Kindergarten. Four of the categories and the associated items were based on the questionnaire of the MoMo-Study (cf. Rohman 2008 pp. 250). The question block PA indoors was added as fifth...
category. Also, the category PA outdoors of the MoMo-Questionnaire was slightly modified. For the whole MoMo-Questionnaire a reliability of \( r = .97 \) could be determined, whereas PA in sports club and PA in leisure time showed a validity of \( r = .66 \) respectively \( r = .56 \) (cf. Romahn 2008, pp. 109). However, the validation was performed with a much older sample\(^{11}\) (cf. Romahn 2008, p. 107) than the one in the present study. Another difference to our case is that in the MoMo-Study the children themselves were asked, not the parents.

This seems reasonable since – as stated above (cp. Table 1) – it is not applicable to use questionnaires for children younger than 10 years. In addition, Sallis et al. (cf. 1993, pp. 99) show vividly that validity grows enormously with the age of the children. In a 7-day-recall interview about the amount of time the children spent with low, medium and strong physical activity they found the following values: 5\(^{th}\) grade: correlation coefficient \( r = .29 \); 8\(^{th}\) grade: correlation coefficient \( r = .45 \); 11\(^{th}\) grade: correlation coefficient \( r = .72 \). “This study determined that children aged 10-16 yr can provide reasonably reliable and valid reports of their physical activities. However, the younger children provided less reliable and less valid data than the adolescents, so there is substantial error in the reports of younger children. Children younger than age 10 should not be expected to provide usable recalls of their physical activity.” (Sallis 1993, p. 107).

Since the present study was about children aged 5 to 7 it can be seen that it is absolutely necessary to ask the parents. To validate the parent questionnaire heart rate measurements was used. This is in general considered a possible procedure (cf. Beneke & Leithäuser 2008, p. 217). The threshold for moderate activity was set at 140 heartbeats per minute\(^{12}\).

\(^{11}\) \( N = 23 \); mean age = 12.7 years

\(^{12}\) Theoretical assumptions in literature identify a value of 140 heartbeats per minute as lower limit of moderate PA. This value could be confirmed under laboratory conditions (for children aged 5 to 7 years cf. Welsman & Armstrong 1998, p. 147; supplementary cf. Armstrong et al. 1993; Armstrong, et al. 2000; Welsman & Armstrong 2000).
The time frame for the measurement was from 8 am to 8 pm. Six children were tested on three days, 18 on five days. Literature assumes that three days are sufficient for a realistic image of PA of children (cf. Bar-Or & Rowland 2004, p. 374). To reconfirm this, for the 18 cases a comparison of the mean values for three and five days was executed. It showed no significant difference (p = .246) and a correlation for paired samples of r = .894 (p = .000). Thus, it was possible to use the full sample of 24 cases for further examination.

Results

The evaluation took place in three steps in which the amount of time spent with physical activity measured through heart rate monitoring (PA Heart Rate) was compared to different categories of physical activity measured through the questionnaire (compare table 2). PA Heart Rate showed a mean value of 76.8 minutes per day. First, it was compared to the overall amount of all five categories of physical activity from the questionnaire (PA All) in which the parents estimated an average of 312 minutes per day. Thus, a significant difference in the mean value could be shown.

In detail, 22 of the 24 parents overestimated clearly while only one estimated quite well, that is with a deviation less than 15 %. But the results showed no significant correlation which means the degree of overestimation differs from parent to parent.

In a second step PA Heart Rate was compared to the overall amount of all categories from the questionnaires except “walk to kindergarten” (PA 2). Thus, it could be examined if the reason for overestimation is that the children walk to slow on their way to kindergarten (that is with a heartbeat of less than 140 beats per minute). But again a significant difference in the mean values but no significant correlation could be found.

Thirdly, from all five categories of the questionnaire PA outdoors and PA at home were excluded. The remaining categories (PA 3) were again paired with PA Heart Rate and showed a significant difference in the mean values which is not astonishing since only three of five categories were left. But the relatively low mean value of 36.91 minutes of physical activity per day shows that the reason
for the overestimation seems to lie mainly in the area of unorganised physical activity outdoors or at home. Nevertheless there was still no significant correlation of the remaining categories with PA Heart Rate to be found.

Table 4 Comparison of mean values and correlations of PA from heart rate measurement and questionnaire

<table>
<thead>
<tr>
<th>Pair 1</th>
<th>N</th>
<th>Statistics for paired samples</th>
<th>Correlation s for paired samples</th>
<th>t-test for paired samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M (min)</td>
<td>SD (min)</td>
<td>r</td>
</tr>
<tr>
<td>PA Heart Rate 24</td>
<td>76.8</td>
<td>32.51</td>
<td>.029</td>
<td>.894</td>
</tr>
<tr>
<td>PA All 24</td>
<td>312.09</td>
<td>157.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 2</td>
<td>76.8</td>
<td>32.51</td>
<td>.080</td>
<td>.710</td>
</tr>
<tr>
<td>PA Heart Rate 24</td>
<td>290.67</td>
<td>157.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA 2 24</td>
<td>36.91</td>
<td>17.27</td>
<td>.058</td>
<td>.787</td>
</tr>
<tr>
<td>Pair 3</td>
<td>76.8</td>
<td>32.51</td>
<td>.058</td>
<td>.787</td>
</tr>
<tr>
<td>PA Heart Rate 24</td>
<td>24</td>
<td>32.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA 3 24</td>
<td>24</td>
<td>17.27</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion and Limitations

The present study aimed at validating a parent’s questionnaire assessing PA of children through heart rate measurement. Results showed that it could not be validated. This stands in contrast to the mentioned degree of validity of the MoMo-Questionnaire. The differing results could be explained with two major differences in the design of the surveys: First, MoMo was only validated for two of the categories of PA whereas the present study validated the whole questionnaire. Second, due to the age of the children the survey underlying this article used questionnaires for parents, not for children. Noticeable was the strong tendency to overestimation of the children’s PA by the parents. Also, the degree of overestimation was highly varying and showed no significant correlation. Thus, no scheme in regard to the judgement could be identified. That rules out the possibility of creating realistic numbers by simply reducing parent’s estimations by a certain amount or factor. The overestimation was especially distinct for physical activity outdoors and inside the house (so-called informal PA).
Consequently, it has to be stated that a questionnaire still is important to assess reasons of physical activities, attitudes or other additional information like socio-demographic data or sport facilities. But to determine effects of physical activity of young children on for example health, complementary methods are indispensable. This counts especially for children in pre-school age. In General, a questionnaire for children younger than 10 years is – as stated above – not applicable. Likewise, a questionnaire for parents is problematic, since PA of young children is characterised through many different movement patterns in play like run, walk, jump etc. (Hands et al. 2002, p. 3). This so-called informal physical activity is very hard to assess by parents. All in all, this implies a limitation to small samples to avoid strong distortion rather than trying to gain a large sample using methods with such a low validity as a parent’s questionnaire for physical activity of children.

However, the presented results have to be reflected in regard to some limitations which accompanied the study. First, the sample of only 24 has to be named which is at least in the area of social sciences regarded as a relatively small research basis. In turn, this is probably why questionnaires are so frequently used even though the validation is sometimes questionable. Further it has to be acknowledged that for validation of the questionnaire mean values were used and not day to day comparisons. On the other hand this is a positive fact in regard to external validation. Also, studies using heart rate measurements are in general limited by some basic problems like missed values or changed movement behavior due to the measurement. Problematic is furthermore the heart beat of 140 beats per minute as threshold for moderate activity which is taken from literature. Amongst others, in reality individual variations in a certain scope are likely. Additionally, the possibility of a threshold exceedance due to other reasons than physical activity (e.g. when a child cries) was neglected.
References


SPORTS LEADERSHIP AND ITS ROLE IN THE DEVELOPMENT OF COMMUNITY SPORT.

Hannah Mawson, Diane Crone, Andrew Parker, John Deane and David James, University of Gloucestershire, UK

This research focuses on the importance and development of sports leadership at the entry level of sport, and considers two perspectives: (i) a community sport perspective, and (ii) a sports leader’s perspective. From a community sport perspective, the presence and development of coaches, leaders and volunteers, is vital in achieving Sport England’s three key outcomes – increase participation, develop talent and improve satisfaction (Sport England, 2008). From a leaders’ perspective, sports leadership can enhance many generic skills, such as communication and organisational skills, teamwork, dedication, commitment, and responsibility. These skills are transferrable to other areas of life, and are often vital for success in business, career progression and education. In addition to exploring the impact that sports leadership has on both of these perspectives, the research will also consider the current prevalence of sports leadership in the UK. To achieve these aims, this research will focus on the views of those participants who engage in Sports Leaders UK awards and qualifications.

Sports Leaders UK (SLUK) is a charity which provides nationally recognised sports leadership qualifications and awards that help people to develop essential life skills such as teamwork, organisational skills, communication and leadership (SLUK, 2009). SLUK contributes significantly to the development of sports leadership in the UK, with over 200,000 leaders trained each year (SLUK, 2009), and can therefore be seen as an appropriate vehicle to evaluate sports leadership at a national level. The concept of Sports Leaders was originally developed by the Central Council for Physical Recreation (CCPR) in 1982, with the inception of the Community Sports Leaders Award (CSLA), which has developed over the past 25 years.

The past two decades has seen an increase in the acknowledgement and promotion of sports leadership, especially for young people, primarily due to changes in sports policy, education and society. Government publications outlining an increased focus on community sport development, levels of volunteering and citizenship, coinciding with
education promoting a shift from purely academic to more vocational options for young people, has presented an opportunity for Sports Leadership to increase its profile and prevalence. The six core values of SLUK echo these policy shifts and feature two key aims: (i) to educate and improve the personal development of the leaders; and, (ii) to impact on the wider social aspects of sport, such as social capital, citizenship and community sport development (see SLUK, 2009). These aims correspond with recent government policy and suggest that successful sports leadership programmes have the potential to have an impact on a wide range of social and educational aims. However, there is currently a lack of empirical research evaluating the extent to which the highly relevant aims of SLUK are realised.

For the purposes of this research, the term ‘community sport development’ is defined as using sport as a vehicle through which to promote “community consultation, empowerment and involvement in sustainable transformative change” (Hylton and Totten, 2007, p. 81). Community sports development is not simply the development of sport in the community; rather practices and interventions need to reflect wider social considerations, including social capital, citizenship, engagement and respect (Coalter, 2007; Hylton and Totten, 2007).

With the publication of key government strategies such as ‘A Sporting Future for All’ (DCMS, 2000) and ‘Game Plan’ (DCMS, 2002), there has been a growing focus on the development of sport from performance at the elite level, to participation and engagement at entry and community level, with an emphasis on opportunities for young people. However, with the more recent government publication ‘Playing to Win’ (DCMS, 2008), intended as a replacement to ‘Game Plan’, many in the sport and physical activity profession argue that this latest government document represents a shift in sport policy from inclusion and social development to elite sport development, given the emphasis on performance and excellence as a consequence of hosting the 2012 Olympic Games in London (DCMS, 2008). Nevertheless, a focus on lifelong participation and young people remains, with education and schools playing a fundamental role in delivering the strategy. The crucial role that education has to play in the development of sport is apparent through government investment in schemes such as PESSYP (Physical Education and Sport Strategy for Young People) and more recent changes to the 14-19 curriculum, with a
broader spectrum of both academic and vocational qualifications available to young people. SLUK have, for many years, facilitated accreditation through vocational qualifications which appear to be increasingly popular for many young people.

The manifestation of New Labour policy addressing the social inclusion agenda and the publication of ‘Game Plan’ (DCMS, 2002), has resulted in sport gaining an increasingly heightened profile as a tool which can help reduce crime, engage the disaffected, create active citizenship and contribute to social and economic regeneration (e.g. Coalter, 2007; Kay and Bradbury, 2009) This wider social role of sport has been the topic of much research in recent years (e.g. Kay and Bradbury, 2009; Collins and Kay, 2003). However, according to much of this research, such claims and benefits are based on assumptions. For example, despite the general tenor of policy in this area, much of the current literature reports difficulties in isolating the benefits of sport from other factors, such as personality type (Obare and Nichols, 2001) and personal circumstances and thus measuring the extent to which it is sport that impacts on such social concerns has proven to be problematic.

The role of sport in promoting health and well-being and contributing to the fight against illnesses resulting from a lack of physical activity has been widely acknowledged (e.g. Department of Health, 2004). Recommendations regarding minimum levels of exercise and physical activity have been adopted by many organisations and placed at the core of their strategies and plans (e.g. Sport England, 2008). However, there appears to be little research systematically investigating the impact of sporting opportunities and interventions on increasing levels of participation and contributing towards these recommendations (Priest et al., 2009).

