ACTA ORTHOPAEDICA SCANDINAVICA
SUPPLEMENTUM NO. 170

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Acute Low Back Pain in Industry

A controlled prospective study with special reference to therapy and confounding factors

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MUNKSGAARD COPENHAGEN 1977

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The study was supported by
grants from:

The Swedish Work Environment Fund
AB Volvo

ISBN: 87-16-02829-5
ISSN: 0300-8827

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AIMS OF THE STUDY

The aims of this investigation were:

1. to describe a population of patients with acute and subacute low back pain,
2. to determine whether certain confounding factors irrespective of treatment given, are of any prognostic value when assessing the course of acute and subacute low back pain,
3. to evaluate the effect of three modes of therapy on acute and subacute low back pain.

ABBREVIATIONS

MMPI = Minnesota Multiphasic Personality Inventory
Hs = Hysteria
Hy = Hypochondriasis
SLR = Straight Leg Raising Test
NHIO = National Health Insurance Office

INTRODUCTION

GENERAL ASPECTS

Incidence and economical aspects

The importance of back pain syndromes is due to their high prevalence in the community, and their effect on the individual in terms of pain and disability. To obtain a diversified picture of the magnitude of the problem, several factors must be considered, including the frequency in the population, the variations in the course, the age distribution, the number of patients with serious disability and inability to work, and the economic consequences. Evaluation of the epidemiology of low back pain is hampered by incomplete statistics and a lack of uniform definitions.

Probably up to 80 % of all people will experience back pain to some extent during their active life (Hult 1954, Horal 1969, Nachemson 1976). In most cases the condition is self-limiting, with recovery within one month in 70 % and within two or three months in 90 %, while about 4 % seem to have a duration exceeding six months (Horal 1969). Recurrences are frequent, and three or more episodes have been reported in 30 – 70 % of the afflicted patients (Hult 1954, Horal 1969). Although the course is usually benign, the number of severely disabled people is considerable, owing to the general occurrence of the ailment. The back pain patients with more than six months' incapacity to work have been found to be comparable in number with those unfit for work due to rheumatoid arthritis and heart trouble (Haber 1971). And it has been reported that of those off work because of back pain for longer than six months, only 50 % will ultimately return to work (McGill 1968). Back pain is most common between the ages of 30 and 55 years (Hult 1954, Horal 1969, Hirsch et al. 1969, Kelsey 1975). Although the long-term disability is most pronounced in the older age groups (Haber 1971, Wood & McLeish 1974), it is clear that back pain usually affects man in

his most productive age. Hence, back pain occupies a prominent position in the statistics on sick-leave, accounting for 10 – 15 % of all lost workdays in Sweden (Helander 1973). Among manual workers in England the annual absence from work because of back pain is calculated to be about 70 weeks per 100 men employed (Anderson, J.A.D., 1976).

The economic consequences are based on the fact that 1 % of all workdays are believed to be lost due to back pain (Helander 1973). To this cost the expenses of treatment must be added. In England (Wood 1976), in a population of 1.000 persons about 20 each year will consult their general practioner, scarcely 10 will be referred to an orthopaedic clinic, and a little less than one will be admitted to hospital on account of back pain.

Etiology and classifications of low back pain

Back pain is a clinical manifestation that can be caused by a variety of known diseases and morphological changes. The herniated disc is thought to account for 5 % of all cases (Hirsch 1966). Back pain is occasionally caused by infection, tumours, fractures, osteoporosis, ankylosing spondylitis, rheumatoid arthritis, spinal stenosis and intraabdominal or intrapelvic disease. Certain radiological abnormalities with a definite or questionable association with back pain are summarized in Table 1, where some changes not related to back pain are also listed (Nachemson 1976). The majority of back pain patients do not fall into any of the abovementioned categories, and as a rule back pain is a complaint where the underlying pathophysiology is unfortunately unknown. Almost every anatomical structure in the motion segment of the spine has been the subject of etiological discussions (Nachemson 1960, Horal 1969).

Morphological changes occur most frequently in the intervertebral disc (Friberg & Hirsch 1949, Nachemson 1971, Jayson & Barks 1973, Rothman 1973), and also in the intervertebral joints (Badgley 1941, Lewin 1964), and in the vertebral body (Vernon-Robert & Pirie 1973, Rolander & Blair 1975). The degenerative changes in the intervertebral joints of the lumbar spine, however, appear relatively late in life (Hirsch 1966, Nachemson 1976). For several decades attention has mainly been directed to the intervertebral disc. There is a lack of conclusive evidence, but a

Table 1. Radiological abnormalities in the lumbar spine that are of significance for low back pain.

Irrelevant:	Single disc narrowing and spondylosis
	Facet arthrosis, subluxation and tropism
	Disc calcification
	Lumbarization, sacralization
	Intraspongy disc herniation (Schmorl)
	Spina bifida occulta
	Accessory ossicles
	Mild to moderate scoliosis
Questionable:	Spondylolysis
	Rethrolisthesis
	Severe lumbar scoliosis (>80°)
	Severe lordosis
Definite:	Spondylolisthesis
	Lumbar osteochondrosis (Scheuerman)
	Congenital/traumatic kyphosis
	Osteoporosis
	Marked multiple disc narrowing

(After Nachemson: The Lumbar Spine – An Orthopaedic Challenge Spine 1: 59, 1976)

number of indirect indications, of a central role of the disc in the etiology of most cases of low back pain (Nachemson 1971). Disc degeneration is a more or less physiological aging phenomenon but it is assured that certain not yet clearly defined stages in the process are of significance for the production of pain syndromes (Nachemson 1971).

The degeneration of the disc includes morphological changes as well as alterations in the content of water, collagen, mucopolysacharides and cells (Friberg & Hirsch 1949, Nachemson 1971, Jayson & Barks 1973, Rothman 1973, Naylor & Shentall 1976, Naylor 1976). The nutrition to

the degenerated disc is by diffusion only and the central parts, especially the boundary zone between the pulpy nucleus and annulus fibrosus posteriorly, are at risk for nutrient defiency (Nachemson et al. 1970, Maroudas et al. 1975, Nachemson 1976). The posterior area of the annulus fibrosus is early and frequently the site of radiating ruptures (Friberg & Hirsch 1949, Nachemson 1971, Jayson & Barks 1973), which might facilitate leakage of chemically irritant products and allow them to come into contact with nerve endings (Nachemson 1971). Disc degeneration with herniation has also been found to be accompanied by auto-immunological phenomena (Bobechko & Hirsch 1965, Gertzbein et al. 1975, Bisla et al. 1976).

Information on the mechanical properties of the spine is available from measures of intradiscal pressure (Nachemson 1960, Nachemson & Morris 1964, Nachemson & Elfström 1970, Nachemson 1976). These studies show that the pulpy nucleus acts hydrostatically, and the whole disc functions as a shock absorber. In the back patient increased mechanical load invariably increases the pain. Those positions that are known to be painful in connection with low back pain, e.g. stooping and sitting without support, give the highest intradiscal pressures. It has also been shown that the tensile stresses in the posterior part of the annulus can exceed the calculated strength of these fibres during e.g. a lifting manoeuvre, resulting in ruptures (Galante 1967, Nachemson 1976).

Whether these ruptures in the annulus fibrosus can cause pain is uncertain, but it is an interesting fact that at least 50 % of all attacks of low back pain are reported to start in connection with a minor accident or strenuous movement (Seager 1959, Glover 1960). This finding is also notable considering the occurrence of fractures in the end plate of the disc and subchondral microfractures in the vertebral bodies, which have been demonstrated in recent years (Vernon-Robert & Pririe 1973, Rolander & Blair 1975, Hansson 1977). Whether these events in the vertebral bodies are of any clinical importance is not known. The role of the increased intraosseous pressure in vertebral bodies in the pain mechanism is also uncertain (Arnoldi 1972).

Since the etiology is not known in most cases of low back pain, the classification of the disease must be based upon symptoms and clinical findings. Unfortunately, there is a lack of general agreement as to definitions and the basic terminology.

The terminology that has been used in this study corresponds to a classification that has recently been presented to the International Society for the Study of the Lumbar Spine (Nachemson & Andersson 1975). This system relates the terminology to symptoms and clinical findings. The duration and the onset of the disease is given as a prefix. In paranthesis after the symptom diagnosis, additional information can be given e.g. x-ray findings.

The whole system of classification and the terminology is outlined in Table 2.

METHODS OF PHYSICAL THERAPY

A great variety of non-operative treatment methods is used in patients with low back disorders. The reason for this is uncertainty about which method to prefer, probably owing to the lack of knowledge regarding the structural changes causing the symptoms.

There are only a few controlled studies reported in the literature in which the effect of different treatment methods has been investigated.

Manipulation has been evaluated in two separate controlled studies (Glover et al. 1974, Doran & Newell 1975).

Both show an immediate slight superiority of manipulation as compared to conventional physiotherapy, orthopaedic corsets and analgesic treatment alone. These differencies in results disappear after one to three weeks. None of the treatments was found to be better than no treatment at all in the long-term perspective. There are few statistically valid trials on different forms of traction. Lidström and Zachrisson (1970) demonstrated an improvement in most patients with low back pain and sciatica, following Tru Trac traction and isometrical exercises, compared to active mobilization of the spine with back muscle strengthening. Lind (1974), on the other hand, noted a deterioration among patients with the same diagnosis treated according to the same method. Auto-traction was demonstrated in the same study to be significantly superior to bed rest and combined physiotherapy.

Table 2. Classification of Low Back Pain. (After Alf Nachemson and Gunnar Andersson: Classification of Low Back Pain, presented to the International Society for the Study of the Lumbar Spine, 1975)

TABLE 1 a

PREFIX

Acute: 0 – 2 months' duration

Chronic: More than 2 months' duration

Recurring: Symptoms recurring after an interval of no symptoms

TABLE 1 b

SYMPTOM DIAGNOSIS

Insufficientia dorsi

Tiredness and light ache or pain provoked by repeated or forceful movements or by some other mechanical stress, e.g. work position or the same work position for a long period of time. The troubles are localized to the lumbar region. The back feels stiff or weak and the patient tries to avoid certain types of stress which he knows will give this feeling of unease.

Lumbago

Ache and pain localized to the lumbar region with an eventual radiation over the gluteal region, the hips or the lower part of the abdomen. This syndrome is aggravated in the acute stages by all movements and loads, in the more chronic stages only by certain movements and loads on the lumbar spine. Mostly the patient needs some type of analgesic. The syndrome can set in suddenly or the onset may be over a shorter time period.

Sciatica

Ache and radiating pain in one or both lower extremities. This is aggravated in the acute stages by all movements and loads to the lumbar spine, in the more chronically ill only by certain movements and loads. In most instances the patient needs analgesics. The symptoms can be either acute or set in over a shorter time period. The clinical picture includes numbness, paresthesia and a feeling of weakness in one or both lower extremities.

Rhizopathy

This is a special form of lumbago-sciatica or sciatica characterized by the fact that the radiation of the symptoms in the leg is according to the segmental innervation. Most often the patient has neurologic signs according to the affected segment.

Lumbago sciatica

Symptoms as in both lumbago and sciatica. One of these can dominate the picture.

TABLE 1 c

CLINICAL FINDINGS

Insufficientia dorsi

More rarely pain on palpation in the lumbar spine occurs. There is no increased muscular tension. There is no increased pain on motion of the lumbar spine. No neurologic symptoms. Straight Leg Raising Test will not give pain in the lumbar spine.

Lumbago

Acute: Pain on palpation in the back and/or pelvic region. Increased tonus in the lumbar muscles. Definite loss of motion and pain by examination of the motion pattern. No neurologic symptoms. Straight Leg Raising Test might be positive. Straining, coughing, sneezing and similar activities give rise to pain in the back.

Chronic: Eventual pain on palpation in the lumbar spine and limitation of motion. No neurologic symptoms. Straight Leg Raising Test can be positive.

Sciatica

Pain on palpation can occur in the lumbar region and/or the leg. No increased tonus in the lumbar musculature. There is limitation of motion in the lumbar spine and also sometimes in the hip joint. Straight Leg Raising Test positive. Neurological symptoms occur in rhizopathy (see below).

Rhizopathy

Clinical findings as in sciatica or lumbago sciatica. Straight Leg Raising Test nearly always positive. Neurological symptoms commonly positive. Straining, coughing, sneezing and similar activities give rise to pain in the engaged radicular segment.

Lumbago sciatica

Clinical findings as in lumbago and sciatica. Either of these can be dominant.

TABLE 1 d

PARENTHETIC INFORMATION

Radiologic diagnosis
Trauma
Psychiatric, psychological or social diagnosis
Pathoanatomically defined diseases of the back (e.g. spondylitis, pelvospondylitis ossificans etc.)
Tumours

Investigations on the curative and preventive effect of strengthening dynamic back exercises (White 1966, Kendall & Jenkins 1968, Lidström & Zachrisson 1970) have given discouraging results. These studies have rather supported recommendations of immobilization of the spine for relief of symptoms (White 1969).

None of the above-mentioned studies provides the answer to the search for an effective, inexpensive and simple remedy for low back disorders.

In an effort to rationalize the therapy towards these goals, a "Back School" was introduced by Lidström & Zachrisson (1973), based on biomechanical and epidemiological studies on low back disorders. This method of treatment is described in detail on page 29 – 31.

VOCATIONAL FACTORS

At present there is not enough evidence to confirm an etiologic relationship between low back disorders and mechanical strain on the back. Consequently the true relationship between the effect of specific strain on the low back and subsequent clinical manifestations has not been established.

It is widely recognized, however, that an increased load on the already afflicted back produces more pain (Hult 1954, Rowe 1969, Nachemson 1971, Chaffin 1973, Magora 1974).

Measurements of the intradiscal pressure in various postures (Nachemson 1970, Andersson 1974) have shown a similar load on the lumbar spine while standing in a stooped position of 20° as in sitting without support.

