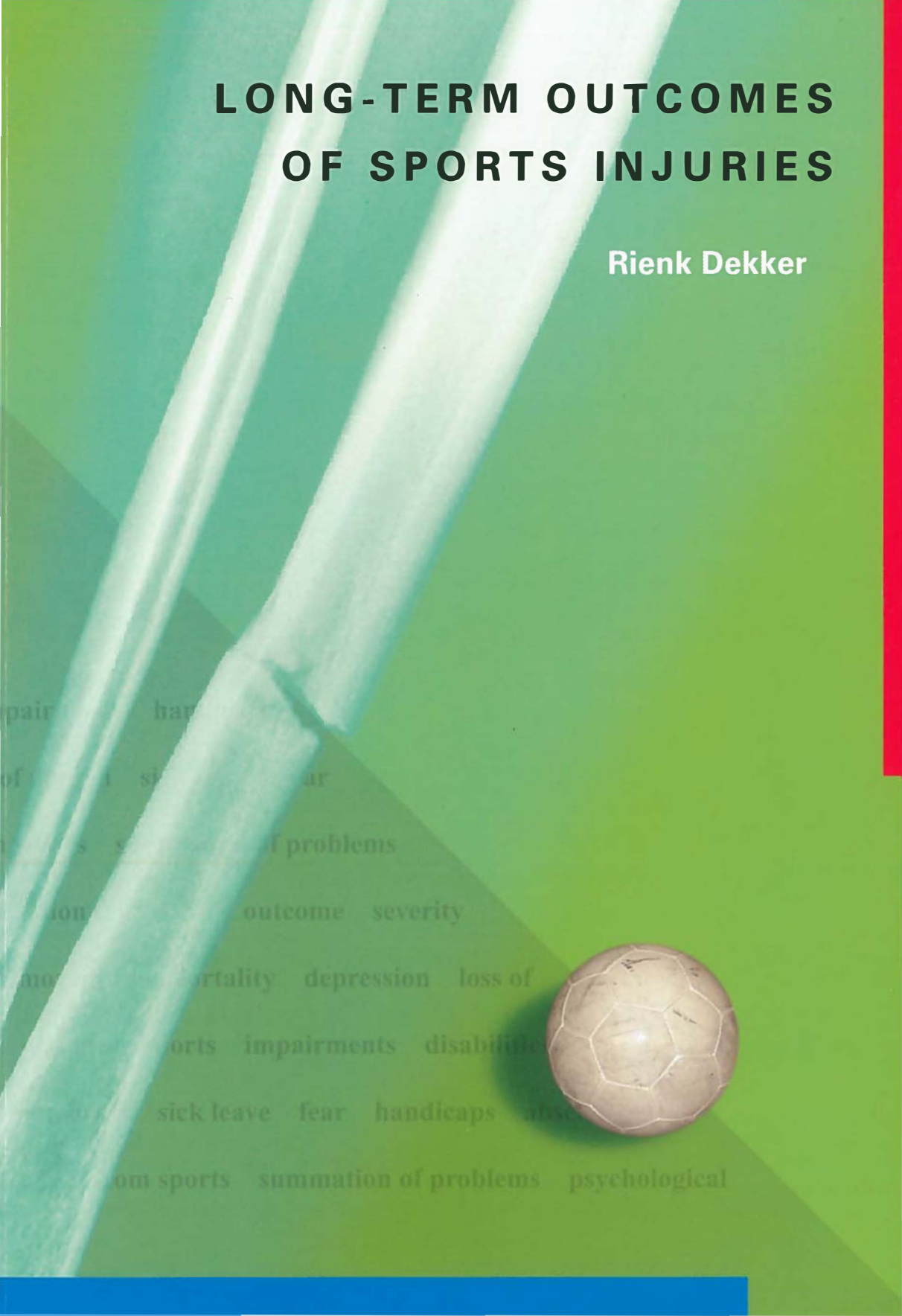
Long-term outcomes of sports injuries

Dekker, Rienk

LONG-TERM OUTCOMES OF SPORTS INJURIES

Rienk Dekker



LONG-TERM OUTCOMES OF SPORTS INJURIES

STELLINGEN

behorende bij het proefschrift

Long-term outcomes of sports injuries

van

R. Dekker

I

Na privé-ongevallen zijn sportongevallen de meest voorkomende oorzaak van letsels die behandeling op een afdeling spoedeisende hulp behoeven.

II

De kans op het optreden van nadelige lange termijn gevolgen is bij klinisch behandelde sportletsels groter dan bij de sportletsels die poliklinisch worden behandeld.

III

Beperkingen en handicaps als gevolg van een paardrijletsel komen dermate veel voor dat intensieve follow-up van de betreffende patiënten geïndiceerd is.

IV

Ondanks het feit dat lange termijn beperkingen en handicaps na een sportletsel veelvuldig optreden, dient sportbeoefening, gezien de vele voordelen ervan, onverminderd gestimuleerd te worden.

V

Er bestaat geen evenredig verband tussen de ernst van een sportletsel uitgedrukt in de Injury Severity Score (ISS) en de kans op nadelige gevolgen van het sportletsel.

VI

Het aantal ernstige letsels optredend bij paardrijden laat zich moeilijk rijmen met de aanname dat een paard een edel dier is.

VII

De verbetering van preventieve medicamenteuze maatregelen heeft de rol van de revalidatiearts bij de behandeling van hemofiliepatiënten ingrijpend veranderd.

VIII

De ernst en de gevolgen van de aandoening Epidermolysis Bullosa rechtvaardigen alleszins een intensieve multidisciplinaire begeleiding.

IX

Het verdwijnen van de gewoonte om aan auto's bijnamen als "eend" en "snoek" te geven is tekenend voor de uiterlijke uniformiteit van het hedendaagse wagenpark.

X

Ook bij het schrijven van een dankwoord is het rechtvaardigheidsprincipe van toepassing: behandel gelijken gelijk en ongelijke ongelijk.

XI

Handicaps, zoals zoveel droeve bijverschijnselen van het leven, worden vaak in eufemismen verpakt. (Colin Dexter, A remorseful day, 2000)

XII

De beloning van makelaars op percentagebasis stimuleert niet te komen tot een zo laag mogelijke aankoopprijs.

RIJKSUNIVERSITEIT GRONINGEN

LONG-TERM OUTCOMES OF SPORTS INJURIES

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Chapter 1

Introduction, general concepts and contents of the thesis

1.1 Introduction

Participation in sports is an important way to spend spare time. In the Netherlands, more than 40% of the population is actively involved in sports[1]. Sports participation has clear advantages, like the improvement of physical endurance and the prevention of Western diseases[2]. It can be questioned, however, whether these advantages are not outweighed by the notable side effects: the occurrence and the consequences of a large number of injuries. In the Netherlands (16 million inhabitants) for instance, annually 2.9 million sports injuries happen, of which 209,000 have to be treated in a hospital[3]. These injuries do not only have societal implications, in terms of costs of medical care and payment of benefits, but also have disadvantages for the individual. Pain and disability immediately following a sports injury, for example, are well-known phenomena in this respect. Sports injuries also cause considerable short-term absenteeism from work and sports[1,4-6]. In order to determine the outcome of sports injuries, it is not sufficient to look at these short-term consequences exclusively; the long-term effects of the injury should also be taken into account. Long-term consequences may be more important in determining the outcome of an injury, since sportsmen are generally young. Consequently, permanent or long lasting disablement will influence their number of productive life years and quality of life.

To be able to weigh the significance of sports injuries[7, 8] in terms of long-term consequences it is important to get insight into the broad spectrum of residual disabilities and handicaps (as defined in the International Classification of Impairments, Disabilities and Handicaps, the ICIDH[9]). Until now, most of the relevant studies[4,10-18] only address a limited part of the disabilities and handicaps or focus primarily on impairments[16-18], on children[16], on one type of sport[17] or on one specific body region[18].

The primary aim of the dissertation is to determine the long-term outcome of sports injuries initially treated in an emergency department of a hospital. The main research questions answered in this thesis are:

- What is the incidence and severity of injuries following sports participation, in relation to injuries due to other causes?
- Do long-term consequences following inpatient treated sports injuries occur? Which determinants for the occurrence of this outcome can be detected?
- Are long-term disabilities and handicaps present in outpatients, treated because of a sports injury, and which potential risk factors can be identified?
- To what extent do long-term consequences of equestrian injuries arise in adult patients? Can risk factors be established?
- Do long-term consequences occur, following equestrian injuries in children, and are prognostic factors determinable?
- Which determinants for the occurrence of long-term consequences following a soccer injury can be hypothesised?

1.2 General concepts.

1.2.1 Definition of 'sports injury'

An important condition to perform research in the field of sports injuries is an adequate definition of the term 'sports injury'. Numerous descriptions are used in literature[19-24]. We followed Van Mechelen[19] who defines a sports injury as a collective name for all types of damage that can occur in relation to sporting activities. Sporting activities, in this respect, imply all activities of an individual, performed according to the rules and intentions of a recognised type of sport, in order to realise personal competence, experiences and emotions in the field of human motion[25]. In addition, it is important that activities like swimming, riding bicycle or walking should only be defined as a sports activity when performed for the sake of sports[20]. Consequently, injuries resulting from a crash during a bicycle training session are to be categorised as a sports injury, whereas an injury sustained during commuter traffic, riding a bicycle, is not.

1.2.2 Outcome: consequences of an injury

Diseases and injuries often heal without lingering symptoms, resulting in a favourable outcome. There are, however, patients who do not recover completely and who experience lasting consequences. Since there is a wide variety of possible consequences the World Health Organisation (WHO) composed in 1980 a three dimensional classification. This model concerns a holistic approach; consequences of a disease or injury are the result of an interaction between a person's physical or mental state and the nature of social circumstances. The WHO classification is known as the International Classification of Impairments, Disabilities and Handicaps (ICIDH)[9]. In this classification, impairment stands for "any loss or abnormality of psychological, physiological, or anatomical structure or function". Disability is defined as: "any restriction or lack (resulting from an impairment) of ability to perform an activity within the range considered normal for a human being"[9]. The WHO definition of handicap is "a disadvantage for a given individual, resulting from an impairment or a disability that limits or prevents the fulfilment of a role that is normal for that individual"[9].

Although this classification is widely applied, especially in clinical practice, it turned out to have several drawbacks. In an attempt to meet part of this criticism, the WHO published a subsequent draft version[26] in 1999; the ICIDH-2. One of the main changes was the reformulating of the three dimensions in positive or neutral wordings. The term 'disability' for instance, was replaced by 'activity', defined as the nature and extent of functioning at the level of the person. 'Handicap' was succeeded by 'participation': the nature and extent of a person's involvement in life situations in relation to impairment and activities. Meanwhile there is already a successor for the ICIDH-2. Implying several major alterations, the WHO endorsed in 2001 the International Classification of Functioning, Disability and Health (ICF) for international use. A Dutch version was published in 2002[27]. In this thesis the concepts and terminology of the first ICIDH-version were applied since data-collection started before the publication of the definitive version of the ICIDH-2, let alone the ICF.

1.3 Contents of the thesis

This study was performed at the departments of Traumatology and Rehabilitation of the University Hospital Groningen (UHG), the Netherlands. The aim of the study was to investigate the long-term outcome of sports injuries in patients initially treated at the emergency department of the UHG.

Different causes can be reported for the occurrence of an injury. In order to provide a clear perspective, the second chapter of the thesis focuses on the incidence and severity of hospital treated sports injuries in relation to injuries due to home and leisure accidents, traffic accidents and violence.

In the chapters three and four the long-term outcome was determined after inpatient and outpatient treatment, respectively. This subdivision was made since inpatient treated injuries are believed to be of a more severe nature, although they are largely outnumbered by the outpatient equivalents. One of the main goals of both these studies was to determine which factors contribute to unfavourable long-term outcome.

In the chapters five, six and seven special attention was paid to the outcome of equestrian and soccer injuries. The results of the former three chapters showed that long-term consequences were found in these types of sports predominantly.

In common, the paediatric and adult perspectives following an injury differ. In order to investigate both populations adequately, two separate studies concerning the outcome of equestrian injuries were employed. In chapter five the outcome after equestrian injury in adults is described. The long-term outcome of equestrian injuries in children is reproduced in chapter six.

Knowledge of prognostic determinants for the occurrence of long-term consequences is of great importance. In addition to the findings reported in the previous quantitative studies, chapter seven reveals the results of a qualitative study into the determinants of long-term consequences of soccer injuries. Qualitative research concerns an in-depth study of a relatively small number of cases[28-30] and focuses on the patient's perspective.

In chapter eight the results of the entire thesis are reviewed. Subsequently, clinical and societal implications are discussed and advise for further research reproduced.

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Chapter 2

Measurement of severity of sports injuries: an epidemiological study

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(*Clinical Rehabilitation* 2000;14:651-656.)

Abstract

Objective: To evaluate the severity of sports injuries in relation to the severity of injuries due to other causes and in relation to type of sport, using generally applied measures of injury severity.
Subjects: A total of 12,403 patients, 4–50 years old, who were treated in the trauma department of the Groningen University Hospital for a sports injury, from January 1990 until January 1997.
Method: All patients treated because of an injury entered the study. A distinction was made between injuries caused by playing sports, home and leisure accidents, traffic accidents and violence. The severity of the injuries was assessed by using the criteria of rate of admission, Injury Severity Scale (ISS). Finally the sports injuries were analysed with regard to type of sport.
Results: In total, 57,760 injuries were registered. After injuries due to home and leisure accidents (44%; 25,228) sports injuries (21%; 12,403) were the most frequent cause of injury. Of the patients with a sports injury, 7.9% (980) were admitted, which is more than with home and leisure accidents (6.7%; 1690) but less than with traffic accidents (21.5%; 2202) and violence (9.3%; 364). In a majority of cases, admission was related to a limited number of types of sport. The mean ISS of sports injuries was low, as with injuries following home and leisure accidents and violence. The percentage of sports injuries with an ISS higher than or equal to 16 and the percentage mortality were both low in comparison to injuries due to violence or traffic accidents.
Conclusions: Sports injuries rank second highest in terms of cause of injury, after home and leisure accidents; and rank third in terms of severity, after traffic accidents and violence. Even though the ISS is low, sports injuries may have serious consequences.

2.1 Introduction

In the Netherlands playing sports is a popular way to spend spare time; 30–40% of the population practise some form of sports[1, 2]. In spite of the (obvious) benefits, such as increase of physical fitness, playing sports can also have disadvantages, such as the occurrence of injuries. The need for medical health care in combination with absenteeism from work resulting from sports injuries[3] incur high expenses; these are often considered to be unacceptably high[4]. To weigh the importance of sports injuries in terms of costs, need for medical health care and absenteeism from work or school in relation to other causes of injuries, it is important to get some insight into the severity of these injuries[5, 6]. Until now, relevant information has been limited and not suitable for comparison[1,5,7]. Estimates of the total number of injuries in the Netherlands, irrespective of their origin, vary from 5.9 [5] to 10 million[8] annually, in a population of 16 million inhabitants. Playing sports accounts for approximately 2.9 million injuries[5] and 1.1million (38%) sports injuries are medically treated, of which 209,000 (19%) are treated in a hospital[5]. The objective of this study is to analyse the severity of sports injuries in relation to injuries due to other causes. Furthermore, severe sports injuries are studied in relation to type of sports performed.

2.2 Methods

The University Hospital Groningen (UHG) is a 1056-bed hospital. In the city of Groningen and the surrounding region the hospital plays a major role as emergency care centre for trauma victims. Also hospitals from the north of the Netherlands refer patients when special trauma care is needed.

All patients treated in the trauma department between January 1990 and January 1997 were included in this retrospective study. Registration was carried out by patient identification, trauma diagnoses (ICD codes), treatment strategy and cause of injury[9]. Four causes of injury were distinguished: (1) accidents caused by playing sports, (2) home and leisure accidents (accidents arising in and around home, in places of public resort, not concerning sports injuries), (3) traffic accidents, and (4) violence.

As this study investigates the severity of sports injuries the following severity criteria were used[5, 10–16]: rate of admission, death risk (Injury Severity Scale, ISS) and mortality.

The rate of admission (number of admissions / the number of injured patients) was assessed per cause of injury. The death risk was assessed by using the Injury Severity Scale (ISS). The ISS is an overall index of injury based on the Abbreviated Injury Score (AIS). The AIS scores the severity of anatomical injury in six separate body areas, on a 1–5 scale[15, 16]. The ISS is calculated by summing the squares of the three most severely injured body areas. It extends from 0, no injury, to a maximum of 75 (a nearly 100% chance of death). An ISS higher than or equal to 16 indicates a major trauma[11, 12]. Per cause of injury the mean ISS, standard deviation, median, range and number of patients with a major trauma were computed.

Mortality is defined as dying in the hospital following an injury and expressed per cause of injury.

Finally, severe sports injuries were analysed with regard to type of sport, age and sex. Per type of sport a relatively high number of admissions may well reflect a relatively high number of injuries treated. In order to rule out this confounder per type of sport the rate of admission was computed (the Sport Severity Index).

Statistical analyses were performed by applying the Z-test for the equality between two proportions (binominal proportion) and Student's t-test for independent values.

2.3 Results

Number of injuries, cause of injury, age and sex

In the period January 1990 and January 1997, 57 760 injuries were registered. About half (44%: 25,228) were the result of home and leisure accidents. Injuries caused by sports number 12,403 (21.5%). Of all sports-related injuries 97% of the patients were older than 4 and younger than 50 years; therefore this cohort was used in our study.

In Table I the age distribution of the patients is given per cause of injury. Thirty-two per cent (18,483) of the injuries occurred in women.

Injury severity (Table II)

Rate of admission

The overall admission rate was 10%. The percentage of inpatients was significantly smaller in sports-related injuries (7.9%) ($p < 0.001$) than in injuries due to violence (9.3%) and traffic accidents (21.5%) ($p < 0.001$), but significantly higher than in injuries due to home and leisure accidents (6.7%) ($p < 0.001$).