The significance of volunteering in sport has been well researched over the past decade (e.g. Gaskin, 1998; Adams and Deane, 2009). However, more formal leadership programmes which include a volunteering role, such as SLUK courses, are not as well documented, particularly with regard to young people. Other national government sponsored initiatives such as ‘Step into Sport’ (Kay and Bradbury, 2009) and ‘Millenium Volunteers’ (Eley and Kirk, 2002) have been evaluated to explore the impact of these programmes on the personal development of the young leaders. Whilst these schemes incorporate SLUK awards, existing research
is limited in demonstrating the impact of these awards on the development of the leaders themselves and the extent to which they contribute towards community sport development. Such studies have also explored the socio-demographics of leaders in an attempt to provide profiles of young sports leaders and those who take on volunteer work (Eley and Kirk, 2002). This can help to identify gaps in provision of sports leadership opportunities for certain populations, and can aid organisations in targeting particular groups of people who are more likely to commit to leadership and voluntary work.

The present research adopts a different approach and will add to the emerging field of sports leadership by exploring the prevalence of SLUK awards, and will investigate the association between the socio-demographics of sports leaders and whether they register with, engage in or attain certification of level two and three awards. This will therefore provide some insight into the key factors associated with those who commit to such sports leadership programmes and those who do not. The present research will also aim to determine the extent to which the completion of SLUK Level 2 and 3 awards influence the personal and career development of those completing the awards, and the subsequent impact these leaders have on the wider community sport context, in particular, levels of participation, volunteering and provision of sporting opportunities. The research will be based on the perceptions of leaders participating in SLUK awards who will provide their own thoughts, feelings and experiences of Sports Leadership.

**Methodology and Methods**

This study adopts a mixed methods approach, utilising both quantitative and qualitative techniques (Teddlie and Tashakkori, 2009). Mixed methods research has become increasingly popular, particularly in the social sciences, due to the flexibility of utilising the most effective methodological tools for answering specific research questions (Teddlie and Tashakkori, 2009). This research adopts the philosophical perspective of pragmatism and implements an explanatory design (Creswell and Plano Clark, 2003), in which the qualitative data collected in the final phase of the study will build upon the initial quantitative findings collected in phases 1 and 2. A purposive, nested sample will be selected from the quantitative data, to be used for the qualitative aspect of the study. This approach will allow a research strategy that enables both analysis of large
data sets and further explanatory investigation into the experiences and perceptions of sports leaders. This will ensure a more complete picture and an enhanced understanding of outcomes, process and perspective, with regard to the impact of sports leadership programmes, such as those offered by SLUK, on vocational success and community sport development, for the participants who undertake them.

The study consists of three phases, each of which will answer a research question. Phase 1 investigates the association between socio-demographic variables and selected outcome variables (registration, engagement or completion of a Sports Leaders award).

This phase will adopt a quantitative methodology and will involve analysis of data stored on the SLUK internal database. The data included for analysis will be all candidates registered for Level 2 and 3 courses run between 1st September 2009 and 31st August 2010 (n=30,000). To ensure complete data sets, SLUK will aim to collect all relevant data and ensure it is recorded on their database. Output areas will be determined from participants’ postcodes and Census 2001 data will be obtained to determine deprivation levels and socioeconomic status (see Gidlow et al., 2007). The data from this stage will undergo binary logistic regression analysis to examine the influence of several independent variables (such as gender, age, socioeconomic status) on the designated outcome variables (registration, engagement or completion of awards). Binary logistic regression results in easily interpreted odds ratios and confidence intervals which are commonly reported in population studies (Gidlow et al., 2007; James et al., 2008).

Phase 2 is also quantitative and will involve a nationwide survey which will be distributed to all participants registered on a Level 3 Sports Leaders award between 1st September 2007 and 31st August 2009 (n=4000). These participants will also have completed the Level 2 (or equivalent) as this qualification is a pre-requisite to acceptance on the Level 3. All leaders must be 18 years of age on completion of the level 3 award to gain the qualification; therefore the potential influence of this level of award on career development will be greater than SLUK’s lower level awards. Prior to distribution, the survey will be piloted using a similar sample to the study participants, to evaluate its design and ease of use. The survey will assess the leaders’ personal perceptions of the SLUK awards, the impact that involvement in the awards has had on their own career development.
and employment potential. Information to be gathered from the participants will include: levels of educational achievement, levels of voluntary experience, and level of coaching and leadership qualifications. Descriptive and bivariate analysis will help to identify relationships between variables, such as completion of SLUK awards and current work/study. This analysis of survey responses will help to build a clearer picture regarding the influence the SLUK awards have had on the leaders’ personal and career development.

The final phase of the study will provide greater insight into the leaders’ perceptions and experiences of the awards, and their journey undertaken to achieve the awards, in relation to their own career development. Grounded theory methodology (Charmaz, 1995) will be adopted to specifically investigate the impact that Sports Leaders awards have on the development of community sport and career development, from the perspective of the leaders who have experienced the awards. Participants for interview will be selected from the survey responses in Phase two and semi-structured interviews (n=20) will be used to capture the worlds of the participants and their thoughts, feelings and actions (Charmaz, 1995) with regard to their personal experiences of sports leadership. Both theoretical and purposive sampling will be used, which according to Corbin and Strauss (2008), will ensure that theoretical saturation is reached in grounded theory studies. This will result in a theoretical model which will explain the impact of sports leadership on the development of community sport from the perspective of those sports leaders who have been involved in the programme.

To date, there has been insufficient research investigating the role and impact of sports leadership, and specifically in the UK, SLUK awards. As a consequence, the findings from this research will help inform SLUK, National Governing Bodies of sport and policymakers of the potential benefits of sports leadership programmes to both individuals and communities, and implications determined through the research will assist in further shaping sports leadership award structures and content. Findings from the research will also be relevant to European and International audiences and the research will also add to the evidence base which is currently lacking in the area of sports interventions and participation (Priest et al., 2009).
References


NON-CONTACT ACL AND HAMSTRING INJURIES: ECCENTRIC HAMSTRING TRAINING FOR INJURY PREVENTION

Mark De Ste Croix, Stephen Fruer, John Iga, Martine Deighan and David James  University of Gloucestershire, Gloucester, UK

Introduction

A wealth of epidemiological studies have indicated that the majority of injuries sustained by soccer players occur in the lower extremity, with the hamstrings the major site for injury (Hawkins and Fuller, 1999; Price et al., 2004; Woods et al., 2004). During sprinting injury is usually sustained late in the forward swing phase of the running action at the more extended knee angles as the hamstring muscle group works eccentrically to prevent hyperextension of the knee and flexion of the hip (Garrett, 1996). Despite extensive study in the area the precise cause of hamstrings strain injuries still remains unclear (Croisier, 2004). A variety of factors have been implicated in the aetiology of hamstring strain injuries, including muscle weakness and muscle imbalances (Croisier, 2004). Data also suggests a higher incidence of hamstrings injuries towards the end of matches and training sessions (Woods et al., 2004; Brooks et al., 2006).

It has been suggested that resistance training to increase the eccentric strength of the hamstring muscle group may improve this muscle group’s capability to absorb kinetic energy prior to failure, attenuating the risk of a muscle strain injury (Stanton and Purdam, 1989). Logistically, exercising with maximal voluntary eccentric action is by no means an easy feat (Hortobagyi, 2003) and traditional training using free-weights and machine-weights involves the performance of alternating concentric and eccentric muscle actions. The ‘Nordic’ hamstrings exercise (NHE) has received increasing interest in recent years as a means of training to increase the eccentric strength of the hamstrings (Brughelli and Cronin, 2007). The main attraction of this exercise is that it requires no additional equipment and can be performed simultaneously by a squad of players in the “field”. Electromyography has confirmed that the NHE is the optimal hamstrings field based exercise for motor unit recruitment, compared to other exercises commonly prescribed for training the hamstrings (Ebben et al., 2006). Data have suggested a
significant reduction in the incidence and severity of hamstring injuries following NHE raining of professional rugby union players (Brooks et al., 2006). Despite this, Brughelli and Cronin, (2007) suggested that due to the bilateral nature of this exercise the stronger limb may compensate for the weaker limb and over time this may induce or exacerbate existing bilateral strength asymmetries, possibly predisposing the weaker limb to injury (Knapik et al., 1991). Brughelli and Cronin, (2007) also questioned the ability of the NHE to engage and thus train the hamstring muscles at more extended knee angles. Therefore the purpose of this study was to examine the recruitment of the hamstrings muscles during the NHE and to examine whether bilateral strength asymmetries are present following a training programme incorporating the NHE.

Methods

Eighteen male professional football players with no history of musculoligamentous injury about the knee and no experience of systematic eccentric-based resistance training of the hamstrings muscles were recruited for this study. The recruitment characteristics of the medial hamstrings (MED) and lateral hamstrings (LAT) muscles in both the dominant (DOM) and non-dominant (NDOM) limbs were examined by the use of surface EMG (DelSys Myomonitor III, DelSys Inc.). Raw EMG data was collected at a sampling frequency of 1024Hz with a common mode rejection ratio of >80 dB and an amplifier gain of 1000. Raw EMG data was band pass filtered at 20 – 450 Hz using the DelSys Acquisition software. An electrogoniometer (S700; DelSys Inc.) was applied to each participant’s right knee, with the axis of rotation centred over the lateral femoral condyle, with the knee flexed at approximately 90°. The EMG RMS data for each section of the movement was normalised against the maximum EMG RMS amplitude recorded in the same muscle over a 2 ms window during the 5 repetitions of the NHE. The velocity of the NHE was standardised by the use of a metronome to perform the eccentric part of the NHE in three seconds. Isokinetic eccentric hamstring testing occurred on both limbs on a calibrated isokinetic dynamometer (Biodex system 3) at 60, 120 and 240°/s. Testing took place in a
prone position with the hips extended during unidirectional movements in which following the eccentric action, the participants’ limb was passively returned to the starting position by the dynamometers’ lever-arm. A strap designed to stabilise the trunk was applied across the waist, and participants were instructed to place their arms to the side of the reclined chair and hold the straps provided. This provided constant conditions across all participants and aimed to mitigate additional movements which may have confounded the test results. The axis of rotation of the dynamometer was visually aligned with the lateral femoral condyle of the knee with the knee flexed at approximately 90º. The resistance pad was placed proximal to the medial malleolus, allowing full dorsi-flexion and plantar-flexion of the ankle joint. Motion ranged from 90º to 10º of knee extension (0º representing full extension). Slow angular velocity assessments were performed before assessment at the higher angular velocities as this may facilitate learning during assessments at high angular velocity of the knee and reduce the risk of injury (Gaul, 1996). At each angular velocity two sub-maximal warm-ups were followed by four maximal test efforts. Limbs were tested in a randomised order across participants but standardised across trials. Five seconds of rest were allowed between each maximal effort. Standardised verbal encouragement was given before each maximal effort, and visual feedback of the recorded torque was provided. Participants were given a rest of 60 s between movements at different angular velocities. The gravitational moment of the leg-foot segment was determined from anthropometric data expressing the weight of the segment relative to the total body weight of the participant and the position of the centre of mass (Kellis and Baltzopoulos, 1996). From this data and the length of the segment (lateral femoral epicondyle-malleolus) moments at 0º of knee extension were calculated (Kellis and Baltzopoulos, 1996). The gravitational moment at any angle during the range of motion was obtained as the product of the above moment and the cosine function of the angle (Kellis and Baltzopoulos, 1996). To avoid the effects of acceleration and deceleration of the lever arm on torque output, only peak torque data obtained from the period of constant velocity, within a 5% range of the preset angular velocity, were analysed (Iga et al., 2009). The training group followed a previously applied
resistance training programme incorporating the NHE (Mjølsnes et al., 2004). The volume of training is illustrated in Table 3.2. The training group performed the NHE as part of their daily warm-up routine. In the NHE, the trainees started in a knelt position with a partner securing the legs by holding the ankles. The movement was to lean forward at the knees whilst maintaining the hip joint in an extended position. Participants were advised to resist the falling motion for as long as possible by engaging the hamstrings muscles. If this was not possible they had to try and maintain the tension in their hamstrings even after they had fallen. Participants were asked to use their hands to both brake their fall and return their torso to the starting position, therefore minimising the concentric contraction of the hamstrings during the movement. The control group continued their normal warm-up routine. Statistical analysis was performed using SPSS version 14 software package (Chicago, Ill). The level of significance was set at \( P < 0.05 \) for all tests. To examine the difference in muscle EMG activity during the NHE between the DOM and NDOM limbs (LAT and MED pooled), a paired sample t-test was applied. Where differences were not present, further analysis of the DOM limb through a two-way (2 x 3) fully repeated measures ANOVA was applied to examine the interaction effect of muscle region (LAT/MED) and knee position (phase 1, phase 2, phase 3) on EMG muscle activity during the NHE. Significant interaction effects and main effects were further examined using Bonferroni-corrected post hoc \( t \)-tests.