These results may be of importance when explaining the outcome of certain studies (Hult 1954, Rowe 1969) on the frequency of low back pain among employees in industry. These investigations indicate that there is no significant difference in the occurrence of low back pain among office employees compared to manual workers. In other studies a significantly higher incidence of back pain is demonstrated among heavy industry workers than among people with less strenuous occupations (Lawrence 1955, Ikata 1965, White 1966, Rowe 1969, Magora 1970, Chaffin 1974).

Other investigations have yielded further information on the incidence of back pain in specific operations of work (Hult 1954, Ikata 1965, Chaffin 1973). A considerably high incidence of back disorders was disclosed in tasks involving very frequent strenuous lifting. A high incidence was also observed in occupations involving only occasional lifting.

A moderate amount of daily lifting was not found to influence the rate of backache. This finding was supported by the results obtained by Magora (1972) who found no relation between lifting and increased incidence of low back pain. Similarly, no evidence was found of an association between the occurrence of acute disc herniation and exposure to lifting, demonstrated in a recent case-control study by Kelsey (1975).

Weight lifting is also mentioned to be one of the most common triggers of low back pain. Magora (1974) related the subjective assessment of the cause to back pain and the occupation. Weight lifting in combination with bending was mentioned to be a very common cause. A combination of flexion, rotation and lifting was found to be the most common cause of back injuries at work according to Troup et al. (1970).

Other physical operations such as bending, rotation, reaching and sudden maximal efforts are also thought to be connected with a high frequency of back pain (Lawrence 1955, Magora 1973). In accordance with the previous analysis of frequent and rare lifting respectively (Chaffin 1973), only excessive bending or occasional ante-flexions during the day increased the number of back cases (Magora 1973).

Sedentary occupations have also been subjected to attention in a few studies. A sedentary occupation, performed for several years, was found to be a significant predisposing factor for acute disc herniation (Kelsey 1975). Similar findings were demonstrated by Kelsey (1975) when studying the association between the driving of motor vehicles and acute disc herniation. These observations support previous implications by Magora (1972), in which a higher incidence of back ailments was found in occupations with prolonged sitting (more than four hours daily). Magora (1972) found a similar high rate in occupations involving almost no sitting but mainly standing. These results indicate that an occupation allowing a proper amount of variation of postures is preferable to a repetitive work as regards the postures.

The discrepancies that seem to be present between the results presented in the above-mentioned investigations may be explained by the various methods of approaching and assessing the same problem. The factors observed to contribute to a high incidence or triggering of low back pain are summarized and listed in Table 3.

Table 3. Factors contributing to the incidence or triggering of low back pain.

Incidence		Triggers
Heavy industry work		Weight lifting
Frequent	lifting	Bending
Occasional		Rotation
Excessive	bending	
Accidental		
Sudden maximal efforts		
Prolonged postures		
Forceful movements		

The occupational environment is in this study treated as a confounding variable, the influence of which is analysed with reference to prognosis among people with acute and subacute low back pain.

PSYCHOLOGICAL FACTORS

In recent literature the distribution of psychological traits in populations of back pain patients is studied, usually without etiological implications. Westrin (1970) found significant differences regarding several personality traits in a comparison between patients who had been sicklisted for back pain and their matched controls. Psychiatric problems, however, were not more frequent among the back patients, except for cerebrolesional symptoms. In another epidemiological study, Nagi et al. (1973) were able to relate certain indices of emotional and psychological problems to the occurrence of back pain.

The psychological conditions associated with back pain are often evaluated using personality inventories, most frequently the MMPI (Minnesota Multiphasic Personality Inventory). The results in groups of chronic back pain patients are uniform in different studies. The hysteria (Hs), hypochondriasis (Hy) and depression (D) scales are elevated, while the other scales are normal or only slightly raised (Hanvik 1950, Beals & Hickman 1972, Sternbach et al. 1973, Timmermans & Sternbach 1974, Wilfling et al. 1973, Gentry et al. 1974, Wiltse & Rocchio 1975). The Hs-, Hy- and D-scales are often referred to as the neurotic triad. Not infrequently they form a specific pattern in the MMPI answer sheet, named the "conversion V", with significant rise of Hs and Hy and a slight rise of D. There is some confusion in the literature about the stability of these scales in low back pain over a period of time (Phillips 1964, Beals & Hickman 1972, Gentry et al. 1974, Wiltse & Rocchio 1975). Sternbach & Timmermans (1975) have shown that the raised neurotic triad has a tendency to become normal after successful rehabilitation. The close connection between the experience of back pain and some of the scales in the MMPI is also obvious from the investigations by Ranford et al. (1976). They classified patients with chronic back pain according to their scores on the Hs- and Hy-scales. A strong correlation was found between a high value on these scales and a tendency to give an anatomical and "expanded" description of their complaints as visualized in pain drawings. Freeman et al. (1976) were able to distinguish between three groups of back pain patients: an organic, a functional and a mixed group. The three groups differed significantly on several of the scales of the MMPI-test.

In a few studies back pain patients have been compared to other groups of patients with regard to psychological factors. Phillips (1964) found that both fracture patients and a group of back patients had higher values on the Hs-, Hy- and D-scales than a group of "normals", but that the differences were more pronounced in the back pain group. Similar findings have been reported by Beals et al. (1972). Sternbach et al. (1973) compared patients with chronic back pain with a number of patients with rheumatoid arthritis in Sternbrocker's anatomical and functional class II–III. The back pain patients were more depressed and more often adopted "an invalid's self concept and life style".

In several investigations the predictive values of psychological factors have been studied in connection with different treatment regimens for back pain. Beals et al. (1972) followed the course of 180 patients in two

groups, one with extremity injuries, and one with back pain. The patients were classified according to physical and psychological ratings. The latter included several inventories, among them the MMPI. Of the two ratings, the psychological one correlated much more strongly to return to work in the back pain group, but not in the extremity injured group. Wifling et al. (1973) tested patients psychologically before spinal fusion was performed. The MMPI discriminated with significance between success and failure, the neurotic triad being found in the failure group. Forrest and Wolkind (1974) described 50 non-operatively treated back patients. They were able to predict the outcome of their treatment using a self-rating scale of psychoneurotic symptoms and behaviour, the Middlesex Hospital Questionnaire. Wiltse and Rocchio (1975) used the MMPI, the Cornell Medical Index and an intelligence test, the Quick test, together with physicians' ratings and biographical data, as predictors of success of chymopapain injection therapy in 130 patients. The MMPI Hs- and Hy-scales were found to be of value. In fact there was a 90 % chance of a good result with very low scores on these scales, but only a 10 % chance when the scores were very high. There were no clinical differences between the high-score and low-score groups. The second best predictor was the physician's own opinion of the patient's psychogenic status. White et al. (1973) found no significant differences in the results of cervical spine fusions in patients with normal and abnormal scores in a psychological inventory, the Cornell Index. An association between back pain and certain psychological traits seems clear on the basis of the reported studies. Some of the studies indicate that populations with and without strong association to these factors have different prognoses. The essential mechanism for this association is obscure, however, and there is a lack of information about the distribution of psychological traits prior to the onset of back pain. Most of the reported studies deal only with chronic cases. It would be of interest, therefore, to study the distribution of the psychological traits and their potential predictive capacity in acute cases.

SOCIAL FACTORS

The literature on back pain in relation to social factors other than purely vocational ones is limited. It is often difficult to define and measure abnormalities in these areas.

In a few Scandinavian socio-medical investigations on back pain a high incidence of multivarious social problems has been found (Westrin 1970, Natvig 1970, Helander 1973). For example, there is an association between sick-leave for back pain and abuse of alcohol (Lokander 1962, Helander 1973). A high percentage of broken marriages, family problems and financial difficulties has been noted among back patients (Natvig 1970, Westrin 1970). Several authors consider that back pain is associated with a low educational level (Natvig 1970, Westrin 1971, Nagi 1973, Gentry et al. 1974), but there is no general agreement on this (Magora 1970), and the association might be caused by a difference in the occupational situation of the less well educated patients.

Roslund (1974) found psychological or social problems in almost half of a population of multi-operated back patients. He was also able to establish that the prognosis in backsurgery was directly dependent on the presence of psychosocial complications.

The investigations quoted point to a link between back disorders and social problems. There is, however, a high proportion of chronic cases and individuals with longstanding sick-leave in the reported studies. The social conditions represent external circumstances that most probably will be affected by chronic disability and inability to work. There is a lack of information as to whether a similar association exists in early, acute, cases and to what degree the occurrence of social problems influences the prognosis in these cases.

PROJECT DESIGN

GEOGRAPHICAL LOCATION

This trial was carried out at the Automotive Division of AB Volvo, Göteborg, Sweden. There are 13,000 people working in the site of the company where this trial was performed. 8,500 are manual workers and 4,500 are clerks and executives. The workshops at the plant are mainly engaged in light industrial work with a predominance of assembly-line work. Most parts of the cars are transported to the Göteborg division from other Volvo factories. Hence, there is also a good deal of materials handling at the factory in Göteborg.

The company has its own health-centre, divided into a Medical Division, an Industrial Safety Division and a Social Welfare Division. The Medical Division has seven physicians, two physiotherapists and a number of nurses. The health service is directed towards preventive medicine and work-related disorders. There is an emergency department to which patients with acute back pain may come for consultation. The investigation was carried out in the health centre by a physiotherapist and an orthopaedic surgeon from the Department of Orthopaedic Surgery I, Sahlgren Hospital, with the assistance of the staff at the centre.

PATIENTS

Criteria for admission to the trial

To be admitted to the trial the patients with low back pain had to meet the following criteria:

1. Acute or subacute back pain localized to the lumbosacral region, with or without radiation to the thigh.
2. Duration of pain before entry to the trial not longer than three months.
3. A pain-free year before the onset of the current episode.

The criteria for excluding patients were as follows:

1. Chronic pain
2. Rhizopathy
3. Pregnancy
4. Back surgery
5. Spondylolisthesis
6. Infections
7. Tumours
8. Ankylosing spondylitis
9. Fractures
10. Senile osteoporosis
11. Structural scoliosis

217 patients were admitted to the trial. All patients were reassessed during the year following the initial examination.

Screening assessment

Patients consulting the health centre because of low back pain were assessed and screened by the physiotherapist according to the criteria for admission to the trial. The patients admitted were at the same time informed about the purpose of the investigation and asked whether they were willing to participate in the trial. They were then asked to fill in a psychological test form and a questionnaire regarding their working conditions described in detail on page 23 and Table 4. They were also examined by the orthopaedic surgeon.

Initial assessment

Standardized assessment forms for onset-related factors, the intensity of pain, functional limitation, and objective clinical findings were utilized by the physician when examining each patient. After being assessed, the patients were allocated at random to one of the three treatments. (See statistical methods page 39). The orthopaedic surgeon was in no way involved in any of the treatments given to the patients.

Reassessment

After the initial examination the patients were reassessed after ten days, three weeks, six weeks, three months, six months and one year. On these occasions the same assessment forms were used as when examining the patients initially. A few additional questions concerning changes in the clinical picture were, however, added. This standardized procedure for interviewing the patients ensured that each patient received an identical examination. If any patient recovered before the ten-day reassessment, the three-week re-examination was excluded. Similarly, the six-week examination was left out if the patient recuperated after the three-week examination. This means that the patients were reassessed at least five times and at the most seven times during one year.

Questionnaire on vocational factors

This form included questions on the category of employment (office or manual work), the occurrence of shift work and an assessment of the physical and mental load on the patient in his work, using questions that have previously been used by Magora (1972, 1973). The questions included an analysis of the patients working posture (sitting, standing, fixed) and an evaluation of the need for bending, twisting, lifting and forceful movements during the patient's work. The need of concentration and the degree of variation during work and possibilities of taking breaks were registered as well as the patient's feelings of fatique and nervousness during work. The patient was also asked about his satisfaction with his work and whether he would like to change jobs. The questions asked have three alternative answers, listed in Table 4.

Questionnaire on socio-medical factors

The form listed questions on family conditions (marriage, children and housing, participation in sports activities (yes, no) and physical exercise (>once/week, not regularly, rarely) and the presence of previous or current psychosomatic symptoms (gastric ulcer, gastritis, headaches, chest pain).

Forms for the registration of symptoms

Initial assessment

The history of back pain was summarized, and the duration of the current episode was recorded. The circumstances of the onset of symptoms were also noted. The intensity and quality of pain and the degree of functional limitation were analysed in the following way:

A. Pain intensity:

Table 4. Vocational questionnaire – alternative answers.

	1	2	3
Mechanical stress; postures	**Often:**	**Sometimes:**	**Rarely:**
Sitting; standing	⩾ 4 hours/day	2–4 hours/day	< 2 hours/day
Bending; twisting; lifting ⩾ 5 kg	⩾ 10 times/day	< 10 times/day	a few times/day
Lifting ⩾ 20 kg	> once/hour	⩽ once/hour	a few times/day
Forceful movements	⩾ 10 times/day	< 10 times/day	a few times/day
Vocational exhaustion:			
Back fatigue	never	now and then	daily
General fatigue	none	slight fatigue	daily exhaustion
Nervousness	never	sometimes	daily
Variation; concentration; breaks:			
Variation in working tasks	none	repetetive but somewhat varied	varied
Variation in working postures	none	a few fixed postures	optional postures
Breaks	rarely	a few times/day	> once/hour
Concentration required	all day	occasionally	none
Satisfaction:			
Working tasks	good	fair	bad
Environment	good	fair	bad
Colleagues	good	fair	bad
Monotony	varied	fairly varied	monotonous

The patients were asked to choose one of the following descriptions of their pain:

1. Terrible pain
2. Intense pain
3. Sharp stabbing pain
4. Spasmodic pain
5. Intense dull aching
6. Slight stabbing pain
7. Slight dull aching
8. Feeling of discomfort
9. Feeling of stiffness
10. Feeling of exhaustion
11. Insignificant pain

The numbers 1 to 5 were pooled into one group under the designation "Intense pain" and the remaining categories were called "Slight pain".

B. Functional limitation:

The patients were asked about 10 different daily activities (Table 5). For every activity the subject was asked whether he could perform it and, if so, whether it was with or without pain aggravation.