ISS

The mean ISS for all injuries was 2.5 (s.d. 3.4). Injuries related to playing sports, home and leisure accidents and violence had a low mean ISS, respectively 2.2, 2.2 and 2.7, whereas traffic accidents score 4.1 ($p < 0.001$). The percentage of severe sports injuries (ISS higher than or equal to 16) related to the total number of sports injuries (33/12 403 = 0.3%) did not differ from home and leisure accidents (75/25 228 = 0.3%), but was smaller than with violence (47/3918 = 1.2%) and traffic accidents (460/10 240 = 4.5%) ($p < 0.001$). The higher the ISS, the higher the probability of admission ($p < 0.001$).

Table I: age distribution per cause of injury

AGE	HOME/LEISURE	SPORTS	TRAFFIC	VIOLENCE	OTHERS	TOTAL
5-9	2215 (8.8%)	471 (3.8%)	635 (6.2%)	43 (1.1%)	42 (0.7%)	3406 (5.9%)
10-14	2290 (9.1%)	1625 (13.1%)	860 (8.4%)	129 (3.3%)	72 (1.2%)	4976 (8.6%)
15-19	3101 (12.3%)	2208 (17.8%)	1853 (18.1%)	492 (12.6%)	602 (10.0%)	8255 (14.3%)
20-24	5874 (23.3%)	3287 (26.5%)	2263 (22.1%)	1160 (29.6%)	1451 (24.3%)	14035 (24.3%)
25-29	3481 (13.8%)	2126 (17.1%)	1475 (14.4%)	752 (19.2%)	1227 (20.5%)	9061 (15.7%)
30-34	2594 (10.3%)	1153 (9.3%)	983 (9.6%)	580 (14.8%)	926 (15.5%)	6228 (10.8%)
35-39	2091 (8.3%)	732 (5.9%)	850 (8.3%)	333 (8.5%)	669 (11.2%)	4675 (8.1%)
40-44	1892 (7.5%)	496 (4.0%)	727 (7.1%)	253 (6.5%)	543 (9.1%)	3911 (6.8%)
45-49	1690 (6.7%)	305 (2.5%)	594 (5.8%)	176 (4.5%)	448 (7.5%)	3213 (5.6%)
Total (%)	25228 (100%)	12403 (100%)	10240 (100%)	3918 (100%)	5971 (100%)	57760 (100%)
%	44%	21.5%	17.7%	6.9%	9.9%	100%

Mortality

One hundred and forty-four patients died in hospital because of an injury (0.25%). Traffic accidents were the main cause: 94 deaths (68%). Four patients (3%) died as a result of a sports injury.

Table II: injury severity outcome measures

MEASURE	HOME/LEISURE	SPORTS	TRAFFIC	VIOLENCE	OTHERS	TOTAL
Admission	1690	980	2202	364	734	5885
(%)	(6.7%)	(7.9%)	(21.5%)	(9.3%)	(12.2%)	(10.2%)
ISS mean (s.d.)	2.2 (2.2)	2.2 (2.2)	4.1 (5.5)	2.7 (3.5)	2.4 (3.7)	2.5 (3.4)
ISS median	1	1	2	1	1	1
ISS range	1-75	1-75	1-75	1-75	1-45	1-75
ISS ≥ 16 (%)[a]	0.3	0.3	4.5	1.2	1.8	1.3
Mortality[b]	11	4	98	10	21	144
Mortality %[c]	0.04	0.03	0.96	0.26	0.35	0.25
Number of injuries	25228	12403	10240	3918	5971	57760

[a] Number of severe injuries (ISS ≥ 16) related to the total number of injuries (percentage).
[b] Number of deaths per cause of injury.
[c] Number of deaths per total number of injuries, as a percentage.

Severe sports injuries per type of sport (Table III)

When hospital admission is used as severity criterion, 7.9% (980) of sports injuries can be classified as severe. Sports injuries with an ISS higher than or equal to 16 ($n = 33$) were the consequence of horse riding (47%), soccer (29%), speed skating (15%), swimming (6%) and motor sports (3%). The results of the SSI are reported in Table III.

Table III: injury measures per type of sport

TYPE OF SPORT	CASES[a]	ADMISSION	SSI[b] (%)	ISS ≥ 16[c]	MORTALITY
Soccer	4341 (35%)	332 (34%)	8	10 (29%)	-
Horse riding	507 (4%)	108 (11%)	21	15 (47%)	1 (25%)
Speed skating	621 (5%)	69 (7%)	11	5 (15%)	-
Physical education	724 (6%)	68 (7%)	9	-	-
Motor sports	249 (2%)	67 (7%)	27	1 (3%)	1 (25%)
Volleyball	1239 (10%)	60 (6%)	5	-	-
Indoor soccer	631 (5%)	23 (3%)	4	-	-
Gymnastics[d]	126 (1%)	19 (2%)	15	-	-
Basketball	617 (5%)	19 (2%)	3	-	-
Martial arts	501 (4%)	15 (2%)	3	-	-
Hockey	626 (5%)	20 (2%)	3	-	-
Korfball	130 (1%)	15 (2%)	11	-	-
Tennis	246 (2%)	22 (2%)	9	-	-
Badminton	124 (1%)	19 (2%)	15	-	-
Handball	122 (1%)	13 (1%)	11	-	-
Swimming	127 (1%)	13 (1%)	10	2 (6%)	2 (50%)
Others	1472 (12%)	98 (10%)	-	-	-
Total	12403 (100%)	980 (100%)	-	33 (100%)	4 (100%)

[a] Number and percentage of injuries, per type of sport, treated in the hospital.

[b] SSI, Sports Severity Index: per type of sport; the quotient of the number of admissions and the number of injuries.

[c] ISS, Injury Severity Scale.

[d] Outside school.

2.4 Discussion

Next to injuries caused by home and leisure accidents (44%), sports injuries are the most frequent reason (21%) for treatment in a trauma department. Some studies [5,17–24] confirm these results, whereas other studies report a lower percentage of sports injuries (4-17%)[10,18–22,24–29]. Comparison is difficult, however, because of differences in the structures of health services.

Injury severity

In this study, 7.9% of the patients with a sports injury were admitted. Flood and Mina [10] (Ireland; 7.6%), Lang-Jensen [21] (Denmark; 8%) and Sandelin *et al.*[22] (Finland; 6%) found comparable rates of admission. The chance of being admitted for a sports injury is higher than with home and leisure accidents, but lower than with traffic accidents and violence, which is verified by other studies.[1,5] This phenomenon is also observed, as reported by Yamamoto *et al.*,[7] by using the ISS as a measure for injury severity. This is not surprising because in general the percentage of high energy accidents is much higher with traffic accidents than with other causes of injuries. Not surprisingly, there is a direct proportional relation between the ISS and the chance of being admitted because of an injury. This is in concordance with the results of a study by Kingma and ten Duis[30]. With an ISS higher than or equal to 16, the chance of admission is nearly 100%. Although the ISS is often used to measure the severity of injuries,[15,16] it is only seldom brought into practice with sports injuries. Ytterstad[25] and De Löes and Goldie[18] only made use of the AIS, not the ISS. The results of Yamamoto *et al.*[7] agree with our ISS results, but in a population limited to patients younger than 21 years old. As most patients admitted because of a sports injury have a low ISS (75%[24]), admission has to be based on other grounds, for example the need for a relatively small operation or observation of abdominal and head injuries. This hypothesis is in agreement with the results of the study by van der Sluis *et al.*[31] stating that minor injuries (low ISS) might have serious consequences.

Mortality is used as the third criterion of severity. The number of deaths caused by sports participation is small, especially when related to the large number of sports injuries. From these results it has become clear that the usefulness of the ISS and mortality as a tool to measure the severity of sports injuries is questionable. Functional and social consequences of sports injuries, such as disabilities and handicaps, as tools of rehabilitation medicine, are not mapped out.

Other variables measuring these consequences, such as the rate of admission (this study) or working and sporting time lost and sustained permanent damage (as reported by Van Mechelen,[6] De Löes and Goldie [18] and Caine *et al.*[32]), may be more appropriate.

Severe sports injuries per type of sport

Injuries resulting in admission are mainly the result of practising soccer, horse riding, speed skating, physical education, motor sports or volleyball. Related to the number of injuries treated per type of sport (the Sports Severity Index) the sequence as mentioned above changes; for instance, soccer ends up eleventh instead of first, while motor sports and horse riding become the most dangerous sports. In this way, better data are provided about the relative risk of being severely injured when playing in a particular category of sports[30].

2.5 Conclusion

Sports injuries rank second in the list of most frequent causes of injury, after home and leisure accidents and third in terms of severity, after traffic accidents and violence. Although with sports injuries the ISS and mortality is low, this does not rule out the possibility of serious consequences, such as a high admission rate (this study), disabilities and handicaps [31] or high costs[4]. In future research other measurements aimed at these consequences should be applied to optimise prevention and treatment strategies, including the input of rehabilitation medicine.

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Chapter 3

Long-term outcome of sports injuries: results after inpatient treatment.

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Abstract

Objective: to investigate whether sports injuries result in long term disabilities and handicaps and to establish variables with a prognostic value for the occurrence of these long-term consequences.

Materials and methods: All patients older than 17 years of age and admitted to the University Hospital Groningen because of a sports injury were entered in the study. By filling in a questionnaire one to four years after the injury an inventory was made of the long-term consequences.

Main outcome measures: "absenteeism from work and sports", "experienced disabilities or handicaps" and the "Sickness Impact Profile68 (SIP68)".

Results: 229 out of 306 patients (75%) returned a completed questionnaire. 67% of the working population had been unfit for work up to one year, whereas 4% still had not resumed work. Absenteeism from sports was also considerable; nearly half of the population did not participate in sports for more than a year. Furthermore, 32% of the patients still experienced disability or handicap following the injury. This finding is in agreement with the results of the SIP68 (Odds ratio: 6.8; c.i. 95%: 3.51 - 13.08).

Two prognostic variables could be distinguished: "gender" and "type of sport". Long-term consequences occur more often in women ($p<0.03$) and with playing outdoor soccer, horse riding or skiing ($p<0.01$).

Conclusions: Sports injuries can lead to long term disabilities and handicaps. The variables "gender" and "type of sport" were of prognostic significance.

3.1 Introduction

Participation in sports is a popular way of spending spare time. 40% of the Dutch population practises some form of sports[1]. A notable side effect is the occurrence of a large number of injuries. In the Netherlands (16 million inhabitants) for instance, 2.9 million sports injuries happen annually, of which 209,000 have to be treated in hospital. These hospital-treated sports injuries are only outnumbered by injuries due to home and leisure accidents but exceed the number of injuries following traffic accidents or violence[2]. In this context the term 'sports injury' refers to an injury resulting from participation in sport and needing hospital treatment.

Apart from the consequences the sports injury may have for the individual patient, such as disability or handicap[3], it is to be expected that such large numbers will also have implications for society in terms of need for medical care and costs. The latter not only concern direct costs following medical treatment but also indirect costs generated by the need for social services. For example the injuries cause considerable absenteeism from work, immediately after the accident[1,4-6].

Long-term consequences are described only by a circumscribed number of studies[4,7-15]. Most of these studies address only some of the disabilities and handicaps[2] or focus primarily on impairments[13-15], children[13], one type of sport[14] or one specific body region[15]. To be able to weigh the significance of sports injuries in terms of long-term consequences, it is important to gain insight into the broad spectrum of residual disabilities and handicaps (as defined in the International Classification of Impairments, Disabilities and Handicaps, the ICIDH[3]), due to the various sports injuries[16,17]. This is in line with Shapiro et al[16], who stated that the use of generic health assessment measures in the studies of sports injuries, alongside with traditional measures, is of the utmost importance in order to demonstrate the true value of treatment of sports injuries to policy makers. In this respect, it is probable that the odds that severe sports injuries cause long-term consequences are greater than for less severe injuries, whereby the need for hospital admission may serve as a criterion for injury severity [2]. We recognise that less severe injuries (for example repetitive strain injuries) may also have an enormous impact but this is not investigated by this

study. The objective of this study is to analyse whether severe sports injuries (requiring hospital admission) lead to long-term disabilities and handicaps[3]. Furthermore, we aim to predict which variables influence the prevalence of these long-term consequences, since previous research[7-11] revealed a prognostic value for a number of variables, such as age, gender and type of injury, in relation to short term consequences of sports injuries but not in relation to a broad spectrum of disabilities and handicaps in the long term.

3.2 Materials and methods

In the city of Groningen (169,000 inhabitants) and the surrounding region (2.5 million inhabitants), the University Hospital Groningen (UHG) plays a major role as emergency care centre for trauma victims. Annually 9980 patients register[2,18] at the emergency unit of the department of Traumatology of the UHG, 17% (1730) of which as a result of participation in sport. The admission rate of patients with an injury due to sports participation was 7.9%.

After approval by the medical ethical board of the UHG all patients older than 17 years of age and admitted because of a sports injury between January 1995 and January 1998 were entered in the study. Using patient records data were collected concerning age, gender, Injury Severity Scale (ISS; an overall injury severity score[19]), cause of injury, type of injury, body region, length of hospital stay and treatment.

In order to investigate the long-term consequences of sports injuries after inpatient treatment the patients were sent a questionnaire containing items about absenteeism from work and sports participation. The patients were also asked: "Do you still experience disabilities or handicaps following the sports injury?". In addition, the Sickness Impact Profile68 (SIP68) was applied as outcome measure in the field of disabilities and handicaps. The SIP68 is a reliable, valid and above all short generic version of the Sickness Impact Profile measuring functional status[20-24]. It consists of 68 items, subdivided in six categories, about health-related behavioural problems reflecting the physical, mental and social dimensions of functional status. The subscales "somatic autonomy", "mobility control", "emotional stability" and "psychological autonomy

and communication scales" may be considered to represent the level of disabilities. The subscales "mobility range" and "social behaviour" relate to the ICIDH[3] concept of handicap[22]. The minimum sumscore is "0", the maximum "68". Higher scores indicate poorer functional health status[3]. Data on reference populations are available[20-24]. Personal communication with the compilers of the SIP68 revealed that a result of "0" versus "greater than 0" can be considered as a relevant functional difference.

In addition, the questionnaire contained supplementary items covering the injury and the sport participation.

Statistical analysis was performed using SPSS 9.0. Descriptive statistics were employed to determine the prevalence of long term disabilities and handicaps. The Z test for the equality between two proportions (binomial proportion) was performed to measure respondents against non-respondents. One sample t-tests were used to compare the results of the SIP68 with a frame of reference. In order to determine the prognostic value of a set of variables (age, gender, type of injury, body region, ISS score, level of education, type of sport, level of sports participation, length of hospital stay and treatment) logistic regression analysis was performed with the dichotomised result of the sumscore of the SIP68 ("0" versus "greater than 0") as the dependent variable.

3.3 Results

Between 1995 and 1998 306 patients older than 17 years of age were admitted to the UHG because of a sports injury. These patients were sent a questionnaire. 61 patients (20%) could not be contacted and 16 (5%) were not willing to participate, resulting in a response rate of 75% (229 of 306). The mean time since the accident in the responding population was 2.8 years (s.d.: 1) with a range of 1 to 4 years.

Table I: basic characteristics of respondents, non-respondents and total population.

	RESPONDENTS	NON-RESPONDENTS	TOTAL
- number of patients	229 (75%)	77 (25%)	306 (100%)
- age (mean/s.d./range)	32/10/52	30/11/56	31/10/58
- gender (%male, number)	75% (n=172)	78% (n=60)	76% (n=232)
- iss* (mean/s.d./range)	4.8/4.1/37	4.9/4.1/17	4.8/3.8/37
- cause of injury: (number, %)			
- fall	98 (43%)	33 (43%)	131 (43%)
- collision / kick opponent	23 (10%)	7 (9%)	30 (10%)
- sports material	16 (7%)	3 (4%)	19 (6%)
- rest (e.g. stumbling)	92 (40%)	34 (44%)	126 (40%)
- type of injury: (number, %)			
- fracture	128 (56%)	37 (49%)	165 (55%)
- soft tissue injury	78 (34%)	34 (44%)	112 (36%)
- internal injury	14 (6%)	2 (2%)	16 (5%)
- intra cranial injury	9 (4%)	4 (5%)	13 (4%)
- body region: (number, %)			
- head/neck	14 (6%)	7 (9%)	21 (7%)
- thorax/abdomen	18 (8%)	2 (3%)	20 (6%)
- spine	18 (8%)	2 (3%)	20 (6%)
- upper extremity	34 (15%)	17 (22%)	51 (16%)
- lower extremity	145 (64%)	49 (64%)	194 (63%)
- length of hospitalisation in days (mean/s.d./median/range)	9/11/6/123	9/8/6/43	9/10/6/123
- treatment (%) (operative v. conservative)	76%/24%	80%/20%	77%/23%

*: ISS: Injury Severity Score[19]

Basic characteristics, responders and non-responders

There were no significant differences between respondents and non-respondents concerning age and gender distribution, ISS score, length of hospitalisation, cause of injury and nature of treatment. Some discrepancies were noted regarding the type of injury and the body region (see Table I).

About one third of the respondents (32%) were highly educated (university or higher vocational education), 49% had an intermediate level education (high school or intermediate vocational education) and 19% had received a low education, either no education, only elementary school, or at most, lower vocational education. These data do not differ from the corresponding percentages (28%, 50% and 21%, respectively) in the general Dutch population[25].

Table II: number of patients per type of sport.

TYPE OF SPORT	NUMBER OF PATIENTS: TOTAL n (%)	NUMBER OF PATIENTS: FEMALE n (%)	NUMBER OF PATIENTS: MALE n (%)
soccer (outdoor)	69 (30%)	2 (3%)	67 (42%)
horse riding	30 (13%)	25 (36%)	5 (3%)
speed skating	16 (7%)	4 (6%)	12 (7%)
volleyball	16 (7%)	6 (9%)	10 (6%)
skiing	14 (6%)	5 (7%)	9 (6%)
motorcross	11 (5%)	-	11 (7%)
soccer (indoor)	9 (4%)	-	9 (6%)
handball	9 (4%)	4 (6%)	5 (3%)
basketball	5 (2%)	2 (3%)	3 (2%)
martial arts	4 (2%)	2 (3%)	2 (1%)
cycle-racing	4 (2%)	-	4 (3%)
badminton	4 (2%)	4 (6%)	-
korfball	4 (2%)	4 (6%)	-
rest	34 (14%)	11 (16%)	23 (15%)
total	229 (100%)	69 (100%)	160 (100%)

Half the responding population (49%) participated competitively in sport. The largest number of sports injuries (69/229: 30%) occurred while playing soccer (Table II) and horse riding accounted for the second largest number of injuries (30/229: 13%).