To examine the effect of the NHE training programme on the DOM and NDOM isokinetic peak torque production and angle of peak torque production at each test velocity, two-way (2 x 2) between (group) within (time) factorial analysis of variance design was applied. When a main effect for time was reported, the interaction between time and limb for isokinetic peak torque for each velocity was analysed using two-way (2 x 2) fully repeated measures analysis of variance. Significant main effects were further examined using Bonferroni-corrected post hoc \( t \)-tests.

**Results**

No difference in the EMG normalised RMS amplitude of the hamstrings between the limbs \( (P = 0.41) \) was observed. No main
effect for muscle region was observed \((P = 0.21)\) but main effects for angle were demonstrated \((P < 0.001)\) indicating that the RMS amplitude was significantly higher at the more extended knee positions. Significant interaction effects for time by group were observed for eccentric strength assessments of the DOM and NDOM limbs across all assessment velocities. Eccentric peak torque production in the training group improved 8 to 21%, whereas no significant change over time was observed for the non training group (~4%). The improvements in leg strength when the DOM and NDOM were pooled together were not velocity specific.

**Discussion**

There appears to be no difference between the amount of involvement of the DOM and NDOM limbs during the exercise and no difference between the contribution of the LAT and MED hamstrings during the movement. We found that the DOM and NDOM limbs contribute to the NHE similarly, with 7.8% (DOM) and 8.3% (NDOM) of the peak RMS EMG value produced by the respective muscle groups during the movement. Further analysis of the EMG data in the DOM limb demonstrated that the LAT and MED involvement were 7.3% (LAT) and 8.2% (MED) respectively. The primary finding from this study is that the NHE involves the hamstrings to a greater degree at the more extended knee angles during the movement \((60-0^\circ)\) when compared to the initial stage of the movement \((90-61^\circ)\). One explanation for this increase in EMG activity in the hamstring muscles at the more extended joint positions could be that the hamstrings are co-contracted during knee extension movements so as to stabilise the knee joint (Hirokawa et al., 1991). A second explanation for this increase in EMG activity in the hamstrings muscles at the more extended joint positions could be simply that gravitational effects are greater at the more extended knee positions during the movement.

The primary findings from the isokinetic strength assessments were that a four week training programme incorporating the NHE does lead to an increase in the eccentric strength of the hamstrings across angular velocities in both the DOM and NDOM limbs. The isokinetic eccentric strength assessments also indicated the improvements in peak torque following the training programme were
symmetrical across both the DOM and NDOM limbs, and appear not to be specific to the velocity of training. The improvement in eccentric strength following NHE training in the current study (15%) is similar to those reported by Tansel et al. (2008) (13%); Askling et al. (2003) 19%; and Mjølsnes et al. (2004) (11%). This rapid improvement in the eccentric strength of the hamstrings could be explained by the fact that soccer training and games play seems to asymmetrically develop the strength of the quadriceps (Iga et al. 2009). Also it is well documented in the literature that the increases in strength that are observed in the early part of a training programme can be attributed to neural adaptations (Gabriel et al., 2006).

Despite performing the NHE at an angular velocity of 30º/s the increase in eccentric strength in both the DOM and NDOM limbs across the three angular velocities tested (60º/s, 120º/s, 240º/s) would indicate that the increases in strength were not velocity specific and are in agreement with previous literature (Kellis and Baltzopoulos 1995; Seger et al., 1998). Conflicting literature is available suggesting that improvements in eccentric strength are greater when training is performed at faster angular velocities, albeit for the elbow flexors and through isokinetic training (Shepstone et al. 2005). Nevertheless findings from the current study implies that training using the NHE at slower angular velocities could provide protection against injuries that occur during running and sprinting activities where angular velocity can be in excess of 300º/s (Knapik et al., 1991).

This is to our knowledge the first study that has systematically explored the EMG activity of the hamstrings during the NHE and it would appear that using the NHE activates both the dominant and non-dominant limb equally, and importantly during the more extended parts of the movement. By incorporating the NHE into a warm up programme we have demonstrated a significant increase in eccentric hamstring strength in just four weeks compared to a control group. This suggests that eccentric conditioning of the hamstrings can increase eccentric torque production and consequently increase the functional hamstring quadriceps ratio that has been linked to both knee joint stability and reduced risk of hamstring strain.
References


The baroreflex is one of the body’s mechanisms for the regulation of cardiovascular control. Ongoing clinical research supports a link between baroreflex sensitivity (BRS) and disease and health (Parati et al., 1997). Some of this research has associated diminished BRS with cardiovascular diseases such as hypertension (Parati et al., 1988), alterations in heart rate control in patients with myocardial infarction (Osculati et al., 1990) and the inability to constrain sympathetic activity in patients with congestive heart failure (Grassi et al., 1995). Evidence has also associated reduced BRS with natural events such as ageing (Parati et al., 1995) and imposed events such as general anaesthesia (Parlow et al., 1999). A marked association between impaired BRS and smoking has also been reported (Mancia et al., 1997). Investigations assessing BRS in diabetic patients found impairment in baroreflex control while classical autonomic testing yielded normal results (Frattola et al., 1997). This suggests that the assessment of BRS may be a useful technique for identifying abnormal autonomic activity which links to mortality and morbidity (Parati et al., 1997). The assessment of BRS may therefore improve prognosis in diseased states and may also provide increased information for the prevention of disease. Thus, as diminished BRS appears to be linked to unfavourable health outcomes, factors that can enhance BRS may be beneficial to cardiovascular health. One factor which appears to enhance BRS in some circumstances is exercise.

Exercise training causes an adaptive response in the cardiovascular system which includes a lowering of heart rate (HR) and blood pressure (BP) at rest and during sub-maximal exercise together with an enhancement of BRS (La Rovere et al., 2002). The enhancement of BRS due to regular exercise training may produce an inhibitory effect on sympathetic activity with increased vagal influence which may help to improve outcomes following myocardial infarction (La Rovere et al., 2002). Exercise training may also bestow increased...
vagal influence on the heart, with decreased sympathetic influence, thus providing improved cardiac electrical stability and improved cardiac mortality (TFESC and TNASPE, 1996). Indeed, evidence of increased levels of vagal activity and BRS gain were found following exercise training in young, healthy individuals (Lénárd et al., 2005). Exercise training has also been found to reduce the age-associated decline in BRS in healthy, older men (Monahan, 2007). Thus, in both healthy individuals and cardiac patients exercise training appears to confer BRS changes that may be associated with positive health outcomes.

A few studies have also investigated the acute effect of a single bout of exercise on BRS. The studies of particular interest are those which report BRS assessment at time points + 1 h to + 24 h post-exercise (Somers et al., 1985; Convertino and Adams, 1991; Piepoli et al., 1993; Halliwill et al., 1996; Raczak et al., 2005; Niemelä et al., 2008). Any BRS assessments before the + 1 h time point are not so relevant, since changes are dominated by the very short-term disturbance of cardiovascular indices that are found immediately following cessation of exercise (Piepoli et al., 1993). Rather, in the present study, longer-term changes in BRS that may persist for one or more hours are the focus, given the possible implications for health outcomes.

There is some evidence for an increase in BRS at + 1 h following a single bout of exercise. The studies by Somers et al (1985) and Raczak et al (2005) reported increases in BRS at + 1 h but made no measurements after + 1 h. The study by Halliwill et al (1996) and Niemelä et al (2008) reported an increase in BRS for longer than + 1 h which had returned to control levels by + 2 h. However, Convertino and Adams (1991) found a substantial and prolonged increase in BRS lasting over 24 h. One reason for this finding could be due to differences in the intensity of exercise and body position for exercise during the intervention. Convertino and Adams (1991) incorporated supine cycling of graded work rate to exhaustion while the participants in the Halliwill et al (1996) study undertook 60 min of upright cycling of moderate intensity (60% VO₂ peak). Indeed, there were other comparability issues between the six studies. These included differences in exercise intervention, participant age, gender...
and exercise history. Furthermore, variations in the methods of BRS assessment were noted including invasive techniques of phenylephrine injection and neck chamber carotid pressure and non-invasive techniques. All of the participants in the various studies were healthy individuals with the exception of the hypertensive subjects who took part in the Somers et al (1985) study. Thus, it may not be valid to directly compare the findings of the studies.

Tilt provides an orthostatic challenge to the participant and this can be achieved by active standing or tilting via a tilt table. Tilt is employed in the assessment of clinical patients suffering from autonomic dysfunction such as syncope and may be employed for non clinical participants during the assessment of BRS as the tilt manoeuvre provides an opportunity to assess the baroreflex while it is very actively engaged. This suggests that it may be useful in some circumstances to include a tilt manoeuvre to assess BRS changes following exercise.

Although exercise has been found to provide positive health benefits exercise recommendations for particular health outcomes have yet to be fully elucidated (Haskell, 2001). Haskell (2001) asks an important question: what is the optimal dose of exercise required to achieve a specific health outcome? Exercise dose recommendations should be tailored to the desired health outcome and therefore specify the intensity, the duration and the mode of exercise. Indeed, Haskell (2001) suggests that a key issue in defining the dose-response relationship is the need to establish the acute physiological response to various exercise intensities and durations.

Baroreflex sensitivity measurement may be particularly useful for assessing overall cardiovascular control post-exercise. Whether BRS may be acutely manipulated following exercise is an important question. Such appraisal may be helpful in providing useful guidelines for recommendations on intensity, duration and mode of exercise for public health outcomes. Currently, there is little research that has investigated the effect of a single bout of exercise on post-exercise BRS and current data is hard to compare. Therefore, the aims of the present study are to investigate the effects of intensity, duration and mode of exercise on BRS following a single bout of exercise.
Research Questions

(i) How reproducible are procedures used to determine a series of cardiovascular outcome measures in supine and tilt position?

(ii) How do the intensity, duration and mode of exercise influence post-exercise baroreflex sensitivity?

Method

Participants and Ethical Considerations

Participants will include healthy, non-smoking, members of the University population between 18 – 35 years of age who have no history of disease, who show no symptoms of disease and who undertake regular exercise (moderate exercise 3 times per week). This research project proposes to recruit 50 participants for the reliability study and 20 participants for each of the three further studies (i.e. independent variables of intensity, duration, mode) although final numbers will be determined with regard to adequate statistical power. Participants will volunteer after providing informed consent and completing a health questionnaire. Informed consent will include describing the nature of the study, describing any risks or benefits of participation, outline the confidentiality of participant data and the right for the participant to be able to withdraw from the study at any time without negative consequences. Ethical considerations will include the following of guidelines and procedures which have been approved by the University of Gloucestershire Research Ethics Committee as presented in the Faculty Laboratory Procedures Manual.

Study Design

Initially, a test-retest reliability study of the procedure for assessment of BRS will be conducted (fig 1a). The following three studies will explore the influence of intensity, duration and mode of exercise respectively on post-exercise BRS. The study design will be within subjects repeated measures with two separate exercise conditions and a control condition in a counterbalanced order (fig 1b). Each participant will be required to visit the laboratory on 7 separate occasions for each study. Visit 1 will include completion of health
questionnaire, consent form and familiarisation with equipment. Visits 2, 4 and 6 will be separated by 2 - 6 days but scheduled at the same time of day to avoid circadian variation. Visits 3, 5 and 7 will be + 24 h after the second, fourth and sixth visit respectively.

**Figure 1.** (a) Design for the reliability study
(b) Design for the exercise studies

**Experimental Procedures**

Data will be gained through the collection of beat-by-beat BP and HR over 10 min periods in both supine and tilted positions. Data collections will always be preceded by a period of 20 min of supine rest. Data will be analysed by the procedures outlined by (Parati et al., 1997) where beat-by-beat BP and HR data are combined to provide an overall index of BRS. There is extensive relevant research which provides evidence that the BP values obtained by the Portapres are comparable to intra-arterial BP measurement thus validating the use of the Portapres system (Imholtz et al., 1998).
Statistical Analysis

The results from the reliability study will be assessed to determine the level of agreement between the measures using a limits of agreement approach to quantify the systematic error (bias) and the random error (limits of agreement) (Bland and Altman, 1986). The results of each of the other three studies will be analysed by assessing the interaction between time (-1 h, + 15 min, + 60 min, + 120 min, + 180 min, + 24 h) and condition (EX1, EX2, Control) using a 6 (time) x 3 (condition) fully repeated measures ANOVA. The main effect of time for each exercise condition will be examined with one-way repeat measures ANOVA. If significant interactions or main effects are found (p ≤ 0.05) post-hoc t-tests with bonferroni correction will be conducted to locate the differences.

