Eur Spine J (2008) 17:64–69
DOI 10.1007/s00586-007-0493-9

ORIGINAL ARTICLE

Low back pain and its risk indicators: a survey of 7,040 Finnish male conscripts

Ville M. Mattila · Timo Sahi · Vesa Jormanainen · Harri Pihlajamäki

Received: 1 April 2007 / Revised: 3 August 2007 / Accepted: 22 August 2007 / Published online: 13 September 2007

Abstract Studies describing risk indicators of low back pain (LBP) have focused on adults, although the roots of LBP lie in adolescence and early adulthood. The objective of the present study was to assess the lifetime occurrence and risk indicators of LBP in young adult males. The survey sample comprised 7,333 male conscripts (median age 19), of which 7,040 (96%) answered a questionnaire during the first days of their conscription. The outcome was lifetime LBP prompting at least one visit to a physician. Associations between 18 background variables and LBP were analysed by logistic regression. Altogether 894 (12.7%) respondents reported LBP. Health status was a strong determinant of LBP. The strongest individual risk indicators for LBP were having two or more other than back-related diseases diagnosed by a physician during past year (OR 2.0; 95% CI 1.6–2.5), below-average self-perceived health (OR 1.6; 95% CI 1.3–2.0) and use of smokeless tobacco (OR 1.4; 95% CI 1.2–1.7). Socioeconomic status was not associated with LBP and health behaviours only weakly. The strongest risk indicators for LBP were related to health problems. Of the socioeconomic background factors, none were associated with LBP. It is evident that LBP is associated with other health problems as well, indicating that its background may be multifactorial. This presents challenges for prevention programme planning and implementation. Longitudinal cohort studies are urgently needed to enhance understanding of adolescent risk indicators of LBP.

Keywords Low back pain · Health behaviour · Risk indicators · Epidemiology

V. M. Mattila (✉) · H. Pihlajamäki
Research Centre of Military Medicine,
PL 50, 00301 Helsinki, Finland
e-mail: ville.mattila@uta.fi

T. Sahi · V. Jormanainen
Department of Public Health, University of Helsinki,
Helsinki, Finland

H. Pihlajamäki
Department of Medical Services, Finnish Defence Forces,
Helsinki, Finland

Introduction

High prevalence rates of low back pain (LBP) have been demonstrated among adolescents and young adults in civil populations [4, 9, 21] as well as during military service [6, 8]. It has been estimated that approximately 50% of people age 20 have ever suffered from LBP [11], while the prevalence of sciatic pain has varied between 1.8% [19] and 4% by the age of 20 [25]. Despite the common occurrence of LBP, hospitalisations due to severe low back disorders, such as lumbar disc herniations leading to lumbar disc surgery, are rare in the early adulthood [25]. In a prospective study, only 5% of the subjects were hospitalised and even fewer (1%) underwent surgery by the age of 38 [5]. The prevalence of LBP increases with age until adulthood and there is strong evidence that adult LBP originates in adolescence [7, 9]. Despite the good prognosis of LBP, it has substantial adverse social and economic consequences.

Most of the studies investigating risk factors of LBP have been conducted among working populations [14, 18]. Given that the roots of LBP are often in adolescence, and despite suggestions that research on the risk indicators of LBP should be focused on the adolescent population [9], published research has been sparse [8]. Some evidence exists that psychosocial difficulties [5] and above-average height growth [3] might be among these indicators. A weak association has been found between smoking and LBP [12], whereas drinking and LBP seem totally unrelated [13]. Although an association has been found between intensive physical activity and LBP among military populations [6, 17], this relationship has been a subject of controversy outside military service [1, 2, 10, 20].

