

A PROSPECTIVE STUDY OF LOW BACK PAIN IN A GENERAL POPULATION

1. Occurrence, Recurrence and Aetiology.

Fin Biering-Sørensen

From the Laboratory for Back Research, Department of Physical Medicine and Rehabilitation, Rigshospitalet, University Hospital; and the Population Studies in Glostrup, Section of Prospective Medicine, Medical Department C, Glostrup Hospital, University of Copenhagen, Denmark

ABSTRACT. A general population of 928 men and women aged 30, 40, 50 and 60 years underwent a lower back examination as part of a general health survey. A 12 month follow-up questionnaire was completed by 99% of them. At the end of the follow-up year, the life time prevalence rates for low back pain (LBP) were 68-70% for men and rose with increasing age from 62% to 81% among women. The one year incidence of first attacks of LBP was 11% among the 30-year-olds and decreased in the older age-groups. Recurrences of LBP in the follow-up year were more frequent among those who had more recently and frequently experienced LBP before. Among those who had experienced LBP on some occasion, 23-31% had such symptoms daily or at least once a week. Heavy lifting, twisting and trauma were the most commonly stated causes of LBP, which 52-60% of the participants claimed to be work-related. A gradual onset and exacerbation of the LBP were of some prognostic value in the follow-up year, while the alleged cause of previous LBP was not.

Key words: Low back pain, prospective study, epidemiology, occurrence, recurrence, aetiology

Low back pain (LBP) or—more appropriately—low back symptoms are a general health problem of major significance in most of the industrialised world (25, 51). Unfortunately little is known about aetiological and prognostic factors, which emphasises the importance of epidemiological studies. Very few longitudinal studies have previously been carried out.

Previous prospective studies on low back complaints have primarily analysed prognostic factors in patients with back pain. The populations studied were thus selected because of referral to physicians or institutions (1, 11, 13, 33, 35, 36, 38, 39, 44, 48). Recent longitudinal investigations on selected occupational groups (8, 9, 10) have identified parameters of possible significance for future back injury.

The present study was designed as a follow-up study of a general population with no selection

regarding health and occupation (2). This study design makes it possible to evaluate risk indicators for LBP, in relation both to first-time occurrence and to recurrence.

The present publication deals with the occurrence, recurrence, stated cause, onset and progress of LBP. The value of some of these parameters as indicators for occurrence of LBP in the follow-up year is evaluated.

POPULATION AND METHODS

Population and design

Of all inhabitants aged 30, 40, 50 and 60 years in Glostrup, a municipal suburb of Copenhagen, Denmark, 82%—449 men and 479 women—participated in a general health survey. This included an extensive examination of the lower part of the back, using questionnaires and objective measurements (2). The participants were not informed beforehand that the health survey would include a specific focus on the lower back.

Twelve months after the examination, 99% of the population examined (442 men and 478 women) completed a follow-up postal questionnaire with particular emphasis on occurrence of LBP in the intervening period. The follow-up answers for 50 participants were obtained by telephone (2).

A detailed description of the design, the representativeness of the population and the characteristics of the non-participants has been given in an earlier publication (2). In brief, the population can be considered representative of Copenhagen County. The lack of agriculture and fishing industry make national generalisations of prevalence and incidence rates questionable. Analyses of LBP in relation to collected parameters will presumably not be influenced to the same degree. Non-participation was more common among the unmarried. However, the general morbidity among non-participants did not seem to differ from that among the participants to any appreciable degree (2). The study design, with four groups of specified ages at intervals of 10 years, improves the possibility of studying the influence of age and other factors of importance for occurrence of LBP (2).

Table I. Combination of statements about low back pain (LBP) before or on the examination day and LBP in the follow-up year

Eight participants did not answer the follow-up questionnaire. Age differences tested with chi-square tests (df 3). Given in percent

	30 years		40 years		50 years		60 years	
	Men n=133	Women n=141	Men n=91	Women n=110	Men n=115	Women n=118	Men n=103	Women n=109
Low back pain								
Both before and in the follow-up year (Group I)	32	31	48 ^a	33	39	43	37 ^b	50
Before, but not in the follow-up year (Group II)	24	21	21	22	25	21	25	27
Not before, but in the follow-up year (Group III)	11	11	0 ^d	6	6	3	6	4
Neither before nor in the follow-up year (Group IV)	32	38	31	39	30	32	32 ^c	19

Sex differences, χ^2 (df 1): ^a $p=0.024$, ^b $p=0.047$, ^c $p=0.033$. ^dFisher's exact: $p=0.013$. All other p -values above 0.21.