Table 5. The inquiry form about difficulties to carry out ten daily activities. Four alternative answers were possible. 1) No difficulties, 2) Painful but possible, 3) Not possible owing to pain and 4) Uncertain.

Walking
Walking in stairs
Running
Stooping over a wash-basin
Carrying a bag
Making a bed
Riding in a car
Going to the theatre or cinema
Participating in sports
Sitting for a longer period of time

C. Quality of pain:

Questions were asked to determine whether the pain was continuous or only felt in connection with movements and strains, and whether it caused sleep disturbances or was aggravated by coughing or sneezing.

Reassessment

The patients were asked about the duration of back pain and the duration of sick leave since the last investigation. If the initial episode of back pain still persisted, the patient was asked the same questions about pain intensity, functional limitation and quality of pain as in the form used at the initial examination. If the patient had developed sciatica, this was also noted. If the initial episode had subsided, the patient was asked about relapses and about the occurrence of lumbar insufficiency since the last examination. The patient was considered to have an episode of back pain if he had continuous or episodic pain in his back every day, and all patients fulfilled this criterion at entry to the study. If he only had a feeling of weakness in his back, or pain only on exertion, not causing daily pain, he was considered to have lumbar insufficiency.

Form for objective findings

The localization of the pain was plotted on a map. The presence of postural scoliosis, muscle spasm and pain on palpation and percussion was registered.

The range of motion and aggravation of pain in the different planes of motion were registered. Flexion, lateral flexion and extension were measured by Schober's modified method, as modified by Moll and Wright (1971).

Flexion was measured by plotting marks on the following locations of the patient's back:

1. The lumbosacral junction ("the spinal intersection of a line joining the dimples of Venus")
2. Ten cms above and 5 cms below the lumbo-sacral junction.

The distance between the upper and the lower marks was measured in standing erect and then in maximal flexion. The difference between the distances represented the ability to flex the spine.

Lateral flexion was measured by plotting one mark on the iliac crest and one mark on a horizontal line through the xiphoid process in the mid-axillary line of the trunk. The distance between the two marks was measured in standing erect and in maximal lateral flexion. The difference of the distances represented the lateral flexion of the spine.

Extension was measured by using the same marks as in lateral flexion. A thread with a pointed weight was held so that the point of the weight coincided with the lower mark. The patient was then asked to bend backwards as much as possible. The pointed weight traversed the flank. The distance was measured as representing the spinal extension.

Rotation was measured with a goniometer with the patient sitting.

Straight Leg Raising test (SLR) was defined as pain in the back when raising passively the straight leg.

The abdominal muscles were tested by the ability to do sit-ups. The patient was placed in a supine position with his knees flexed at 100°. Normal strength of the abdominal muscles was defined as a sit-up without using the hands or moving the feet.

The back muscles were tested with the patient in a prone position on the bench of examination. The ability to lift the trunk from the bench was defined as normal back muscle strength.

The presence of fixed or impaired gait was registered. A neurological examination, including sensibility in the legs, strength of the great toe extension, and patellar and achilles tendon reflexes was carried out. At the initial assessment the neurological status was always normal, owing to the criteria for the patient selection.

Forms for psychological tests

The Hysteria (Hs) and Hypochondriasis (Hy) scales have been isolated from the Minnesota Multiphasic Personality Inventory (MMPI) (Hathaway & McKinsley 1967). These scales will from now on be called the Hs- and Hy-scales. Earlier experience of this test in studies of low back pain is reported on page 17-19. The isolated scales were modified for a Swedish population by exclusion of certain questions. In its modified form the questionnaire comprised 56 questions altogether. At the six-month ex-

amination the Eysenck Personality Inventory (Bederoff-Petersson et al. 1968) was administered to the patients. This inventory included a neuroticism-scale, an extroversion-scale and a lie-scale.

Additional data

The patients' sociomedical circumstances have been further elucidated by information obtained from the social workers employed at Volvo. Any contact with the social workers was registered, and whether the contact had occurred before or after 1974, and the reason for the contact was noted.

Information about the total amount of sick-listing under various diagnoses during a period of 2 years before entry to the study was obtained for each patient from the National Health Insurance Office (NHIO). The patient's own statement as to his sick-listing for back pain during the time of the study was also checked with the NHIO.

"Pain index"

In order to describe changes in pain of the population studied a "pain index" was introduced. The "pain index" was based on several of the questions regarding pain as listed in Table 6. The inquiries were provided with scores arbitrarily chosen by the investigators. An attempt was made to range the scores according to the intensity of pain. The range of scores of the "pain index" was 0 – 70 points. (0 = no pain; 70 p = a maximum of pain).

Table 6. Questions about pain with scores giving rise to the »pain index». The range of scores = 0 – 70 points.

	No		Yes
»Intensive pain»	0		15
Sleep-disturbing pain	0		5
Continuous pain	0		5
Increased pain when coughing and sneezing	0		5
Increased pain when flexing back	0		10
Increased pain when extending back	0		10
Functional limitation (10 questions; each ranging from 0 – 3 points)	0	–	30

Analgesics

Only in case of need the patients were provided with analgesics. The choice of analgesics was standardized to either salicylates, paracetamols or a combined analgesic (Doleron® ☆, Astra).

METHODS OF TREATMENT

Back school – M. Zachrisson-Forssell

The Back School was put together and initiated by Marianne Zachrisson-Forssell, Registered Physiotherapist, at the Department of Orthopaedic Surgery at Danderyd Hospital in 1970. It is based on research on the etiology of low back pain, intradiscal pressure measurements, EMG, and epidemiological studies.

Aims and procedure

The Back School is divided into four 45-minute sessions during a 2-week period under the supervision of a physiotherapist. Between 6 and 8 patients participate in each course and all patients are given thorough information about the Back School at their first appointment at the clinic. The instruction at the Back School is carried out by means of a sound slide program, "The Back School". A plastic skeleton, flipover charts and other practical aids, such as cleaning materials, boxes, weights etc. are also used.

First lesson

The first lesson starts with a presentation of the contents of the whole course and the patients are told that they will be given a test of their knowledge at the end of the course. They are told this at an early stage in order to stimulate their active attention.

☆ Acid. acetylsalicyl., (2-diaethylaminoacthyl.) phenthiazincarboxyl.-(10)-chlorid., constit. q.s., dextropropoxiphen. chlorid., coffein, phenazon. constit. obd.

Different aspects of back disorders are discussed, including their occurrence and which patients suffer pain and when, and it is emphasized that many people have the symptoms periodically. The patients are given full details of the anatomy and function of the back and the results of research and studies on back pain. Various methods of treatment are discussed and the body's natural capacity for healing is emphasized. The fact that decreased strain on the back somewhat relieves the painful back is also emphasized. It is also stressed that increased strain on the tissues gives an increase in symptoms. It is, therefore, important that the patients learn, right from the beginning, the most restful position during rest, the Semi-Fowler position. The entire instruction, therefore, takes place in this position instead of in the seated position which in itself is a more strenuous position for the back.

Second lesson

During the second lesson the mechanical strain in different positions and during different movements is discussed and the influence of the centre of gravity on the strain on the back is explained. The function of the muscles and their influence on the back is demonstrated. The patients are instructed in isometric abdominal muscle exercises and encouraged to continue these exercises, as the only "programme of home exercises", every day for the rest of their lives. (The exercises take 40 seconds to perform). Back muscle exercises are discussed and the patients are told that these exercises expose the back to increased strain, with a risk of aggravation of the symptoms.

Third lesson

The third lesson consists of practical application of the previously acquired theoretical knowledge and is the most important part of the Back School in order to give the patient the confidence needed to eliminate factors unfavourable to his back.

Two common unfavourable working postures are analysed in detail. In the seated position support should be provided behind (by means of a back-rest) or in front of the body, but an alternating position is preferable. Working in the standing position, leaning forwards, is just as bad as the seated position as regards strain, but the strain can be lessened by using various aids and distributing the body weight.

The patients are asked to describe their own work situations and the group endeavours to arrive at a more suitable solution for each individual.

Special attention is devoted to lifting techniques. Strong leg muscles are a prerequisite for consistent use of a correct lifting technique i.e. with the knees bent. Exercises for strengthening the leg muscles are therefore included.

In order to enable the patients to get into and out of bed even during periods of acute pain, they are also trained in this manoeuvre. Patients are instructed to rest on their beds in the Semi-Fowler position frequently during acute back pain and to avoid strain.

Fourth lesson

The fourth and final lesson mainly consists of encouraging the patients to increase their level of physical activity during leisure hours in spite of their back disorder. The advantages of starting physical training in water are emphasized. The supportive effect of water contributes to a relief of pain and its constant resistance is regarded for fitness training.

Participation in various types of physical activity and sports is encouraged in order to improve psychological and physical tolerance to pain and stress.

Finally, the patients are examined to see how much they have learnt from the course and to give the physiotherapist an opportunity to clear up any misunderstandings.

The patients are on the same occasion provided with a written summary of the principal contents of the Back School.

Additionally, patients attending the School are also offered one session of pool exercises under the supervision of the physiotherapist. The exercises are individually adjusted to the condition of each patient.

In this trial 70 patients were allocated to the Back School at random. None of the patients was absent from any of the four lessons.

The physiotherapist finally made an analysis of the working conditions by visiting the patient's work-site for about an hour. The physiotherapist was well acquainted with the working conditions since, before the beginning of the trial, she was doing assembly line work for a considerable time. Improper working postures were, when possible corrected. The physiotherapist did a follow-up visit at the work site two weeks later, for about half an hour to see whether the patients still succeeded in following the instructions given.

Certain tasks of work could not be carried out in proper working postures owing to the construction of the work site. Suggestions were then made to the work managers on adjusting the work sites in order to improve the working conditions for the back patients.

If immediate changes were not possible, attempts were made to transfer the patients to another work-site if the condition of the back so required.

Ten patients changed occupation during the year of observation owing to their back disorders.

Combined physical therapy – B. Malmström, A. Zellman.

The patients in the combined physical therapy group were treated by registered physiotherapists specially trained in manual therapy. This therapy is based on methods developed by Dr J. Cyriax (1959), England (general diagnosis), the Norwegian physiotherapist F. Kaltenborn (1975) (examination and treatment) and dr Karel Lewit (1977), Czechoslovakia

(especially the pelvic examination and diagnosis). Where this was adequate, the patients in this group were treated with manual therapy and in accordance with the methods developed by Dr V. Janda (1975), Czechoslovakia, who has made special studies of the muscular system. He has concentrated his attention to the muscles with mainly postural function and which contract as a result of incorrect movements and strain. He also refers to muscles with mainly phasic function and which react with inhibition and weakening. According to Janda, these incorrect muscle movements often lead to back symptoms.

The patients were also given a five minute information on lifting technique and on the importance of avoiding strenuous movements.

Methods of examination

The treatment is based on a thorough investigation in order to be able to arrive at as specific a diagnosis as possible on the basis of the various tests described below.

The investigation comprises the active and passive mobility in the patient's back and adjacent joints and also isometric muscle tests. The treatment given depends on which structure or structures (muscles, joints, ligaments or discs) that cause(s) the symptoms.

The patient is investigated standing up, sitting with his pelvis fixed, lying prone, supine, and in the lateral position.

Standing

The patient is undressed and inspected from the front, back and side for control of static posture, any difference in leg length, the position of the pelvis, lordosis-kyphosis-scoliosis, and the position of the head and shoulders. Walking on the toes and heels and Trendelenburg's test are also carried out. The patient is asked to lean backwards, sideways and forwards until pain occurs for control of the curvature of the spine, investigation for scoliosis and lateral deviations when leaning forward due to pain. The spine is also investigated during the active movements for signs of rigid segments indicating hypomobility or excessively mobile segments indicating hypermobility. The distance between the fingertips and floor when the patient leans forwards is measured.

If pelvic imbalance or a difference in leg length is suspected the patient is placed on two scales. Any difference in the load is measured and one or more plates are placed under the shorter leg in order to test whether balance can be restored.

To distinguish between true leg-shortening and pseudo-shortening due to rotation of the pelvis (i.e. one half of the pelvis is rotated forwards or backwards in relation to the other half) additional tests are performed in the prone and supine positions (see below).

Sitting

The position of the spine is checked once again and tests are carried out to see whether any scoliosis due to leg shortening disappears and whether the patient can sit up straight or adopts a special posture due to pain. The rotation of the upper half of the body with the pelvis fixed is also investigated. The patient sits astride the treatment bench. The rotation is tested actively, passively and against resistance. The main factor investigated in the passive tests is whether the spine permits a slight additional elastic stretching in the extreme position. Pain in any rotational direction shows which movement should be avoided during the investigation, particularly in the lateral position.

Prone

Kibler's test is the first test performed in this position. A fold of skin on each side of the spinal process is "rolled up" the spine between the thumbs and index fingers. A positive finding (a distinct change in consistency of the skin, with or without pain) suggests engagement of the corresponding segment, dermatome, myotome, or sclerotome. A springing test for control of the elasticity between the vertebrae is also performed. The index and middle fingers are placed stepwise over the transverse process of each vertebra. With the other hand placed over the fingers, light pressure is applied in the ventral direction. Positive Kibler's test findings, such as a dermatome, myotome or sclerotome, will now be discernible. A "normal" elasticity between the vertebrae in spite of pain is a stronger indication of a myotome if several pairs of vertebrae are engaged and the muscle itself feels hard. A dermatome is more local and shows segmental extension. Lack of elasticity between one or more lumbar vertebrae must be further investigated in the lateral position.

Hyper- or hypomobility in the iliosacral joints is investigated. Manual pressure is applied distally over the sacrum in the ventrocranial direction and the two iliosacral joints are palpated alternately and compared. Slight elasticity should normally be detectable between the edges of the joint surfaces. If hypomobility is present the joints feel inelastic and hard and they are usually painful. The hypomobility in the iliosacral joint can be confirmed by passively lifting one leg during simultaneous fixation of the sacrum. If the leg on the same side as the suspected hypomobile iliosacral joint feels heavier and cannot be lifted up as high as the other leg, the findings are positive. This is known as Mennell's test.