Outcome measures

At the time of their accident, 74% (169) of the patients were employed. Five percent of this working population did not experience any absenteeism but 67% had not been able to work for up to one year (Table III). The latter percentage is not only an indication of the severity of sports injuries but probably also an indication of the nature of the social security system in the Netherlands. Four percent of the population was still unfit for work due to the sports injury, at the time of the interview.

Absenteeism from sports occurred in 96% of the patients. Nearly half of this population (Table III) was not able to participate in sports for more than a year.

Table III: absenteeism from work and sports, due to the sustained sports injury

ABSENTEEISM FROM WORK (number of patients, % with absenteeism)	1995 (n=59)	1996 (n=49)	1997 (n=61)	TOTAL (n=169)
- < 1 month	12 (20%)	16 (32%)	21 (34%)	49 (29%)
- 1 month - 1 year	43 (73%)	33 (68%)	38 (61%)	113 (67%)
- permanent	4 (7%)	-	2 (3%)	7 (4%)
ABSENTEEISM FROM SPORTS (number of patients, % with absenteeism)	77 (96%)	63 (95%)	79 (95%)	219 (96%)
- < 1 month	-	1 (2%)	6 (7%)	7 (3%)
- 1 month - 1 year	38 (49%)	30 (49%)	41 (53%)	109 (50%)
- > 1 year	36 (47%)	29 (46%)	31 (40%)	96 (44%)
- unknown	3 (4%)	3 (4%)	1 (1%)	7 (3%)

Thirty-two percent (73) of the population stated that, after an average time since accident of 2.8 years, they "still experienced disabilities and handicaps following the sports injury". This finding is in accordance with the results of the SIP68 mentioned below (Odds ratio: 6.8; C.I. 95%: 3.51-13.08).

The results of the SIP68 are listed in table IV. In order to weigh the ignificance of this outcome a comparison is made with the results of two reference populations: patients with a spinal cord injury (SCI) and patients with neck and back complaints[22]. The SIP68-score was calculated for all three populations. As far as the sumscore and all of the subscales are concerned, patients with a sports injury had a significantly lower score compared with the SCI patients but there was no significant difference with the population of patients with neck and back complaints. Further, 24% of the patients had a sum score "greater than 0", indicating some residual disability or handicap following the sports injury. This primarily concerned the subscales "social behaviour", "mobility control" and "emotional stability". The remainder (76%) of the population was not suffering

Table IV: results of SIP68: reference populations: patients with a Spinal Cord Injury (SCI)[23] and patients with neck or back complaints[23].

SIP68*	SPORTS INJURIES	SCI	NECK/BACK COMPLAINTS
SUBSCALES:	(n=229)	(n=41)	(n=338)
- somatic autonomy	0.4	6.5	0.2
- mobility control	1.2	6.6	1.0
- emotional stability	0.6	0.8	0.4
- pacs**	0.7	1.1	0.7
- social behaviour	1.7	4.6	1.6
- mobility range	0.1	2.6	0.2
Sumscore	4.7	22.3	4.1

* : SIP68: Sickness Impact Profile68
** : psychological autonomy and communication scales

from long-term consequences following the sports injury at the time of the interview.

After performing logistic regression analysis only gender ($p<0.03$) and type of sport ($p<0.01$) proved to be of prognostic significance. Long-term consequences

of sports injuries occur more often in women and with horse riding, outdoor soccer and skiing.
The other variables mentioned in "material and methods" had no significant prognostic value for the occurrence of long-term consequences of sports injuries.

3.4 Discussion

Little is known about the long-term outcome of patients with a sports injury nor how many of them have residual disabilities and handicaps. Such information is important in order to get insight in the consequences of these injuries for both patients and society, as is reported that a large number of patients are treated annually in hospital due to these injuries[2]. Almost all of them belong to the working population.
Therefore, all patients with a severe sports injury (needing hospital admission) and older than 17 years of age (n=306) were selected from the total number of patients with a sports injury (n=5190) treated in the UHG over a 3 years period. By using hospital admission as a selection criterion the results and conclusions of this study are valid for comparable populations but they are not applicable for patients with a sports injury treated otherwise or not treated at all.
Residual disabilities and handicaps following a sports injury were measured, amongst others, by making an inventory of the absenteeism from work. The burden of the long lasting (for several months) payment of benefits to two-thirds of the population who were employed at the time of the accident gives an indication of both individual handicap and the financial consequences of sports injuries to society. Even to a higher degree this goes for the continuing payment to 4% of the total population and even to 7% of the population injured in 1995 (Table III). This is further underlined by the fact that the costs generated by one year of absenteeism from work amount on average € 27.000[26] and that the research population is young; therefore, a large number of potential laborious years are lost. The percentage of patients being permanently out of work is lower with patients injured in 1996 and 1997 in relation to patients injured in 1995 (Table III). A possible explanation for this difference is the change in

legislation in the Netherlands in the year 1996 whereby the conditions on which someone is declared unfit for work became stricter. Also improvement of the labour market may have contributed.

Another measure for long term consequences of sports injuries is the sporting time lost. The vast majority of the research population (96%) had to refrain from sports participation for some time, due to the injury. It is a noteworthy that nearly half of the population was not able to participate for more than a year. Not being capable to participate in sports is known to be of important psychosocial influence[27], whereby this influence may be manifest already after an absenteeism of 3 to 4 weeks[28], let alone after one year. One should however realise that admission itself (entry criterion in this study) will be a reason for absenteeism from work or sports.

Long term consequences of a sports injury as measured by the absenteeism from work or sports are not only determined by the severity of the injury. Also psychosocial factors may play an important role, like the (lack of) contentment in working or in participating in sports. It even can be argued whether stopping sports is a sensible choice rather than an inevitable consequence of the injury.

The SIP68 is a more objective measure to weigh long term consequences. The results of the SIP68 reveal that 24% of the patients scored "larger than 0" indicating some long-term consequences. This finding coincides with the fact that 32% of the patients stated "they still experienced some disabilities or handicaps, 3 years after the injury". The difference in percentages may well be explained by a possible sloppiness in filling out the SIP68-form. Although the dichotomy "0 - larger than 0" may seem disproportionate it is not only the experience of the composers of the SIP68 that it is relevant but also its relevancy is underlined by the weight attributed to results of the SIP136, the extended version of the SIP68 consisting of 136 questions. Already a seemingly low score on this SIP136 corresponds to some degree of disability: 0-8 out of 136 (Patrick[29]), 0-9 out of 136 (Bergner[30]) and 6-9 out of 136 (Gilson[31]).

The mean sum score of the SIP68 was 4.7. The relevance of this result can be elucidated by comparing it with the results in reference populations. It becomes clear that the level of disabilities and handicaps in patients with a sports injury is comparable with the level in patients with neck and back complaints. A demonstration of the impact of low back complaints is the fact that its lifetime

prevalence is 50 to 80%[32] and that in the Netherlands 35% of the budget for illness- and disablement benefits is spent on this patient category[33]. The mean sumscore of the SIP68 in the population of patients with a sports injury is significantly lower than in the population of SCI patients.

The variable "gender" turned out to be of prognostic significance: women are more prone than men to experience long-term consequences of a sports injury. In part this can be explained by the finding that relatively more women suffer from an injury due to horse riding. This type of sport incurs disability or handicap significantly more often than other types of sports. Other studies subscribe to these findings[34-37].

An explanation for the fact that only two prognostic variables could be distinguished may be the limited uniformity concerning the variables "body region" and "type of injury".

From a study concerning sports injuries not needing inpatient treatment (unpublished data), it becomes clear that these injuries can also cause long-term disabilities and handicaps. On average these consequences are less severe than in inpatients: for example, the percentage of outpatient population not resuming sport is 11%; in inpatients 44%. Furthermore, 20% of the outpatients still experience disability or handicap following the injury versus 32% of the inpatients.

3.5 Conclusions

The results of all four of the applied measures: (1) absenteeism from work, (2) absenteeism from sports participation, (3) the question "Do you still experience disabilities and handicaps following the sports injury", and (4) a generic measurement instrument (the SIP68) show that severe sports injuries lead to long term disabilities and handicaps. The injuries and above all their long term consequences are not only a burden for the patients involved but also incur substantial direct and indirect costs and need for medical health care.

Two variables ("gender" and "type of sport") with a prognostic value concerning the appearance of long-term consequences could be distinguished. Therefore, prevention and treatment strategies should be aimed at the broad spectrum of

patients with a sports injury, with a predominance for women and injuries due to horse riding, outdoor soccer and skiing.

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Chapter 4

Long-term disabilities and handicaps following sports injuries: outcome after outpatient treatment.

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Abstract

Purpose: The aim was to investigate whether long-term disabilities and handicaps arise from a sports injury requiring outpatient treatment and to identify the potential risk factors.

Method: A representative sample was taken from a population of patients treated as outpatients due to a sports injury. The selected patients were sent a questionnaire, one to five years after the injury.

Results: Thirty-nine percent of the patients studied were unable to work for up to one month after the injury, 19% was not able to work for up to three months and another 5% could not work for a maximum of eight months. Participation in sporting activities was hampered for up to one year in 76% of the patients and 11% had not resumed sports participation at all. In addition, 20% of the population stated that they still suffered from disabilities and handicaps following the sports injury. The outcome of the SIP68 underlines these results. Nine percent of the patients had a sumscore larger than 0. The variables which could be identified as risk factors were the body region: knee and sex: female.

Conclusions: Sports injuries requiring outpatient treatment can lead to long-term disabilities and handicaps, especially in patients with knee injuries and injuries in women. On average these consequences are less severe than those associated with inpatients; however, this finding is of great value since the number of outpatients is much higher than in patients admitted to a hospital.

4.1 Introduction

Participation in sporting activities in the Netherlands results annually in 2.9 million injuries. A substantial number (209,000) of these patients require hospital treatment[1], and almost 8% of this group is admitted[2]. It has already been proven that severe sports injuries can lead to long-term disabilities and handicaps if hospital admission is used as a criterion for injury severity[3]. Hereby, according to the World Health Organisation (WHO), disability is defined as: "any restriction or lack (resulting from an impairment) of ability to perform an activity within the range considered normal for a human being"[4]. The WHO definition of handicap is "a disadvantage for a given individual, resulting from an impairment or a disability that limits or prevents the fulfilment of a role that is normal for that individual". Impairment, as mentioned in the above definitions stands for any loss or abnormality of psychological, physiological, or anatomical structure or function.

It might be expected that less severe sports injuries, not needing admission, could have less serious consequences. However, there are indications that considerable long-term consequences can occur following less severe injuries unrelated to sport[5]. It is unclear whether such a finding can also be applied to sports injuries.

The objective of this study is to investigate whether sports injuries treated in an outpatient setting can lead to long-term disabilities and handicaps, and to determine which factors contribute to the occurrence of these long-term consequences.

4.2 Materials and methods

Between 1995 and 1998, 4537 patients between 17 and 60 years of age were treated for a sports injury in the outpatient department of the University Hospital Groningen. In order to examine whether long-term consequences arise from these injuries a random sample was taken. We aimed at a study population of 15 to 20 patients. If, as can be derived from other studies[6,7], 10 to 30% of the patients, treated in an outpatient hospital facility, will experience long-term

disabilities and handicaps, at least 100 respondents should be involved. With an expected response rate of 50 to 60% (as in comparable studies[8,9]) approximately 200 patients should be accessed. The sample was composed by entering every twentieth consecutive patient into the study. In order to determine the representativeness of the sample information on patient characteristics and injury details was collected. The patients received a postal questionnaire with items on absenteeism from work and sports, the question: "do you still experience disabilities and handicaps following the injury?" and the 68 version of the Sickness Impact Profile (SIP68)[10-14]. The latter is a generic measurement instrument in the field of disability and handicap. It consists of 68 items, subdivided in six categories; somatic autonomy, mobility control, emotional stability and psychological autonomy and communication scales, mobility range and social behaviour. The minimum sumscore is 0, and the maximum 68. A higher score indicates a worsening of the health status. Reference population data was available[10-14].

Statistical analysis was performed using SPSS 10.0. Descriptive statistics were employed to determine the prevalence of long-term disabilities and handicaps. The Z-test for the equality between two proportions (binomial proportion), was carried out to compare respondents to non-respondents. One sample t-tests were used to compare the results of the SIP68 with a reference population. Logistic regression analysis was performed in order to determine whether a set of variables, such as age, sex, type of injury, body region, level of education, type of sport, level of sports participation, length of hospital stay, treatment and the Injury Severity Score (ISS)[15] served as risk factors. The ISS is an overall injury severity scale, extending from 0, no injury, to a maximum of 75 (a nearly 100% chance of death).

The dichotomised results of the question whether patients still experience disabilities or handicaps (yes / no) due to the sports injury and the sumscore of the SIP68 (0 versus larger than 0) were used as dependent variables in a logistic regression analysis.

4.3 Results

The inclusion of every 20th patient from the overall sample of 4537 patients resulted in a total of 213 patients eligible for the study. Twelve of the 213 patients refused to co-operate and 103 patients could not be reached or did not respond, giving a response rate of 46% (98/213).

The mean age of the respondents was 30 years and 68% were males. The median of the injury severity, as measured by the Injury Severity Score (ISS)[10], amounted to 1 (S.D.: 1, range: 1 to 4). No significant differences concerning these characteristics or the type of injury and the body region were noted in relation to the group of non-respondents (see Table I).

Table I: basic characteristics of respondents, total sample and total population.

	RESPONDENTS	TOTAL SAMPLE	TOTAL POPULATION
number of patients	98	213	4537
age (mean/s.d./range)	30/12/18-54	29/9/18-56	30/9/18-56
sex (%male)	67%	72%	72%
ISS (median/s.d./range)	1/1.3/1-4	1/1.3.1-9	1/1.5/1-10
type of injury:			
- fracture	21%	19%	16%
- soft tissue injury	78%	80%	82%
- intracranial injury	0%	0%	2%
- rest	0%	1%	0%
body region:			
- head/neck	9%	7%	13%
- trunk	0%	3%	2%
- upper extremity	38%	34%	40%
- lower extremity	49%	56%	45%

Follow-up results

On average 3.8 years (median: 3.8, s.d.: 0.8, range: 2.3 to 5.3) had elapsed since the accident.

Nine percent of the respondents had received a low standard of education, ranging from no education to elementary school or lower vocational education, whereas 57% were educated to an intermediate standard of secondary school or intermediate vocational education and 34% were highly educated having

received university education or higher vocational education.

Half of the population (48%) participated competitively in sports. Outdoor soccer (n=25; 26%), volleyball (12; 12%) and skiing (8; 8%) were the types of sport accounting for the largest number of sports injuries (Table II). Male predominance was found in outdoor and indoor soccer, speed skating and martial arts. In women relatively more injuries occurred during volleyball and skiing.

Table II: number of injured patients: total, males and females per type of sport.

TYPE OF SPORT	PATIENTS (n,%)	MALES (n,%)	FEMALES (n,%)
Soccer (outdoor)	25 (26%)	22 (35%)	3 (10%)
Volleyball	12 (12%)	7 (10%)	5 (26%)
Skiing	8 (8%)	3 (5%)	5 (16%)
Speed skating	6 (6%)	6 (9%)	-
Basketball	5 (5%)	3 (5%)	2 (7%)
Soccer (indoor)	5 (5%)	5 (8%)	-
Water skiing	4 (4%)	3 (5%)	1 (3%)
Horse riding	3 (3%)	-	3 (10%)
Hockey (field)	3 (3%)	2 (3%)	1 (3%)
Martial arts	3 (3%)	3 (5%)	-
Handball	3 (3%)	1 (2%)	2 (7%)
Rest	21 (21%)	12 (18%)	9 (30%)
Total	98 (100%)	67 (100%)	31 (100%)

Outcome measures

Continuing work, despite the injury, was possible for 37% (n = 25) of the total working population of 67 patients. Absenteeism from work lasted no longer than one month in 39% (n = 25) of the patients and no more than three months in 19% (n= 13) of the patients. The remaining 5% (n = 3) of the patients was unfit for work for up to a maximum of eight months. At the time of the interview, no lasting absenteeism from work existed due to the sports injury (Table III).

The majority of the patients (76%) had to refrain from sports participation (Table III) for some time, up to maximum of one year, and 11% of the population (n = 11) did not resume sports activities at all because of the sports injury.

Twenty percent (n=20) of the patients answered the question "do you still experience disabilities and handicaps following the equestrian injury?" affirmatively at the time of the follow-up, despite standard medical treatment. Furthermore, 9% (n=9) of the population had a sumscore larger than 0 on the SIP68, also indicating that some degree of disability or handicap following the sports injury is experienced. If we compare our results of the SIP68 with the results of patients with a spinal cord lesion or
patients with neck/low back pain[12] (Table IV), it is clear that the disablement is far lower in the patients injured by a sporting activity (mean SIP68 sumscore: 0.4 versus 22.3 and 4.1 respectively, $p < 0.001$).

Table III: Absenteeism from work and sports due to the sports injury sustained

	ABSENTEEISM FROM WORK (n,%) (n=67)	ABSENTEEISM FROM SPORTS (n,%) (n=98)
None	25 (37%)	3 (3%)
< 1 month	26 (39%)	21 (21%)
1 month – 3 months	13 (19%)	29 (29%)
3 months – 1 year	3 (5%)	26 (26%)
Permanent	-	11 (11%)
Unknown	-	8 (8%)

Table IV: results of SIP68: comparison of patients with a sports injury to patients with a spinal cord injury (SCI) and patients with neck or back complaints[7].