Delimitation of LBP

The questionnaire's enquiry about the occurrence of LBP was phrased as follows: "Have you /ever/within the last 12 months/ experienced pain or other symptoms in the lower part of your back?" LBP in relation to menstruation alone was excluded.

Data analysis

Data included in this presentation were obtained both from questionnaires completed at the primary examination and from the one year follow-up questionnaire. The parameters were analysed for possible sex differences within each age group and possible age differences within each sex.

For those participants with previous experience of LBP, their statements at the primary examination concerning time since last LBP, frequency of LBP, number of days with LBP, stated cause, onset and progress were tested for their value as indicators for occurrence (recurrence) of LBP in the follow-up year. This applied to 281 men and 294 women (follow-up information was not obtained for five men and one woman).

Chi-square, Fisher's exact and Mann-Whitney rank sum tests were used.

RESULTS

Occurrence

Table I shows the frequencies of LBP before or on the day of examination and in the follow-up year alone and in combination. The sum of the frequencies in groups I, II and III constitutes the life time prevalences for the 31-, 41-, 51- and 61-year-old men (68%, 69%, 70% and 68%) and women (62%, 61%, 68% and 81%). Group III alone corresponds to the one year incidence of LBP, i.e. the proportion of participants who had their first experience ever of LBP in the follow-up year. The sum of the

frequencies in groups I and III gives the one-year period prevalence for the follow-up year, i.e. all those who experienced LBP in this period.

Recurrence

Table II correlates the risk of experiencing LBP in the follow-up year to the participant's statement as to when last, if ever, he had had LBP. Thus the bottom line in Table II shows the risk of experiencing LBP for the first time ever during the follow-up year. The table indicates that a longer passage of time since the last episode of LBP meant a lesser risk of LBP occurrence in the follow-up year. For all participants together this tendency gives a $p < 10^{-9}$ ($\chi^2=267.5$, df 6). The pattern is uniform in all eight sex/age groups, and in no instance do sex or age differences show p -values below 0.05.

For those participants who at some time had experienced LBP, Table III gives the participants' statement regarding the frequency of LBP episodes up to the day of examination. The age differences observed in Table III do not disclose clear age trends, although for the women daily LBP was more frequent with increasing age. This tendency is also the basis for the only noteworthy sex difference, viz. between the 60-year-olds.

Table IV examines the value of the stated previous frequency of LBP as an indicator for occurrence of LBP in the follow-up year. A clear trend towards a higher risk was seen where LBP was experienced more frequently in the earlier life. This trend was uniform for all eight sex/age groups.

Exactly the same tendency was demonstrated

work-related. No particular age trends were observed. The category "other causes" included pregnancy (15 participants), illness (10 participants), after-effects of trauma (10 participants), and stated back anomalies (14 participants) such as straight back, scoliosis, bad posture and sacralisation.

Neither the data summarised in Table V nor those in Table VI gave any systematic indication for occurrence of LBP in the follow-up year.

In Table VII figures comparable to those in Table VI are given for the follow-up year, though the wording of the questions was somewhat different. The largest group in the "other causes" category consists of some sort of back-related illness or anomaly (32 participants), while other diseases including psychic tension were given as the cause by 12 participants. Cold or draught was indicated by 11 participants, and a similar number gave trauma (a fall, for instance) as the cause. The participant's bed or bed rest was claimed to be responsible in eight instances, while five women gave pregnancy and three participants obesity as the cause.

Onset and progress of LBP

Table VIII shows whether the participants reported the onset of LBP to have been sudden or gradual.

Table II. *The risk of experiencing low back pain (LBP) in the follow-up year depending on the duration since last experience of LBP*

All age groups together. Unknown for 11 participants

	Percent (rate ^a) with LBP in the follow-up year	
	Men	Women
LBP on the examination day	90 (44/49)	89 (64/72)
Interval from last episode of LBP to the day of examination		
≤ 1 week	77 (33/43)	75 (38/51)
> 1 week	62 (23/37)	63 (37/59)
≤ 4 weeks	54 (43/79)	49 (30/61)
> 4 weeks	43 (13/30)	42 (11/26)
≤ 1 year	33 (10/30)	19 (4/21)
> 1 year		
≤ 5 years		
> 5 years		
No LBP before or on the examination day	17 (28/166)	16 (30/185)

^a rate: (number with LBP)/(number at risk).

All ages		Age difference <i>p</i> -value	
Men <i>n</i> =442	Women <i>n</i> =478	Men	Women
18	39	0.11	0.0046
24	23	0.88	0.73
6	6	0.0085	0.58
31	32	0.97	0.0057

when the stated number of days with LBP within the last year before the examination (2) was used as an indicator. Testing with the Mann-Whitney rank sum test, the *p*-values were below 0.0005 for men as well as women. For none of the eight sex/age groups did this trend show a *p*-value above 0.04.