In hypermobility the elasticity in the joint is considerably increased and is often associated with pronounced pain.

The above tests for hyper- and hypomobility place great demands on the therapist's palpation sensitivity.

Any tension in the piriform muscle or pain from the origin of the iliac muscle is palpated. The psoas and rectus femoris muscles are investigated to see whether they are shortened or contracted due to pain.

According to Janda, the function of the above muscles is mainly postural i.e. they react to incorrect movements by contracting. The elasticity of the muscles and joints is tested in the prone and the supine positions (see below). If the elasticity in the iliosacral joints is normal but the patient experiences pain during passive lifting of the leg and extension is restricted, a pure muscle reaction should be suspected. The elasticity of the rectus femoris muscle is tested by flexion of the knee.

Supine

A straight leg raising test (SLR) is done and if this causes lumbar pain a forced test is performed i.e. the foot is dorsiflected passively and the patient flexes his neck actively. A positive SLR between 0 and 30° in the hip joint with increased radiation of pain to the lumbar region and along the sciatic nerve below the knee when the joint is forced also indicates root engagement. Pain behind the knee and in the back of the thigh, often bilaterally, during passive leg lift above 45° indicates pseudo-positive SLR due to shortening of the hamstrings.

According to Janda, these muscles – biceps femoris, semimembranosus and semitendinosus – also belong to the group with mainly postural function. If the patient is able to flex the hip joint to 80° with his leg straight the elasticity of the hamstrings is normal.

For investigation of the hip joint, maximal flexion with the knee bent is checked and inward and outward rotation and adduction (Downing's test) are tested at 90° flexion.

In Patrick's test for abduction the leg is allowed to fall outwards with the knee flexed and the foot level with the knee of the other leg, with fixation of the superior anterior iliac spine on the opposite side to prevent movement of the pelvis. In all these tests the two sides are compared. Positive findings in Patrick's and Downing's tests, i.e. reduced mobility often combined with pain, suggests blockage in the iliosacral joint if the findings for the hip joint in other tests are normal.

Positive findings in Patrick's test may also be caused by contraction of the short adductors (mainly postural function). In this case the mobility will be fairly equal in the two hip joints during abduction and the patient will experience tightness in these groups of muscles.

The ligamentous apparatus of the pelvis is also tested, particularly the iliolumbar, dorsal, iliosacral and sacrotuberal ligaments.

In this test the ligament is first exposed to passive stretching. With the patient in the supine position, the test leg is adducted at the hip with the knee flexed. The degree of flexion and adduction in the hip joint depends on which ligament is to be tested. The ligament is stretched by applying pressure to the adducted leg in the longitudinal direction of the femur for about 20 seconds. An increased dull pain over the iliosacral joint or in the groin may be a positive finding.

Leg length is investigated once again if earlier tests of the pelvis indicated hypomobility with or without rotation. To confirm this the following test is performed. If the pelvis is "rotated", the legs become longitudinally displaced, relative to one another, when the patient sits up from the supine position with his legs straight. The medial malleoli are used as reference-points. In a positive test one leg is displaced relative to the other and primary restriction of mobility is then almost always present in the pelvis and not in the lumbar spine. This is known as the Yo-Yo test.

Any radiation of the pain and abnormal sensibility is noted. The strength of the rectus abdominis and obliquus muscles is checked and the iliopsoas muscle is investigated for contraction. If the test in the prone position gave reason to suspect contraction, the following test is performed. The patient sits on the edge of the treatment bench, lifts one leg and holds it flexed against his chest in order to fix his pelvis. The patient is then helped into the supine position. The leg being tested hangs

freely and relaxed. If the psoas muscle is normal the thigh will hang below the horizontal line, and if the rectus femoris muscle is normal the knee can be flexed to 90° without causing flexion of the hip joint (to compensate for knee flexion).

Lateral position

With the patient in the lateral position, the specific mobility between the spinal processes is investigated. A palpating finger is placed stepwise between two spinal processes and the patient's flexed leg is held with the other hand. By lordosing and kyphosing the patient's lumbar spine alternately it should be possible to feel the spinal processes moving apart and towards each other. A positive finding between two processes means too much (hypermobility) or too little (hypomobility) movement between the spinal processes compared to the movements in other segments.

It will often be found that the segment above or below a hypomobile segment is hypermobile. Conversely, the segment above or below a hypermobile segment is often hypomobile.

After completion of the extension-flexion investigation, the patient's lower leg is moved towards the ceiling and the floor with the hip and knee joints still at an angle of 90°. This leads to a sidebending of the lumbar spine which is also palpated between the spinal processes. Finally, the patient's pelvis and leg are held still and his spinal processes are palpated while he is made to perform rotational movements with his trunk. All these tests are carried out in the least painful direction, as indicated by findings in the standing or seated position.

In general, the investigation in the lateral position is performed with the patient lying on the painful side. Thus, if the pain radiates down into the left leg, the patient lies on his left side.

The findings of the investigation are assessed and the patient's treatment is individualized on the basis of these findings.

Treatment

Patients with pronounced pain, sometimes in connection with postural scoliosis and difficulty in walking, have been taught how to lessen the strain on their back. When the pain begins to decline the patient returns for more specific tests and is treated in accordance with the findings.

Patients with restricted mobility are given mobilizing treatment for the hypomobile area. Mobilization preferably means that only the hypomobile segment is moved passively (articulated), the adjacent mobile segments being fixed. This is usually done with the patient in the lateral position when the lumbar spine is engaged.

Patients with hypermobile segments are given stabilization exercises and a strict back regimen described below, including information on how to sit down and get up out of a chair, how to sit properly, how to choose a suitable chair etc. The stabilization exercises consist of the therapist applying manual pressure in certain directions and the patient responding by pushing back. This is done in various positions, starting with the individual segment and gradually increasing the number of segments until the whole of the lumbar spine is stabilized.

The aim of this treatment is to train the patient to stabilize certain parts of his back reflexively with his muscles and thus prevent the hypermobile parts from coming into the extreme position and causing pain. The patient is taught to work from his hip joints.

Patients with a blocked iliosacral joint are treated with gapping. The patient lies on the side in which the iliosacral joint is blocked (e.g. the left side). His left ilium is then fixed and his right leg is flexed at the hip joint. The therapist holds the sacrum and right ilium fixed with one or both hands and places her finger-tips just medial to the left iliosacral joint. The patient performs a maximal right rotation of his trunk and body and tries to look at the floor while taking a deep breath and slowly breathing out through his mouth. Gapping occurs at the movement of relaxation caused by exhalation. The effect can be checked immediately by repeating the passive leg lift test with the patient in the prone position. If both legs are equally heavy and extension is increased the procedure has been successful.

Patients with a "rotated" pelvis are treated with articulation. In cases in which the left ilium is rotated forwards (it is actually the sacrum that has rotated around its own axis) the patient is placed on his right side with his right leg fixed in extreme extension in order to lock the right ilium with the iliofemoral ligament. The left hip joint is flexed and the therapist presses backwards on the superior anterior iliac spine with one hand and pulls on the ischial tuberosity with the other. This results in a rotational movement in the left iliosacral joint. A positive effect can immediately be detected by performing the Yo-Yo test: both legs now have the same length both when the patient is lying down and when he sits up. Restitution of the balance can also be checked by placing the patient on two scales.

Patients with contraction of postural muscles are given stretching exercises for the groups of muscles concerned. For stretching of, for example, the hamstring muscles of the right leg, the patient is placed in the supine position and his right hip joint is flexed until tightness occurs in the back of the knee and/or until the pelvis begins to rotate. The patient is then made to perform a maximal isometric contraction of the hamstring muscles for 5 – 6 seconds against manual resistance. This is followed by total relaxation during which the leg is immediately flexed passively at the hip joint with the pelvis firmly fixed and the leg straight. It is important to avoid the slightest abduction, adduction or rotation in the hip joint. The leg is held in this new position for up to 20 seconds. The exercise is repeated 4 – 5 times, each time in the new starting position that the increased elasticity of the hamstring muscles allows. The passive stretching occurs during the muscle's refractory period.

These exercises, which the patient also performs at home, using a somewhat different technique but according to the same basic principles, must not be carried out in the morning. Through this special stretching technique, several of the normal protective mechanisms of the muscle are put out of action. Fine coordination through the gamma system does not function satisfactorily until some hours after the individual gets up.

Patients with weak muscles are of course given static and dynamic exercises to increase their strength.

72 patients were allocated at random to the above described treatment. Four patients never came to treatment. The non treated patients were included in the physiotherapy group in all analyses except the estimation of the duration of symptoms following the first treatment.

The number of treatments in the physiotherapy group were maximized to ten. The average number of treatments given were four.

Table 7 shows the clinical findings and subsequent treatment of 68 patients, assessed by the physiotherapists.

"Placebo"

Short-waves of the lowest possible intensity has been the third method of treating a group of patients. The heat produced at this intensity may, at the most, increase the local blood-flow of the subcutaneous tissues (Hovind & Nielsen 1973).

This treatment has therefore been regarded as a placebo.

75 patients in this study were randomized to this third group. 59 patients followed the treatment.

A maximum of ten treatments was given to each patient. The average number of treatments given were five.

The non-treated patients were included in the "placebo" group in all analyses except the estimation of the duration of symptoms following the first treatment.

Table 7. Distribution of clinical findings and subsequent treatment in the physical therapy group. – The therapists' assessment.

Diagnosis	No.	%	Treatment[1]
Hypomobile lumbar segment	11	16	1. Articulation of hypomobile segment with simultaneous fixation of adjacent segments 2. Specific movement-promoting active exercises of the engaged segments
Hypomobile lumbar segments and shortened postural muscles	6	9	1. Articulation 2. Specific movement-promoting active exercises 3. Stretching of shortened postural muscles
Hypomobile sacro-iliac joint	8	12	1. Gapping with blockade 2. Articulation with rotated pelvis
Hypomobile sacro-iliac joint and shortened postural muscles	4	6	1. Gapping or articulation 2. Stretching of shortened postural muscles
Hypomobile lumbar segment and hypomobile sacro-iliac joint	9	13	1. Articulation of hypomobile lumbar segment 2. Gapping or articulation of hypomobile sacro-iliac joint 3. Specific movement-promoting active exercises
Hypomobile lumbar segment, hypomobile sacro-iliac joint and shortened postural muscles	4	6	1. Articulation of hypomobile lumbar segment 2. Gapping or articulation of hypomobile sacro-iliac joint 3. Stretching of shortened postural muscles 4. Specific movement-promoting active exercises
Disc engagement	8	12	1. Pain relief a) analgesics b) unloading resting position, usually Semi-Fowler position 2. Test-traction
Muscular disorders	15	22	According to clinical findings, one or a combination of the following alternatives: 1. Heat 2. Stretching of shortened postural muscles 3. Isometrical strengthening-exercises of weak muscles 4. Exercises of endurance 5. Exercises of coordination 6. General physical exercises
Inflammation of the dura mater	3	4	Antiphlogistics

[1] The methods of treatment are mentioned in the same order as they are performed on the patients.

STATISTICAL METHODS

Stratification and randomization

Stratification of the patients was based on vocational and psychologic factors. The vocational and psychologic forms described on pages 23, 27 were filled in by the patient at the screening assessment and given a score according to a standardized pattern. The vocational questionnaire scored from 10 – 30 points. The hs- and hy-scales had scores from 0 – 41 points and 0 – 31 points respectively.

Every score above or below a middle value of each scale was given a code.

Depending on the scores of the questionnaires each patient was at last provided with one of eight possible combinations of codes. The eight combinations of codes were used when randomizing the patients to one of three modes of therapy. Separate tables of random numbers were used for each combined code.

Evaluation of results

When estimating the relation between certain confounding factors and certain criterion variables the data was arranged in the form of contingency tables from which chi-square test was carried out. The median values of the criterion variables were used in the contingency tables for the calculations with chi-square test. The median values were chosen due to a skew distribution of the criterion variables.

Contingency tables and chi-square test were also used when comparing absence from work, number and length of recurrences in one year in the three groups of therapy.

When estimating the differences in "pain index" between the treatment groups an analysis of variance was performed and contrasts of the differences between the three groups were constructed.

A covariance analysis was used when comparing the duration of symptoms following the first treatment in the three groups. The covariance analysis was used to see whether possible effects of any of the treatments could be explained by differences in time between the onset of symptoms to the first treatment in the treatment groups.

The test functions of covariance analysis require underlying normal distributions and as the distribution of the duration of the initial episode was rather skew, logarithms of the values were used.

Results Part I

The profile and the clinical manifestations in the 217 patients are presented in Part I, by means of frequency tables.

Results Part II

The influence of certain confounding factors on the course of acute and subacute low back pain is assessed by relating the confounding variables to:

1. The duration of the initial episode,
2. the duration of sick-leave during the initial episode,
3. the summarized duration of recurrences of pain in one year, and
4. the total absence from work in one year owing to recurrences.

Results Part III

The efficacy of the three different modes of treatment for acute and subacute low back pain is evaluated by comparing:

1. The duration of symptoms following the first treatment,
2. the length of absence from work during the initial episode,
3. the variation in experience of pain during the initial episode, by means of the "pain index" (see Methods, page 28.)
4. the number of recurrences in one year,
5. the length of recurrences in one year, and
6. the total absence from work in one year owing to recurrences.

RESULTS PART I

PATIENT PROFILE

Age and sex

The distribution by age and sex in the studied population is illustrated in Fig. 1. 13 % of the patients in the study were women while 20 % of the employees at Volvo Gothenburg are women.

The youngest patient in this study was 17 years old and the oldest was 64 years of age. The median age was 34.5 years.