All Finnish men are obligated to enter a 6–12-month-long military service, a new batch of conscripts entering the service twice a year, in January and July. Of any specific age group, over 80% of men perform military service. Conscript age varies between 18 and 29 years (median 19). The basic training of 8 weeks is similar for all conscripts and consists of increasing levels of walking, marching, bicycling, running and other physical activities. The total duration of service varies from the maximum of 362 days (officers, and conscripts trained for particularly demanding duties), to 270 days (conscripts trained for work requiring special skills), and to a minimum of 180 days (other rank and file duties). Annually, an average of 27,000 male and 370 female conscripts start their basic military service in the Finnish Defence Forces.

The aims of this cross-sectional survey study were to estimate the cumulative incidence of LBP prompting a visit to a physician and to assess the risk indicators of LBP among young Finnish males.

Subjects and methods

The nationwide Finnish Conscript Health Survey has the purpose of exploring conscripts' health and health-related lifestyles. The conscripts are asked to answer the survey questionnaire on the first days of their military service. Of the 7,333 male conscripts included in this sample, 7,040 answered (response rate 96%). The conscripts were selected randomly from ten garrisons for the years 2002 ($n = 1{,}870$ respondents), 2003 ($n = 1{,}678$), 2005 ($n = 1{,}788$), and 2006 ($n = 1{,}747$). The median age of the respondents was 19 (range 18–29) years. The questionnaires have always been anonymous, and thus, without any identification information.

The main outcome variable in our study was lifetime LBP prompting a visit to a physician by the time the person entered the military service (self-reported cumulative incidence). The occurrence of LBP was elicited with: "Have you ever visited physician due to low back pain?" The following question assessed the effect of LBP on respondents' completion of military service, with two alternatives (performing normally, not normally).

Background variables

A total of 18 variables obtained from the questionnaire were used to describe conscripts' socioeconomic background, health status and health behaviours (Tables 1, 2, 3). Socioeconomic background was described in terms of six variables (Table 1). Geographical area of residence was classified by three regions: Southern, Central and Northern Finland. Urbanisation level of residence was determined by the population density under five categories: capital area (Helsinki and the adjoining cities), city/large town (population over 100,000), small town, village (densely populated area in rural municipalities), and sparsely populated rural municipality (isolated homestead in rural municipalities). Childhood family composition was categorised into nuclear (child's own parents) and non-nuclear (other than child's own parents). Three categories of achieved level of education were used: comprehensive school, vocational school and upper secondary school or university. Marital status was categorised to single or other.

Conscripts' health status was described by three variables (Table 2). Body mass index (BMI) values were calculated by dividing weight (kg) with the square of height (m^2), and height was divided into quartiles. The subjects were classified in three BMI categories: <25 kg/m^2 (normal), 25–30 kg/m^2 (overweight), and >30 kg/m^2 (obese). Conscripts' health was assessed by their self-perceived health status (good, average, below average), and physician-diagnosed diseases (other than back-related) during the past year using a 15-item list (pneumonia, bronchitis, allergy, eczema, tonsillitis, asthma, migraine, otitis, maxillary sinusitis, epilepsy, chickenpox, chlamydia, gonorrhoea, syphilis, scabies).

Respondents' health behaviours were described by eight variables (Table 3). Conscripts were asked how they perceived their physical fitness (poor, average, good) and about the intensity of leisure-time physical activity during a half year period prior to their military service (no physical activity, light activity <5 h/week, moderate activity 5 h/week, regular sports training. Questions concerning the most common types of physical training performed at least once a week were asked (jogging/running, swimming and team sports). Smoking and drinking habits were assessed by questions about daily smoking, smokeless tobacco use, frequency of drunkenness (abstinence, less than once a year, once a month, and more often than once a month).