Future directions

This research will be useful in assessing the influence of intensity, duration and mode of exercise on cardiovascular control following exercise which could assist in providing more bespoke exercise prescriptions for specific health outcomes. Further research will be required to investigate the transferability of findings to other healthy and disease populations to ascertain any differences between, for example, age, gender, clinical population. Ultimately, it would be useful to track the time course of change in BRS post-exercise after a given exercise bout as this would establish the duration of such change. Finally, the establishment of the time course of BRS change would be beneficial for future BRS research studies as this would provide increased confidence in steps necessary to control for the influence of prior exercise.

References


INTRODUCTION

The association between muscular work and ammonia production has been known since the late 1920s. The hydrolysis of ATP forms ADP and via the myokinase reaction AMP (Fig. 1). Accumulation of ADP and AMP during intense exercise activates the AMP deaminase which lead to the formation of IMP. The reamination of AMP via adenylosuccinate occurs mainly during the recovery phase.

The purine nucleotide cycle (PNC) has been cleared up by Lowenstein (10). The PNC has been imputed the following functions (16, 18): Maintenance of a high ATP/ADP ratio and a high energy charge by deamination of AMP to IMP, regulation of phosphofructokinase activity by ammonium ions, regulation of phosphorylase by IMP, providing intermediates for the citric acid cycle by forming fumarate, and the deamination of amino acids for the aerobic energy metabolism.

During continuous endurance exercise with 65 to 80% of VO2max ammonia accumulates linearly whereas lactate shows a steady state (3, 11, 19). Because ammonia overcomes the blood brain barrier very easily high systematic plasma ammonia concentration could lead to an accumulation of ammonia in the brain with an impairment of neurotransmitter function that may cause central fatigue (1).

In the literature there are no studies concerning the behaviour of plasma ammonia concentrations in the phase of exhaustion of an constant load exercise resulting to a lactate steady state. The decrease of adenylate nucleotides and concomitant increase of IMP during constant load exercise suggest an increase of plasma ammonia during the phase of exhaustion.
Ammonia easily passes the blood brain barrier and influences the function of neurotransmitters and brain metabolism. These effects may contribute to the mechanism that causes central fatigue and influences the ratings of perceived exertion.

Therefore, the aim of the present study was to investigate the behavior of plasma ammonia and lactate in the phase of exhaustion during constant load endurance exercise.

![The purine nucleotide cycle.](image)

Fig 1: The purine nucleotide cycle.
Methods

Ten subjects (26±4 years, 181±3 cm, 76±4 kg) participated in the study. Each subject performed a graded cycle ergometry (50 watts increase every 3 min, beginning with 50 watts) to determine maximal workload (W\text{max}). After that they performed one or two continuous exercise tests with 60% and 65% W\text{max} until exhaustion. Lactate (from earlobe), plasma ammonia (from antecubital vein), heart rate and rating of perceived exertion (RPE) were determined every 5 (65% W\text{max}) or 10 min (60% W\text{max}) up to every 30 s just before the break-off.

Ammonia was determined using a modification of the enzymaticalmonotest© Method of Boehringer according to the method of DaFonseca-Wollheim (1973). Lactate was measured with the ESAT 6660. Heart rate was registerated with the Polar Vantage heart rate monitor.

Results

Twelve exercise tests were performed in a lactate steady state but only five subjects were able to perform six tests to maximal exhaustion. The others had to be stopped prematurely because of seating disorders or lack of motivation. Mean maximal exercise time was 106±11 min (60% W\text{max}: n=2) and 52±6 min (65% W\text{max}: n=4). Steady state lactate concentrations (10.-30. min) were 2.7 (60% P\text{max}) and 4.2 mmol/l (65% P\text{max}).

Only one exercise test showed a continuous decrease of lactate until the cessation of exercise. All the other exercises showed a mutual simultaneous increase of ammonia and lactate just before the termination of exercise (Fig. 2). The beginning of the final increase was about 19 min for 60% W\text{max} and about 9 min for 65% W\text{max}. Maximal plasma ammonia concentration at the end of exercise was 202±46 (60% W\text{max}) and 182±40 µmol/l (65% W\text{max}), respectively.
Fig 2. Ammonia, lactate, heart rate und RPE during bicycle exercise with 60% $W_{\text{max}}$ in one subject until exhaustion.

In each exercise test there was a close correlation between plasma ammonia and RPE with $r>0.9$ (Fig. 3). The correlation between lactate and RPE was much weaker.
Fig 3. Regression between RPE and plasma ammonia (right) and lactate (left) during exhaustive bicycle exercise with 60% $W_{max}$. Because of the upper restriction of RPE scale only the first maximal RPE value was taken for regression analysis.

**Discussion**

During long lasting constant load exercises glycogen concentration in the working skeletal muscle decreased continuously (7, 8, 9).

Glycogen depletion has an influence on IMP formation. Norman et al. (14, 15) found a greater IMP content in glycogen depleted muscles fibers after constant load exercises.
A progressive glycogen depletion in exercising muscle fibers can explain the increase of ammonia but not the increase of lactate in five of six exercise tests. Glycogen depletion would expect a lower lactate concentration because of a lower availability of carbohydrates as substrates for glycolysis (3, 20). Only in one subject this behavior has been seen in the 65% $W_{\text{max}}$ exercise.

The time to exhaustion in the 65% $W_{\text{max}}$ group correspond to the results of the study of Baron et al. (2), in which the subjects performed a cycle ergometer test at maximal lactate steady state until exhaustion.

After exhaustive endurance exercises muscle biopsies showed ultrastructural changes of mitochondria (5, 6, 12, 13). These alterations indicate an impairment of oxidative energy metabolism leading to a decreased ATP/ADP-quotient. In consequence deamination of AMP to IMP and ammonia will occur under conditions of low energy potential in working skeletal muscle.

If glycogen depletion would be the cause for the break-off of exercise a decrease of lactate has to be expected. The concomitant increase of lactate and plasma ammonia can be explained by an impairment of the oxidative energy metabolism. This impairment could be due to observed ultrastructural changes of mitochondria and/or an efflux of tricarboxylic acid cycle intermediates (17).

Baron et al. (2) found no association with evidence of failure in any variable of energy metabolism or cardiopulmonary system during prolonged exercise performed at maximal lactate steady state and exercise termination. However the frequency of blood sampling just before the cessation of exercise was not as dense as in this study.

In conclusion, the findings of this study suggest that an impairment of the aerobic energy metabolism may play a significant role for local fatigue in constant load exercise. Furthermore rate of perceived exertion seems to reflect the state of dephosphorylation in exercising skeletal muscles.
References


INFLUENCE OF EXERCISE DURATION ON THE MAXIMUM LACTATE PRODUCTION RATE

Thomas Hauser, André Mäbert, Henry Schulz
Department of Sports Medicine, Chemnitz University of Technology, Chemnitz, Germany

Introduction

In addition to the maximum oxygen uptake (\(\dot{V}O_2\text{max}\)), the maximum lactate production rate (\(\dot{V}L\text{amax}\)) has an important influence on the formation of the lactate performance curve. While an improvement of the endurance performance is characterized by a right shifting curve, a left shifting curve is accompanied by an aggravation of the endurance. But the lactate curve does not show any details in relation to specific characteristics of the performance. Either the aerobic pathway, expressed by the \(\dot{V}O_2\text{max}\), or the described glycolytic pathway, might be responsible for the diagnosed endurance performance. This maximum lactate production rate is defined as the maximum velocity, which can be used for producing lactate. It is the maximum performance of the glycolysis. The lower the \(\dot{V}L\text{amax}\) the better the long time endurance, because the muscle does not produce that much lactate. This maximum rate can be estimated by performing short supramaximal sprints. The duration of these tests was an important focus of many studies. The time varies from 7 to 15 seconds (Bleicher 1999, Heck/Schulz 2002, Weber 2003). It seems that the maximum lactate production rate depends on the duration of the performance, because the rate of glycolysis is decreasing, which is caused by the acidosis (Danforth 1966).

The aim of this study was to investigate the influence of exercise durations on the maximum lactate production rate during cycling.

1. Which duration has the most important influence of reaching the maximum lactate production rate?
2. How does the maximum post exercise lactate vary between the different test durations?

Methods

22 male cyclists (27.1 ± 4.0 years, 71.7 kg ± 7.5, 177.9 cm ± 6.4) took part in this investigation.

The subjects completed seven supramaximal tests with durations of 6, 9, 11, 13, 15, 18 and 20 seconds in a randomised order. These tests were performed on different days with at least 24 hours rest between two tests. In order to prepare the organism, the subjects underwent a 12 minutes warm up period with a constant load set with 1.5th of the individual weight, followed by a second exercise with a constant load of 50 Watt. At the beginning of the second warm up exercise, one earlobe was anoint with Finalgon® extra stark for advancing the supply of blood. Direct after finishing the warming up phase, two blood samples were obtained from one earlobe, in order to measure the resting lactate concentration. Then, the test person was instructed again with the most important test details. After an countdown of 3 seconds, the subject had to start pedaling as fast as possible in a sitting position. When a cadence of 130 rpm was reached the pedaling frequency was kept at a constant level. That accords to an isokinetic mode. The subjects had to keep the power as long as possible. After finishing the test, blood samples were taken immediately and then each 60 seconds till the 9th minute after the end of the test, to define the maximum effect of post exercise lactate. Then all performance data was saved and converted in ASCII-Format.

Statistic:

- Average value, Standard deviation, Correlation, ANOVA

To approximate the maximum lactate production rate, the following 4 parameters needed:
• Maximum of post exercise lactate ($NBL_{max}$), Resting lactate ($VBL_a$), Duration of test ($t_{bel}$), Alactic intervall ($t_{alak}$)

$$\dot{V}L_a_{max} = \frac{NBL_{max} - VBL_a}{t_{bel} - t_{alak}}$$

The alactic intervall was defined as the 3,5% decline of maximum power.

![Figure 1: Determination of the alactic intervall](image)

**Results**

With increasing duration the amount of maximum post exercise lactate expands. The highest values were measured after 20 seconds, the lowest after 6 seconds. All differences, except between 18 and 20 seconds, were significant (Figure 2). With increasing time, the maximum lactate production rate declined (Figure 3).

The highest lactate production rate was detected in the 6 second test, with an average value of $1,51 \text{ mmol l}^{-1} \text{ s}^{-1} \pm 0,41 \text{ mmol l}^{-1} \text{ s}^{-1}$ lag.

The load duration has an significant influence on the maximum lactate production rate (ANOVA, $p<0,001$).
Figure 2: Maximum Post Exercise Lactate concentration (NBLamax)

Figure 3: Maximum lactate production rate (VLamax)
Discussion

It is not possible to measure the maximum lactate production rate directly in the muscle. With the quotient shown above the \( V\dot{L}_{\text{max}} \) can be approximated. Attention should be paid to the denominator of that equation, because it can take a value of zero. Then the equation would not be defined. That happens, when the load duration accords to the alactic intervall. Inferential, the testduration must be longer than the alactic time. The maximum lactate production rate is estimated at a high level, if the denominator is calculated near zero. This is because of a short alactic intervall and a short load duration. This problem appears especially after short test durations of 6 seconds, where the highest values were meassured. Sprinter reach their maximum power much faster then endurance athletes.

That means, that PCr is decreasing faster and so the glycolysis is activated early (Mader 1984). That causes a short alactic intervall. However, endurance athletes are not able to accelerate as fast as sprinters. These athletes reach their maximum power at a later time. PCr decreases slowly and the glykolyis is activated later. The result is a longer alactic intervall. The denominator of the equation is getting lower, all in all theis calculated higher for endurance athletes as for sprinters. These results were not found in the reality. With longer load durations the alactic intervall does not change significantly. But sprinters produce higher maximum post exercise lactate than endurance athletes which is the reason for higher lactate production rates. It must be pointed out, that the load duration has effectual be away from the alactic interval but has also finished before the pH-value starts to fall, because the glycolysis would stop (Danforth 1966). Further studies should investigate the influence of load durations of 5,6,7 and 8 seconds and the influence of different pedal frequencies on the maximum lactate productionrate for sprinters and endurance athletes.
References


Sex Differences in the Functional Hamstring to Quadriceps Ratio and Neuromuscular Performance.
Youssif Omran Elnagar, Mark De Ste Croix, David James

Context
The anterior cruciate ligament (ACL) is often injured when athletes execute running and crosscutting manoeuvres during sport activities such as soccer, basketball, and rugby (Arendt and Dick, 1995). Approximately 70% to 80% of all ACL injuries are non-contact in nature (Griffin et al, 2000; Hertel et al, 2004) and, compared with male athletes, female athletes are reportedly 4 to 6 times more likely to sustain a sports-related non-contact ACL injury (Arendt and Rick, 1995). Numerous risk factors for non-contact ACL injuries have been identified in the literature (Hughes and Watkins, 2006) where suggestions focus on potentially modifiable risk factors related to body positioning, joint loading, and neuromuscular coordination in preventing and reducing the incidence of this injury.