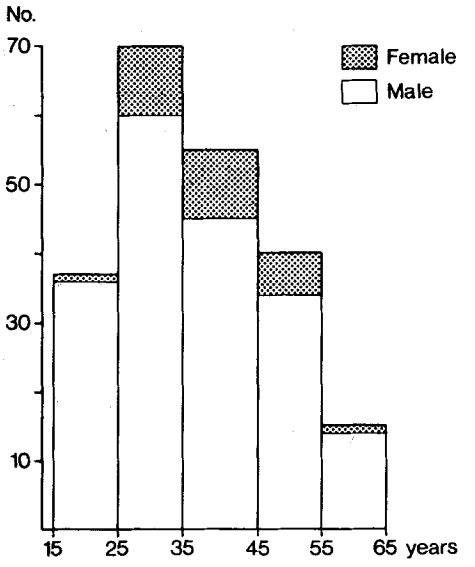

Fig. 1. Age and sex distribution of the patients.

History of back pain

43 % of the patients reported no previous episodes of back pain. 32 % had had back pain only once before, while 25 % of the patients had had more than one episode of back pain. Table 8.

Table 8. The occurrence of previous episodes of back pain.

Number of episodes	Number of patients
None	93
One	69
Two	15
Three	10
More than three	27
Information lacking	3

Onset of current episode of back pain

The onset of back pain was sudden in 44 % of the group while 56 % of the patients reported a more insidious onset. 42 % stated that the symptoms had started during working-hours and 51 % of the patients reported that the pain first occurred during leisure time. 7 % were unable to relate the onset of their symptoms to time. In 45 % of the patients the symptoms appeared in connection with a specific incident i.e. bending, twisting, lifting, a sudden movement or a fall. The circumstances of the onset of symptoms are shown in Table 9.

Table 9. Circumstances of the onset of back pain.

		Number of patients
Type of onset:	sudden	96
	insidious	121
Time of onset:	working hours	92
	leisure time	110
	uncertain	15
Incident related to onset:	none	119
	a fall	2
	a lift	36
	bending	34
	a sudden movement	7
	other incident	17
	information lacking	2

Duration of symptoms before entry to the study

The time between the onset of back pain and the initial assessment of the patient ranged from 1 to 86 days. Most patients (83 %) had had their back pain for less than three weeks at the first examination. The median duration of symptoms of the studied group before entry to the study was 9 days. The duration of symptoms before entry to the study is shown in Table 10.

Table 10. Duration of symptoms before entry to the study.

Duration of symptoms	Number of patients
Less than 1 week	79
1 to 2 weeks	63
2 to 3 weeks	37
3 to 4 weeks	11
4 to 8 weeks	25
More than 8 weeks	2

Subjective symptoms

The pain was considered intensive by 67 % and not intensive by 33 % of the patients, according to the ten possible answers to the questions regarding pain. Continuous pain during the day was reported by 49 % while the remaining patients stated that pain occurred only in connection with movements or strain. Some pain at night was experienced by 40 %, but only 23 % of all the patients reported sleep disturbances. The pain was accentuated by coughing and sneezing in 42 % of the patients. The characteristics of pain in the group of patients are presented in Table 11.

Table 11. Characteristics of pain

	Number of patients			
	Yes	No	Uncertain	Total
Intensive pain	145	72	0	217
Continuous pain	106	111	0	217
Night pain	86	131	0	217
Sleep disturbances	49	168	0	217
Accentuation of pain when coughing and sneezing	92	105	20	217

The degree of functional limitation due to back pain with respect to ten activities of daily living is listed in Table 12.

Table 12. Functional limitation of activities of daily living.

	No increase of pain	Uncertain if the pain increased	Increase of pain but can be done	Cannot be done because of pain
Walking	124	2	86	5
Walking up stairs	82	24	109	2
Carrying a bag	75	62	71	9
Riding in a car	63	24	128	2
Sitting	42	0	159	16
Going to a theatre or cinema	36	8	58	115
Stooping over a wash-basin	10	0	174	33
Making a bed	9	61	107	40
Running	13	51	56	97
Participation in sports	1	14	18	184

Location of pain

All the patients had pain in the lumbar region. The pain was mainly located centrally in the lower lumbar area or in the paravertebral region as illustrated in Fig. 2. Pain in the gluteal region or the thigh occurred in 26 % of the patients. Pain was more common in the right gluteal region and thigh than on the left side.

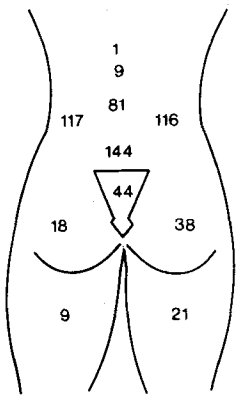

Fig. 2. Location of pain in the studied patients. Combination of the locations of pain is possible. Figures = number of patients.

Objective findings

The Straight Leg Raising test (SLR) was performed. The test was positive unilaterally in 27 % and bilaterally in 35 % of the patients. Only 14 % of the patients had an SLR below 60°.

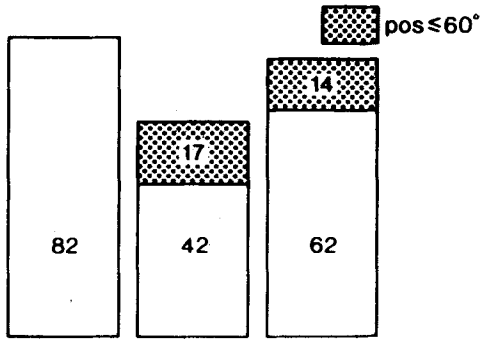

Fig. 3. The straight leg raising test.

The range of flexion, extension, and lateral flexion, measured by a modification of Schober's method, and the range of rotation are presented in Figs 4 – 6. Values for a normal population of 35-year-old males are inserted in the figures. These values were taken from a study by Moll and Wright (1971) who used the same method. A decreased ability to bend forwards was observed in the studied group of back patients compared with the values of the normal population. The range of extension and lateral flexion did not differ from the values obtained in the normal population.

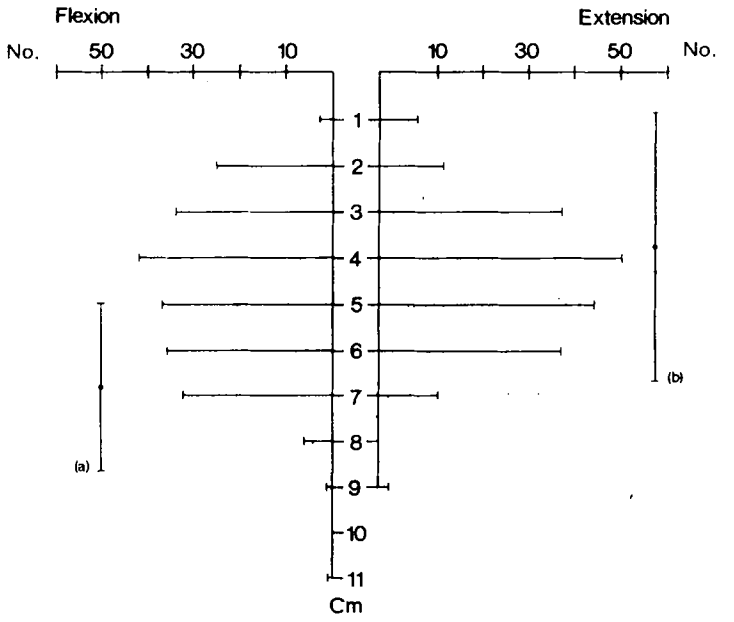

Fig. 4. The range of flexion and extension. (a) = mean value of flexion ± 2 s.d. in a normal population of 35-year-old males. (b) = mean value of extension ± 2 s.d. in a normal population of 35-year-old males.

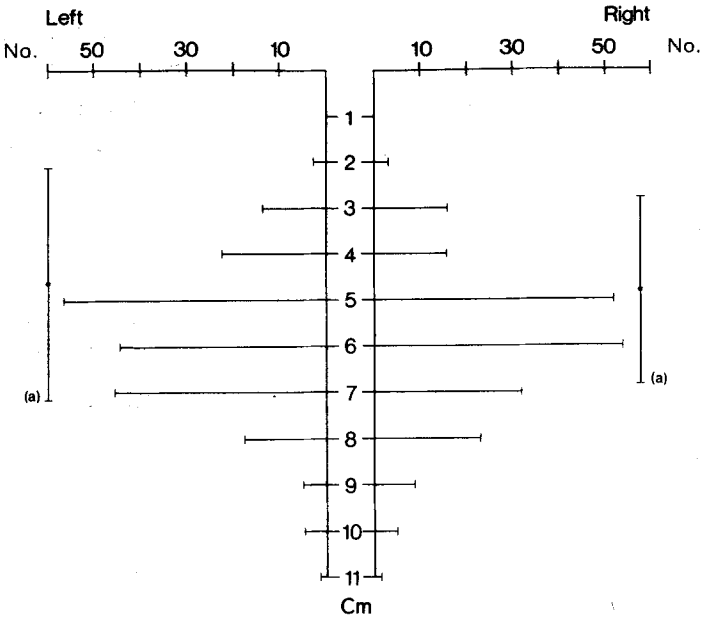

Fig. 5. The range of lateral flexion. (a) = mean values of lateral flexions ± 2 s.d. in a normal population of 35-year-old males.

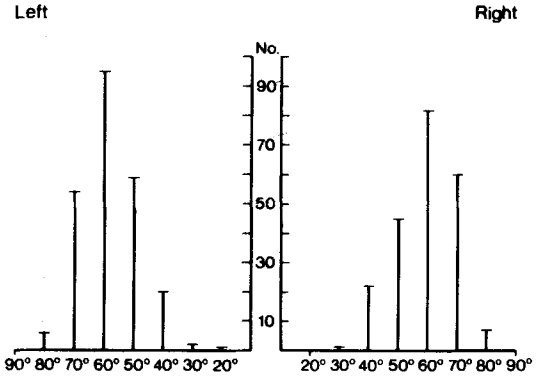

Fig. 6. The range of rotation.

The presence of postural scoliosis, paravertebral muscle spasm, and tenderness on palpation and percussion was registered. Less than 20 % of the patients had pronounced paravertebral muscle spasm and postural scoliosis.

Tenderness on palpation was registered in 60 % and tenderness on percussion in 39 %.

Impaired and fixed gait was present in 9 % of the patients.

Pain was registered in the planes of motion as well as when doing sit-ups and back-lifts. An increase of pain when bending forwards was reported by 89 % of the patients while increase of pain was not so frequent in the other planes of motion. The additional clinical findings are presented in Table 13.

Table 13. Additional clinical findings.

Clinical findings		Number of patients Yes	No
Postural scoliosis		40	177
Muscle spasm		38	179
Impaired, fixed gait		20	197
Pain on palpation		129	88
Pain on percussion		84	133
Increase of pain on:	flexion	193	24
	extension	157	60
	unilateral rotation	33	184
	bilateral rotation	69	148
	unilateral lateral flexion	72	145
	bilateral lateral flexion	89	128
	doing sit-ups	165	52
	doing back-lifts	120	97
Reduced ability to do sit-ups		185	32
Reduced ability to do back-lifts		101	116

Vocational factors

Of the 217 patients 59 were office staff and 158 were manual workers. This proportion corresponds well to the proportion of office staff and manual workers at Volvo, Göteborg. Fig. 7.

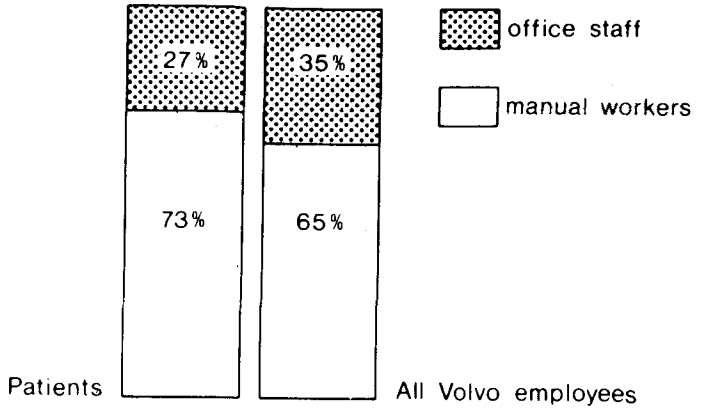

Fig. 7. The proportions of office staff and manual workers among 217 patients in relation to the proportions of all employees at Volvo.

Of the manual workers, 71 were working according to a two-shift schedule while the remaining patients were working a day-time schedule. The proportions of shift-workers and day-time workers are compared with the corresponding proportions among all employees at Volvo, Göteborg in Fig. 8.

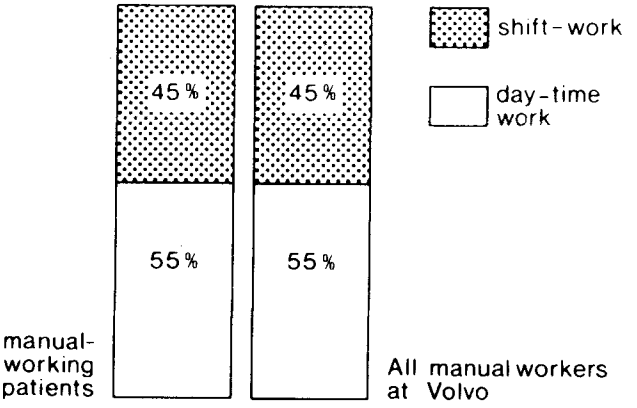

Fig. 8. The proportion of daytime- and shift-workers among the patients in relation to the corresponding proportions at Volvo.

The patients' assessment of the postures required in their work is shown in Table 14. A predominance of the standing posture for the greater part of the day was reported by the manual workers. A fixed posture throughout the working-day was reported by 26 % of the patients.

Table 14. Patients' answer regarding their working postures. Manual workers = m, Office staff = o.

Working posture	Often No.	% m, o	Sometimes No.	% m, o	Rarely No.	% m, o
Sitting★	55	(13, 60)	34	(15,17)	127	(72,23)
Standing	135	(77, 23)	39	(14, 26)	43	(9, 51)
Fixed working posture	Fixed		Partly fixed		Varied	
	52	(26, 16)	69	(38, 12)	96	(36, 72)

★ Data lacking for one patient.

The necessity for bending, twisting, lifting and forceful movements, according to the patients, is presented in Table 15. A high frequency of bending and twisting movements was reported by the manual workers while lifting and forceful movements were not considered to be necessary as frequently.