SIP68*	SPORTS INJURIES	SCI	NECK/BACK COMPLAINTS
SUBSCALES:	(n=98)	(n=41)	(n=338)
- somatic autonomy	0.1	6.5	0.2
- mobility control	0.1	6.6	1.0
- emotional stability	0.0	0.8	0.4
- pacs**	0.1	1.1	0.7
- social behaviour	0.2	4.6	1.6
- mobility range	0.0	2.6	0.2
Sumscore	0.5	22.3	4.1

* : SIP68: Sickness Impact Profile – 68 items version
** : Psychological autonomy and communication scales

Risk factors

By using the outcome measure -experienced disabilities and handicaps-, as a dependent variable in a logistic regression analysis, one variable (body region) emerged as a significant predictor concerning the occurrence of long-term consequences of sports injuries. It was found to be significant that injuries to the knee more often incurred long-term disabilities and handicaps than other injuries (Odds ratio: 13.8, 95% C.I.: 2.7 – 70.1).

When the outcome measure: SIP68-sumscore = 0 versus SIP68-sumscore > 0 is applied, sex appeared to be a significant predictor of long-term disablement. In women, the chance of persisting disabilities and handicaps is higher than in men (Odds ratio: 5.0, 95% C.I.: 1.2 – 21.7).

4.4 Discussion

The highest number of accidents requiring hospital treatment are home and leisure accidents (44%)[2]. Accidents following sports participation are in number the second cause of injury (21%) needing hospital treatment. The fast majority of these injuries (92.1%) is treated in the outpatient department, and only 7.9% is admitted. The patients requiring hospitalisation often experience long-term consequences following their injury, which has implications for both patient and society in terms of costs and reliance on social services[3]. If long-term

disabilities and handicaps are experienced by the sizeable group of patients with sports injuries treated as outpatients, then the personal and societal implications could be more serious than was first expected. However, thus far outcome studies have focused only on short-term consequences, or on a limited part of the disabilities and handicaps, or primarily on impairments. Other studies have focused on children or on one type of sport or on specific body regions[6, 16-27]. This study aims to investigate the entire spectrum of disabilities and handicaps following outpatient treated sports injuries.

No significant differences concerning the basic characteristics between the total population of outpatients and the sample of respondents were found. It can therefore be assumed that the respondents accurately represent the entire population of outpatients. However, some caution regarding this statement is needed if we review the response rate of 46%. This fair response rate is probably due to the fact that we only studied outpatients. In our experience, clinically treated patients who sustained a sports injury are more willing to co-operate. This is based on the fact that in a previous study we realised a response rate of 75%[3]. An explanation for this difference may be that an injury needing admission generally results in more patient-hospital staff interaction and therefore results in more commitment by the patient to collaborate in a study.

Different criteria can be used to determine the severity of an injury. Apart from the ISS[15] and inpatient or outpatient treatment following the injury[2], long term consequences arising from the injury[2, 27] may serve this purpose.

In this study 'experienced disabilities and handicaps', the SIP68, and absenteeism from work and sports participation were all used to assess long-term consequences of an injury. In general it is assumed that patients treated in an outpatient facility experience fewer disabilities and handicaps than patients admitted to a hospital because of an injury. In the present study, however, we found that a considerable proportion (20%) answered the question "Do you still experience disabilities and handicaps following the sports injury?" affirmatively. Furthermore, 9% of the population indicated some degree of disability or handicap by means of the results of the SIP68. This finding is confirmed by van der Sluis et al[5] declaring that the outcomes of 'lesser' injuries may have more serious consequences than we tend to assume.

Nearly two-thirds of the working population experienced absenteeism from work following the sports injury. Although this proportion is smaller, and the duration of the sick leave is on average shorter than in the population of patients admitted because of a sports injury[3], the previously mentioned societal consequences could be considerable when the large number of outpatients is taken into account.

Sports injuries may also have substantial personal consequences. This is underlined by the fact that after a period of three to four weeks absenteeism from sports may lead to psychosocial problems[28,29]. The majority of the patients involved in our study were not able to participate in sports for up to or more than one year. Physicians often underestimate these psychosocial aspects. Therefore, we suggest that patients suffering from sports injuries and prone for long-term disablement should be treated in a specific multidisciplinary setting. In such a treatment setting a psychologist or a social worker could work together with a physiotherapist and a rehabilitation physician.

Logistic regression analysis was used in order to establish which patients are at risk of experiencing long-term consequences due to a sports injury. Women turned out to be more prone to experience long-term disabilities and handicaps following a sports injury than men. Apart from the fact that in general women tend to present more health problems than men[30], no explanation for this sex difference could be deduced from our study results.

The variable body region also proved to be a risk factor. Knee injuries more often lead to disabilities and handicaps than injuries to other areas of the body. This finding is supported by the results of other studies[31, 32] stating that long-term consequences can occur following any sports injury, but in particular following knee strains.

4.5 Conclusion

In this study, substantial long-term disabilities and handicaps were found in patients treated for sports injuries at an outpatient department. The importance of this finding is emphasised by the fact that the absolute number of outpatients by far exceeds the number of inpatients. On average these consequences were

not as severe and lasting as in clinically treated patients, however, absenteeism from work and sports activities was considerable.

Women with a sports injury and patients suffering from knee injuries are particularly at risk of developing long-term consequences. During follow-up, therefore, special attention should be paid to these patient categories. Research should be carried out to develop specific rehabilitation programmes on behalf of patients who sustained sports injuries, resulting in fewer disabilities and handicaps.

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Chapter 5

Clinical treatment of equestrian injuries in Groningen: 1990-1998: serious long-term effects.

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Abstract

Objective: To determine whether equestrian injuries result in long-term consequences and to establish the risk factors for this outcome.

Design: Retrospective, descriptive.

Patients and methods: 88 patients older than 17 years of age who had been admitted to the University Hospital Groningen during the period 1990-1999 because of an equestrian injury were included in the study. After an average period of five years, an inventory was made using the 'Sickness Impact Profile68 (SIP68)', 'absenteeism from work and sports' and 'experienced disabilities or handicaps'. Subsequently the risk factors for the occurrence of long-term effects were investigated.

Results: The response was 65/88 (74%). Equestrian injuries often resulted in long-term consequences: 35% of the patients had a SIP68 score '>0', 11% of the working population was permanently unfit for work, 25% no longer participated in sports as an effect of the injury, and 43% still experienced some form of disability or handicap. The type of injury (notably intracranial, fracture), body region (notably trunk), and injury severity score (ISS) were significantly associated with the occurrence of the long-term consequences.

Conclusion: Equestrian injuries which required clinical treatment were serious in nature and often resulted in long-term consequences; therefore, the follow-up of these patients should be long and extensive.

5.1 Introduction

Thirty to 40% of the Dutch population (16 million inhabitants) practise a sport[1, 2]. Besides advantages, such as physical fitness[3], there are also disadvantages to playing a sport, for instance the risk of incurring injury. In the Netherlands, the number of sports injuries is estimated at 2.9 million a year. Not only this absolute number is an indicator, the severity of the injuries is also an important factor, for instance expressed in the risk of hospitalisation. An estimated 8%[4] of the 209,000[5] sports injury patients are hospitalised every year. There are striking differences here per branch of sport; the hospitalisation percentage is highest for injuries resulting from horseback riding (21%)[4]. This underlines the relatively serious nature of equestrian injuries. Earlier studies[8-16] reach a similar conclusion. As well as the hospitalisation percentage, other criteria of severity are also used, such as mortality, Injury Severity Score (an index for the degree of anatomical injury resulting from a trauma, expressed in a figure between 0 and 75, a higher number implying a more serious injury)[17,18] and the occurrence of long-term consequences[4,19]. These relate to specific disabilities (problems with walking, lifting etc.) and handicaps (e.g. absenteeism from work and sports), as defined by the World Health Organisation[20]. The last criterion is important, because the population of sports injury patients, including therefore patients with an equestrian injury, are on average young and hence, as regards the occurrence of residual phenomena, run the risk of a long-term impairment of health-related quality of life and disablement. There are no reliable data on the occurrence of these long-term residual phenomena. The aim of this study is to determine to what extent long-term consequences are present as a result of clinically treated equestrian injuries in adults. The study will also examine what risk factors can be distinguished for the occurrence of these consequences.

5.2 Patients and methods

In this retrospective cohort study, all patients involved were older than 17 and were admitted to the Department of Traumatology of the University Hospital Groningen in the period from 1990 to 1999 following an equestrian injury. This

patient population was identified by means of Registration of Injuries and Accidents Groningen (RLOG), a computerised injury registration system, from which information on age, sex, diagnosis, and treatment was obtained.
An average of five years (s.d.: 2.7) after the occurrence of injury, patients were asked to fill out a questionnaire. This questionnaire consists of a general part, dealing with personal characteristics, injury and treatment data, and a specific part relating to long-term consequences in the form of the Sickness Impact Profile68 (SIP68), absenteeism from sports and work, and the question 'are you still experiencing disabilities as a result of the injury?' The SIP68 is a valid generic measuring instrument that has proved reliable and focuses on the physical, psychological, and social functioning of the patient. The scale is made up of 68 items divided over 6 subscales: Somatic Autonomy, Motor Control, Psychological Autonomy and Communication, Social Behaviour, Emotional Stability, and Mobility Range. The minimum score is '0', the maximum score '68', a higher score being an indication of poorer functioning[21-25].
The results were statistically analysed with SPSS 9.0. Descriptive techniques were applied to determine the response percentage and to examine whether long-term effects occur. Logistic regression analyses were applied to estimate Odds ratios for potential risk factors for the occurrence of long-term consequences. The dichotomised results of the sum score of SIP68 ('0' versus 'greater than 0'), ongoing absenteeism from work and sports, and experienced disabilities were used as dependent variables. Independent variables were 'age', 'sex', 'type of injury', 'injury location', and 'ISS'.

5.3 Results

In the inclusion period, a total number of 396 equestrian injury patients were treated at University Hospital Groningen. The number of patients treated in the outpatients' department was 308, with an average age of 29 (s.d.: 9.4) and a male-female ratio of one to four. A questionnaire was sent to all 88 hospitalised patients. 74% (n=65) returned it.

Table I: personal characteristics and injury data of 65 patients hospitalised after an equestrian injury.

Variable		Result
Age (average/s.d./range)		31 / 9.2 / 18-51
Sex (female)		58 (89%)
ISS* (average/median/range)		7.5 / 5 / 1-25
Type of injury:	- fractures	52 (80%)
	- soft tissue injuries	5 (8%)
	- intracranial injury	5 (8%)
	- internal injury	3 (5%)
Location:	- head/neck	10 (15%)
	- upper extremity	7 (11%)
	- lower extremity	13 (23%)
	- trunk	33 (51%)
Diagnosis:	- cranial/facial fractures	5 (8%)
	- vertebral fracture without damage to spinal cord	21 (32%)
	- vertebral fracture with damage to spinal cord	1 (2%)
	- pelvic fracture	7 (11%)
	- upper extremity fracture	5 (8%)
	- lower extremity fracture	13 (23%)
	- commotio/contusio cerebri	5 (8%)
	- soft tissue injury (contusion, sprain, luxation, neural injury)	5 (8%)
	- obtuse injury of the stomach/pneumothorax	3 (3%)

*: Injury Severity Score

Personal characteristics and injury data (see Table I).

The average age of respondents with an equestrian injury was 31 (s.d.: 9.2); 87% were women.

As regards location, most injuries occurred in the trunk (51%) or the lower extremity (23%). Fractures were the main type of injury (80%). In 8% of cases, there was intracranial injury. The average ISS score was 7.5 (median: 5; s.d.: 4.7). For the diagnoses, see Table I. There was no significant difference between respondents and non-respondents concerning the variables mentioned above.

Table II: results of 65 patients treated during hospitalisation after an equestrian injury.

Variable		result
SIP68*: % >0		23 (35%)
SIP68* (average/median/range)		
- total score (range: 0-68)		6 / 0 / 0-36
- subscale Somatic Autonomy (range: 0-17)		1 / 0 / 0-15
- subscale Motor Control (range: 0-12)		2 / 0 / 0-12
- subscale Psychological Autonomy and Communication (range: 0-11)		1 / 0 / 0-11
- subscale Social Behaviour (range: 0-12)		4 / 0 / 0-12
- subscale Emotional Stability (range: 0-6)		1 / 0 / 0- 6
- subscale Mobility Range (range:0-10)		0 / 0 / 0
Absenteeism from sports: N (%) with absenteeism		61 (94%)
- duration:	- < 1 month	2 (3%)
	- 1 month – 1 year	32 (53%)
	- > 1 year	27 (43%)
- no longer able to practise sports:		26 (41%)
as a result of injury:		16 / 26 (59%)
Absenteeism from work:	- working	47 (74%)
- duration:	- none	1 (2%)
	- weeks	6 (13%)
	- months	35 (75%)
	- unemployed or specially adapted work due to injury	5 (11%)
'Still experiencing disabilities as a result of injury'		28 (43%)

*: SIP68: Sickness Impact Profile68[21-25]

Outcome measures (see Table II) and determinants for the occurrence of long-term consequences.

Thirty-five percent of the population had a SIP68 score 'greater than 0'. It proved impossible to demonstrate a risk factor for this outcome. The results per subscale are given in Table II.

At the time of the equestrian accident, 47 patients (74%) held paid jobs. On later inquiry, 11% of these were found to receive a disablement benefit as a result of the accident. This permanent disablement mostly occurs in patients with intracranial injury (Odds ratio: 60.0; 95% C.I.: 0.9-72.4).

Absenteeism from sports, the third outcome measure, occurred in almost all equestrian injury patients (94%). 43% were unable to practice sport for longer than a year owing to the injury. Ultimately, 25% (16/65) were forced to give up sports permanently for this reason. Prolonged absenteeism from sports mainly happens in patients with a trunk injury (Odds ratio: 4.5; 95% C.I.: 1.5-13.9).
Asked whether they experienced residual phenomena years after the accident, 43% of the riders answered in the affirmative. A higher ISS score is found to be correlated with a greater risk of the occurrence of disabilities and handicaps in the long term; per point increase in ISS score, a risk increase by a factor of 1.15 (95% C.I.: 1.0-1.3).

5.4 Discussion

General remarks

Sports injuries can lead to disabilities and handicaps in the long term. There are indications that this particularly applies to patients hospitalised with an equestrian injury[4]. In this sport, these are often high-energy injuries such as a fall under a horse weighing 500 kilograms or a kick from a horse (with a force of 10,000 Newton[26]). In general, it is true that the number of hospitalised patients, as a measure of injury severity, correlates with the number of participants in the sport[6, 7]. Thus in the service area of University Hospital Groningen, the number of senior members of the Royal Dutch Equestrian Federation, as a measure of the number of riders, is estimated at 1050. This means that, per 1000 riders, the number of annual hospitalisations is approximately 10. By way of comparison: per 1000 soccer-players an estimated 1.25 patients are hospitalised. The results of the study seem representative for the rest of the Netherlands. Oskam et al.[27] state that there are clear similarities between injury patterns as seen in the University Hospital Groningen and in the rest of the Netherlands. They also conclude that there are no major differences in demographic patterns between Groningen and the rest of the Netherlands.

Outcome variables

The results of the SIP68 score (35% 'greater than 0') and the answer to the question: 'are you still experiencing residual phenomena as a result of the injury?' (43% answer 'yes') show that residual phenomena occur frequently. The average SIP68 score in this population is 6.0 (median: 0). A score between 0 to 9 on a version of the SIP numbering 136 questions is already indicative of considerable disabilities[28-30]. The SIP68 score found in the study is comparable with the score among patients with chronic neck and back complaints[24]; both with regard to the total score and the distribution of scores among the various domains. Thus, in both populations the average score is found to be highest in the domains of 'social behaviour' and 'motor control'.

The fact that 35% of the budget for medical expenses and disablement benefits in the Netherlands is spent on this reference population of patients with neck and back complaints[31] emphasises the importance of the SIP68 results. This is underlined by the considerable percentage of permanent disablement (11%).

The risk of prolonged absenteeism from sports after an equestrian injury is also high: almost half the population cannot participate in sports for at least a year, while one in four must give up sports permanently. Earlier research underlines the importance of this finding; inability to participate in sports may lead to distinct psychosocial problems[32, 33].

Risk factors for the occurrence of long-term consequences

Equestrian injury patients with a high ISS score are more liable to experience long-term consequences. This finding is new. Although earlier research[6] has demonstrated that a higher ISS score is linked to a higher risk of hospitalisation, an explanatory basis was lacking for the correlation with 'disabilities and handicaps in the long term'.

The type of injury is also a risk factor for the occurrence of long-term consequences. Thus, intracranial injuries lead relatively often to disablement. The fact that this type of injury often goes together with cognitive disorders shows that it can seriously interfere with occupational activities. Finally, long-term disabilities and handicaps are also seen relatively often after trunk injuries. These mainly involve vertebral fractures, with or without damage to the spinal cord, and pelvic fractures.

5.5 Conclusion

Riding is a risky sport if we look at the consequences of accidents for health in the long term. Permanent disablement and residual phenomena occurring years after the injury figure largely in our study. These consequences were so serious and occurred so frequently that we recommend that every patient who is hospitalised in connection with an equestrian injury be properly followed up. In any case, this intensive follow-up should be directed at patients with a high ISS score, intracerebral injury, and/or trunk injury. Attention should be paid to somatic, psychological, and relational problems, limitations in activities of daily life, and problems related to work and leisure activities.

5.6 References

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Chapter 6

Long-term outcome of equestrian injuries in children

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Abstract

Purpose: To investigate the possible development of long-term disabilities arising from paediatric equestrian injuries.

Method: All patients, aged 17 years or younger, treated in a hospital setting because of an equestrian injury during a five-year period received a questionnaire. A reference population and healthy friends served as controls.

Results: Four years post-injury, 41 of the 100 respondents still experienced disabilities following the injury. The median Injury Severity Score was 4. Absenteeism from school lasted 2 weeks, and from horse riding, 4 months. Compared to the reference population, the results of the Child Health Questionnaire were poorer considering most of its subscales. In comparison with the friends, the patients only scored lower on "physical functioning". The risk factors concerning poor long-term outcomes were being an advanced rider, sustaining injuries other than fractures of the extremities or sustaining subsequent injuries following the riding accident.