Investigators have demonstrated that women tear their ACL more frequently than men (James et al, 2004) even when differences in rates of participation and other obvious potential confounding factors are accounted for. The reason for this is unclear; however, possible causes include anatomical differences, (James et al, 2004) mechanical differences (McLean et al, 1999) and hormonal differences (Pflum et al, 2004). Most injuries occur in the second half of an athletic event (Hertel et al, 2004) when fatigue is present. Therefore, identifying fatigue as a potential risk factor for an ACL injury, and exploring the interaction between fatigue and other potential risk factors, may allow for the development of improved prevention strategies.

Evaluation of isokinetic eccentric antagonistic strength relative to concentric agonist strength may be of value in describing the maximal potential of the antagonistic muscle group (Coombs and Gorbutt, 2002). The hamstring to quadriceps ratio has conventionally been expressed as concentric hamstrings to concentric quadriceps strength (Lund-Hansen, 1996) which does not reflect the functional
capacity of the knee during dynamic movement. A functional eccentric hamstring to concentric quadriceps ratio of about 1.00 has been reported for fast isokinetic knee extension movement, indicating a significant capacity of the hamstring muscles to provide dynamic joint stabilization during active knee extension (Aagard et al., 1998). Knee joint stability is known to be important in risk of injury (Blackburn et al., 2009). The functional eccentric hamstring to concentric quadriceps ratio is velocity and joint angle dependent (Aagard et al., 1998), and the current study builds on the work of Sauret (2007), who suggested that the functional ratio should be calculated at controlled angles to avoid differences in peak torque between quadriceps and hamstring due to varying joint angle. However, sex differences in functional ratio, taking into account angle and velocity, remain to be investigated, particularly in a fatigued state, and may reflect predisposition to injury (Croce et al., 1996).

High levels of neuromuscular control are also necessary to create dynamic knee stability (Besier, 2001). Neuromuscular pre-planning allows feed forward recruitment of the musculature that controls knee joint positioning during landing and pivoting manoeuvres (Besier, 2001). Imbalanced or ineffectively timed neuromuscular firing may lead to limb positioning during athletic manoeuvres that puts the ACL under increased strain and increases the risk of injury (Myer et al., 2005). It has been suggested that females display a longer latency period than males between preparatory and reactive muscle activation (Winter and Brookes, 1991). The electromechanical delay (EMD), which is defined as the time delay between the onset of muscle activity and onset of joint acceleration (Norman et al., 1979), may be associated with the unrestrained development of forces of sufficient magnitude to damage ligamentous tissue during prolonged exercise (Winter and Brookes, 1991). Sex differences in muscle recruitment and timing of muscle activation may affect dynamic knee stability (Hewett et al., 2005). To date no studies appear to have examined sex differences in EMD of the hamstrings under eccentric conditions during knee extension movements, let alone under conditions of fatigue.
The fatigue produced by any activity can be assessed by comparing the force of maximal voluntary contraction before and after exercise (Rahnama et al, 2003). For the functional hamstrings to quadriceps ratio, if the hamstrings eccentric peak torque is equal to the peak concentric quadriceps torque then the ratio is 1:1 and the joint is supposedly not at risk whereas if the quadriceps is stronger, then the ratio is less than 1, and the joint is considered at risk (Hughes and Watkins, 2006). Consequently it may be hypothesised that, in the fatigued state, the functional hamstring to quadriceps ratio would be less than in the non fatigued state if it is to be considered that the functional hamstring to quadriceps ratio mediates the link between fatigue and injury risk of the knee. Although fatigue has been proposed to increase the risk of ACL injury (Hertel et al, 2004), there is currently no evidence to suggest that fatigue has a greater effect on the incidence of ACL injury in females compared with males (Hughes and Watkins, 2006). Furthermore, no studies have investigated sex differences in either dynamic knee stability or functional ratio following a field based fatigue task. Therefore, the proposed research will examine sex differences in the functional eccentric hamstring to concentric quadriceps ratio and neuromuscular functioning of the knee joint muscles that appear to be associated with reduced knee stability and an increased risk of ACL injury in both a fatigued and non-fatigued state.

Participants, recruitment and ethical considerations

Male (n=55) and female (n=55) participants with no previous history of knee joint musculoligamentous injury will be recruited from the student population at the University of Gloucestershire. Participants will be given an information sheet to explain the procedures involved in the studies and questions will be answered. A standardised Health Questionnaire which has been approved by Research Ethics sub-Committee (RESC), as detailed in the laboratories procedures document, will be used and acceptance in the study will be granted once it has been determined that health status does not present a risk in relation to the requirements of the study. On each testing occasion the participants will be asked to review their answers to the questionnaire and date and sign it again if their answers are identical to those previously reported. All methods will be based on RESC
approved laboratory procedures manual. All raw data will be stored confidentially in electronic form using ID codes and all participants’ results will be reported anonymously. For female participants, all testing will be conducted whilst taking account of the phase of the menstrual cycle.

**Torque Assessment**

Isokinetic concentric and eccentric assessments of the knee joint muscles will be performed on a calibrated Biodex System-3 Isokinetic Dynamometer (Biodex Corp., Shirley, NY, USA.). The dominant leg will be determined according to procedures of Rizzardo et al, (1988) and the leg will be weighed to correct for the effect of gravity on torque measures.

**Electromechanical Delay Assessment**

Electromechanical delay (EMD) represents the time lapse (ms) between start of EMG activity and force generation for each response (Sandra et al, 1999). Determination of the EMD will be according to the procedure of Zhou et al (1995). The onset of EMD is determined as the point at which a +15 µV deviation from baseline is observed for the EMG signal (RMS amplitude). The onset of force generation is defined as a 9.6 Nm increase in torque. To investigate the true EMD in a contraction, the maximal electromechanical delay (EMD max) value will be determined as the longer EMD of the three muscles (see below).

Electromyography (Delsys Myomonitor III, Delsys Inc., Boston, MA, USA) will be used to investigate the activity of the hamstrings during the eccentric hamstrings peak torque. Delsys bipolar active surface electrodes (DE– 2.3 MA, Delsys Inc., Boston, MA, USA) will be placed on the muscle belly of the biceps femoris (BF) semitendinosus (ST) and semimembranosus (SM) muscles to determine the EMG activity. The EMG unit includes a common mode rejection ratio of >80 dB and an amplifier gain of 1000. Raw EMG data is band pass filtered at 20 – 450 Hz using the DelSys Acquisition software. The EMG data for each section of the movement will be normalised against the maximum EMG RMS amplitude recorded in the same muscle. Torque measurements to determine the onset of force generation will be performed during
eccentric hamstrings action using an isokinetic dynamometer (see procedure for torque assessment).

**Study design**

**Study 1**

The functional HQ ratio will be determined by measuring torque produced about the knee joint during concentric quadriceps and eccentric hamstrings action (see procedures for torque assessment) and expressing results in relation to joint angle and joint velocity. Assessments will be conducted at hip angle of 0° at slow (60°/s), intermediate (180°/s) and fast angular velocities (240°/s) for both concentric and eccentric actions, with concentric actions performed first. Participants will perform 3 maximal efforts at velocities of 60°/s, 180°/s and 240°/s. The velocities chosen are based on similar velocities used in previous investigations (Rahnama et al, 2003; Kellis and Katis, 2007). Hamstring to quadriceps muscle strength ratios will be calculated separately based on maximal peak moments and knee angle-specific moments at 15°, 30° and 45°.

For study one, analysis will be performed for the independent variables of knee angle, knee angular velocity and sex (3 x 3 x 2) using a mixed-factorial analysis of variance (ANOVA) to determine the influence on dependent variable of the concentric quadriceps and eccentric hamstrings ratio. The three independent variables include two within-subjects factors: knee angle (15°, 30° and 45°), joint angular velocity (60°, 180°, and 300 deg/sec) and a between-subjects factor of sex (male and female).

**Study 2**

To determine EMD, three maximal eccentric actions of the hamstrings will be performed with a 30 s break between each action. Each action will be performed at a different joint angular velocity. During each action the time lapse between the start of EMG activity and force generation will be determined.

For study two, analysis will be performed for the independent variables of hamstring muscle group, knee angular velocity and sex (3 x 3 x 2) using a mixed-factorial analysis of variance (ANOVA) to determine the influence on the dependent variable of
electromechanical delay based on EMG and torque values. The three independent variables include two within-subjects factors: hamstring muscles (BF, ST, SM), velocity (60°, 120°, and 240 deg/sec) and a between-subjects factor of sex (male and female).

**Study 3**

The functional hamstrings to quadriceps ratio and electromechanical delay of the hamstrings will be determined pre and post a fatigue task. As used in previous studies (Eston et al., 1996) a downhill run protocol will be used to provide fatiguing exercise. The protocol consists of 40 min of intermittent bouts (i.e., 5 × 8 min) on a -10% decline on a motor-driven treadmill, with 2 min standing rest interval between each bout. The speed of the treadmill is set to elicit 80% of the age-predicted maximum heart rate (220 - age). At the end of each 8 min bout, heart rate and treadmill speed will be recorded.

Although the final form of analysis will be dependent on the findings of study 1 and 2, the analysis might be as follows:

- The independent variables of time (pre and post), knee angle (15º, 30º and 45º), angular velocity (60°, 180°, and 240 deg/sec) and sex (male and female) using a mixed-factorial (2 x 3 x 3 x 2) analysis of variance (ANOVA) to determine the influence on dependent variable of the functional ratio. The four independent variables include three within-subjects factors: time, knee angle, joint angular velocity and a between-subjects factor of sex (male and female).

- The independent variables of time (pre and post), hamstring muscles (BF, ST, SM), angular velocity (60°, 180°, and 240 deg/sec) and sex (male and female) using a mixed-factorial (2 x 3 x 3 x 2) analysis of variance (ANOVA) to determine the influence on dependent variable of the electromechanical delay. The four independent variables include three within-subjects factors: time, hamstring muscles, joint angular velocity and a between-subjects factor of sex (male and female).
Conclusion

The findings of these studies should provide greater insight into the potential reasons for differences in injury incidence between males and females, and the basis for the link between fatigue and injury incidence. In particular, the findings will establish whether males and females differ in functional ratio and electromechanical delay, and whether any differences persist in a fatigued state.

References


EFFECTS OF MEDICAL EXERCISE THERAPY IN NEUROLOGICAL REHABILITATION

-Case study on brachial plexus lesion-


Introduction

The brachial plexus lesion shows an incidence of a total of approximately 1000 - 1500 Plexus - lesions in Germany a year (HIERNER & BERGNER, 2002). The treatment of this disease are often designed to be long and complex because there are anatomic situations difficult and often is part of a polytrauma with severe associated injuries. For this reason, different individual and the clinical picture, there is no single treatment approach. Accordingly, there are many discussions about the optimal type of therapy, as also the effectiveness of each procedure is poorly predictable. The study examines the effects of isometric strength exercises at an isokinetic system in conjunction with an individual adjusted training as part of the medical training therapy which is focused of the development of strength capabilities and the scale of flexibility in the elbow joint after transplant of n. plexus and m. biceps brachii. The objectives of medical training therapy includes the co-activation of the paretic muscles through targeted training of intact synergists, the innervation of the antagonists, the activation of the symmetrical muscles of the opposite side through bilateral training and reintegration into the movement patterns with a slight stretch stimulation (see DRUSCHKY, 1979).

The objective of this study is to present a possible therapeutic path in physical exercise therapy through selected movement refered measures after the transplant of the aforesaid muscle. This therapy is examined with regard to its effect on the function and the changes of the active movement extent of the cubital joint. Clinical studies on the effect of medical training therapy in the context of neurological rehabilitation are in deficit. Up to now, physical exercise rather than supplements to the manual therapy, so here are initial findings are obtained. Which was to answer the following questions: Which show the injured muscle activity compared to the healthy upper extremity?
If there are significant increases in strength of the reconstructed muscle through strength training? If there is to improve active range of motion?

**Methods**

A prospective single case study was put into effect on a patient (age: 30 years, sex: female, height: 168 cm, weight: 53 kg, bmi: 18.7) with a complete plexus brachialis lesion on the left side. She received a transplant of the m. gracilis to the m. biceps with fixation at the Proc. coracoideus together with a reconstruction of the appropriate nerves (7 months earlier). The therapy period was about 10 months and took place in an out-patient rehabilitation clinic.