Table 15. Patients' answers regarding movements required during work. Manual workers = m, Office staff = o.

Type of movement	Often No.	% m, o	Sometimes No.	% m, o	Seldom No.	% m, o
Bending forward	140	(81, 19)	34	(14, 21)	43	(5, 60)
Twisting	140	(79, 21)	37	(16, 21)	40	(5, 58)
Lifting (≥ 5 kg)	66	(39, 5)	62	(36, 9)	89	(25, 86)
Lifting (≥ 20 kg)	25	(14, 2)	37	(23, 4)	155	(63, 94)
Forceful movements	25	(15, 2)	38	(24, 0)	154	(61, 98)

Table 16 illustrates the need to concentrate during work, the degree of variation in working tasks and the possibilities of taking pauses during work. A high proportion of the patients reported a moderate to great need to concentrate during the working day. Variation in working tasks was more frequent than no variation. Manual workers predominate among patients giving answers representing no necessity for concentration, no variation and no possibility to take pauses during work.

Table 16. Variation, pauses and need to concentrate during work. Manual workers = m, Office staff = o.

	Often		Sometimes		Seldom	
	No.	% m, o	No.	% m, o	No.	% m, o
Concentration necessary	96	(41, 51)	87	(38, 47)	34	(21, 2)
Possibilities to take pauses during work	76	(29, 54)	96	(46, 37)	45	(25, 9)
	Much		Some		None	
Variation in working tasks	89	(29, 74)	78	(42, 21)	50	(29, 5)

Only a moderate proportion of the patients, mainly manual workers, experienced daily back fatigue and pronounced exhaustion in connection with their work. Very few patients reported nervousness. Table 17.

Table 17. Back fatigue, exhaustion and nervousness after work. Manual workers = m, Office staff = o.

	Often		Sometimes		Never	
	No.	% m, o	No.	% m, o	No.	% m, o
Back fatigue during work	28	(17, 3)	106	(52, 37)	83	(31, 60)
Nervousness after work★	3	(2, 0)	61	(27, 25)	152	(71, 75)
	Much		Some		None	
Exhaustion after work	22	(13, 0)	160	(76, 68)	35	(11, 32)

★ Data lacking for one patient.

A majority of the patients were satisfied with their working duties, their working environment and their relations with their colleagues, Table 18. On inquiry, 63 patients stated that they wished to change their jobs (38 % of the manual workers and 14 % of the office staff).

Table 18. Satisfaction with working duties, working environment and relations with colleagues. Manual workers = m, Office staff = o.

Satisfaction with:	Good		Fair		Poor	
	No.	% m, o	No.	% m, o	No.	% m, o
Working tasks	157	(69, 86)	50	(25, 14)	10	(6, 0)
Working environment	116	(50, 65)	87	(42, 32)	14	(8, 3)
Relations with colleagues	194	(90, 89)	21	(9, 11)	2	(1, 0)

The length of employment at Volvo is given in Fig. 9. Only 4 % of the patients had been employed for less than one year and 28 % had been employed for more than ten years.

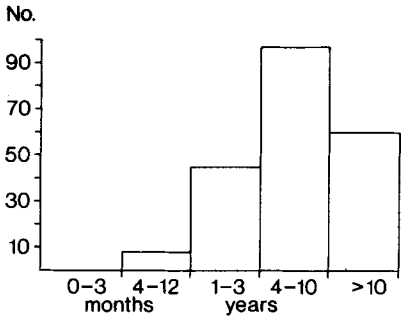

Fig. 9. The length of employment.

Social factors

Most patients were married or cohabiting and half of them had children below 16 years of age. The majority of the patients lived in a flat consisting of more than two rooms. Table 19.

Table 19. Family circumstances.

	Number of patients		
	Yes	No	Data lacking
Married or cohabiting	168	48	1
Children below 16 years of age	101	107	9
Housing bigger than 2 rooms	154	53	10

Regular participation in physical exercise was reported by 34 % of the patients and 16 % were actively engaged in some kind of sport.

The previous or recent occurrence of psychosomatic symptoms is given in Table 20.

Table 20. Psychosomatic symptoms.

Symptoms	Number of patients		
	Yes	No	
Gastric or duodenal ulcer	13	204	
Frequent headaches	12	205	
	Recently	Previously	No
Gastritis, irritable colon	17	65	135
	Often	Sometimes	Never
Palpitations or discomfort in the chest	8	22	187

It was found that 12 % of the patients had had continuous contacts with the social welfare authorities since the start of the investigation in 1974. The reasons for these contacts are presented in Table 21.

Table 21. Contact with social welfare authorities.

Reason for contact	Number of patients
Constant financial problems	22
Family problems	8
Difficulties in adjusting	12
Alcoholic problems	7

The tendency to report sick under any diagnosis during two years before entry to the study was registered for the 217 patients. The mean duration of sick-leave was 15.5 days per year. The distribution of sick-listing during these two years is shown in Fig. 10.

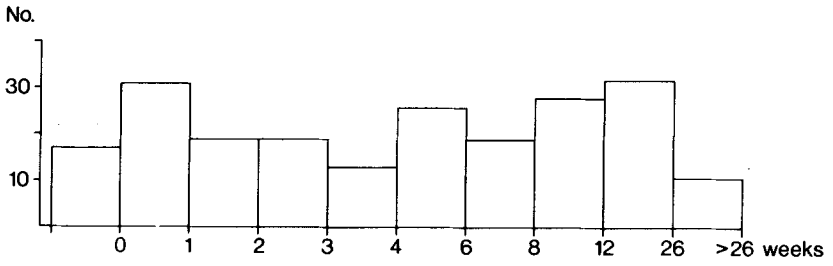

Fig. 10. Sick-listing of all patients during two years before entry to the study.

Psychological factors

The scores of the Hy- and Hs-scales of the MMPI test are illustrated in Fig. 11. There is a pronounced accumulation around the lowest values of the Hy-scale. A normal distribution of the Hs-scale was observed, although with some shift towards lower values.

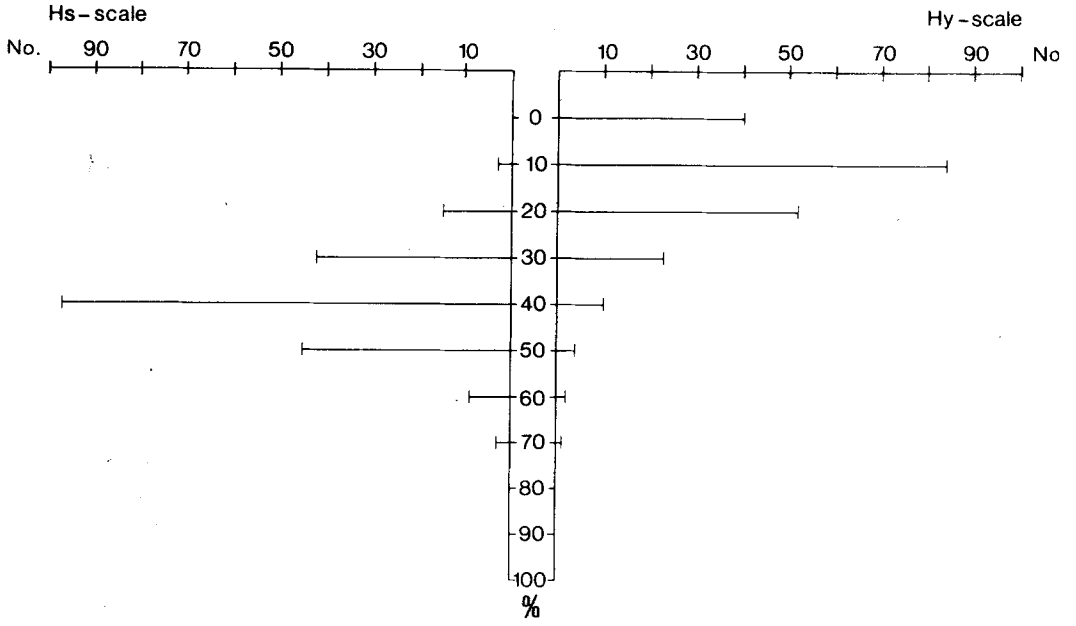

Fig. 11. Scores of Hs- and Hy-scales expressed in per cent of the maximal values. The range of scores is 0 – 41 points for the Hs-scale and 0 – 31 points for the Hy-scale.

The scores on the scales of extroversion (E), and neuroticism (N) of the Eysenck test are shown in Fig. 12. The range of scores for both scales is 0 – 24 points. The median score was 12 for the (E)-scale and 5 for the (N)-scale. The lie-scale, ranging from 0 – 9 points, with a median score of 3.5 points, was normally distributed.

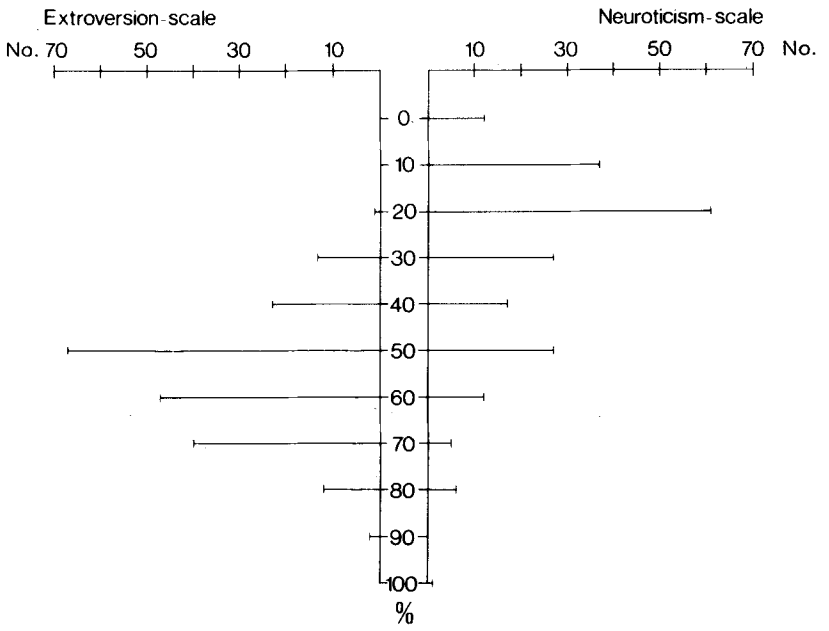

Fig. 12. Scores on the extroversion and neuroticism scales of the Eysenck test expressed in per cent of the maximal score. The range of scores for both scales is 0 – 24 points.

COURSE OF THE DISEASE DURING ONE YEAR

Duration of the initial episode of pain

The time from the onset of pain until the disappearance of symptoms is presented in Fig. 13. None of the patients had a duration of symptoms shorter than one week. The pain disappeared within one month in 35 %, within two months in 70 % and within three months in 86 % of the patients. An initial episode of pain lasting more than six months was found in six per cent of the patients, while four per cent still experienced pain after one year. The median duration of pain was 35 days.

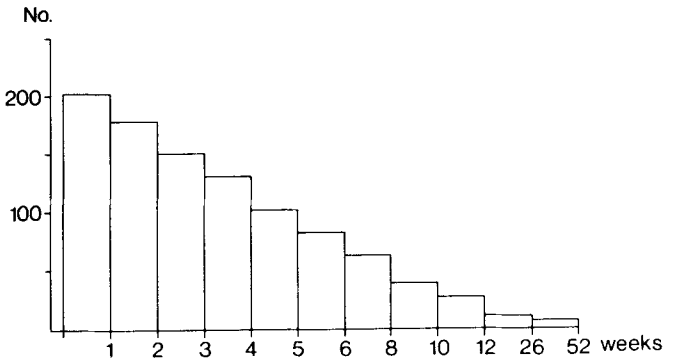

Fig. 13. Duration of the initial episode of pain.

Duration of sick-leave during the initial episode

During the initial episode 34 patients were never sick-listed. The sick-listing of the other 184 patients is presented in Fig. 14. 68 % of the sick-listed patients were back at work within one month. The median duration of sick leave when it occurred, was 21 days.

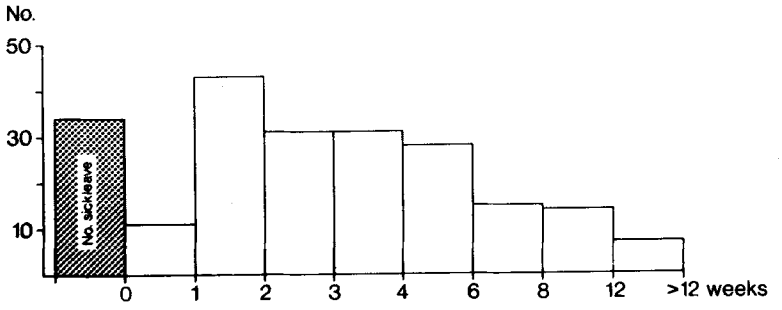

Fig. 14. Duration of sick-leave during the initial episode.

Changes in clinical manifestations during the initial episode

The location of pain

The location of pain at the initial examination and at ten days, three weeks and six weeks is given in Table 22.

Table 22. Location of pain during the first six weeks of the initial episode.

Location of pain		Time of examination Initial %	10 days %	3 weeks %	6 weeks %
Central pain	A	5	4	3	4
	B	37	38	34	47
	C	66	71	67	80
	D	20	19	12	11
Flank pain	E	54	48	45	47
	F	53	56	47	51
Buttock pain	G	8	12	8	11
	H	18	14	12	18
Thigh pain	I	4	7	6	11
	J	10	6	9	13
No. of patients		217	151	86	55

The zones for the location of pain are shown in Fig. 15.

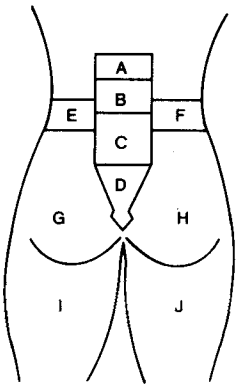

Fig. 15. Zones for the location of pain.