Conclusions: Although equestrian injuries in children are minor to moderate in their severity, these injuries are significant considering that a large proportion of patients experience long-term disabilities.

6.1 Introduction

In the United States an estimated 30 million people go horse riding[1]. In the United Kingdom this number is approximately 3 million[2] people, whereas in the Netherlands 500,000 people go horse riding. On a yearly basis, almost 75,000 equestrian injuries occur in the Dutch population, 45% of which require medical treatment. Approximately one third of these injuries (9,100 injuries) require hospital treatment and 720 patients have to be admitted every year[3].

The majority of the patients injured by a horse riding accident are females younger than 20 years of age. On average the absolute number of equestrian injuries is relatively low, however, the severity of these injuries is greater than in many other paediatric sports activities[4-6].

Various studies regarding the severity of equestrian injuries apply different criteria[7, 8], such as the type of injury (spinal cord injuries[9-13] or serious head injuries [14,15]), hospital admission rate[5], mortality[10], costs or the Injury Severity Score (ISS)[16]. The severity of sports injuries can also be expressed in the nature and extent of resulting long-term disabilities and handicaps[5]. Permanent disablement is very important for the younger population, particularly regarding their number of productive future life years. However, at the present time there is only a limited amount of information available in the literature [7,14,17-19].

The aim of this study is to analyse whether long-term consequences arise from equestrian injuries in children. Furthermore, we attempted to identify prognostic variables in order to clarify the long-term outcome results.

6.2 Materials and Methods

All patients who had been involved in an equestrian injury, and who had been treated at the emergency department of University Hospital Groningen (UHG), the Netherlands, between 1 January 1995 and 31 August 2000, were entered in the study. In order to participate, patients were required to be under the age of 18 years at the time of the follow-up in January 2002. Patients were identified using a computerised trauma registration system (RLOG: Registratie Letsels en Ongevallen Groningen)[20]. This system provides data concerning the patients'

age, gender, injury cause, injury diagnoses and treatment on an inpatient or outpatient basis. Equestrian injuries correspond to the codes E82820-1, E82824-5 and E82828-9 of the International Classification of Diseases (ICD-9CM). Injury diagnoses were categorised into the body regions of the Abbreviated Injury Scale (AIS). From the AIS scales, the Injury Severity Score (ISS) was calculated, which is an indicator of injury severity and ranges from 0 (no injury) to 75 (virtually unsurvivable injury)[21,22].

At the time of follow-up, patients were sent a questionnaire assessing patient characteristics, the nature and type of injury, residual disabilities and handicaps and absenteeism from school and sports. Furthermore, the questionnaire included the Dutch translation of the Child Health Questionnaire-Child Form (CHQ-CF87)[23]. The CHQ-CF87 is a valid and reliable instrument measuring disabilities and handicaps in children of 9-17 years of age. The 87 items are divided into 12 subscales: "physical functioning", "role functioning": emotional, behavioural and physical, "bodily pain", "general behaviour", "mental health", "self esteem", "general health perceptions", "change in health", "family activities" and "family cohesion". All scales are transformed into 0-100 scales, except the subscale "change in health" which is categorical. In the scales, a higher score reflects a better health status. According to the authors of the scale, summary component scoring is not applicable.

Reference data of the CHQ-CF87 on 444 Dutch schoolchildren of 9-17 years of age were used[24].

In order to compare the results of the study population with an additional group of controls, the participating patients were asked to invite a healthy friend of the same age, sex, social class and cultural background to take part in this study. After obtaining written authorisation and informed consent, the friends also received a questionnaire. This questionnaire contained the CHQ-CF87 and a set of questions concerning demographical characteristics.

The study was approved by the medical ethics committee of University Hospital Groningen (no.: mec 01/138).

Statistical methods:

Statistical analysis was performed using SPSS 10.0. Chi-square tests were applied to compare discrete data. T-tests for independent samples were used to compare means of continuous variables. Confidence interval analysis was used

to analyse the results of the CHQ-CF87 and compare it to control friends and the reference group. This analysis provides 95% confidence intervals for the differences between the groups.

In order to determine whether variables acted as risk factors for the occurrence of long-term disabilities and handicaps, chi-square tests and univariate analyses (ANOVA) were performed with the variables listed in Tables I and II (causes of injury inclusive) as independent variables. The main outcome measure was the physical functioning scale of the CHQ-CF87. Risk factors for the long-term problems regarding physical functioning identified by means of chi-square tests and ANOVA analysis were entered in a logistic regression analysis (method: backward conditional). Logistic regression was used because the scales of the CHQ-CF87 are of an ordinal level. The physical functioning scale of the CHQ-CF87 was dichotomised into favourable outcomes, scores ≥> 96.8 being the mean score of the normal population[24], and unfavourable outcomes, scores < 96.8. A significance level of $p < 0.05$ was applied.

6.3 Results

Response rate and basic characteristics

One hundred and thirty-nine patients met the inclusion criteria of the study. One hundred of these patients co-operated in the study, which was a response rate of 72%. The basic characteristics of the respondents are listed in Table I. No statistically significant differences were found between respondents and non-respondents concerning the variables of age, gender, type of injury, body region and ISS-score.

Table I: basic characteristics of the population studied (n=100)

Variable:	Result:
Age at the time of the accident (mean/s.d./range)	11 / 2.3 / 5-17 years
Age at the time of the interview (mean/s.d./range)	15 / 2.4 / 8-19 years
Follow-up time (mean / range)	4.3 / 2-7 years
Sex (% female)	90% (n=90)
Type of injury: (123 injuries in 100 patients)	
- fracture of the extremities	45.5% (n=56)
- soft tissue injury	43.1% (n=53)
- intracranial injury	8.1% (n=10)
- internal injury	3.3% (n= 4)
Body region: (123 injuries in 100 patients)	
- upper extremity	56.9% (n=70)
- lower extremity	17.9% (n=22)
- head / neck	16.3% (n=20)
- trunk	8.9% (n=11)
Injury Severity Score (ISS) (median/s.d./range)	4.0 / 2.3 / 1-13
Hospital admission rate	16% (n=16)
Level of education	
- primary school	58% (n=58)
- vocational education	7% (n= 7)
- secondary school	35% (n=35)
Sustained further injuries after horse riding incident: yes : no	31% : 69%

Control group: healthy contemporaries

Almost two thirds (61%) of the patients succeeded in finding a healthy friend who was willing to participate in the study. Ultimately, 46 of the 61 controls returned the questionnaire, which was a response rate of 75%. The controls were younger than the patients with a mean age of 14 years versus 15 years old, p=0.002. An equal distribution of sex was found between the patients and friend controls.

The horse-riding incident

The injuries were sustained during horseback riding in 88% of the cases. The remaining incidents took place during mounting or dismounting the horse (5%),

during grooming of the horse (2%), or this statement was not mentioned in the questionnaire (5%). In the majority of the accidents (78%) the horse or pony took fright, usually due to people, noises or traffic. Consequently, the riders lost control resulting in a fall from the horse. The remaining causes of the horse-riding incidents were due to the horse stumbling (4%), riding too fast (4%), defective material (4%), not concentrating (2%), or other causes (8%). Further characteristics related to the riding incident are listed in Table II.

Table II: characteristics related to the horse riding accident (n=100)

Variable:	Result:
Type of horse: horse : pony	30% : 70%
Type of riding supervision : instructor present	44% (n=44)
Riding frequency (median/s.d./range in hours per week)	3.0 / 4.4 / 0-21
Level of riding proficiency:	
- beginner	46% (n=46)
- advanced	54% (n=54)
Helmet use: yes : no	80% : 20%
Type of horse-riding activity	
- free riding	45% (n=45)
- competition	9% (n=9)
- riding class	39% (n=39)
- not applicable	7% (n=7)

Outcome measures (percentage in question equals the number of patients)

Thirty-nine per cent (39/100) of the patients experienced absenteeism from school following the accident. The mean time was 2 weeks, and the standard deviation was 4.5 weeks. This information is given in Table III.

Table III: absenteeism from school and horse riding (n=100)

Absenteeism (in weeks)	from school	from horse riding
0	60%	9%
1 – 9	37%	37%
10 – 19	1%	26%
20 – 29	1%	-
30 – 39	1%	35%
40 – 49	-	-
≥ 50	-	3%

It took the patients on average four months (s.d.16) to take up horse riding again. At the time of the interview, 29% of the patients had stopped horse riding completely. Eight of these 29 patients revealed that the injury was the primary reason not to go riding any more. On average, 41% of the study population stated that 4.3 years post-injury, they still experienced physical or psychosocial complaints due to the injury.

The results of the CHQ-CF87 are summarised in Table IV. In relation to the reference population of 444 persons (Table IVA), patients (n=100) had a significantly lower outcome regarding physical functioning, role functioning – physical, bodily pain, general behaviour, mental health, self esteem and family cohesion. In comparison with the matched controls, patients had more complaints about their physical functioning (Table IVB).

Table IV: CHQ-CF87 results of the patients in relation to the normal population (A) and friend controls (B).

IV A. Results of the patients (n=100) and the normal population (n=444)

CHQ-CF87-scales	Patients		Normal population (n=444)	95% CI
	N	Mean (SD)	Mean (SD)	
Physical functioning	100	91.9 (12.4)	96.8 (5.4)	-6.5 to –3.3*
Role functioning-emotional	100	88.8 (20.4)	92.3 (16.8)	-7.3 to 0.3
Role functioning-behaviour	100	93.2 (16.6)	91.4 (13.7)	-1.3 to 4.9
Role functioning-physical	100	92.3 (18.3)	96.5 (11.6)	-7.0 to – 1.4*
Bodily pain	100	70.7 (26.4)	78.2 (19.5)	-12.1 to –2.9*
General behaviour	97	79.4 (10.8)	83.6 (10.2)	-6.5 to –1.9*
Mental health	97	74.0 (15.1)	78.2 (13.0)	-7.2 to –1.3*
Self esteem	97	72.3 (12.7)	75.4 (12.5)	-5.9 to –0.3*
General health	96	74.2 (19.9)	74.6 (15.9)	-4.1 to 3.3
Family cohesion	99	70.7 (22.4)	75.7 (23.1)	-10.0 to 0.0

IV B. Results of the patients (n=46) and friend controls (n=46)

CHQ-CF87-scales	Patients		Friend controls (n=46)		95% CI
	N	Mean (SD)	N	Mean (SD)	
Physical functioning	46	94.0 (9.4)	46	97.3 (5.6)	-6.5 to –0.1*
Role functioning-emotional	46	90.8 (17.4)	46	91.3 (15.7)	-7.4 to 6.4
Role functioning-behaviour	46	94.2 (13.4)	46	94.7 (12.3)	-5.8 to 4.8
Role functioning-physical	46	94.4 (13.8)	46	97.6 (7.4)	-7.7 to 1.4
Bodily pain	46	70.9 (26.2)	46	72.2 (23.4)	-11.6 to 9.0
General behaviour	45	79.4 (9.1)	41	80.8 (9.8)	-5.5 to 2.6
Mental health	45	72.9 (13.0)	46	76.6 (13.4)	-9.1 to 1.9
Self esteem	45	73.5 (10.9)	45	75.0 (11.2)	-6.1 to 3.1
General health	45	75.8 (18.7)	41	77.6 (15.2)	-9.1 to 5.6
Change in health	46	3.0 (0.7)	46	3.2 (0.8)	-0.5 to 0.1
Family cohesion	46	68.9 (19.7)	46	73.7 (19.4)	-12.9 to 3.3
Family activities	46	84.9 (12.6)	45	89.3 (10.3)	-9.3 to 0.3

*: In the 95% confidence interval of the mean difference, the neutral value (zero) is not included. This implies that it is a significant difference.

Prognostic variables

The results of the sub-scale physical functioning of the CHQ-CF87 were considered to be the main outcome measure of the current study (dependent variable), since both the friend controls and the reference population differed from the study population regarding their physical functioning. After univariate analysis was carried out, the following (independent) variables could be entered

in a logistic regression analysis to identify those variables predicting low physical functioning: age (t=-3.45, p<0.001), level of riding proficiency (advanced riders versus beginners, χ^2=3.93, p=0.05), type of injury (all other injuries versus fractures of the extremities, χ^2=5.72, p=0.02) and whether the patients sustained new injuries following their horse-riding accident (no injuries versus subsequent injuries, χ^2=3.69, p=0.05).

From logistic regression it appeared that age did not significantly predict physical functioning. The prognostic value of the three remaining variables, expressed in Odds Ratios (OR), was: level of riding proficiency OR 2.6 (95% C.I.: 1.0-5.2), type of injury OR 3.3 (95% C.I.: 1.36-7.3) and subsequent injuries OR 2.8 (95% C.I.: 1,0-5.5). These findings can be interpreted as follows: the chance of an unfavourable outcome for advanced riders and for those with injuries not concerning an extremity fracture is respectively 2.6 and 3.3 times higher than for novice riders or for those patients with a fracture of the extremities. Finally, those patients who sustained subsequent injuries in the period after the horse-riding accident are 2.8 times more at risk than those who did not.

6.4 Discussion

Falling off a horse whilst sitting at a height of 1.5 meters and travelling at a speed of more than 15 miles per hour, as well as being kicked by a horse, are examples of high energy accidents. Injuries resulting from such accidents are apt to be severe in nature. Several studies[4, 5,7-15,25] accentuate this fact, but thus far little attention has been focused on long-term disabilities and handicaps following equestrian injuries. This present study reveals the long-term consequences of horse-riding accidents and identifies the factors predicting low outcome results.

We found an overrepresentation of girls in our study population, which corresponds with the fact that horseback riding is practised predominantly by females[1, 3,4,19,25]. The distribution of injuries in our study shows that no relevant differences were observed in relation to the literature[3, 4].

A relatively large percentage (56.9%) of the injuries in our study affected the upper extremity, whereas in other studies a proportion of 41%[3,4] is mentioned. In comparison with the Nijland[3] study this difference might be explained by the different proportions of patients who sustained their injuries by falling off the horse (55% versus 78% in the present study).

Remarkably, the injuries sustained by our study population were only of mild to moderate severity (ISS range 1-13); no polytrauma patient could be identified in the five-and-a-half year study-period. Furthermore, only 10 of the 123 injuries sustained concerned intracranial injuries (8.1%). Prevalence rates considering cerebral injuries in international literature vary from 6 to 36% [3,4,17,18,26,27]. In the current study 80% of the riders wore a helmet. In a study[26] with comparable helmet use (73%), comparable proportions of intracranial injuries (6%) were found. Nijland et al[3] describe a higher incidence of cerebral injuries (12%), possibly due to the fact that fewer horse riders wore helmets (57%).

Absenteeism from school was considerable in our study population (39%) but not long-lasting, with a mean duration of two weeks. This finding is supported by Gierup[17], Christey[1], Niskanen[28] and Nijland[3]. The period in which the patients were unable to go horse riding lasted longer: on average 4 months, and 8 (8%) patients stopped riding completely due to the injury.
Although the severity of the sustained injuries was mild to moderate and the proportion of intracranial injuries, as a principal cause of long-term disablement, was relatively low, 41% of our study population stated that they still had complaints related to the equestrian injury. After an average follow-up time of more than four years this population was still hampered in daily activities.
If we compare these results with findings in the literature, only a very limited amount of information regarding long-term outcomes after equestrian injuries could be found. Hughes et al.[29] revealed 40% long-term disablement. The majority of their patients did not wear protective headgear resulting in 44% cranial, facial and brain injuries. Gierup et al.[17] showed persisting symptoms in 13% of the children one year post-injury, while Christey[1] and Niskanen[28] reported 1.3% and 0% permanent sequelae, respectively. None of the studies mentioned used a reliable and valid measurement tool to determine the extent

and severity of the disabilities, which makes a dependable comparison of the respective results very difficult.

The disabilities and handicaps experienced by our study population were confirmed by the results of the CHQ-CF87. The children who sustained an equestrian injury scored worse on several subscales of the CHQ-CF87 when compared to the reference population of Dutch schoolchildren. In order to clarify the relevancy of these findings, a further comparison was made with friend controls. The friend controls were one year younger than the patients. After reference to the manual of the CHQ-CF87 it was not clear whether such a difference is of significant importance in interpreting the study results.

Our patients scored worse on the subscale "physical functioning". Long-term consequences of a physical nature are probably most distinct; however, it is possible that children tend to be more open about physical problems than psychosocial troubles.

Our results should be compared to other groups of injured children for a more profound explication of the relevancy of the CHQ-CF87 outcome results. As far as we know, such data is not available. However, if we compare our study results with studies on populations with different pathology, such as rhinosinusitis needing surgical treatment[30], mild and severe asthma[31] and end stage renal disease[32], we can conclude that the long term outcome of equestrian injuries is less severe (Table V).

Table V: comparison of CHQ-CF87-results of patients who sustained an equestrian injury with patients suffering from other diseases.