**Course and Equipment**

The strength diagnostics and the isometric strength exercises were carried out at CYBEX Norm 6000™. The diagnostic is aimed at the ascertainment of strength abilities of the elbow flexion and extension musculature. The electromyographic activity of the M. biceps could measured only at the end of the therapy period because a voluntary contraction immediately after the implant was impossible. The measurement consisted of three maximum voluntary contractions (MVC – Maximum Voluntary Contraction) with an elbow flexion angle of 90° (3 seconds contraction time, 2 seconds rest). The electrode application (Arbo AgCl) occurred in imitation of SENIAM. The recording (A/D transformer 1000 Hz) and the evaluation of data was carried out with Dasylab 10.0 (national instruments). The raw data are filtered (high pass 10Hz/ low pass 500Hz), rectified and smoothed out (RMS 70ms). The on-off-set identification is made by means of two-times standard deviation of the rest-electromyogram. Parameters are the average amplitude (MEAN), the maximum amplitude (PEAK) and the integral (IEMG). A manual goniometer at the olecranon was used to measure the active joint play of the elbow.

**Statistical Analysis**

To ensure a better course description the strength values were collected over 10 months and subdivided in 3 fine distances. At the paretic arm the values just reached small amounts. Their development was compared over the exceeding frequency of the
median. The Kolmogorov-Smirnov-test was used to review for normal distribution and significant differences in the time phases were ascertained with a k-test. A combined t-test was employed to analyse the EMG results. Not parametric tests according to Wilcoxon occurred in case of not-normal-distribution. The significance level was fixed at 5%. The statistical analysis and evaluation was carried through SPSS 11.5.

Results

Considering the entire therapy period the torques of the elbow flexors and extensors have significant increased (p<0.05) after transplantation. As showed in diagram 1 the number of the values which lay over the particular median. The medians of the maximum and the average torques at the beginning of the therapy have been used as reference values.

Diagram 1: On display are the curves of the average torques, which have crossed over the three periods the median.
Diagram 2: On display are the curves of the maximum torque, which have crossed over the three periods the median.

**Range of Motion**

The active flexion angle expanded over the therapy period from 0° up to 100° with an existing extension deficiency of 10°. This corresponds to an increase of 90° of joint play.

**Electromyography**

Between the injured and the healthy arm the EMG-measurements show significant differences (p<0.05) for the maximum (PEAK) and the average amplitude (MEAN) as well as the integral (IEMG). Regarding the maximum and the average tension the flexor on the left side exhibits just half as big values (48,05%) than the right side (p<0.05).
Diagram 3. Watch are the average amplitude of three maximal voluntary contractions. Specify the values in microvolts. Each contraction lasted for three seconds.

**Discussion**

The assumption can be confirmed that a significant rise of the strength capabilities of the flexors and extensors in the elbow will occur. The EMG-measurements at the M.gracilis transplant detect an improved innervation which leads to a better intramuscular co-ordination. Also more consistent strength faculties at the isokinetic ergometer could be recorded. In comparison with the extensors the elbow flexors exhibit in 59 of 84 cases (70%) higher strength values. They reached in 48 cases of it twice or even triple torques. This improvement can be explained with the long-termed and steady training. The rapid rise of the flexion power particularly in the end of the observation period attributes to the training with additional weight. Because of that we assume that the real possible flexion power is not reached yet. Regarding the motion of the elbow is therefore attributable to using specific strength training will improve. At the end of the therapy the subject was able to lift her left arm over the middle of the body and hold this position for a short time. Before
the kinesitherapy that was impossible. BRIESCHENK (1996), BONNARD (1999) and BRÜSER (1999) report on similar effects. The small extension deficit (10°) can be classified as tolerable. This is caused by the anatomy of the gracilis transplant. Its length is not exactly corresponding to that of the M.biceps brachii and associated with this is a certain muscle pre-tension.

Summary

A complete plexus lesion shows even after the reconstruction using muscle graft neuromuscular significant differences to the healthy limb. The usual therapeutic way of physical therapy is described by external electrostimulation (DRUSCHKY, 1979). The aim of this case study was the effect of hierarchically coordinated training methods of strength training as part of a medical training therapy to check on the development of active power and agility. This was done on a patient (age 30 years, weight 53kg, size 168cm), which is a reconstruction of the N. plexus and muscular biceps get transplants of the gracilis to M. had. The observation period was between 01 August 2008 and 31 May 2009. The training was carried out on an isokinetic and free weights. The data collection took place by means of isokinetic testing system, EMG, and protractor. A measurement of voluntary contraction using EMG was possible because of the innervation of the transplanted muscle only at the end of the observation period. For a better description of the developmental trajectories of the observation period into three time-equivalent sections was divided. The results showed significant increases in the force capabilities across all three periods. The innervation of the graft was still significantly different to the healthy limb. However, can be achieved by increasing the power capability, a slow integration into the motor suspect by growing nerves. Thus, the chosen methodology as a potential therapeutic approach can be reconstructed by nerve Plexus are considered.
References


THE NOTION OF A SCIENCE OF SPORT: SOME CONCEPTUAL CONSIDERATIONS

Emily Ryall, University of Gloucestershire

Whilst it is accepted that science and scientific methods are contested concepts, traditional definitions and understanding still favour a positivistic, inductivist model whereby some type of systematic testing is undertaken in order to produce a general conclusion about the phenomena being studied. Essentially, science aims to provide us with reliable knowledge about the composition of the world and how it works. Scientific methods (in contrast to supernatural methods or methods based on whim or emotion) are held up as being rigorous and repeatable; the two mainstays of scientific investigation are explanation and prediction. Thus, those using scientific methods will maintain that knowledge about the world develops from being able to assess and control relevant variables and deduce accurate conclusions from the results. However, this essay will argue that utilising scientific methods when studying humans (and that includes the study of sport) is inappropriate and misses the point of our investigations; as Gaita (Winch, 2008) says in his introduction to Winch’s work, “[it] is not to deepen our understanding of the subject matter with which one began, but to lose it altogether” (pxxiv). My intention is to overlay Winch’s ideas on to those areas of investigation that are regarded as sport sciences; areas of investigation which are blind as to the type of discipline that they are. This mis-appropriated desire to be categorised as a science is, I suspect, due to the low value that the study of sport is given in many academic circles and the subsequent desperation of many of those working in this area to generate respect and credibility by emulating the methods and tangible results that appear to be displayed by the so-called ‘hard sciences’.

Essentially, what I wish to do is to demonstrate that sport science is a misnomer and that apart from some very specific and delineated aspects of study, the majority of those studying sport are at worst doing nothing of merit and, at best, doing bad philosophy. Why ‘bad philosophy’? The reason being, that philosophy is uncommitted enquiry; it aims to make sense of various forms of life, and that includes the form of life of what might be described as ‘scientific investigation’ but, in doing so, it is also willing to critique itself. In contrast, the sport sciences are already committed to a position: one that justifies the use of the term ‘science’.
I wish to attack the notion of a sport science on two fronts. First, by taking the main thrust of Winch’s argument in that we can only understand human behaviour from the position of being human; that is, we are already within that form of being and inherently adopt a notion of meaning and understanding of concepts already contained within that perspective; thus rendering the ‘external, objective’ perspective occupied by physical scientists absolutely unobtainable. Second, and as a consequence of the first, an attempt to construct general principles of human minds and behaviour is to bypass the very rationale we give in making such generalisations in the first place, namely, to gain some understanding of human action and behaviour.

Theories that attempt to explain human behaviour in an objective, rational way can be appealing. For example, giving an account of altruistic acts by reference to evolutionary psychology appears to provide a way of grounding non-scientific (philosophical, ethical, axiological and aesthetical) questions in science. But - and this is what Wittgenstein (2001) meant when he said, “We feel that even when all possible scientific questions have been answered, the problems of life remain completely untouched,” (§6.52) - this neglects a huge swathe of important questions about being human and part of human society. This is arguably what Winch was getting at when he criticised the social sciences for essentially conducting ‘bad’ philosophy, for these questions are not scientific questions at all. The very rationale behind the human sciences is to give an account of human phenomena in general. Yet the misconception and mistreatment of such problems as a facet of science is, Winch labels, ‘misbegotten epistemology’ (p41). The question as to whether it is appropriate to utilise scientific methods in the study of humans is fundamental. Yet Winch’s criticism is that such issues, he says, are not empirical ones but conceptual:

It is not a question of what empirical research may show to be the case, but of what philosophical analysis reveals about what it makes sense to say. I want to show that the notion of a human society involves a scheme of concepts which is logically incompatible with the kinds of explanation offered in the natural sciences. (p67-8)

Here, Winch attacks the assumption held by those studying human behaviour and interaction that it is possible to uncover fundamental laws governing their behaviour in the same way that causes can be reduced to generalisations as they are in the physical sciences. It is not the
generalisation itself that is particularly problematic, for such generalisations may provide an accurate prediction of behaviour (although not in the same way that biologists can produce generalisations about a cell’s behaviour), but rather that simply by believing that a generalisation is appropriate is to neglect a fundamental and conceptual difference. For Winch, an understanding of human behaviour is gained not through an application of causal processes but rather through an appreciation of reasons, and this is only recognised through the meaning and concepts understood in relation to that community.

The study of humans in sport is to attempt to gain an understanding of human behaviour, mental states, and human relations in a sports environment. And it falls directly into the arena where Winch is attacking. It is here whereby the distinction between reasons and causes becomes paramount. Causes can be ascribed to physical phenomena by a detached observer (our traditional conception of ‘scientist’) and that observer is not contained within the world, or rather form of life that is being observed. Reasons on the other hand, are provided as justification of action. That is, they are ascribed by the phenomena being studied themselves and is part of an ongoing dialogue between the observed and the observer. It is contained within that form of life and only makes sense when understood as such. As humans are already contained within the form of life that is being studied (that is, the form of life whereby we already have an pre-positional, pre-thetic, and pre-reflective understanding of sport), it makes no sense to treat it as otherwise.

Since through our own existence of being human we grant humans with mental states, i.e. beliefs, thoughts and desires, we accept that humans are both self-reflective and conscious of the mental states of others iii. This therefore affects the way in which situations are interpreted and the behaviour that results. To illustrate this important point, Winch shows how we recognise the different type of relationship that exists between lightning and thunder, and a sergeant issuing a command which his soldiers then carry out. We do not say that the sergeant causes his soldiers to act in the same way that lightning causes thunder. Although on the surface there may appear to be causal relationships between the two examples, the issuing and following of a command only makes sense when those involved are aware of the meaning of the concept. In contrast, the events of thunder and lightning exist independently of the concepts themselves. The soldiers act
through an understanding of what a command by their superior officer means. In the case of response by the soldiers to the command of the sergeant, behaviour is governed by the concept, in the case of thunder and lightning, it is merely an explanation.

So whilst it may be possible to predict the effect that a particular psychological technique on the performance of an athlete it does nothing to aid our understanding of what that athlete is really doing. As Hume (2000) said, we see two concurrent happenings and infer the relationship between them. Prediction in the social sciences has a different role to that in the natural sciences. When an observer (a sociologist or psychologist for example) identifies that an athlete is following a rule, it does not carry the same strength as observations in the natural sciences.

For example, players may follow a rule in football that says ‘when a player is injured the team in possession will put the ball out of play. When the play restarts, the opposition will pass the ball back to the team who originally held possession.’ However, as was aptly illustrated by a FA cup match between Sheffield United and Arsenal in 1999 the relationship between the phenomena (as described by the rule) is not the same type of relationship that a physicist might described when she discusses the relationship between gravity and a ball. The rule in the former example is not definitive. It is dependent on the athlete’s subscription to that form of life, namely, what it means to follow a rule in the first place.

As Winch identifies, if a social or human scientist were doing the same thing as a natural scientist, then there must be some criteria or set of rules that determines whether two observations are comparable in terms of being examples of the same occurrence. Yet the difficulty for the investigators of human phenomenon is that they have to conform to two sets of rules: the set that governs the investigator’s study itself (i.e. the methods that ensure validity and reliability), and the rules that the subjects themselves are following. For example, when a scientist studies the effects of vitamin C on ferritin levels, the cells studied do not behave in accordance to a set of rules about what it is to be a cell. Yet, a study that attempts to measure of muscle torque via the use of an Isokinetic-dynometer requires the participant to understand what is involved in following instructions; in this case, to exert maximal effort in a particular movement at a particular time. In contrast to the scientist studying ferritin, the interpretation of human behaviour needs to take into account the intention or reasons behind that behaviour. It
requires the participant to respond to the experimenter’s instructions and requires the experimenter to infer that the participant is responding to the instructions in the way that she herself understands. Although standardization attempts may be made to improve the internal validity of the experiment it is impossible for the biomechanist to determine whether two actions essentially count as the ‘doing the same kind of thing’.