The location of pain at the different assessments was uniform. At the six-week assessment there was a tendency towards an increased radiation of pain to the thighs.

"Pain index"

The change of pain during the first six weeks after the initial assessment as determined by means of the "pain index" is shown in Table 23 and Fig. 16. There was a marked decrease of the pain index score between the initial and the 10-day assessment, indicating relief of pain during this period. At the three-week examination the median value of the pain index was unchanged, while it was slightly raised among those who still had pain at the six-week examination.

Table 23. The change of pain during six weeks, expressed as median values of the pain index scores. The range of scores of the pain index is 0 – 70 points.

	Time of examination			
	Initial	10 days	3 weeks	6 weeks
Median value	42	22	22	27
Number of patients	217	151	86	45

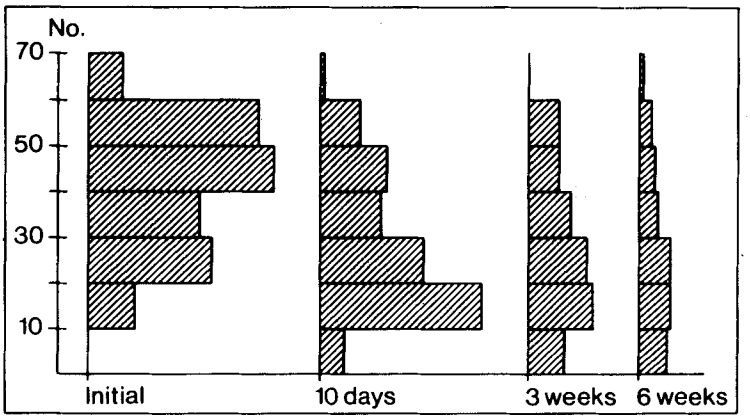

Fig. 16. The change of pain during six weeks as determined by means of the "pain index". The range of scores of the "pain index" is 0 – 70 points.

Recurrences of pain in one year

Number of recurrences of pain

During the year of observation 62 % had one or more recurrences of pain. More than six recurrences were not observed in any of the patients. The distribution of recurrences is illustrated in Table 24. The median number of recurrences was 1.3.

Table 24. Number of recurrences of pain during one year of observation.

No. of recurrences	0	1	2	3	4	5	6
No. of patients	83	56	37	23	8	6	4

Time between recovery from initial episode to first recurrence of pain

Of the 134 patients with more than one episode of pain, 6 % had their first relapse of pain within 2 weeks after recovery from the first episode. In 24 % of the patients the first recurrence occurred after more than six months. The median time between the recovery from the initial episode and the beginning of the first recurrence was 63 days. Table 25.

Table 25. Time between recovery from the initial episode and the beginning of the first recurrence.

Time (weeks)	0–2	2–4	4–6	6–12	12–26	>26
Number of patients	8	22	16	26	31	31

Total duration of recurrences of pain in one year

The total duration of all recurrences of pain during one year of observation for the 134 patients with relapses is presented in Fig. 17. The duration of all recurrences varied from less than one week to 40 weeks. The median duration of all recurrences was 27 days.

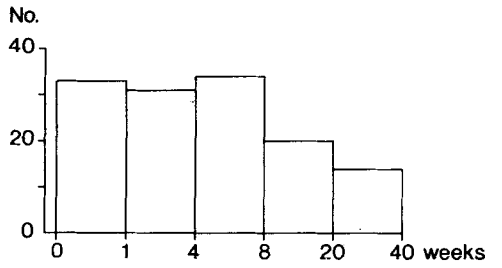

Fig. 17. Total duration of recurrences of pain in one year (n = 134 patients.

Total duration of absence from work in one year owing to recurrences

Among all the patients with recurrences of pain, 66 patients were never absent from work. The duration of sick-leave during the recurrences varied from less than one week to 30 weeks, Table 26. The median duration of sick-leave during all the recurrences was 16 days.

Table 26. Total duration of sick-leave during all recurrences. n = 68 patients.

Time (weeks)	0–1	1–2	2–4	4–8	8–30
Number of patients	7	23	17	14	7

Total duration of low back pain in one year

The duration of episodes of low back pain during one year of observation was calculated. The duration of back pain in one year among 217 patients is given in Fig. 18. During the time of the study 24 % of the patients had back pain for less than one month, 47 % had back pain for less than two months, 66 % for less than three months and 88 % for less than six months. The median duration during one year was 60 days.

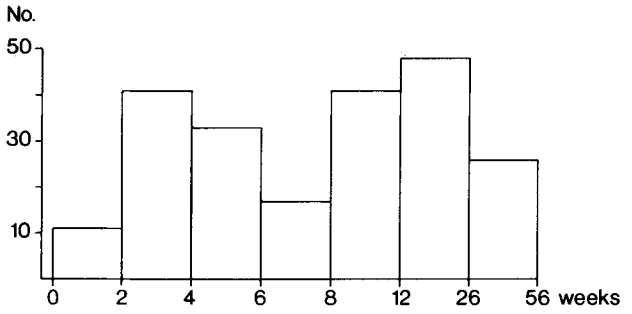

Fig. 18. Total duration of low back pain in one year.

Development of rhizopathy

During the time of the study 8 % of the patients developed sciatica resembling rhizopathy, with or without neurological findings. No surgery for disc herniation was carried out.

Development of lumbar insufficiency

In addition to the registered episodes of low back pain, 62 % of the patients had one or more episodes of lumbar insufficiency i.e. fatigue and discomfort in the back during strenuous movements.

Change of occupation

During this study of 217 patients with acute low back pain 52 % changed their jobs. The back disorders were reported to be the main reason for changing jobs by 32 % of these patients. The transfer took place within Volvo or to another company.

RESULTS PART II

INFLUENCE OF CONFOUNDING FACTORS ON THE COURSE OF THE DISEASE

The factors characterizing the patient profile (part I) were related to 1) the duration of symptoms during the initial episode of pain, 2) the duration of sick-leave during the initial episode, 3) the total length of recurrences of pain in one year and 4) the total duration of absence from work due to recurrences in one year.

History of back pain

Earlier episodes of back pain

The course of the disease was found not to differ between patients with earlier low back disorders and those who reported no earlier episodes of back pain.

Onset of symptoms

A tendency ($p < 0.05$) towards a longer duration of the initial episode was found among patients with an insidious onset compared to those with a sudden onset of pain. The course of the disease was not influenced by the type of onset of symptoms in any other way.

Clinical findings

"Pain index"

The "pain index", based on the sum of scores of several questions regarding the duration of pain, ranged from zero to 70 points.

The patients whose scores were above the median value for the initial examination were found to have a longer absence from work ($p < 0.05$) during the initial episode than the patients with less pronounced pain, according to the index. A high pain score at the initial assessment was found not to prolong the initial episode. However, a much longer initial episode of pain ($p < 0.001$), with a subsequent longer absence from work ($p < 0.001$), was found among patients still afflicted with severe pain at the ten-day examination, compared to patients with only moderate pain.

The "pain index" score at the ten-day examination was not related to the length of relapses or absence from work in connection with relapses.

Objective findings

No evidence was found of a relation between the course of back pain during the year of observation and the range of motions (flexion, extension, lateral flexion and rotation) registered at the initial assessment. The presence of clinical manifestations, like postural scoliosis and radiation of pain in one or both thighs, did not seem to influence the course of the ailment.

The duration of sick leave during the initial episode was found to be significantly longer ($p < 0.01$) among patients who manifested pain on percussion of the lower lumbar spine. The duration of absence from work during the initial episode was also significantly longer ($p < 0.01$) among patients who had a positive Straight Leg Raising Test (SLR) at the initial assessment.

There were no indications of a relation between the presence of pain on percussion and SLR and the remaining variables determining the course of acute back pain.

Vocational factors

Mechanical strain and working postures

The influence of working postures on the duration of the initial episode was observed among patients who sat less than two hours per day ($p < 0.05$), bent ($p < 0.01$) and twisted ($p < 0.05$) their backs more than ten

times per hour and who were forced into fixed postures ($p < 0.05$) for the greater part of the working day. Correspondingly shorter durations were found among patients who sat more than four hours a day, who seldom bent or twisted their backs and whose postures varied. No relation was found between a longer duration of the initial episode and standing, lifting and forceful movements.

Patients whose work involved sitting for less than two hours per day ($p < 0.001$), frequent bending ($p < 0.001$) and twisting ($p < 0.01$) movements and lifting ($\geqslant$ 5 kg) at least ten times per hour ($p < 0.01$) were absent from work longer during the initial episode. No relation was found between longer sick leave and fixed postures, standing, lifting ($\geqslant$ 20 kg) and forceful movements.

Fixed working postures were found to be related to a longer duration of symptoms due to relapses in one year ($p < 0.01$).

None of the other working postures tested showed any relation to the duration of recurrences.

A longer duration of sick-leave during relapses was related to bending ($p < 0.05$) and twisting ($p < 0.01$) more than ten times per hour as well as frequent forceful movements ($p < 0.05$).

The amount of sitting, standing, fixed postures and lifting was not related to the length of absence from work during relapses.

Vocational exhaustion

A significantly longer duration of the initial episode was observed among patients who experienced daily fatique in their backs ($p < 0.01$) before the present episode and among patients who were exhausted after work ($p < 0.05$).

No evidence was found of a relation between fatigue and absence from work or recurrences. Only the patients who reported daily nervousness after work exhibited a longer total duration of relapses ($p < 0.01$) in a year.

Variation, concentration and breaks at work

A longer duration of the initial episode together with a longer duration of absence from work was registered among patients with repetitive ($p < 0.001$, $p < 0.05$) or monotonous ($p < 0.01$) jobs compared to patients with varied jobs. Low requirements of concentration at work were also related to a longer duration of sick-leave during the initial episode ($p < 0.05$).

The number of breaks during the working day did not seem to influence the course of the disease.

Job satisfaction

Patients, reporting discontent with their jobs were found to have a longer initial episode ($p < 0.01$) and a longer absence from work ($p < 0.05$) than the satisfied patients.

Dissatisfaction with the working environment was also associated with a longer duration of absence both during the initial episode ($p < 0.001$) and during recurrences ($p < 0.05$).

Relations with colleagues and a desire to change jobs did not have any significant influence on the course of the disease.

Category of employment

The course of the disease was compared between office staff and manual workers because of the different working conditions in the two groups.

A significantly longer initial episode ($p < 0.01$), a longer duration of absence during the initial episode ($p < 0.001$) and an increased duration of sick-leave during relapses ($p < 0.01$) were observed among the manual workers with correspondingly shorter durations among the office staff.

There was no relation between the category of employment and the duration of recurrences.

Influence of vocational factors on the course of the disease among manual workers and office staff separately

A separate analysis of the influence of vocational factors was carried out on each category of employees because of the significant differences in the two groups regarding the duration of the initial episode and absence from work. The same vocational variables were tested as on the whole population.

A significantly longer duration of the initial episode was still observed in manual workers who stated daily back fatigue ($p < 0.5$) and who had repetitive ($p < 0.01$) and monotonous ($p < 0.05$) jobs. A longer absence from work during the initial episode was also observed in manual workers who sat less than two hours per day ($p < 0.05$) compared to the manual workers who sat for much of their working day or needed to bend only occasionally.

None of the other vocational factors had an influence on the course of the disease when related to each category alone, provided that the significance test could be carried out.

The influence of most of the vocational factors could not be assessed among office staff separately as the distributions in the alternative answers to the questions asked, were highly skewed.

Skew distributions were also found among the manual workers in respect of the questions concerning the amount of bending and twisting. Only very few workers were not required to bend and twist frequently at work and the chi-square test could therefore not be applied. Similarly, it was not possible to evaluate the influence of job satisfaction since the number of manual workers who were discontented with their work was insufficient to be related to the course determining variables.

Interrelations between vocational factors

Working postures

Highly significant relations were obtained between standing for more than four hours per day and sitting for less than two hours per day and frequent bending, twisting, lifting, forceful movements and fixed postures ($p < 0.001$).

Frequent bending, twisting, lifting, forceful movements and fixed postures were all found to be strongly correlated to one another ($p < 0.001$).

Vocational exhaustion

Daily back fatigue was significantly related to exhaustion after work ($p < 0.001$).

Variation and concentration

Highly significant relations were obtained between repetitive work, monotonous work and work involving little need for concentration ($p < 0.001$).

Job satisfaction

The patients who reported dissatisfaction with their jobs were also dissatisfied with their working environment ($p < 0.001$).

Interrelations between working postures, vocational exhaustion, variation and concentration, and job satisfaction

Significant relations were also obtained between demanding working postures, pronounced vocational exhaustion, little variation, low requirements of concentration and discontent with duties and the working environment.

Psychological factors

The Hy- and Hs-scales

The course of the initial episode was compared between patients given a score above and below the median value on the Hy-scale. The patients with scores above the median value (2 points) were absent from work significantly longer during the initial episode ($p < 0.05$). No other differences in the course were observed between the two groups. The patients who had scores above six points were than compared with the patients with zero points and a significantly longer duration of the initial episode of pain ($p < 0.05$) was found among the patients with scores above six points. When the same procedure was carried out on the Hs-scale no differences were detected between patients with scores above and below the median value or between groups of patients with extreme scores.

Eysenck test

Extroversion and neuroticism

High and low scores on the scales of extroversion and neuroticism were compared and related to the course of pain and absence from work during the year of observation. Patients having a low score on the scale of extroversion tended to have more days of pain due to relapses in the year of observation ($p < 0.05$). The other scores on the two scales were not found to be course-related.

Social factors

A significantly longer duration of pain ($p < 0.01$) during the initial episode was found among patients who had had continuous contact with the social welfare authorities since 1974, compared to the patients without any known contact with the social welfare authorities. Neither the duration of sick-leave nor the total duration of recurrences in one year was related to contact with the social welfare authorities.

Previous psychosomatic symptoms

The course of low back pain was not related to affirmative answers to questions concerning previous psychosomatic symptoms.