In statistical analysis, age-adjusted logistic regression models were used and each independent variable was tested separately. Odds ratios (OR) were calculated with 95% confidence intervals (95% CI). Finally, all significantly associated background variables were entered into the same age-adjusted forward stepwise logistic regression

Table 1 The number and percentage of males with and without LBP according to socioeconomic status and the age-adjusted odds ratios with 95% confidence intervals for the association between LBP and socioeconomic status calculated by logistic regression

Background variable	Number (%)		OR (95% CI)
Socioeconomic status	LBP+	LBP–	
Age			
17–18	142 (15.9)	1,055 (18.0)	1.0
19–20	637 (71.5)	4,309 (73.4)	1.1 (0.9–1.3)
21 or older	112 (12.6)	509 (8.7)	1.6 (1.2–2.1)
Geographic area			
Southern	401 (45.4)	2,378 (40.6)	1.0
Central	344 (38.9)	2,456 (42.0)	0.9 (0.7–1.0)
Northern	139 (15.7)	1,020 (17.4)	0.8 (0.7–1.0)
Urbanisation level of residence			
Sparsely populated rural municipality	99 (11.4)	655 (11.4)	1.0
Village	123 (14.2)	811 (14.2)	0.8 (0.7–1.0)
Small town	152 (17.5)	1,042 (18.2)	0.9 (0.7–1.1)
City	276 (31.8)	1,962 (34.3)	0.9 (0.7–1.2)
Capital area (Helsinki and the adjoining towns)	218 (25.1)	1,252 (21.9)	0.9 (0.7–1.2)
Marital status			
Single	766 (85.7)	5,211 (88.4)	1.0
Cohabiting, married, divorced	128 (14.3)	687 (11.6)	1.2 (1.0–1.6)
Childhood family composition			
Nuclear	742 (83.4)	5,005 (85.4)	1.0
Non-nuclear	148 (16.6)	853 (14.6)	1.1 (0.9–1.4)
Level of education			
Comprehensive school	128 (14.9)	700 (11.9)	1.0
Vocational school	291 (33.9)	2,074 (36.1)	0.8 (0.6–1.0)
Upper secondary or university	440 (51.2)	2,968 (51.7)	0.8 (0.7–1.0)

model. To test for possible time effects, the data were divided into four data sets based on the survey year, and separate logistic regression models were calculated for each year. However, as no time effect was seen (data not shown), a pool analysis of all data was performed.

The logistic regression analyses were performed only on those respondents who had provided answers to every question and, thus, persons with incomplete answers were excluded. The frequency of missing values in the explanatory variables varied from 1 to 3% while the frequency of missing values in the dependent variable (LBP yes/no) was 4%.

Results

Altogether 894 (12.7%) conscripts reported having experienced LBP that had prompted a visit to a physician by the time they entered the military service. Most of them (691, 78%) expressed an opinion that their LBP would not affect their ability to undertake military service.

In the univariate models, age was associated with the occurrence of LBP. Conscripts older than 20 years reported LBP 1.6 times (95% CI 1.2–2.1) more frequently than their younger peers (Table 1). In the age-adjusted models, none of our socioeconomic background variables were significantly associated with LBP in this young Finnish male cohort.

The strongest health-related risk indicators of LBP were two or more diseases (other than back-related) diagnosed by a physician (OR 2.1, 95% CI 1.7–2.6) and below-average self-perceived health status (OR 1.6; 95% CI 1.3–2.0) (Table 2). Height or overweight was not associated with LBP in our sample.

Among the health behaviours that were significantly associated with LBP were use of smokeless tobacco and daily smoking (Table 3). Neither drinking nor respondents' physical fitness activities were associated with LBP.

When all the statistically significant background variables were entered into the same forward stepwise logistic regression model (Table 4), diseases diagnosed by a physician remained the strongest risk indicator of LBP (OR 2.0; 95% CI 1.6–2.5), followed by below-average self-perceived health (OR 1.6, 95% CI 1.3–2.0) and use of smokeless tobacco (OR 1.4; 95% CI 1.2–1.7). Smoking lost its significance when entered into the multivariate model (Table 4).