Alleged cause of LBP

For participants who experienced LBP at least once the stated cause of onset is given in Table V. The pattern here was the same in the four age groups, though a higher proportion of the younger women (28%) indicated pregnancy or delivery as a cause than the older women did (11%).

Of those participants who related their LBP to illness, three had sequelae after poliomyelitis, one with severe scoliosis and another with moderate scoliosis. Four stated gastrointestinal and two kidney illness as causes. Illness alone was stated as the cause by 16 (3%) of the participants with LBP on some occasion.

Of other causative factors given, the sitting position was mentioned by 15; five of these indicated driving of motor vehicles to be the cause. Fifteen participants wrote in more general terms that their LBP was due to their working position. Heavy work was alleged as the cause by 12, and nine claimed draughts or cold in the environment to be the cause.

Table VI gives the participants' opinion on whether their LBP was related to work or leisure activities. The majority claimed that their LBP was

Table III. Frequency of low back pain (LBP)

Unknown for 10 participants who experienced LBP at least once. For the age differences were found: Men, $p=0.022$ ($\chi^2=23.78$, df 12); women, $p=0.023$ ($\chi^2=23.66$, df 12)

Per cent	30 years		40 years		50 years		60 years		All ages	
	Men <i>n</i> =75	Women <i>n</i> =74	Men <i>n</i> =63	Women <i>n</i> =59	Men <i>n</i> =73	Women <i>n</i> =76	Men <i>n</i> =64	Women <i>n</i> =81	Men <i>n</i> =275	Women <i>n</i> =290
In all only a couple of times	25	19	13	12	15	24	34	20	22	19
A couple of times yearly	39	24	33	31	45	33	31	20	37	27
A couple of times monthly	23	31	21	22	19	16	8	23	18	23
A couple of times weekly	7	18	13	17	5	9	11	7	9	12
Daily	7	8	21	19	15	18	16	30	14	19
Sex differences										
χ^2 (df 4)	7.87		0.56		4.07		13.59		11.50	
<i>p</i> -value	0.096		0.97		0.40		0.0087		0.021	

More men than women reported a sudden onset. The same trend was observed in all age groups. The age differences gave *p*-values above 0.1. The value of this parameter as an indicator for LBP in the follow-up year is seen in Table IX. A uniform trend was seen in all eight sex/age groups with the gradual onset to be most indicative of future LBP.

Table X shows that most participants reported that their LBP had been either less pronounced or was unchanged since onset. None of the sex or age differences showed *p*-values below 0.09. Table XI gives the value of this statement as an indicator for LBP in the follow-up year. The pattern in Table XI was observed in all eight sex/age groups. This

means more LBP in the follow-up year among those with an aggravated course of the LBP up to the day of the primary examination and less LBP in the follow-up year among those who had experienced an improvement in their LBP up to the day of examination.

Table XII shows the progress of the LBP in the follow-up year. The 60-year-olds particularly tended to report worsened LBP.

DISCUSSION

LBP is a subjective complaint and thus is impossible to validate objectively (51). In addition, when

Table IV. The value of the stated previous frequency of low back pain (LBP) as indicator for occurrence of LBP in the follow-up year (cf. Tables II and III)

All age groups together

Frequency of LBP up to the day of examination	Percent (rate) of LBP in the follow-up year	
	Men	Women
No LBP up to the day of examination	17 (28/166)	16 (30/185)
In all only a couple of times	42 (25/59)	36 (20/55)
A couple of times yearly	50 (51/102)	59 (45/76)
A couple of times monthly	75 (36/48)	63 (42/67)
A couple of times weekly	86 (19/22)	81 (29/36)
Daily	95 (37/39)	87 (48/55)
χ^2 (df 5)	126.2	136.3
<i>p</i> -value	$<10^{-9}$	$<10^{-9}$

Table V. Stated cause(s) of the onset of low back pain

Combination of causes were given by 63 participants (2 causes in combination were given by 52 participants, 3 by 9, and 4 by two participants). Unanswered by three men. All age groups together

Stated cause(s)	Men (%)	Women (%)
Direct blow or bump against the back	2	1
Fall	10	5
Heavy lift	37	24
Twist of the back	18	13
Other wrong movement of the back	17	15
Relation to pregnancy or delivery	—	20
Relation to illness	3	5
Other causes	13	16
100% (number)	(230)	(255)
Cause unstated (number)	(83)	(81)