CHQ-CF87 (mean / sd)	Equestrian injuries n=100	Rhinosinusitis** n=21	Asthma mild n=136	Asthma moderate/severe n=100	End stage renal disease n=19
Physical functioning	91.9 / 12.4	85.4 / 16.1*	92.4 / 15.7	89.8 / 9.7	73.9 / 19.7
Role functioning-emotional	88.8 / 20.4	82.5 / 9.5	92.0 / 16.0	88.2 / 19.5	72.8 / 30.3*
Role functioning-social-behaviour	93.2 / 16.6	82.5 / 9.2*	92.4 / 20.5	84.7 / 25.0*	77.8 / 29.5*
Role functioning-physical	92.3 / 18.3	72.0 / 11.9*	93.0 / 19.1	81.5 / 26.3*	68.9 / 31.6*
Bodily pain	70.7 / 26.4	54.3 / 11.1*	80.5 / 19.7*	67.0 / 22.2	60.0 / 18.9
General behaviour	79.4 / 10.8	81.9 / 5.9	-	-	70.3 / 14.4*
Mental health	74.0 / 15.1	70.0 / 5.0	-	-	64.6 / 18.0*
Self esteem	72.3 / 12.7	81.7 / 6.5	79.3 / 14.5*	77.9 / 13.5*	68.6 / 18.6
General health	74.2 /19.9	61.5 / 9.9*	67.5 / 15.9*	57.7 / 18.8*	47.2 / 18.4*
Family activities	70.7 / 22.4	-	-	-	86.7 / 17.6

*: In the 95% confidence interval of the mean difference, the neutral value (zero) is not included. This implies that it is a significant difference.
**: Patients in need of surgical treatment

The moderate physical functioning of our patients more than four years after the equestrian incident raises the question which patients are at risk of long-term disablement. Such information may be interesting for (para-)medical professional workers to select patients in need of extra attention during treatment follow-up. Three predictive variables could be identified from statistical analysis. Injuries not concerning an extremity fracture, for example intracranial injuries, are more at risk with regard to long-term disablement. This finding can be explained by the fact that, in general, fractures heal well in a relatively short period and without rest defects, while recovery from cerebral damage is often incomplete. Secondly, patients seeking medical care on a regular basis due to an equestrian injury also need additional medical attention. The possibility that these patients are more or less accident-prone should not be overlooked[7,18]. Finally, the level of riding proficiency is of prognostic significance as the more experienced riders appeared to have worse outcomes.

This raises the question whether the more experienced riders ride faster and take more risks. This is in itself a quite interesting finding.

6.5 Conclusion

A large percentage of patients (41%) experienced long-term disabilities and handicaps despite the fact that the severity of the injuries sustained in a horse-related accident, in terms of the ISS (≤ 13), was relatively low. These lasting sequelae cover psychological and social areas, but physical complaints were predominantly mentioned by the patients.

Three risk factors affecting the long-term outcome could be identified: "the type of injury", "recurrence of injuries" and "level of riding proficiency". In order to prevent long-term sequelae, special attention during follow-up should be paid to those patients suffering from injuries other than a fracture of the extremity, experiencing further injuries, or being an experienced horseman.

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Chapter 7

Determinants of long-term consequences of soccer injuries: a qualitative study.

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Abstract

Background: Sick leave and absenteeism from sports participation following soccer injuries are considerable. Knowledge on the determinants of these long-term consequences is therefor of importance. However, until now only insufficient relevant data are at hand.

Aim: to investigate which determinants can be identified in the occurrence of long-term consequences following a soccer injury.

Methods: a qualitative methodology was employed. Data-collection was achieved by administrating a semi-structured interview to 15 consecutive patients who had been admitted because of a soccer injury. Data-analysis was carried out, following the current precepts, leading to the construction of determinants.

Results: six determinants for the occurrence of sick leave and absenteeism from sports participation were identified: 'injury related impairments', 'type of work', 'problem summation', 'fear', 'role of occupational health physicians and attending physicians' and 'alternatives for spending spare time'.

Conclusion: qualitative research turns out to be an adequate methodology to explore and direct possible determinants for the occurrence of long-term consequences following soccer injuries. Based on the present results it can be hypothesised that company medical examiners and physicians can play a more important role to reduce the occurrence of sick leave and absenteeism from sports.

7.1 Introduction

In the Netherlands playing soccer is the most popular way to participate in sports. In a population of 16 million inhabitants there are as much as one million soccer players registered[1]. This sports participation has clear advantages, like the improvement of endurance, but also has a major drawback: the occurrence of injuries. Annually, 28% (51,000 out of 180,000) of the total number of hospital treated sports injuries are caused by playing soccer[2]. Apart from the direct medical costs (23 million Euros)[2], these soccer injuries lead to considerable long-term consequences[3-10]. Some disability or handicap is experienced by 20 to 30% of the players, even years after the injury[3, 11]. Participation in work or sports, for instance, can be hampered due to the injury[3,11] and this absenteeism can lead to psychosocial problems[12,13].

In order to understand and eventually prevent the occurrence of the soccer injury related consequences it is important to have knowledge of the determinants associated with those sequelae. In clinical practice, outcome of injuries is related in particular with physical variables like the type of injury and the presence of co-morbidity. Psychosocial variables however can also be regarded as important determinants of outcome but are seldomly involved in this perspective. Lenehan et al[9] for instance, indicate that impairments, fear of refracture and lack of interest are reasons for not returning to soccer. Performing a qualitative study, being an in-depth examination of a relatively small number of cases[14-17], may lead to a better understanding of the determinants from the patient's perspective.

The objective of this study, applying a qualitative concept, is to investigate which determinants are associated with the occurrence of long-term consequences in terms of absenteeism from work and sports following a soccer injury.

7.2 Patients and methods

Patients:

The number of patients needed in a qualitative study is determined by the concept of 'theoretical saturation'[18], implying that data collection has to be carried out until no new relevant data emerge[18]. Generally, 10 to 15 patients have to be included to achieve the level of saturation.

All consecutive Dutch speaking patients, older than 17 years of age and only those admitted to the University Hospital Groningen (UHG) because of a soccer related injury in the period of 1-1-2001 until 1-6-2002 were entered in the study (n=33). Patients not living in the catchment area of the UHG at the time of the interview were excluded (n=11), due to practical reasons. Of the remaining 22 patients, six could not be reached and one refused to cooperate. Ultimately, 15 patients gave informed consent and participated in the study. A survey of the patient characteristics is reproduced in Table I.

Methods:

In qualitative research, two components can be identified; data-collection and data-analysis[15, 18]. In our study, data-collection was achieved by administrating a semi-structured interview by the researcher (RD) in April 2003. Subjects of the interview were the circumstances leading to the injury itself and the influence of the injury on participation in work and sports. Approval was obtained by the medical ethical board of the UHG.

Each interview was recorded on tape and thereafter typed out completely and unabridgedly.

Based on the work of Strauss and Corbin[18], Wester[19] and Hycner[20] and applying aspects of the Grounded Theory (Glaser and Strauss[21]) a number of steps were taken in the process of data-analysis. First of all, the typed versions of the interviews were read integrally. Secondly, 'units of meaning' were identified, being parts of the interview possibly related to determinants of long-term consequences. These units consist of verbatim text. Subsequently, superfluous parts and restatements were left out.

Table I: characteristics of the participating patients

Patient	Age*	Gender	Type of injury	Time since incident** (months)	Recovery period of impairment (months)	
					Expected	Observed***
A	29	Male	Fracture of the lower leg	11	3	2.5
B	25	Male	Ankle fracture (Weber B)	23	3	2.5
C	24	Male	Fracture of the lower leg	11	3	3
D	29	Male	Fracture of the lower leg	19	3	2.5
E	29	Male	Fracture of the lower leg	18	4	5[1]
F	68	Male	Fracture radius	15	3	3
G	36	Female	Rupture Anterior Cruciate Ligament	26	3	3.5
H	29	Male	Rupture Achilles tendon	19	3	2 .5
I	24	Male	Zygoma fracture	12	0.5	0.5
J	46	Male	Ankle fracture (Weber B)	21	3	3
K	33	Female	Rupture Achilles tendon	22	3	6[2]
L	34	Female	Ankle fracture (Weber C)	18	3	6[3]
M	21	Male	Fracture humerus	23	3	7[4]
N	26	Male	Ankle fracture (Weber C)	26	3	2.5
O	34	Male	Tibia plateau fracture	13	3	3

* : at the time of the incident
** : point of reference: April 2003
*** : explanation of the difference between the observed and the expected duration of recovery:
[1]: patient underwent a second operation: change of nail
[2]: prolonged pain and irritation of the scar
[3]: prolonged pain
[4]: prolonged pain due to the screws and an impaired range of motion

Thirdly, the same steps were also conducted by a co-researcher (CKvdS) for reasons of reliability.

Afterwards, units of meaning in line with each other were clustered. Thus, a list of determinants for the occurrence of long term consequences of soccer related injuries was composed.

7.3 Results

Patient characteristics: the mean age of the participants was 32 years (s.d.: 11.6 years, range: 21-68 years) and 12 out of 15 were male. The most frequent type of injury was a fracture of the lower leg (Table I).

Theoretical saturation: after interviewing 11 patients saturation was achieved; the information collected from the final four patients did not result in further units of meaning but was nevertheless valuable in confirming the findings.

Employment: 12 patients were employed at the time of the soccer accident. The mean duration of sick leave was 16 weeks (s.d.: 11.3 weeks, range 2-30 weeks).

Sports participation: nearly half the study population (7/15: 47%) ended their active sports participation due to the injury. Two patients stopped playing soccer, but started another sports activity. Those who kept on playing soccer needed on average 40 weeks (s.d.: 18.8 weeks, range: 13-52 weeks) to resume their soccer activities.

Determinants of occurrence of long-term consequences of soccer injuries.

After performing the data-analysis six units of meaning were identified (Table II).

1. Injury related impairments.

In order to determine the influence of a prolonged appearance of impairments on the long-term outcome, the expected and observed duration of the impairment recovery was established (Table I).

The expected duration was established by means of general clinical consensus (surgical staff, UHG). The observed duration was determined by retrieving information from the patient case history. In most patients (11 out of 15: 73%) the expected and observed duration of recovery were comparable. However, in four patients the recovery took longer than expected, having implications for the outcome. Apart from a case of fracture non-union, pain was the main reason. One patient (K), for example, reported unusually pronounced pain after rupture of an Achilles tendon:

> *"The pain lasted very long. Because of that I had difficulties with walking and climbing stairs. Also the pain made it impossible for me to participate in sports and to do my work as a waitress".*

Table II: outcome and determinants

Patient	Employment			Sports	
	Yes/No	Duration of Sick leave	Main reason(s) for sick leave[1]	Duration of absenteeism	Main reason(s) for absenteeism[2]
A	Yes	4 weeks	1	18 weeks	1;6
B	Yes	10 weeks	2	permanent	1;6
C	Yes	22 weeks	2	52 weeks	1;5
D	Yes	27 weeks	2;5	permanent	1;5
E	Yes	27 weeks	1;5	permanent	1;4;5;6
F	No	-	-	permanent	4
G	Yes	2 weeks	1	permanent	1;5
H	Yes	6 weeks	5	52 weeks	1;5
I	No	-	-	permanent	1;6
J	Yes	18 weeks	1;5	permanent	5;6
K	Yes	30 weeks	1;3	permanent	1;3;5
L	Yes	30 weeks	1;3	52 weeks	1;3;5
M	No	-	-	permanent	1;5
N	Yes	9 weeks	1	52 weeks	1;5;6
O	Yes	2 weeks	5	13 weeks	1

[1,2]: Legends:
1: injury related impairments
2: type of work
3: problem summation
4: fear
5: role of company medical examiner or physician
6: alternative for spending spare time

Nearly half the working population (7 out of 12) declared that the nature and severity of the impairments due to the injury was primarily related to their sick leave. All patients linked their impairments to their absenteeism from sports. (Table II)

2. Type of work.

The nature and physical load of employment influences the duration of sick leave in three patients.

Patient A for instance, fulfils a white-collar function. After sustaining a fracture of the lower leg he was able to resume his work quickly (10

weeks) because he could stay in a sitting position all day. On the other hand, patient C, recovering also from a fracture of the lower leg, could not resume his work before a period of 22 weeks, mainly because his blue-collar job required the ability to walk, stand and lift objects.

> *"After two months I wanted to start working again but I was not able yet to pull the heavy pallets through the factory. So I restarted several months later in the course of which I was allowed to quit work when the heavy work caused any pain".*

3. Problem summation.

A soccer injury may have more serious consequences concerning sick leave and absenteeism from sports when certain aggravating circumstances, not primarily associated with the injury, are involved. The fact that patient K also suffered from fibromyalgia and just recently gave birth to twins worsened the outcome of the Achilles tendon rupture.

> *"I just managed to keep on working despite the fibromyalgia and the burden of looking after my twins. However, rupturing my Achilles tendon made the cup run over. It was as if everything converged".*

The occurrence of life events or suffering from nervous exhaustion may also aggravate the negative outcome, as was the case in patient L.

4. Fear.

In two patients absenteeism from sports was due to or prolonged by fear of recidivism of the injury. The risk of additional sick leave following another injury can discourage patients to take up sporting again. Patient E for instance, stopped playing soccer after the injury, mainly because of fear for recidivism:

> *"I am still reluctant to restart playing soccer because I don't want to make through again all the misery following the injury. Being able to work is very important for me and I don't want another injury to interfere with that".*

Patient F quitted soccer because he feared the consequences of recidivism. He was afraid that, when he would be injured again, he would not be able to look after his disabled wife.

5. Role of occupational health physicians and attending physicians.

Occupational health physicians and other health and safety executives often fail to give the necessary support, expressed in a lack of sufficient counselling (patient D, E, H, K, N) and accumulation of failure in communication (patients E, J, L).

> *"Although I was not able to work for more than 6 months, the occupational health physician only contacted me three times and only by phone. The last time we spoke, he told me that I was declared unfit for work for 27%, without even having performed a physical investigation. He was obviously not aware of the fact that, at that time, I was working fulltime already (patient E)".*

Counselling in the field of work or sports reintegration was mostly poor. The accuracy of the advise given by the counsellors was open to question in several cases. Patient D, for instance, was advised not to resume his work for a long period because of judicial aspects, however, without convincing argumentation:

> *"I wanted to restart my work as a taxi driver but the medical officer involved did not give me permission to drive my cab for more than six months. He feared that I was not able to react quickly enough while driving, although I was never tested in this regard".*

Only one patient (patient O) reported that detailed information was given how to build up sports participation after the injury. Other than that no or no sufficient advice was provided (patients C, E, G, H, L, M, N). Sometimes advice was even wrong and unfounded.

> *"After the initial treatment in the hospital I consulted my general practitioner because I was not told when to start playing soccer again. The general practitioner stated that resuming sports activities within one year after the injury would be very unwise, because of the risk of re-rupturing my Achilles tendon (patient E)".*

6. Alternatives for spending spare time

Patients A, B, E, I, J and N did not resume playing soccer after the injury although they were physically capable of doing so. After the period of recovery they had changed their schedule and timetable in such a way that there was no room left for sports participation.

> *"When I was able to walk again I got used to spending my spare time with my girlfriend. It was convenient for her that I was available to perform more*

household activities. On the other hand I like to sleep late and play with my children (patient N)".

7.4 Discussion

Until now, no set of determinants was available to help explaining the occurrence of long term consequences following soccer injuries, in terms of sick leave and absenteeism from sports.

Adequate counselling of patients on sick leave, based on knowledge of relevant determinants, is important since the appeal on social services following sick leave is considerable[22]. Furthermore, it is of great importance to limit the length of sick leave following an injury since, as sick leave lengthens, it becomes more difficult for the patient involved to resume work[23]. Continuation of sports activities is also of significance because of its beneficial health effects, like the prevention of Western diseases and the increase of physical fitness.

In order to hypothesise which variables are related to sick leave and absenteeism from sports participation qualitative research, applying personal statements, appeared to be a suitable and directional instrument. The technique is designed to facilitate the classification of theoretical concepts[14-17]. Moreover, this methodology pre-eminently enables participants to raise items of importance from their own perspective[15,16].

One has to bear in mind that qualitative research also has some drawbacks. Although the outcome can be used to identify potential determinants, it is not allowed to generalise the results of the study. Also a selection bias may occur, for instance, following the exclusion of patients living outside the catchment area. In our study, selection bias was averted by entering all consecutive patients and by applying the concept of theoretical saturation.

Another possible drawback may be the recall bias. As the interval between the injury and the interview is longer, remembrance may become less exact[24].

The administration of a semi-structured interview the individual's experience of disability enabled us to define six units of meaning[16]. These units are: 'injury related impairments', 'type of work', 'problem summation', 'fear', 'role of medical examiners and physicians' and 'alternatives for spending spare time'.

The nature of the impairments following the injury turns out to be an important determinant for the occurrence of sick leave on the long term. The expected duration of morbidity associated with the injury can be interpreted as the minimum length of sick leave. A prolonged absenteeism from work can be attributed to other causes like the variable interpersonal perception of the impairment 'pain'. This mechanism is also recognised in other patient categories [25].

Another determinant for prolonged sick leave is the combination of the type of work and the body region on the one hand and the type of injury on the other. Shaw et al subscribe the importance of this finding[25]. For instance, after suffering from a fracture of the lower extremity it generally is more difficult to perform heavy work in a standing position than performing work not requiring physical load or having a sitting job. In this perspective, offering adaptive work, temporarily, is an important option. The need for such facilities is obvious.

Prolonged absenteeism from work can also be caused by the role of the occupational health physician or attending physician. Frequently, patients experience insufficient support and inadequate counselling. Assessing the extent and timing of the work reintegration is of great importance but often not provided. This can be originated from the fact that in the Netherlands work reintegration is not a regular component of the medical treatment. Most physicians are not even trained to offer advice to patients on this matter. Occupational health physicians, not being involved in the treatment of patients, are allowed to prescribe the length of the sick leave. In this regard intensive and appropriate consultation between these occupational health physicians and the attending physicians is of utmost importance but rarely takes place. Upgrading of this co-operation and providing adequate education to physicians regarding work reintegration seems to be important measures to improve the counselling.

Finally, 'summation of problems' is mentioned as a determinant for absenteeism from work. Each problem on itself may not be responsible for any absenteeism but in combination with other burdensome variables the summation may lead to sick leave. In this framework it concerns the involvement of psychosocial determinants in particular. Recognising this pattern is essential. Treatment of the injury should incorporate an inquiry into and adequate approach of

accompanying diseases or aggravating circumstances, for instance by establishing counselling through a welfare officer.

Absenteeism from sports participation was associated by all participants with the nature and severity of the impairments following the injury. Part of this absenteeism was due to hospital admission or evolving complications. On the other hand, perception of the severity of impairments, like pain, may play an important role, as mentioned earlier. In order to make an attempt to assess and objectify this perception of pain, patients could be asked to fill out a Visual Analog Scale (VAS)[26]. Subsequently, behavioural pain-strategies could be applied to prevent pain form evolving into a chronic problem. This is important since it is generally accepted that the longer pain is appreciated as an impairment, the more difficult treatment becomes.