Table 2 The number and percentage of males with and without LBP according to health status and the age-adjusted odds ratios with 95% confidence intervals for the association between LBP and health status calculated by logistic regression

Background variable	Number (%)		OR (95% CI)
Health status	LBP+	LBP–	
Height (quartiles)			
First	207 (23.4)	1,436 (24.6)	1.0
Second	238 (26.9)	1,576 (27.0)	1.1 (0.8–1.3)
Third	222 (25.1)	1,495 (25.7)	1.0 (0.8–1.3)
Fourth	219 (24.7)	1,321 (22.7)	1.1 (0.9–1.4)
Body mass index			
Normal (BMI under 25 kg/m^2)	621 (70.5)	4,170 (71.9)	1.0
Overweight (BMI 25–30 kg/m^2)	214 (24.3)	1,255 (21.6)	1.1 (0.9–1.3)
Obese (BMI over 30 kg/m^2)	46 (5.2)	374 (6.4)	0.8 (0.6–1.1)
Self-perceived health status			
Good	148 (16.8)	1,299 (22.3)	1.0
Average	391 (44.3)	2,728 (46.7)	1.3 (1.0–1.5)
Below-average	344 (39.0)	1,809 (31.0)	1.6 (1.3–2.0)
Diseases (other than back-related) diagnosed by physician during past year			
None	163 (18.2)	1,579 (26.7)	1.0
One	431 (48.2)	2,953 (50.0)	1.4 (1.2–1.7)
Two or more	300 (33.6)	1,375 (23.3)	2.1 (1.7–2.6)

Discussion

The most interesting finding in the present study was the strong association between health status and LBP. It seems that the roots of LBP are multifactorial and that LPB is not unrelated to other health problems, not even in persons at the age of 20. We cannot overlook the possibility that LBP has occasionally been the reason to report poor self-perceived health thus biasing the results. However, since all persons with severe back disorders are exempted from military service after physician's examination for failing to meet the requirements set for the service, conscripts in this study sample are unlikely to have any severe back disorders. Further, it has been shown that LBP in adolescents and young adults is a fluctuating rather than a chronic phenomenon [8, 22]. Furthermore, conscripts who reported having diseases other than back related also had a significantly increased risk of LBP. Thus we may safely conclude that a significant association exists between LBP and poorer than average health in our sample, which rather well represents healthy young adult Finnish males. Naturally, the causality of association cannot be confirmed based on a cross-sectional finding. The finding is, nonetheless, interesting and opens questions when planning prevention strategies of LBP.

The cumulative incidence of LBP prompting at least one visit to a physician was 13%, which concurs with previously published figures [5, 16]. Increasing age was associated with LBP, a result which corresponds with previous studies [9]. Only a small number of conscripts anticipated that LBP might cause problems during their military service, which indicates that despite the relatively common occurrence of LBP in conscripts, medical requirements of military service are set at the right level. Unfortunately due to the anonymous data collection we had no opportunity to follow conscripts during their military service in order to find out whether conscripts reporting LBP before their military service also actually experienced LBP during that service.

Use of alcohol and LBP were not associated in our sample. This is in agreement with previous findings [13]. Smoking was a significant risk indicator in the age-adjusted univariate models, but its significance disappeared in the multivariate model. Previously, smoking has shown to be a weak risk indicator of unspecified LBP [12]. An interesting association between use of smokeless tobacco and LBP was found in the present study. A possible explanation for this finding may be that the use of smokeless tobacco is popular among males participating in organised sports, which in turn may be related to LBP [6, 17]. However, further studies are required to find out the underlying mechanisms. Body mass index was not associated with the occurrence of LBP in this study. However, it must be taken into account that severely obese persons are excluded from the military service.