Table VI. The participants' opinion on the day of examination of where the cause of their low back pain was to be found

All age groups together. For the sex difference $p=0.0033$ ($\chi^2=13.71$, df 3)

Cause	Men (%)	Women (%)
Primarily at work (incl. housework)	58	60
Primarily during leisure time activities	10	4
Equally at work and leisure time activities	16	11
Other causes	15	25
100% (number)	(201)	(215)
Unknown (number)	(80)	(79)

using the survey method much of the information is anamnestic; the quality of recollection varies with the recency of the episode and the persistence of questioning (51). Against this background the delimitation of LBP in this study was done only on the basis of the question quoted above. At an interval of about six months, 84% answered this question consistently (3). The reliability of the history of LBP will be further discussed elsewhere (3).

Occurrence

The life time prevalence rates for men were nearly constant within all age groups. This implies that men generally experience their first episode of LBP when young, i.e. before the age of 31. However, forgetfulness may partially explain this finding, particularly among those older men for whom a long time may have elapsed since their last experi-

Table VII. The participants' opinion of where the cause of their low back pain in the follow-up year was to be found

A combination of causes was given by 48 participants (2 causes in combination were given by 42 participants, 3 by 5, and 4 causes were stated by one participant). All age groups together

Cause	Men (%)	Women (%)
Paid work	54	30
Housework	2	22
Leisure-time activity	17	8
Other causes	27	41
100% (number)	(183)	(223)
Unknown (number)	(37)	(25)

Table VIII. The stated type of onset of low back pain (LBP)

All age groups together. Unknown for 13 participants. Given in percent. Sex difference: $p=0.007$ ($\chi^2=7.25$, df 1)

Type of onset	Men <i>n</i> =271	Women <i>n</i> =291
Sudden	55	44
Gradual	45	56

ence of LBP (2). In contrast the women showed an increasing life time prevalence rate for the 51- and, especially, the 61-year-olds. Postmenopausal osteoporosis has been suggested as partly responsible for this increase (2). The life time prevalence rates in this study are among the highest observed in studies of general populations (15, 18, 28, 29, 41, 45, 46). This difference may be due to the varying methods used in obtaining the information (2, 3).

The 11% one-year incidence rate of first time LBP (Table I, Group III) among the 30-year-olds, decreasing with age, accords well with results from Holland (45).

Recurrence

The findings on risk of LBP recurrence clearly show that the more recently and frequently a person experienced LBP previously the more liable he or she will be to experience LBP in the year to come. This was regardless of age. The high significance of previous low back symptoms as a predictor of future symptoms has previously been demonstrated in longitudinal studies (9, 13, 17, 33, 35, 44, 50).

Of those who reported having experienced LBP at least once 23-31% had experienced it daily or

Table IX. The value of the reported type of onset of low back pain (LBP) as indicator for occurrence of LBP in the follow-up year (cf. Table VIII)

All age groups together

LBP in the follow-up year	Men		Women			
	<i>n</i>	Yes (%)	No (%)	Yes (%)	No (%)	
Type of onset						
Sudden	145	56	44	127	54	46
Gradual	121	70	30	163	70	30
χ^2 (df 1)		5.82		8.21		
<i>p</i> -value		0.016		0.0042		

Table X. Progress of low back pain since its onset Unknown for 20 participants. All age groups together

Progress	Men (%) n=272	Women (%) n=283
Has become less pronounced	43	43
More or less unchanged	46	41
Has become worse	11	17

at least once a week (Table III). This is in accordance with other Scandinavian studies (15, 27, 41).

Alleged cause

One of the most frequently alleged causes of LBP is heavy lifting (Table V), and this is well documented in the literature (1, 4-7, 12, 14, 16, 19-21, 31, 37, 39, 40, 42-44, 47, 48). Claims of LBP being caused by a twist or other "wrong movement" of the back are also well-documented (1, 5, 14, 16, 31, 39, 40, 43, 44, 49) as are trauma, including a fall (1, 4, 6, 16, 19-21, 27, 35, 37, 39, 44, 48).

An association between LBP and pregnancy or delivery has also been indicated in previous publications (14, 26, 32, 39). The possible association with illness does not seem to be well illustrated in epidemiological studies, although Rowe (34) also found an association of low back complaints with illness in three percent of the participants in his study.

Regarding the sitting position, Magora (30) observed a high frequency of LBP in subjects who had to sit for prolonged periods of time or who were unable to sit down at all during the work day.