Not being able to play soccer after an injury can also be attributed to the simultaneous occurrence of different aggravating variables. The negative influence of each of these variables can summate. An adequate treatment of soccer injuries should therefore include recording of these variables and, if feasible, directional remedy.

Surprisingly, two out of 15 patients stated that fear of recidivism was the main reason for not returning to sports activities. It can be questioned whether in general medical practice fear is recognised as a determinant for the outcome of soccer injuries. Not taking this variable into account, however, makes the inventory of determinants incomplete. Furthermore, bringing about and discussing with the patient involved the possibility of fear being a determinant may contribute to the favourable outcome of the injury. Offering guidance, for instance by means of physical therapy, may attribute to a quicker resumption of sports.

The extent of absenteeism from sports participation is also influenced by the role of the company medical officers and attending physicians. Adequate counselling in the field of resumption of sports activities after an injury should be a standard component of the involvement with and the treatment of patients with a sports injury. It can be questioned however, whether company medical officers are sufficiently equipped, trained and interested. Physicians on the other hand, generally lack specific knowledge and experience or do not take

sufficient time to explain and instruct the necessary steps in the resumption of sports participation.
Finally, it is convenient for some patients not to resume soccer. In the course of the recovery alternatives for spending spare time are experienced. This determinant should not be disregarded since it puts the severity of soccer injuries, as measured by the extent of the absenteeism, into perspective.

7.5 Conclusion and recommendations

Performing a qualitative study six determinants for the occurrence of long-term consequences of soccer injuries in terms of sick leave and absenteeism from sports could be identified.
Taking into account the nature of qualitative research, these results are strictly spoken not generalisable but can be directive in counselling and treatment as well as in the planning of future research.
Given the restriction mentioned above, it is recommended that occupational health physicians and attending physicians should confer more frequently with each other and are better educated. In order to optimise outcome also more attention should be paid to the patients involved. This concerns a better counselling and directed treatment of pain, psychosocial variables including fear, summation of problems and alternatives for spending spare time. Furthermore, options for temporarily adaptive work should be made more available.
Finally, future quantitative research, for instance by applying a prospective methodology, is an appropriate strategy to provide further evidence for the present results.

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7.6 References

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Chapter 8

General discussion and conclusions

8.1 Introduction

The main purpose of the studies composing this thesis was to elucidate the long-term consequences of sports injuries, initially treated at an emergency department of a hospital. Such an outcome study is of importance in order to provide prognostic information for both patients and health care workers and to plan adequate treatment strategies. As described in chapter one, only scarce relevant information was available at the start of the study.
First, this general discussion focuses on the most important outcome findings of all the studies performed. Subsequently, prognostic determinants of unfavourable outcome after sports injuries are discussed. Clinical and societal implications are addressed and recommendations for future research are provided. Finally, the answers to the research questions are given.

8.2 Long-term outcome

Hospital treated injuries can lead to long-term consequences. Years after the injury, a substantial proportion of the patients still experiences residual disabilities and handicaps. Although there are differences in their manifestations and degree, this outcome is established irrespective of in- or outpatient treatment or the maturity of the patients involved. These findings substantiate the opinion of Lindenfeld et al[1] and van Mechelen[2]. They state that, looking at injury severity, an important issue is how residual effects affect the remainder of a players' life. In this respect, long-term outcome turns out to be a better parameter for severity of sports injuries, than, for example, the generally used measure of injury severity, the Injury Severity Score (ISS)[3]. This is in concordance with the fact that the ISS correlates with mortality, whereas the chance of death following a sports injury is small (chapter 2).

8.2.1 Long-term outcome: in - and outpatient treated sports injuries

The majority of the patients treated in a hospital because of a sports injury are treated as outpatients (92.5%). The severity of the injuries of these outpatients, as defined by the ISS, is on average lower than in inpatients (mean ISS 1.8

versus 4.8, respectively). Furthermore, the nature of the injuries differs substantially between inpatients and outpatients. Comparing outpatients to inpatients, a relatively small proportion of injuries in outpatients concerns fractures (21% versus 56%) whereas soft tissue injuries are represented frequently (78% versus 34%). No internal or intracranial injuries were diagnosed in the outpatient population; in inpatients this concerns 6% and 4% of the cases. Based on these results, one may conclude that inpatient treated sports injuries are of a more severe nature. This observation is in line with the results of the long-term outcome measures. Inpatients more often stated that they still experience negative consequences following the injury in comparison with outpatients (32% against 20%). The proportion of the inpatient population having a SIP68-score[4] larger than 0 is also more sizeable than in outpatients. Looking at absenteeism from work, the majority of the outpatients (76%) had no or had just a short period of sick leave due to the injury, whereas most inpatients experienced a relatively long absenteeism. In absenteeism from sports the same pattern is displayed; inpatients more frequently suffer from long-lasting absenteeism from sports participation than outpatients.

Subsequently, emphasis of treatment and guidance of hospital treated sports injuries should predominantly be laid on the inpatient population in order to diminish the number and severity of poor long-term outcomes (paragraph 8.4). However, given the fact that the incidence of the outpatient treated injuries is also substantial and that long-term consequences, though less frequent and less severe, do occur, strategies towards optimal treatment of this category should be developed as well.

8.2.2 Long-term outcome: equestrian injuries in adults and children

Before the start of the study we recognised from our clinical experience that sports injuries not only incur adverse long-term outcome in adults but also in children. The results on equestrian injuries, as described in chapter five and six of the thesis, subscribe to this impression. Prevention and treatment strategies should therefore be conducted, irrespective the maturity of the patients involved. The importance of adequate treatment of the child population is underlined by the fact that disabilities and handicaps will hamper their

development and may decrease their large number of future productive life years.

8.3 Prognostic variables

In order to optimise treatment and to provide patients and medical professionals with adequate prognostic information it is essential to identify, at an early stage, those patients who are at risk of a poor long-term outcome. Ideally, a set of variables should be available to determine the long-term outcome of a sports injury, analogous to, for instance, the Injury Impairment Scale[5]. The latter scale enables the prediction of impairments following an injury. Although the results of this thesis do not supply sufficient data to compose a similar scale for sports injuries, an initial impetus is given. Several variables with a possible prognostic significance emerged from the descriptive retrospective studies of the thesis. Furthermore, a qualitative study was performed to explore possible determinants of poor long-term outcome.
To provide a clear overview, the prognostic variables related to sports injuries needing in- or outpatient treatment are discussed separately. Subsequently, other determinants of long-term outcome are passed in revue: gender, Injury Severity Score (ISS)[3], type of injury / body region and type of sport.

8.3.1 In- versus outpatient treatment

An injury requiring *inpatient treatment* indicates a higher risk of occurrence of a poor long-term outcome. This finding is in concordance with the general assumption that inpatient treated injuries are of a more severe nature. However, one should bear in mind that the decision to admit a patient can be based on several grounds, not on the severity of the injury alone. For instance, logistics like the planning of surgery, as well as the social circumstances of the patient can be the reason for admission.
Within the inpatient population adverse long-term effects were noted especially in female patients and patients injured during horse riding, playing soccer or skiing.

When a patient is treated in an *outpatient* facility because of a sports injury, a poor outcome is seen in females in particular (see paragraph 8.3.2). Furthermore, this unfavourable outcome appears to be related with the body region involved (see paragraph 8.3.4).

8.3.2 Gender

A possible reason for *female* patients being more at risk is the fact that women tend to express complaints more easily than men[6,7]. Consequently, injuries of a comparable severity are apt to incur more complaints in women, whereas less severe injuries in women may lead to a similar conduct of complaining as in men suffering from relatively more severe injuries.

Another explanation may be that women ride horse more frequently than men do. This type of sport incurs disability or handicap significantly more often than most other types of sports.

8.3.3 Injury Severity Score (ISS)[3]

The ISS is not an adequate measure for the severity of sports injuries. Only inpatient treated *equestrian* injuries resulting in a poor long-term outcome concern injuries with a high ISS. This finding may reflect the fact that equestrian injuries are often the result of a high-energy accident.

8.3.4 Type of injury / body region

Based on clinical grounds, we expected *intracranial injuries or fractures of the spine, with or without a spinal cord injury, and fractures of the pelvis* to result in *a* poor long-term outcome. This impression is confirmed by the results of the thesis. For instance, patients with intracranial injuries especially had difficulties in returning to work due to changed cognitive capacities.

Furthermore, a poor outcome is seen predominantly in outpatient treated *knee injuries*. A possible explanation may be the fact that these outpatient treated injuries often involve ligamental problems, like ruptures of the anterior cruciate ligament. These ruptures are known to be related with a high risk of lasting symptoms[8, 9].

8.3.5 Type of sport

Horse riding. Adult patients suffering from an *equestrian* injury are prone to develop a poor long-term outcome, especially when it concerns intracranial injuries or fractures of the spine or injuries with a high Injury Severity Score (ISS)[3].

In children the risk of a poor long-term outcome after an *equestrian* injury is also considerable. Such an outcome appears in particular in riders with a high level of proficiency, possibly because they take more risks to live up to high standards. Finally, an unfavourable outcome is frequently seen in young equestrian patients suffering from secondary injuries following in the years after the initial sports injury. A certain accident proneness may be involved.

Soccer. Inpatient treated injuries following participation in *soccer* are also particularly at risk to raise an adverse long-term outcome. When prolonged sick leave is used as a parameter of outcome, possible determinants of this outcome are lasting impairments like pain, the type of work in association with the type of injury, summation of (health) problems and the often inadequate advisory role of the attending and occupational health physicians. An extended absenteeism from sports was linked to lasting impairments, fear of recidivism, inadequate counselling in the field of resumption of sports activities and finding alternatives for spending spare time.

Skiing. Skiing injuries frequently result in long-term disabilities and handicaps. Since the concerning injuries are often of a high-energy nature this may not be surprising.

The variables *age, level of education, level of sports participation, length of hospital stay and nature of treatment (operative versus conservative)* could not be related to long-term disabilities and handicaps.

8.4 Clinical and societal implications

8.4.1 Clinical implications

- *Prognostic information*. Health care workers should bear in mind that a significant proportion of the patients with a sports injury are likely to develop

long-term disabilities and handicaps. Attending physicians should therefore inform and treat their patients accordingly.

- *Prevention and treatment strategies.* Since it is evident that long-term disabilities and handicaps occur following sports injuries, adequate prevention and treatment strategies should be developed. The broad spectrum and variety of these disabilities and handicaps imply the need for the application of a multidisciplinary team of healthcare workers, each with their specific field of expertise. Such a team includes a trauma surgeon or an orthopaedic surgeon, a rehabilitation physician with the staff of a rehabilitation team and a sports physician. Furthermore, co-operation with an occupational health physician is important. In order to follow an efficient operating procedure patients should be seen in a regular multidisciplinary office hour, preferably at an early stage after the injury.

The field of expertise of the trauma surgeon (or the orthopaedic surgeon) is the combination of injury treatment skills in general, the expertise on trauma physiology and their specific knowledge about fractures, soft tissue injury treatment, abdominal and thoracic injuries.

The assessment, prevention and treatment of disabilities and handicaps following an injury is predominantly the working field of the rehabilitation physician, who is also responsible for the co-ordination of the rehabilitation team. A rehabilitation team taking part in the treatment of patients with a sports injury, should at least include a physiotherapist, a psychologist, a social worker and a staff member involved in vocational assessment.

The sports physician has a clear perception of the nature and qualities of sports injuries and is therefore pre-eminently able to counsel and support a patient in the process of resuming sports participation.

Finally, the occupational health physician should combine knowledge of sports injury characteristics with occupational expertise.

Since the activities of a multidisciplinary team are labour intensive and therefore costly, adequate triage is of importance. Only those patients who already experience or are at risk of developing disabilities or handicaps should be consulted. Although this thesis does not provide a conclusive set of determinants of long-term disablement, the findings described in paragraph 8.3 can be directional in determining possible candidates.

- *Education of occupational health physicians and attending physicians.* From the results of the thesis it can be questioned whether occupational health physicians are sufficiently equipped, trained and interested to consult patients with a sports injury on the matter of resumption of work. It is known that recommendations are generally taken more seriously if the injured athlete perceives that the doctor understands the sport mentality[10]. Furthermore, there are indications that attending physicians generally lack specific knowledge and experience or do not take sufficient time to explain and instruct the necessary steps in the resumption of sports participation. Post-graduate courses on this subject could rectify these deficiencies.

8.4.2 Societal implications

As was stated earlier, 2.9 million sports injuries happen each year in the Netherlands. Of those, 209,000 need treatment in a hospital. From these figures we may conclude that there is a huge consumption of medical supplies because of sports injuries. Furthermore, absenteeism from work due to sports injuries also incur high expenses[11, 12]. In an attempt to decrease the costs evolving from sick leave the following measures can be considered: optimisation of treatment of impairments and pain, extension of the facility to perform temporary adaptive work and improvement of medical counselling. Subsequently, it can be given into consideration to compel sportsmen to insure themselves not only against the costs of medical care but also against the costs of sick leave, following a sports injury.

Finally, the fact that long-term disabilities and handicaps can result from injuries can be interpreted as an additional drawback of sports participation. However, we believe that playing sports should still be advocated, since it has many advantages[11] like an increase of fitness and relaxation, the stimulation of child development and the prevention of western diseases. Furthermore, the adverse effects of injuries are decreased by developing and applying adequate prevention strategies. Primary prevention campaigns have been described to be successful[13], whereas secondary prevention strategies, as described earlier, may also play an important role in averting the negative side effects.

8.5 Future research

An outcome study generally constitutes the first step of a consecutive number of research projects. The second step should be pointed at developing a strategy to improve the outcome. Under the terms of this thesis, attention should be paid to the target group, the constitution, the operating procedures and (cost-) effectiveness of a multidisciplinary team preventing and treating long-term disabilities and handicaps. In this context, additional research is also required to compose a prognostic set of outcome variables. Finally, implementation of the results of the projects has to be applied.

8.6 Answers to the research questions

- What is the incidence and severity of injuries following sports participation, in relation to injuries due to other causes?

Sports injuries rank second highest in terms of cause of injury, after home and leisure accidents. Traffic accidents generally lead to the most severe injuries, followed by injuries caused by violence. Sports injuries rank third in terms of severity of the injury.

- Do long-term consequences following inpatient treated sports injuries occur? Which determinants for the occurrence of this outcome can be detected?

Sports injuries can lead to long term disabilities and handicaps. Sixty-seven percent of the working population was unfit for work up to one year, whereas 4% did not resume work. One year post-injury, absenteeism from sports was also considerable. Nearly half of the population did not participate in sports for more than a year. Furthermore, 32% of the patients still experienced disabilities or handicaps following the injury. Two prognostic variables could be distinguished: "gender (women)" and "type of sport (horse riding, soccer and skiing)".

- Are long-term disabilities and handicaps present in outpatients, treated because of a sports injury, and which potential risk factors can be identified?

Sports injuries requiring outpatient treatment can lead to long-term disabilities and handicaps, especially in females and in patients with knee injuries. On average these consequences are less severe than those associated with inpatients. However, the latter finding is of great value since outpatients outnumber inpatients by far.

- To what extent do long-term consequences of equestrian injuries arise in adult patients? Can risk factors be established?

Equestrian injuries requiring clinical treatment were serious in nature and often resulted in long-term consequences. The type of injury, body region, and injury severity score (ISS) were significantly associated with the occurrence of long-term consequences

- Do long-term consequences occur, following equestrian injuries in children and are prognostic factors determinable?

Although equestrian injuries in children are of minor to moderate severity when the Injury Severity Score (ISS) is taken into account, these injuries are significant if the large proportion of patients experiencing long-term disabilities is considered. The risk factors concerning poor long-term outcomes were being an advanced rider, sustaining injuries other than fractures of the extremities or sustaining subsequent injuries following the riding accident.

- Which determinants for the occurrence of long-term consequences following a soccer injury can be hypothesised?

Six determinants for the occurrence of sick leave and absenteeism from soccer participation were identified: 'injury related impairments', 'type of work', 'problem summation', 'fear', 'role of occupational health physicians and attending physicians' and 'alternatives for spending spare time'.

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Summary

Chapter 1: introduction

Participation in sports is an important way to spend spare time. Being actively involved in sports has clear advantages, like the improvement of physical endurance and the prevention of Western diseases. However, it can be questioned whether these advantages are not outweighed by the notable side effects: the occurrence and the adverse outcome of a large number of injuries. Long-term consequences are of importance in determining this outcome, since sportsmen are generally young and, consequently, permanent or long lasting disablement will influence their number of productive life years and quality of life. Remarkably, little information is available on the long-term outcome of sports injuries. The primary aim of this thesis is therefore to determine the long-term outcome of sports injuries, treated at the emergency department of the University Hospital Groningen. In addition, the determinants of outcome are subject to investigation.

In the first chapter the aim and research questions are formulated and general concepts and the contents of the thesis are elucidated.

In **Chapter 2** we determined the incidence and severity of sports injuries in relation to the severity of injuries due to other causes and in relation to type of sport. A distinction was made between injuries caused by playing sports, home and leisure accidents, traffic accidents and violence. The severity of the injuries was assessed by using the criteria; rate of admission and Injury Severity Scale (ISS). Finally the sports injuries were analysed with regard to type of sport.

In total, 57,760 injuries were registered in the trauma department of the University Hospital Groningen, from January 1990 until January 1997. After injuries due to home and leisure accidents (44%; 25,228) sports injuries (21%; 12,403) were the most frequent cause of injury. Of the patients with a sports injury, 7.9% (980) was admitted, which is more than with home and leisure accidents (6.7%; 1,690) but less than with traffic accidents (21.5%; 2,202) and violence (9.3%; 364). The mean ISS of sports injuries was low, as with injuries following home and leisure accidents and violence. The percentage of sports

injuries with an ISS higher than or equal to 16 (severely injured) and the percentage mortality were both low in comparison to injuries due to violence or traffic accidents. Finally, severe sports injuries are mainly the result of practising soccer, horse riding, speed skating, physical education, motor sports or volleyball.
Sports injuries rank second highest in terms of cause of injury, after home and leisure accidents; and rank third in terms of severity, after traffic accidents and violence.