Socioeconomic status is strongly associated with a person's health in general. There is definitive evidence that mortality and morbidity reflect socioeconomic differences [24]. It also seems that in societies where the

Table 3 The number and percentage of males with and without LBP according to health behaviours and the age-adjusted odds ratios with 95% confidence intervals for the association between LBP and health behaviours calculated by logistic regression

Background variable	Number (%)		OR (95% CI)
Health behaviours	LBP+	LBP–	
Physical fitness			
Poor	159 (18.2)	930 (16.0)	1.0
Average	378 (43.3)	2,491 (42.9)	1.1 (0.9–1.2)
Good	336 (38.5)	2,390 (41.1)	1.2 (1.0–1.5)
Intensity of leisure-time physical activity			
No physical activity	236 (27.5)	1,624 (28.2)	1.0
Light activity less than 5 h/week	298 (34.7)	2,084 (36.2)	1.0 (0.8–1.2)
Moderate activity 5 h/week)	222 (25.8)	1,484 (25.8)	1.0 (0.9–1.3)
Regular sports training	103 (12.0)	562 (9.8)	1.3 (1.0–1.7)
Physical training by jogging or running at least once a week			
No	656 (75.4)	4,186 (72.2)	1.0
Yes	214 (24.6)	1,608 (27.8)	0.8 (0.7–1.0)
Physical training by swimming at least once a week			
No	816 (93.8)	5,380 (92.9)	1.0
Yes	54(6.2)	414 (7.1)	0.9 (0.6–1.2)
Physical training by team sports at least once a week			
No	588 (67.5)	4,038 (69.7)	1.0
Yes	283 (32.5)	1,757 (30.0)	1.1 (1.0–1.3)
Daily smoking			
No	532 (59.5)	3,836 (64.9)	1.0
Yes	362 (40.5)	2,071 (35.1)	1.2 (1.1–1.4)
Use of smokeless tobacco			
No	699 (81.7)	4,864 (86.6)	1.0
Yes	157 (18.3)	751 (13.4)	1.4 (1.2–1.7)
Frequency of drunkenness before military service			
Abstinence	102 (11.4)	646 (11.0)	1.0
Once a year	266 (29.8)	1,869 (31.8)	0.9 (0.7–1.2)
Once a month	305 (34.1)	1,971 (33.5)	1.0 (0.8–1.2)
More than once a month	221 (24.7)	1,397 (23.7)	1.0 (0.8–1.3)

Table 4 Odds ratios with 95% confidence intervals for the association between LBP and socioeconomic background, health and health behaviours calculated by forward stepwise logistic regression adjusted by age

Background variable	OR (95% CI)
Self-perceived health status	
Good	1.0
Average	1.3 (1.1–1.6)
Below the average	1.6 (1.3–2.0)
Number of diseases diagnosed by physician during the past year	
None	1.0
One	1.4 (1.2–1.7)
Two or more	2.0 (1.6–2.5)
Smokeless tobacco use	
No	1.0
Yes	1.4 (1.2–1.7)

Only the significant variables are shown

socioeconomic differences are the smallest, such as Finland [15], the association between socioeconomic status and health is the weakest. In the present study, none of the rough measures of socioeconomic background were associated with LBP. This result may be explained either by the comprehensive school system in Finland or the fact that socioeconomic differences are smallest just after adolescence, as described previously by West [23].

Our study limitations arise from the recall bias. It has been shown that episodes of LBP are poorly remembered and thus a relatively short recall-period has been recommended [9]. In the present study, the interest was in lifetime incidence of LBP prompting at least one visit to physician and it is possible that recall bias contributed to a lower occurrence of LBP. In addition, persons with severe back and other chronic disorders were excluded from the sample based on the assumption that they are not capable of performing physically demanding military tasks. The associations between risk indicators and LBP may have been stronger if persons with severe back disorders had been included.

In conclusion, the strongest risk indicators of LBP were number of diseases (other than back-related) diagnosed by physician during past year, below-average self-perceived health and use of smokeless tobacco. It is evident that LBP is associated with other health problems as well, indicating that its background may be multifactorial. This presents challenges for prevention programme planning and implementation. Longitudinal cohort studies are urgently needed to enhance our understanding of adolescent risk indicators of LBP.

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