Table XII. Low back pain (LBP) in the 12 months of follow-up compared with previous experiences

For those participants with LBP in the follow-up year. Unknown for 16 participants. All sex differences were with p -values above 0.23. For the age differences: Men, $p=0.033$ ($\chi^2=18.21$, df 9); women, $p=0.12$ ($\chi^2=14.06$, df 9). The figures shown in the table are percentages

LBP in the follow-up year	30 years		40 years		50 years		60 years		All ages	
	Men n=56	Women n=55	Men n=43	Women n=42	Men n=51	Women n=53	Men n=42	Women n=55	Men n=192	Women n=205
First experience	21	18	9	14	10	13	10	5	13	13
Has become worse	7	16	14	21	16	19	33	42	17	25
More or less unchanged	61	56	65	52	63	57	40	44	58	52
Has become less pronounced	11	9	12	12	12	11	17	9	13	10

Table XI. The value of the stated progress of the low back pain (LBP) since onset and to the day of examination as indicator for occurrence of LBP in the follow-up year (cf. Table X)

All participants taken together. $p=1.5 \times 10^{-10}$ ($\chi^2=45.28$, df 2)

Progress of LBP up to the examination day	n	LBP in the follow-up year	
		Yes (%)	No (%)
Has become less pronounced	234	50	50
More or less unchanged	238	65	35
Has become worse	77	92	8

Sedentary occupations have been found to increase the risk of lumbar disc herniation (23). Prolonged driving of motor vehicles, especially trucks, is a particular source of low back complaints (7, 14, 23, 24).

Draughty or cold environments have also been associated with LBP (20, 22, 27, 49), while results regarding the seasonal influence are conflicting (2).

Work was given as the primary cause of LBP by 52-60% of the participants (Tables VI & VII) which is somewhat higher than the 42-50% seen in other studies (1, 7, 16, 27). Pedersen (33) found a relation between work and LBP in only 28% of the cases in a general practice. A similar discrepancy was observed in a study of persons who had taken more than five weeks sick leave because of back pain (5). In that study 56% of the patients (48/86) claimed their work to be the cause, whereas

the physicians found this to be the case for only 19% (16/86) of the persons concerned. The high proportion of participants with LBP who relate their symptoms to work may reflect the recent publicity about the possible relation between working conditions and LBP. On the other hand physicians seem to have been more reluctant to accept this relationship.

Onset and progress

The type of onset reported, sudden or gradual, has also been investigated previously (1, 5, 31, 33), and a sudden onset was found among 40–47% of cases, which is similar to the results in the present study (Table VIII). However, none of the previous studies report a sex difference such as shown in Table VIII, with a higher frequency of sudden onset among men. This difference may be related to the reported cause of LBP (Table V), where men more often than women attributed the onset to trauma and a heavy lift.

The prognostic value of the type of onset for LBP in the follow-up year (Table IX) shows a gradual onset to be predictive of a worse prognosis with regard to recurrence. This confirms the finding in two other prospective studies (1, 33), where patients with a gradual onset of LBP had a longer duration of symptoms than patients with a sudden onset. As pointed out earlier (1) this might indicate that back pain with differing types of onset may vary in some respect. This is supported by the observation of Weber (48), who found a tendency for insidious onset of LBP to be a forerunner of sciatica.

Regarding reported progress, aggravation since the onset was a strong indicator for occurrence of LBP in the follow-up year (Table XI). The progress in the follow-up year (Table XII) emphasises the aggravation of the LBP especially among the 60-year-old women.

CONCLUSION

The descriptive data presented concerning the reported cause and type of onset accord largely with previous findings. Not previously stressed is the heavy burden of LBP on the 60-year-old women in the form of a high prevalence rate, more frequent daily experience of LBP and exacerbation of the trouble since its onset; postmenopausal osteo-

porosis is suggested as partly responsible for this. The sex difference in relation to the type of onset does not seem to have been investigated earlier. The more frequent sudden onset among men is probably connected with their indication of trauma and heavy lifting as the cause of their LBP.

The prospective design of this study made it possible to demonstrate clearly the marked effect of previous episodes of LBP on the occurrence of future complaints. This means that the more recently and frequently a person has had LBP in earlier life, the more liable he or she will be to experience it in the year to come. Similarly a reported exacerbation of the LBP since onset would predict further LBP in the following year. Finally a gradual onset of LBP was found to indicate a greater risk of LBP in the follow-up year than a sudden onset. This observation is probably worth further investigation as it may indicate that the nature of LBP varies somewhat according to the type of onset.

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Address for offprints:

Fin Biering-Sørensen
Laboratory for Back Research
Department of Physical Medicine and Rehabilitation
Rigshospitalet 2001
University Hospital
Blegdamsvej 9
DK-2100 Copenhagen Ø, Denmark