The objective of the study described in **Chapter 3** was to investigate whether inpatient treated sports injuries result in long term disabilities and handicaps and to establish variables with a prognostic value for the occurrence of these long-term consequences.
The study group consisted of all patients older than 17 years of age and admitted to the University Hospital Groningen because of a sports injury. By filling in a questionnaire one to four years after the injury an inventory was made of the long-term consequences. The outcome measures were: "absenteeism from work and sports", "experienced disabilities or handicaps" and the "Sickness Impact Profile68 (SIP68)".
A completed questionnaire was returned by 229 out of 306 patients (75%). 67% of the working population had been unfit for work up to one year, whereas 4% still had not resumed work. Absenteeism from sports was also considerable; nearly half of the population did not participate in sports for more than a year. Furthermore, 32% of the patients still experienced disability or handicap following the injury. This finding is in agreement with the results of the SIP68 (Odds ratio: 6.8; C.I. 95%: 3.51 - 13.08).
Two prognostic variables could be distinguished: "gender" and "type of sport". Long-term consequences occurred more often in women ($p<0.03$) and with playing outdoor soccer, horse riding or skiing ($p<0.01$).
It was concluded that sports injuries can lead to considerable long-term disabilities and handicaps.

The aim of the study described in **Chapter 4** was to investigate whether long-term disabilities and handicaps arise from a sports injury requiring outpatient treatment and to identify the potential risk factors.
A representative sample was taken from a population of patients treated as outpatients due to a sports injury. The selected patients were sent a questionnaire, one to five years after the injury. The same set of outcome measures, as described in chapter 3, was used.
Thirty-nine percent of the patients studied were unable to work for up to one month after the injury, 19% was not able to work for up to three months and another 5% could not work for a maximum of eight months. Participation in sporting activities was hampered for up to one year in 76% of the patients and 11% had not resumed sports participation at all. In addition, 20% of the population stated that they still suffered from disabilities and handicaps following the sports injury. The outcome of the SIP68 underlines these results: nine percent of the patients had a sumscore larger than 0. The variables which could be identified as risk factors were the body region (knee) and sex (female). On average the consequences are less severe than those associated with inpatients (chapter 3). This finding is of great value since the number of outpatients is much higher than in patients admitted to a hospital.

Chapter 5 concerns a study with the objective to determine whether equestrian injuries in adult patients result in long-term consequences and to establish the risk factors for this outcome.
The study population comprises 88 patients older than 17 years of age who had been admitted during the period 1990-1999 because of an equestrian injury. After an average period of five years, an inventory was made of the long-term outcome using the 'Sickness Impact Profile68 (SIP68)', 'absenteeism from work and sports' and 'experienced disabilities or handicaps'. Subsequently the risk factors for the occurrence of long-term effects were investigated.
The response was 65/88 (74%). Equestrian injuries often resulted in long-term consequences: 35% of the patients had a SIP68 score '>0', 11% of the working population was permanently unfit for work, 25% no longer participated in sports as an effect of the injury, and 43% still experienced some form of disability or handicap. The type of injury (notably intracranial, fracture), body region (notably

trunk), and injury severity score (ISS) were significantly associated with the occurrence of the long-term consequences. It is recommended that the follow-up of these patients is long and extensive.

The purpose of the follow-up study described in **Chapter 6** was to investigate the development of long-term disabilities arising from paediatric equestrian injuries and to establish possible risk factors.
To achieve this purpose, all patients, aged 17 years or younger, treated in a hospital setting because of an equestrian injury during a five-year period received a questionnaire. The outcome was made operational by listing the residual disabilities and handicaps and the absenteeism from school and sports, and by applying the Child Health Questionnaire (CHQ-CF87). A reference population and healthy friends served as controls.
The results showed that four years post-injury, 41 of the 100 respondents still experienced disabilities following the injury. The median Injury Severity Score was 4. Absenteeism from school lasted 2 weeks, and from horse riding, 4 months. Compared to the reference population, the results of the CHQ-CF87 were poorer considering most of its subscales. In comparison with the controls, the patients only scored lower on "physical functioning". The risk factors concerning poor long-term outcomes were: being an advanced rider, sustaining injuries other than fractures of the extremities or sustaining subsequent injuries following the riding accident.

Sick leave and absenteeism from sports participation following soccer injuries are considerable. Knowledge on the determinants of these long-term consequences is therefore of importance. However, until now only insufficient relevant data are at hand. The aim of the study described in **Chapter 7** was to investigate which determinants can be identified in the occurrence of long-term consequences following a soccer injury.

Employing a qualitative methodology, data-collection was achieved by administrating a semi-structured interview to 15 consecutive patients who had been admitted because of a soccer injury. Data-analysis was carried out, following the current precepts, leading to the construction of determinants.
Ultimately, six determinants for the occurrence of sick leave and absenteeism from sports participation were identified: 'injury related impairments', 'type of work', 'problem summation', 'fear', 'role of occupational health physicians and attending physicians' and 'alternatives for spending spare time'.
This qualitative research turns out to be an adequate methodology to explore and direct possible determinants for the occurrence of long-term consequences following soccer injuries. Company medical examiners and physicians can play an important role to reduce the occurrence of sick leave and absenteeism from sports.

In **Chapter 8** general conclusions and recommendations are addressed. From the thesis it becomes clear that sports injuries can lead to long-term consequences. Years after the injury, a substantial proportion of the patients still experience residual disabilities and handicaps. Adverse outcomes were found in different manifestations and degrees, in inpatients and outpatients and in adults as well as in children. Several variables with a possible prognostic significance for a poor long-term outcome emerged: nature of the treatment (inpatient), gender (women), type of injury / body region (intracranial injuries or fractures of the spine, with or without spinal cord injury, fractures of the pelvis, knee injuries) and type of sport (horse riding, soccer and skiing). In addition, specific determinants for sick leave and absenteeism from sports following a soccer injury came to light.
The results of the thesis provide information to the patient and to practitioners and can be used to develop adequate prevention and treatment strategies. Future research should focus on the operating procedures and (cost-) effectiveness of these strategies. Finally, we still advocate playing sports, despite the fact that long-term disabilities and handicaps can result from injuries.

Samenvatting

Introductie

Sportbeoefening is een populaire manier om vrije tijd te besteden. Deze populariteit hangt samen met de voordelen van het sporten, zoals ontspanning, verbetering van de lichamelijke conditie en het voorkomen van welvaartziekten. Het is echter de vraag in hoeverre deze voordelen opwegen tegen de nadelen van het sporten: het optreden van letsels en de gevolgen daarvan.

Gevolgen op lange termijn zijn van belang, omdat sporters over het algemeen jong zijn en, dientengevolge, blijvende beperkingen langdurig van invloed zullen zijn op kwaliteit van leven. Opmerkelijk genoeg is er slechts weinig informatie voorhanden over de lange termijn gevolgen van sportletsels.

Het doel van dit proefschrift is het in kaart brengen van de gevolgen die op lange termijn optreden na een sportletsel, initieel behandeld op de Centrale Spoed Opvang (CSO) van het Academisch Ziekenhuis Groningen. Daarnaast zullen de factoren die samenhangen met het al dan niet optreden van deze lange termijn gevolgen worden onderzocht.

In het eerste hoofdstuk wordt de globale inhoud van het proefschrift kort uiteengezet.

In **hoofdstuk 2** is het onderzoek beschreven naar de incidentie en ernst van sportletsels in relatie tot de letselernst ten gevolge van een andere ongevalsoorzaak en in relatie tot het type sport. Hierbij is onderscheid gemaakt tussen letsel ten gevolge van sportbeoefening, privé-ongevallen, verkeersongevallen en geweld. Het opnamepercentage en de Injury Severity Scale (ISS) zijn hierbij als criteria voor letselernst gebruikt.

In de periode van januari 1990 tot januari 1997 zijn in totaal 57.760 letsels geregistreerd op de CSO. Na letsels ten gevolge van privé-ongevallen (44%; 25.228) waren sportongevallen (21%; 12.403) de meest frequente letseloorzaak. Van de patiënten met het sportletsel werd 7,9% (980) opgenomen in het ziekenhuis. Dit aantal is hoger dan bij de patiëntencategorie met een privé-letsel (6,7%; 1690), maar lager dan in de categorie patiënten met een verkeersongeval (21,5%; 2202) en geweld (9,3%; 364).

De gemiddelde ISS van sportletsels is laag. Dit geldt ook voor letsels ten gevolge van privé-ongevallen. Het percentage sportletsels met een ISS groter of gelijk aan 16 (ernstig gewond) en de mortaliteit waren laag in verhouding tot de letsels ten gevolge van verkeersongevallen en geweld.
Tenslotte bleken sportletsels, behandeld op de CSO, met name opgetreden te zijn tijdens voetbal, paardrijden, schaatsen, gymnastiek, motorsport en volleybal.
Het doel van het onderzoek, zoals beschreven in **hoofdstuk 3** was te onderzoeken in hoeverre klinisch behandelde sportletsels leiden tot lange termijn beperkingen en handicaps én vast te stellen welke variabelen van prognostische waarde waren voor het optreden van deze lange termijn gevolgen.
De studiepopulatie betrof patiënten ouder dan 17 jaar en opgenomen in verband met een sportletsel in het Academisch Ziekenhuis Groningen. Door middel van het invullen van een vragenlijst, één tot vier jaar na het optreden van het letsel, zijn de lange termijn gevolgen geïnventariseerd. Hierbij zijn als uitkomstmaten gebruikt: werkverzuim, sportverzuim, ervaren beperkingen en handicaps en de Sickness Impact Profile 68 (SIP 68).
Een ingevulde vragenlijst werd door 229 van de 306 aangeschreven patiënten (75%) geretourneerd. Van de werkzame populatie bleek 67% (n=113) een arbeidsverzuim tot een maximum van 1 jaar te hebben ervaren, terwijl 4% ten tijde van het invullen van de vragenlijst nog steeds niet werkte. Het sportverzuimpercentage was eveneens aanzienlijk: bijna de helft van de populatie heeft langer dan een jaar niet aan sportbeoefening gedaan. Voorts ervoer 32% van de patiënten ten tijde van het invullen van de vragenlijst nog steeds beperkingen of handicaps ten gevolge van het sportletsel. De resultaten van de SIP68 (Odds ratio: 6,8; C.I. 95%: 3,5-13,1) ondersteunen laatstgenoemde bevinding.
Twee variabelen van prognostische waarde konden worden onderscheiden: geslacht en type sport. Lange termijn gevolgen treden meer op bij vrouwen ($p < 0,03$) en bij letsels ten gevolge van voetbal, paardrijden en skiën ($p < 0,01$).
In **hoofdstuk 4** zijn de resultaten beschreven van het onderzoek naar lange termijn gevolgen na een poliklinisch behandeld sportletsel en de hiermee samenhangende risicofactoren. Daartoe is een representatieve steekproef

genomen uit de populatie patiënten met een poliklinisch behandeld sportletsel. Deze patiënten is vervolgens, één tot vijf jaar na het optreden van het letsel, een vragenlijst toegestuurd waarbij gebruik gemaakt is van dezelfde uitkomstmaten als beschreven in hoofdstuk 3.

Ten gevolge van het sportletsel trad bij 39% van de patiënten werkverzuim op korter dan één maand. Negentien procent van de onderzochten verzuimde maximaal drie maanden en 5% maximaal acht maanden. Sportverzuim, maximaal één jaar durend, werd geconstateerd bij 76% van de patiënten, terwijl 11% volledig gestopt was met sportbeoefening.

Beperkingen en handicaps ten gevolge van het letsel werden ten tijde van het interview nog steeds ervaren door 20% van de populatie; 9% van de patiënten hadden een SIP68-score groter dan nul.

De variabelen die samenhangen met het optreden van lange termijn gevolgen waren geslacht (vrouw) en aangedaan lichaamsdeel (knie).

Hoofdstuk 5 betreft een onderzoek naar lange termijn gevolgen van paardrijletsels bij volwassenen en de hiermee samenhangende risicofactoren. De populatie betreft 88 patiënten, ouder dan 17 jaar en opgenomen in verband met een paardrijletsel in de periode 1990-1999. Na een periode van gemiddeld vijf jaar zijn de lange termijn gevolgen geïnventariseerd, gebruikmakend van de uitkomstmaten ziekteverzuim, sportverzuim, ervaren beperkingen en handicaps en de SIP68.

Van de onderzochte patiënten bleek 43% nog steeds beperkingen en handicaps te ervaren ten gevolge van het letsel. Voorts bleek 11% van de werkzame populatie blijvend arbeidsongeschikt en was 25% van de patiënten gestopt met sportbeoefening. Een SIP68 score groter dan nul werd door 35% van de patiënten aangegeven.

Het letseltype (intracranieel letsel, fractuur), aangedaan lichaamsdeel (romp) en de ISS bleken significant samen te hangen met het optreden van lange termijn gevolgen.

Gezien het feit dat lange termijn gevolgen veelvuldig optreden bij de populatie klinisch behandelde patiënten met een letsel opgelopen tijdens paardrijden, verdient het de aanbeveling deze populatie langdurig en intensief te vervolgen en te begeleiden.

Het doel van de follow-up studie, zoals beschreven in **hoofdstuk 6** was het bepalen van de lange termijn gevolgen optredend na een paardrijletsel bij kinderen en het vaststellen van de met deze gevolgen samenhangende voorspellende factoren.

Middels vragenlijstonderzoek werden de lange termijn gevolgen geïnventariseerd. Persisterende beperkingen en handicaps, schoolverzuim, sportverzuim en de Child Health Questionnaire (CHQ-CF87) werden als meetinstrumenten gehanteerd. Gezonde vriend(inn)en van de onderzochte kinderen vormden een controlegroep.

Honderd patiënten hebben een volledig ingevulde vragenlijst geretourneerd. Van deze populatie bleken 41 patiënten nog steeds nadelige gevolgen te ervaren van het letsel. De gemiddelde ISS was 4. Schoolverzuim duurde gemiddeld twee weken en sportverzuim vier maanden. In vergelijking met een referentiepopulatie waren de meeste resultaten van de CHQ-CF87 slechter. In vergelijking met de controlegroep scoorden de patiënten alleen slechter voor wat betreft het lichamelijk functioneren. De risicofactoren samenhangend met lange termijn beperkingen en handicaps waren: niveau van paardrijden (gevorderd), letseltype (een ander letsel dan een fractuur van de extremiteiten) en het oplopen van letsels na het paardrijongeval.

Ziekteverzuim en sportverzuim ten gevolge van een voetballetsel treden veelvuldig op. Kennis omtrent de determinanten van deze lange termijn gevolgen is van groot belang. Hieromtrent zijn echter tot nu toe onvoldoende gegevens bekend. Het doel van de studie, zoals beschreven in **hoofdstuk 7** was derhalve te onderzoeken welke determinanten samenhangen met lange termijn beperkingen en handicaps ten gevolge van een voetballetsel. Door middel van het toepassen van een kwalitatieve onderzoeksmethodologie werden gegevens verzameld van 15 patiënten die opgenomen geweest waren in verband met een voetballetsel.

Na analyse van de interviews, konden zes determinanten samenhangend met ziekte- en sportverzuim worden vastgesteld. Deze determinanten zijn functiestoornissen, het soort werk, een cumulatie van medische en / of sociale problemen, angst, de rol van de bedrijfsarts en de behandelend arts en tenslotte de alternatieven voor vrije tijdsbesteding.

De kwalitatieve onderzoeksmethodiek lijkt een adequate techniek te zijn om onderzoek te doen naar determinanten van het optreden van lange termijn gevolgen na een sportletsel. De rol die bedrijfsartsen en behandelend artsen spelen bij het optreden van deze lange termijn gevolgen moet niet worden onderschat.

Hoofdstuk 8 betreft de discussie gebaseerd op de resultaten van de studies die in dit proefschrift zijn beschreven. Geconcludeerd wordt dat sportletsels kunnen leiden tot lange termijn beperkingen en handicaps. Jaren na het letsel blijkt nog steeds een aanzienlijk deel van de patiënten nadelige gevolgen te ervaren van het sportletsel. Deze nadelige gevolgen worden in verschillende mate en uitingsvorm gezien bij klinisch en poliklinisch behandelde patiënten als ook bij volwassenen en bij kinderen.

Verschillende determinanten voor nadelige lange termijn gevolgen konden worden onderscheiden. Deze betreffen: aard van de behandeling (klinisch versus poliklinisch), geslacht (vrouw), type en plaats van het letsel (intracraniaal letsel, wervelkolomfracturen, al dan niet gepaard gaand met een dwarslaesie, bekkenfracturen en knieletsels) en type sport (paardrijden, voetbal en skiën). Voorts konden specifieke determinanten worden onderscheiden voor ziekte- en sportverzuim na een voetballetsel.

De resultaten van dit proefschrift vormen een bron van informatie voor zowel patiënt als behandelaar en kunnen gebruikt worden voor het verder ontwikkelen van preventieve maatregelen en behandelstrategieën. Toekomstig onderzoek dient gericht te zijn op de ontwikkeling van deze strategieën met speciale aandacht voor praktische uitvoering en (kosten) effectiviteit.

Ondanks het feit dat lange termijn beperkingen en handicaps na een sportletsel nadelen van sportbeoefening zijn, wordt toch een lans gebroken voor het stimuleren van sportbeoefening gezien de vele voordelen die deze activiteiten hebben.

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Northern Centre for Healthcare Research (NCH)

and previous dissertations

The Northern Centre for Healthcare Research (NCH) was founded in 1986 as a research institute of the University of Groningen (RUG), The Netherlands. Researchers from both the Medical and Social Faculty, with various professional backgrounds, are members of the NCH. These include medical sociologists, medical doctors, psychologists and human movement scientists. Research of the NCH is aimed at optimising quality of life of patients and quality of healthcare, and focuses on (a) determinants of health and illness, (b) consequences of illness, (c) the effects of medical treatment and decision making, and (d) the evaluation of health services and various types of interventions. At the time that this thesis is published, the NCH comprises five research programs.

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