This is but one example of the many ways that biomechanists, physiologists, psychologists and sociologists of sport attempt to gain an understanding of human behaviour through utilising scientific methods. When, as Winch notes, humans are governed by reasons not causes, to study humans via these methods under the guise ‘science’ is wholly inappropriate and is to misunderstand one’s own practice.

In conclusion, it is not simply that the study of humans is inherently more complicated than the study of physical phenomena, but rather the activities of studying the two are conceptually different. It is more appropriate to view the activity of those studying sport to a physicist’s understanding of what her colleagues do as part of their day to day work, than the physicist’s research of physical systems themselves. Ultimately, as Winch argues,

> What in fact one is showing… is that the central concepts which belong to our understanding of social life are incompatible with concepts central to the activity of scientific prediction. When we speak of the possibility of scientific prediction of social developments of this sort, we literally do not understand what we are saying. We cannot understand it, because it has no sense. (p88)

Winch’s work, in the same way, shows how the notion of a sport science also makes no sense and that an attempt to utilise scientific methods in the study of sport is to mis-conceptualise what one is doing.

References

Note

Whereby the human qua human is not under investigation and such investigations fall under other scientific disciplines such as material science, physics or chemistry.

2 This is understood to be the different system of reference that allows sentient beings to make sense of themselves and their environment and other ontological and axiological questions. It recognises that simply by being human, or a white male, or of the twentieth century, we are restricted in our perspective or world-view.

3 That is, we ascribe humans with an inner mental state similar to our own and do not treat them as zombies or purely material (non-mental) objects.

4 For more information on this controversial ‘rule breaking’ incident see <http://www.guardian.co.uk/uk/1999/feb/14/deniscampbell.theobserver> [Accessed January 2010]
It is important that we recognize that new technological innovations in sport and elsewhere are developed to enhance performance. Whether it is steroids or running spikes, the 3rd umpire or ProZone, Botox or Viagra, pacemakers or breast augmentations, what we want is to be better.

Paradoxically, this technological arms race has seen a concurrent demonization of technology, particularly in the sporting sphere; one need only have a look at the WADA website to understand how the modern athlete is under complete technological siege (of course, some might argue that we are in need of a radical cultural reappraisal if we can name doping as a horseman of the apocalypse while letting the demons of Prozac and Ritalin run amok).

Consider Hollywood’s treatment of the humble cyborg. Arnie and Jean-Claude explode onto our screens carrying impossibly large guns and spouting memorable one-liners in a plethora of violence, blood and cold, calculating machine rationale. We shudder as the skin melts off of Arnie’s face, revealing a monstrous, metallic skeletal substructure with glowing red eyes. We are horrified by the ease with which Jean-Claude kills people on command; he swings his gun in an efficient arc, a computerized movement devoid of emotion. Yes indeed, it is manifestly clear to the edutainment authorities – the media of the masses – that the interaction between technology and humanity can only lead to bad things. But is that really what a cyborg looks like? Is that really how a “technologically assimilated” person behaves?

Technology and Culture

In Metal and Flesh, Ollivier Dyens discusses the place of homo sapiens in the world as being one of an interaction of ‘cultural bodies’. “We are thinking matter…We exist in order to inseminate this planet with representations, ideas, and culture, with conscious and thinking dynamics…We are containers of representations, colonies of ideas, and
What separates us from other evolving species is that thing or those things that have allowed us to evolve up until this point: namely, our ability to think, our consciousness, our intelligence. “Human intelligence is not a strange gift bestowed upon us by God, Destiny or even Nature. On the contrary, Homo sapiens are the way they are because intelligence is not only a useful tool for survival but also a fruitful niche in which to expand.\textsuperscript{14}

It is however, not just our ability to think that ensures our continuing evolution. Our intelligence is in a symbiotic relationship with its products: our tools, our books, our information superhighways, our culture. “Technologies are both the materialization of intelligence and the seed which makes it grow and expand. For if every living being converges as much as possible towards his niche, then every living being also attempts to draw his niche in toward him….Technologies are our extensions, not only sensory and nervous, not only prosthetic and mechanical, but also ontological. Technologies are human beings fused to their niche.”\textsuperscript{15} This combination of our intelligence and its offspring is roughly defined by Dyens as ‘culture’; we are inescapably ‘cultural bodies’.

“Our world is now filtered, translated and transformed by culture. Technologies, news media, sciences, and so forth are the basic materials of our new abiological reality. We can no longer define, understand or represent ourselves without cultures help…We already are cultural bodies.”\textsuperscript{16} And as much as sport has within it different cultures, sport is also a culture and is also part of culture.

For Donna Haraway, our elite athletes, along with the rest of us, are already cyborgs. The boundary between the cyborgs of \textit{Blade Runner, Terminator}, and \textit{Universal Soldier} and our social reality is an illusion – that organism

\textsuperscript{13}Dyens, O. \textit{Metal and Flesh}, Cambridge: MIT Press, 2001, pg. 6

\textsuperscript{14}Ibid, pg. 7

\textsuperscript{15}Ibid, pg. 7-8

\textsuperscript{16}Ibid, pg. 19
called Usain Bolt is a totality of human talents and potential and machine processes. For Haraway, we need to get over our puritanical reactions to the invasion of human minds and bodies: “Intense pleasure in skill, machine skill, ceases to be a sin, but an aspect of embodiment. We can be responsible for machines. The machine is not an “it” to be animated, worshipped and dominated. The machine is us, our processes, an aspect of our embodiment.”17 Perhaps then Hollywood has misled us about the true nature of a cyborg. Usain Bolt may be, in biological terms, fully human; it’s just that the techno-parts we are used to seeing on the bodies of Arnie and Jean-Claude are in reality the culture-parts we know are acting on our Olympic champion every day.

Progress and Value

To quote Langdon Winner, “If the experience of modern society shows us anything… it is that technologies are not merely aids to human activity, also powerful forces acting to reshape that activity and its meaning.”18

What interests Winner more, however, is that humanity is so often blind to the effects of the processes we set in motion through out technological evolution. For “the interesting puzzle in our times is that we so willingly sleepwalk through the process of reconstituting the conditions of human existence.”19 One need only look at the controversy surrounding Speedo’s LZR Racer swimsuit, to realize the truth of this statement.

We are in the process (as we always are) of redefining our environment and its meaning, and we seem incapable of understanding the full effects of our commitment to profit and performance, particularly in the sporting sphere.


19 Ibid, pg. 61
We have created a technological culture geared primarily towards world records and million-dollar contracts. Unfortunately - human logic being as it is – we infer that if this is a somewhat unsatisfactory state of affairs ("In my day, you played because you loved the game, old boy") it is technology that is to blame; all technological innovation inevitably leads us to greater efficiency, to packaging and selling performance. Can there be anything of lasting value in the merger of human and “machine”?

Our worship of success and our concurrent demonization of the technological have made us blind to the value technology can offer us as people and sportspeople if we approach it the right way. As we sleepwalk toward more records and more money, we fail to understand fully and ultimately depreciate the metaphysical value sport offers us, and the role technology can play in helping us rediscover it. Perhaps considering yet another cyborg could help to begin this process.

Oscar, Technology and Metaphysical Sporting Value

Oscar Pistorius is a South African double-amputee 800m runner who recently petitioned the IAAF to allow him to compete against able-bodied athletes in the Olympic Games. The subsequent controversy surrounding his “Cheetah” running blades was somewhat moot as Pistorius did not get anywhere near the requisite qualifying time (although he remains head and shoulders above other disabled athletes). But what is of interest with Oscar and his use of technology is not the world records he has set or his challenging of able-bodied athletes. What is of interest is what technology allows Oscar to gain from sporting competition. Yes, he has broken world records, become famous and made a lot of money from sport. This is partly to do with him being so good, and also partly to do with sporting goods companies loving a man to whom “Impossible is Nothing.” But what of his 8 year-old fan, also without legs, who runs simply because his Cheetahs allow him to? It is my contention that regardless of ability or motivation, Oscar allows us to see certain possibilities of technology, possibilities that are realized by an 8 year-old as much as they are by a world record-holder. In either case, before achievement and recognition, before money and fame, comes the challenge issued to the individual by the activity they are undertaking. These challenges, and the ability of technology to help us overcome them, are at the root of metaphysical sporting value. What
follows then is a short examination of a tripartite division of metaphysical sporting value; what it seems to me, “comes first”, not in the sense of importance, but in the sense of universality.

**Self-Affirmation**

Nietzsche argues that “the knightly-aristocratic value judgements presupposed a powerful physicality, a flourishing, abundant, even overflowing health, together with what serves to preserve it: war, adventure, hunting, dancing, war games, and in general all that involves vigorous, free, joyful activity.” Nietzsche is establishing a link between his knightly or noble morality, a noble mode of being, and the necessity of competition and self-affirmation. Further, he is gesturing at the form such competition should take - it should be vigorous, free and joyful. For Nietzsche, we learn about and affirm ourselves triumphantly through certain activities, and he specifically mentions war games; I would place sport in that category.

Nietzsche writes further that this “noble mode of valuation…acts and grows spontaneously, it seeks its opposite only so as to affirm itself more gratefully and triumphantly…” or, as Chuck Palahniuk’s Tyler Durden has it “How much can you know about yourself if you’ve never been in a fight?” I must stress that I’m not just talking about self- or body-knowledge; although this is important, I am referring to the celebration and affirmation of what it means to be alive as we are. As Nietzsche might say: a “constant over-coming.” For Oscar and his 8 year-old fan, every time they prepare to run, every time their being is challenged, they are presented - as we all are in our sporting endeavors – with an opportunity to triumphantly assert and affirm existence; their existence.

---


21 Ibid, pg. 37

22 Palahniuk, C. *Fight Club*, Holt, New York, 1999
Will and Beauty

For an object or experience to properly be termed beautiful or sublime, Schopenhauer claims, it must divorce us from the pull exerted by our will. The will is representative of our driving forces, those “emptinesses” which as human beings we continually strive to fill.

All willing arises from need, and therefore from deficiency, and therefore from suffering. The fulfillment of a wish ends it; yet for one wish that is fulfilled there remain at least ten which are denied. Further, the desire lasts long, the demands are infinite; the satisfaction is short and scantily measured out.23

When an object or experience allows us to become a “pure will-less subject of knowledge” 24, that object can be called either beautiful or sublime. Athletic performance – sport – has a similar power to take all of use away from the cacophonic admonishments of our wills; we step outside “ourselves” and fully “into the game,” primarily as athletes, but also as spectators. This phenomenon has been well-noted by sports psychologists in the guise of “flow”; that complete immersion in an activity - that annihilation of the separation between subject and object - that very often allows peak performance.

The Taoist idea of the disharmony and imbalance caused by our attempts at willful control mirror Schopenhauer’s idea of the dictatorship imposed by our wills. Sport is beautiful because there we can have a silent, unfettered experience of ourselves and our capabilities. There would seem to be truth in beauty after all…

Freedom of Creation

In his discussion on justice and power with Michel Foucault in 1971, celebrated linguist and social activist Noam Chomsky sheds some light on an aspect of human nature which though suppressed by the dull

23 Schopenhauer, A. The World as Will and Idea, Section 39

24 Ibid
drudgery of the everyday lives of the majority, finds its consummation far more easily in the arts, and, if we are willing to let it, in sport as well. Chomsky states that if “a fundamental element of human nature is the need for creative work, for creative inquiry, for free creation without the arbitrary limiting effect of coercive institutions, then, of course, it will follow that a decent society should maximize the possibilities for this fundamental human characteristic to be realized.”

This type of creative energy can be seen as much in a cheeky back-heel pass in soccer or an alley-hoop in a game of basketball as it can in finding a way to run without legs. So long as we can still “play to see what happens,” so long as we can still try something new on the field, so long as we can still express the us in the activity we are performing we do not have anything to fear from advances in sporting technology.

So even if “technology is already us,” we needn’t demonize it so long as we do not lose the ability to affirm our existence, the chance to move ourselves away from the stresses imposed by our delusions of power, or our capacity for creative expression. If the idea of the natural body has already perished, as many have argued it has, what do we have to fear from embracing technology completely, especially if technology can help us pursue valuable aspects of sport? Some one like Oscar Pistorius embodies all that is good in us and all the great potential of athletic endeavor, even though he runs with metal legs.

CHOOSING ILL-HEALTH: ASPECTS OF A CRITICAL SOCIOLOGY OF PHYSICAL ACTIVITY

Malcolm MacLean, University of Gloucestershire

Success in British physical activity promotion is limited to demonstrating the specific ways that physical activity is good for health, however there has been statistically significant but relatively poor change in physical activity practice. At the centre of this policy failure seems to be a taken for granted view that acceptance of physical activity as good for health will lead to the rational decision by individuals to become more physically active. This view fails to recognise the social and cultural context of health and physical activity promotion. In this light, this paper outlines the key contours of a critical sociology of physical activity. At the heart of the analysis is a broader socio-cultural and political shift in western capitalism leading to deep-rooted alienation of individuals from control over the material existence of life alongside a reification and fetishisation of choice in public policy.

Understandings of physical activity

The case for increasing rates of physical activity across the British population as a whole is compelling, both in terms of individual and collective quality of life, and public and private economies. The World Health Organisation indicates that around 3% of the developed world’s disease burden is caused by physical inactivity and within that low levels of physical activity contribute directly to around 20% of coronary heart disease and 10% of strokes. For the UK, recent estimates suggest 37% of CHD is linked to poor physical activity rates, compared to 19% for smoking and 13% for high blood pressure (noting and taking account of the overlap in these conditions). Physical activity promotion programmes are therefore a response to the research findings that moderate levels of PA are sufficient to significantly reduce these chances of CHD and strokes. Economic impacts are more difficult to assess, although the UK Department of Health has suggested that the annual costs of obesity, taking account of health costs and lost production, may be £6.6-7.4 billion for England, and that the annual costs of physical inactivity may be £8.2 billion for England. These figures should not be seen as the savings to be made from enhancing physical activity, noting for instance that an aging population associated with falling rates of preventable disease will increase health costs in other ways.
There is evidence that many of the physical activity messages have been received by their intended publics, even if they have not been acted on. The Health Survey for England, for instance, shows that over 75% of adults agree that even moderate physical activity is good for health, that short periods of physical activity are beneficial, but that the benefits increase if each bout of activity lasts for a longer period. Nearly half of the respondents also agreed with the statement that it is possible to get enough physical activity without engaging in specific bouts of exercise or sport, although few respondents agreed strongly with this statement. Although it is not clear in the report, there is an implicit understanding that this physical activity is of the appropriate intensity. These beliefs are in line with health education advice provided since the early 1990s. These data need to be interpreted cautiously, given that only 28% of respondents indicated that they knew the recommended levels of physical activity.

The challenging thing about the HSE data is not the responses of the public, although there is some indication that impact of the messages is limited, but the epistemological framing of the survey itself. This is most obvious in the exploration of ‘barriers’ to increasing physical activity. In its exploration of ‘external barriers’ the data presented suggests that respondents were offered a limited range of options, including work demands, availability of leisure time, and financial constraints, yet findings from qualitative studies include alternative external barriers such as “lack of money, having no-one to exercise with, having no local facilities, and not having the right clothes or equipment”. The failure to address these external barriers combined with the triteness of the responses to issues of work commitments and leisure availability (“planning buildings and developments to improve access to sports or leisure centres or gyms close to workplaces”, p 82) suggests a policy framework that has ossified. The gap in creative thinking appears to be not so much the predictability of proposed solutions, as the statement that the principal source of complexity is that overcoming these barriers depends “to a large extent on individuals’ lifestyles” (p 82). The problematic word, at the heart of the failure of physical activity promotion policy, is ‘lifestyles’: it is an empty signifier in health promotion, a catch-all term that has no specific meaning.

There are two principal challenges associated with contemporary notions of ‘lifestyle’ in this context. The first is the question of lifestyles and ‘leisure’ practices in everyday life. The second is the notion of lifestyle as choice.
Leisure and lifestyles in everyday life

Many leisure studies discussions draw on the notion of groups and individuals as cash rich but time poor, and vice versa. This mode of analysis underpins the HSE endorsement of proposals to improve access to leisure and sports facilities and gyms, including building them close to workplaces. In short, the approach centres on resource mobilisation and a notion that enhancing access to leisure facilities will lead to their greater use. Such a resource mobilisation approach, where the key uncontrollable factor is linked to lifestyle choice, leads to the conclusion that inactivity, where facilities are otherwise available, is an irrational choice.

The first problematic assumption in this resource mobilisation and availability approach is that leisure centres and gyms will be used if they are more conveniently located, and if they are more financially affordable. This is a lazy conclusion that flies in the face of the under-use of British leisure centres since the 1970s and suggests a one-size-fits-all approach of commercialised leisure services. As such, it fails to consider the variable meanings of leisure in everyday life, and indicates the power of an unreflexive mode of thought that can be seen to typify Planet Health Promotion (PHP). PHP is self-referential, it has its own language and system of value exchange that are a mysterious code to outsiders. Inhabitants of PHP seem to assume that their specific codes and world views are shared by others, and that the objective of health promotion is equally shared: as a result it becomes the unquestioned centre of their policy outlooks and practice. Data from sources such as the HSE suggests that this assumption of the importance of health promotion through enhanced physical activity is not widely shared.

There does seem to have been some recognition in Planet Health Promotion that the uniform notion of leisure is not valid, and in particular some recognition that understandings and experiences of ‘leisure’ are gendered, given the gendered character of paid work and domestic and family responsibilities. There seems, however, to be little reflection in PHP of the meaning and character of leisure, or the local, communal, and social significance of leisure in general and specific leisure practices. That is, despite attempts to develop more localised, community based partnership physical activity promotion programmes, the policy framework that continues to construct these as interventions done to communities fails to take account of the need to understand specific forms of everyday life, and in doing so seems to have as its subject an abstract individual. For, as Henri Lefebvre has noted, everyday life is to be found in work, in
leisure, and in family life: it is, he argues, in “their unity and their totality, and it
determines the concrete individual”.xv Without close attention to the specifics of
the ‘concrete individual’ as determined by the unity and totality of work, leisure,
and domestic life, the subject of physical activity promotion policy remains an
abstract object, and as such the bases of their failure to fit PHP is not
recognisable because they remain objectified. Surveys such as the HSE are too
blunt an instrument to explore the subtlety of meanings attached to ‘leisure’ and
discern patterns in the everyday existence of ‘concrete individuals’ to provide
any meaningful basis for successful programmes to enhance physical activity
rates.

Managing and controlling time

The common factor in the barriers cited by participants in the HSE is time: work
constraints and limited leisure time. Noting that these categories are
predetermined by the survey developers, there is an alternative reading of these
data. If we look at the HSE data in total, there are two significant factors. In all
age groups and all income quintiles, the majority of men and women indicated a
desire to do more physical activity: noting any social desirability bias, this
figure is telling.xvi Alongside these data, significant proportions of men and
women reported time constraints – caused by work pressures, which appears to
mean paid work, caring for dependents, or unspecified lack of leisure time.
These categories are problematic, in that two (paid work and care for
dependents) indicate specific sources of time constraint, while one (lack of
leisure time) provides policy makers with no clear indication of the problem to
be addressed.

There seems, however, to be a more fundamental issue with these data. Each of
them points to a question related to the control of time, similar to the issue that
underpins policy and industrial debates about work-life balance. In the two
cases where specific time constraints are identified (paid work and care of
dependents), the respondents are indicating that they have submitted themselves
to the control of others – for a higher proportion of men than women this is
through their paid work, and for a higher proportion of women it is through the
care of dependents. Despite the failure of the research to incorporate elements
that allow for the exploration of the everyday life of concrete individuals, and
noting that this is not a deficiency of the HSE as such but of ‘closed-question’
questionnaires, a significant proportion of adult respondents to the HSE
indicated that the barrier to greater physical activity participation is their lack of
autonomy.
This control of time becomes important when we consider the various opportunities for physical activity in everyday life. The British Heart Foundation, for instance, suggests that there are four primary sites for physical activity: “at work”; “for transport”; “in domestic duties at home”; and “in leisure time”.

Where work does not regularly involve physical labour, however, these opportunities are limited, and a lack of autonomy in work further limits those opportunities. Furthermore, the demands of employment, to a large extent, control the life of all those in paid employment and many of those dependent on them. The timing of work as socialised labour is determined by others, and “its form and content are determined by technical imperatives independent of all individual choice and judgement”.

As a result, the extent to which work determines the experience of time and therefore life is the extent to which both employment and free-time are determined by others, and tasks are heteronomous, rather than autonomous.

Fetishised and reified choice, and the rationality of inactivity

The problem of heterodetermination (determination by others) of time, therefore, must be at the centre of a critical sociology of physical activity promotion, as it was when trades unions mounted campaigns for an eight hour working day around the slogan ‘eight hours for work, eight hours for sleep, and eight hours for what we will’. Poor responses to physical activity promotion campaigns have in recent analyses been attributed to a lack of clarity and to contradictory messages. The authors of the HSE suggest that “the HSE 2007 findings suggest that improved awareness is required as a first step, with clear communication of the guidelines so that people know what levels of physical activity they should be aiming for”. (p 81) The state sees a need for clear communication, and a need to change the form and style of health promotion messages away from information dense epidemiological findings towards ‘actionable insights’.

Yet despite all the messages that physical activity does not necessarily need to amount to a significant change in everyday activity – housework, gardening, and active transport are regularly cited as means to enhance physical activity rates – the call to be more active for longer term health, whether in family-based settings or not, does not seem to be a very strong incentive. Central to the problem is the paradox of autonomy. Conventional scholarly and popular understandings of ‘leisure’ juxtapose it to ‘work’ (studies of leisure are generally poor at incorporating domestic life, Lefebvre’s third strand) as freedom as opposed to necessity, although the notion of the heterodetermination
of time undermines the notion of autonomous leisure. Despite the banality of many of the things that ‘count’ as enhanced physical activity participation, they may be seen as an imposition. The ‘choice’ is forced—freedom to choose is limited to choosing more physical activity, and if members of the public do not do so, health services are entitled to refuse them care. The public is asked, via these public policy interventions, to choose health because there is a rational basis for understanding that physical activity leads to better health, and that more physical activity therefore maximises the public and private good that is improved personal and collective health. That is, individuals are asked to sacrifice their freedom (leisure time) to a broader public and private good, and in doing so are asked to sacrifice the autonomy they have within what is perceived (as the HSE shows) limited, and heterodetermined, leisure time. The interventions, by their very nature, may be seen as coercive—a thing required, and therefore not a choice. In this way there is a profound contradiction between these public policy programmes and neoliberal ideology that prioritises market-based choice of enjoyable experiences and of commodified lifestyles (‘green’, ‘healthy’, ‘ethical’ and so forth) as the arbiter of quality and correctness: in short, public policy conflicts with an ideology that leads to a conclusion that if the people choose inactivity/sedentary lives, those lives must be good.

Conclusion

In summary, physical activity promotion suffers from two fundamental weaknesses. Its advocates analyse the public’s failure to act as a problem of the lack of clarity of health promotion messages. As such, they seem unable to step beyond an unreflexive and self-referential analytical and discursive frame that results in the objectification of the subjects of its work. There is some potential for this ontological straightjacket to weakened through, for instance, community based programmes and partnership work—but these remain conceived as interventions where the terms of analysis are pre-determined by the epistemological outlook that fails to recognised the concrete individual in their material conditions of life. The second weakness is related to the objectification of the policy subjects—it various publics. They live and work in political and economic order where they lack autonomy—that is, they are alienated from their work and from their ability to self determine. In a policy environment where choice is reified and fetishised, and where access to choice is seen as the objective of policy in that it both creates and is a test of a market in social policy practice, choosing inactivity, choosing ill-health, may well be a rational decision to assert autonomy and in the material conditions of life for the concrete
individual involved. While physical activity promotion policy and programmes fail to recognise the rationality of this choice, and fail to mount the sorts of ethnographic research projects needed to grant those concrete individuals their subjectivity in policy – that is, until PHP develops a critical sociology of physical activity promotion – there is little indication that physical activity rates will change significantly.

Notes

i Whereby the human qua human is not under investigation and such investigations fall under other scientific disciplines such as material science, physics or chemistry.

ii This is understood to be the different system of reference that allows sentient beings to make sense of themselves and their environment and other ontological and axiological questions. It recognises that simply by being human, or a white male, or of the twentieth century, we are restricted in our perspective or world-view.

iii That is, we ascribe humans with an inner mental state similar to our own and do not treat them as zombies or purely material (non-mental) objects.

iv For more information on this controversial ‘rule breaking’ incident see [http://www.guardian.co.uk/uk/1999/feb/14/deniscampbell.theobserver> [Accessed January 2010]


xii HSE 2007, p 86.

xiii HSE 2007, p 82.


xvi HSE (2007), figures 4D and 4E, p 77.


See, as a sports-based example, Malcolm MacLean ‘The Routine Ritual of Rub of the Mill Rugby’ Educational and Sociological Issues in Sport and Physical Education, University of Århus, Denmark, 8-10 December 2004.