Tendency to report sick

Patients who, according to the NHIO, were sick-listed under any diagnosis for long periods of time during the two years before entry to the study were also absent from work much longer during the initial episode of pain ($p < 0.001$) than patients with a shorter record of sick-leave during the two years preceding the study. The amount of sick-listing during these two years did not influence the sick-listing during recurrences or the duration of episodes of back pain during the year of observation.

Participation in physical exercise

Patients who regularly participated in physical exercise did not show any dissimilarity in the course of back pain compared to patients who only occasionally or never took exercise.

Demographic factors

Age

Patients below 30 years of age tended to have a significantly longer initial episode of pain ($p < 0.05$) and longer absence from work during relapses in the year of observation ($p < 0.05$) compared to the age groups 30 to 50 years and above 50 years of age. The other course-determining variables were not related to age.

Sex

No differences were observed between men and women as regards the duration of back pain and subsequent absence from work during one year.

Table 27 summarizes all the confounding factors found to be of significance in relation to the periods of pain and absence from work in one year.

*Table 27. The confounding factors found to be related to the course of disease. Definitions: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$*

Confounding factors	Duration of initial episode	Duration of sick-listing during initial episode	Duration of relapses	Duration of sick-listing during relapses
History of back pain				
Onset of symptoms	*			
Pain index				
Initially		*		
After ten days	***	***		
Objective findings				
Pain on percussion		**		
Straight Leg Raising Test		**		

→

Table 27, continued

Vocational factors				
Category of employment	**	***		**
Sitting	*	***		
Fixed posture	*		**	
Bending forward	**	***		*
Twisting movements	*	**		**
Lifting (⩾ 5 kg)		**		
Forceful movements				*
Fatigue back	**			
Fatigue after work	*			
Repetitive work	***	*		
Monotonous work	**			
No need to concentrate		*		
Satisfaction with working tasks	**	*		
Satisfaction with working environment		***		*
Nervousness after work			**	
Vocational factors manual workers separately				
Fatigue back	*			
Repetitive work	**			
Monotonous work	*			
Sitting (⩽ 2 hours)		*		
Psychological factors				
MMPI-test: Hy-scale	*	*		
Eysenck-test: Extroversion-scale			*	
Social factors				
Tendency to report sick		***		
Contacts with social welfare authorities	**			
Demographic factors				
Age	*			*

RESULTS PART III

EFFECTS OF THERAPY

Duration of symptoms in the treatment groups following the first treatment

A comparison of the duration of symptoms following the first treatment between the treatment groups was performed. The influence of the time between onset of symptoms and first treatment (x) was eliminated by means of a covariance analysis with x as a concomitant variate. The adjusted mean values of the time between first treatment and recovery (y) were compared. Fig. 19. The antilogarithms of the adjusted mean values were 14.8 days for the Back School group, 15.8 days for the combined physiotherapy, and 28.7 days for the "placebo" group. The 95 % confidence interval for the difference between the combined physiotherapy group and the "placebo" group was 0.59 ± 0.37. No difference was detected between the Back School group and the combined physiotherapy group.

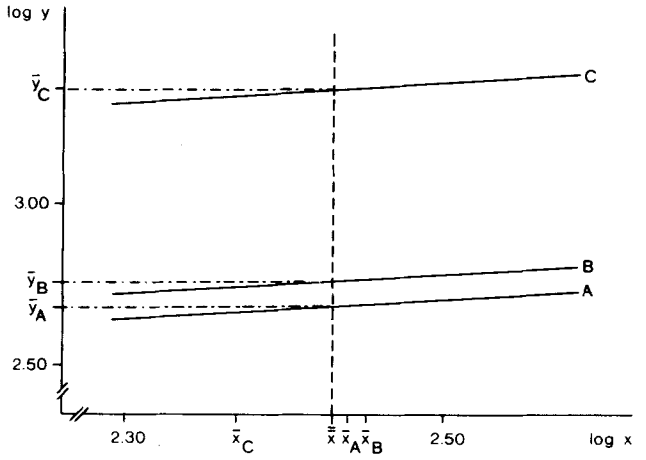

Fig. 19. The regression lines of the time between first treatment and recovery (y) on the time between onset of symptoms and first treatment (x) of the groups. Number of days in logarithms. $\bar{\bar{x}}$ *= overall mean. A = Back School, B = Combined physiotherapy, C = "Placebo".*

Twentytwo patients were excluded from the analysis as they refused treatment. Four patients were initially randomly allocated to the physiotherapy group and 18 patients were allocated to the "placebo" group. Since a predominance of patients from the "placebo" group refused treatment, a separate comparison of the duration of the initial episode between the "placebo" patients and the non-treated patients was carried out. A chi-square test did not reveal any differences between the two groups ($\chi^2 = 0.22$).

Duration of sick-leave during the initial episode of pain

A comparison was carried out between the number of non-sick-listed and sick-listed patients in each treatment group during the first episode of back pain. No significant difference was found between the groups.

The median duration of absence from work during the initial episode among the sick-listed patients was 20.5 days in the Back School group, 26.5 days in the physiotherapy group and 26.5 days in the "placebo" group.

When the three groups were analyzed in relation to the total duration of absence from work (median 21 days), there were significantly more patients with a shorter duration of sick-leave in the Back School group compared to the "placebo" group. Table 28.

Table 28. Sick-leave during the initial episode of pain in the treatment groups. Group A = Back School, B = combined physiotherapy, C = "placebo".

	⩽ 21	> 21 days	total
Group A	37	18	55
Group B	30	31	61
Group C	25	41	66

$\chi^2 = 10.44$; df = 2; $p < 0.01$

The change of pain during the initial episode

The change of pain and the degree of functional limitation in the treatment groups are shown in Table 29 and Fig. 20 in terms of the "pain index" as described on page 28.

Table 29. The change of pain during six weeks in the treatment groups by means of the median values of the "pain index". Range of scores for the "pain index" is 0 – 70 points. Group A = Back School, Group B = Combined physiotherapy, Group C = "Placebo". Figures within parentheses indicate the number of patients examined on each occasion.

	Time of examination			
	Initial	10 days	3 weeks	6 weeks
Group A	43	20	19	22
	(70)	(44)	(25)	(14)
Group B	42	22	18	21
	(72)	(50)	(19)	(16)
Group C	42	28	25	17
	(74)	(56)	(32)	(15)

A similar decrease of pain was observed in all three groups from the initial to the six-week assessment. The mean difference in the "pain index" per group was calculated by comparing the values from the initial assessment with the values from the ten-day and the three-week assessments, Table 30.

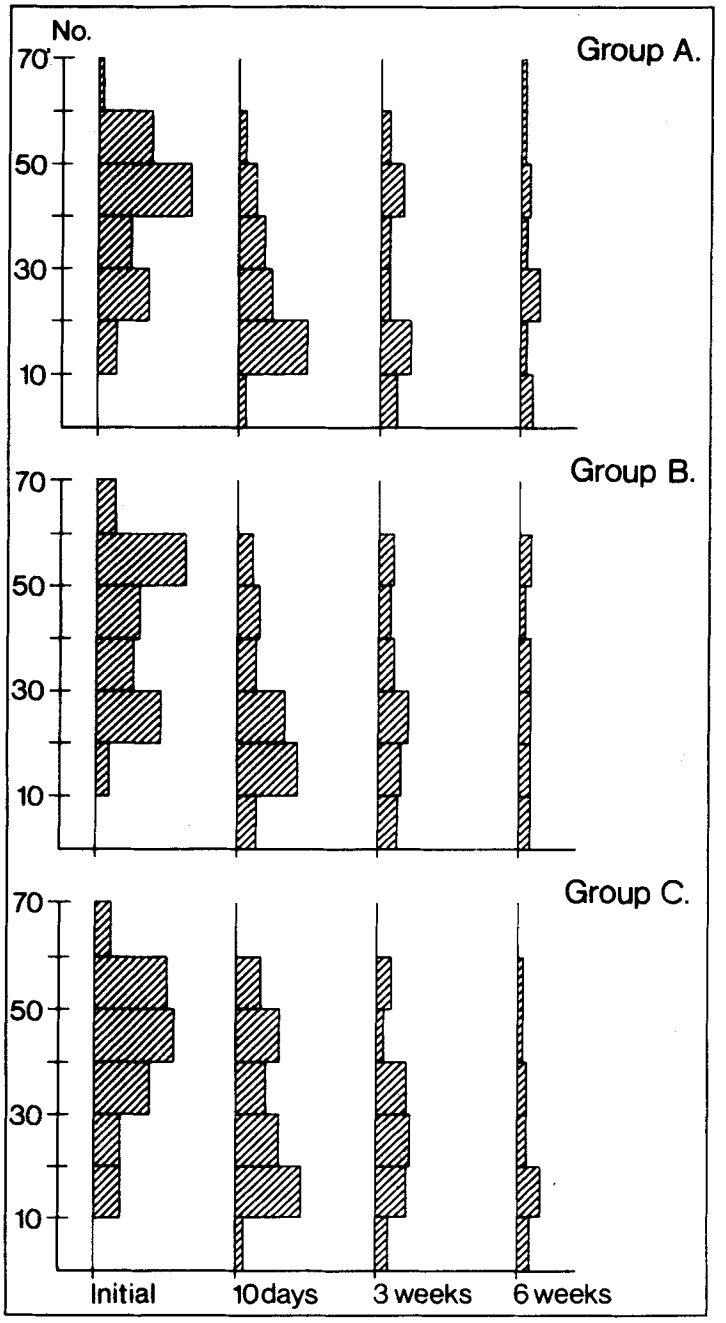

Fig. 20. The change of pain in the treatment groups during six weeks as determined by means of the "pain index". The range of scores of the "pain index" is 0 – 70 points.

Table 30. Comparison of the mean difference of the "pain index" per group on three occasions of assessment. Group A = Back School, Group B = Combined physiotherapy, Group C = "Placebo".

	Initial – 10 days $\bar{d}$	Initial – 3 weeks $\bar{d}$
Group A	15.10	15.21
Group B	19.22	17.20
Group C	12.52	17.53

When comparing the mean values of the Back School and physiotherapy groups with the mean value of the "placebo" group, a similar mean decrease of pain was observed in all three groups on the two occasions of assessment following the initial assessment.

Recurrences of pain in one year

Number of recurrences

The number of patients in each treatment group with no recurrences was compared with the number of patients with recurrences during one year. 36 % of the patients in the Back School, 40 % of those in the physiotherapy group and 29 % in the "placebo" group had no recurrences during one year. No relation was found between the type of treatment given and the incidence of recurrences. The median number of recurrences in one year was 2.75 in the Back School group, 2.75 in the physiotherapy group and 2.25 in the "placebo" group. On comparison of the number of recurrences in the different groups no relation was found between the type of treatment given and the number of recurrences of pain.

Total duration of recurrences of pain in one year.

The median number of days of recurrences for the three groups together was 27 days. No significant differences were detected when comparing the total length of recurrences in days during one year in each group.

Total duration of absence from work in one year owing to recurrences

The number of patients not reporting sick during relapses was compared to the number of patients who were sick-listed in the different treatment groups. 51 % of the patients in the Back School, 49 % of those in the physiotherapy group and 46 % of the "placebo" group were not absent from work during one year because of recurrences. The median number of days of sick leave owing to recurrences in one year was 7.5 days in the Back School group, 7.5 days in physiotherapy group and 8 days in the "placebo" group. No significant differences were found between the groups.

Development of chronicity, rhizopathy, and lumbar insufficiency

The distribution of patients developing chronic pain, rhizopathy and lumbar insufficiency in the three treatment groups is demonstrated in Table 31.

Table 31. Development of chronic pain, rhizopathy and lumbar insufficiency.

	Group A	Group B	Group C	Total
Chronicity	4	4	2	10
Rhizopathy	5	7	6	18
Lumbar insufficiency	44	46	45	135

Change of occupation

More than half of the 217 patients changed their jobs during the year of observation. More patients changed jobs in the "placebo" group (61 %) compared to the Back School patients and the physiotherapy group (50 %, 46 %). Also the patients changed their jobs because of back pain more frequently in the "placebo" group (27 %) than in the other treatment groups (10 %, 14 %).

DISCUSSION

GENERAL DISCUSSION

When interpreting the results of this study certain general limitations of clinical research of this type have to be considered.

The requirement of blindness in this type of a study is difficult to fulfill when the patients are aware of what treatment they are subjected to. It is also difficult to guarantee that the patients do not reveal the treatment received to the assessing physician. In a study by Doran and Newell (1975) it was found that the assessing physician inadvertently discovered the treatment in 10 % of the cases. No systematic control of the number of patients reporting their treatment was carried out in this study.

The reliability of information obtained from the patient has been investigated by Westrin et al. (1972). They came to the conclusion that the information could be influenced by the investigator as well as by the investigated individual.

The validity of diagnoses of low back pain may also be questioned in view of the lack of knowledge regarding the pathophysiology of low back disorders. In this study an attempt was made to achieve homogeneity of diagnosis in the studied group by only including patients with 1) pain in the lumbar region with or without sciatica to the thigh, 2) a duration of symptoms not exceeding three months, 3) a pain-free year preceding the current episode.

However, nothing can be said with certainty about the homogeneity of the underlying causes of the pain in the studied group.

The lack of knowledge about the etiology of back pain also makes it difficult to find objective methods of assessing clinical manifestations. Thus, the clinical methods available for measuring the mobility of the spine or the strength of certain muscles lack normal value. Furthermore, when pain is present the difficulties in obtaining objective values increase, since the methods for registering pain are inadequate. Hence, at an examination the investigator obtains the patient's own assessment of pain intensity and functional limitation rather than measures of mobility and strength.

An investigation of a multifactorial disorder like low back pain may be characterized by an abundance of soft variables the influence of which is not always easy to determine.

PATIENT PROFILE

In this part of the report the distribution of demographic, clinical, vocational, psychological and social factors among the patients is presented. The sources of data contributing to the patient profile are of different kinds. Three classes of information, with different modes of collecting and differing reliability, can be distinguished:

1. Patients' own statements.

a. with undoubtedly good reliability.
This class comprises information about age and certain checkable and unequivocal vocational data such as category of employment and the occurrence of shiftwork.

b. With unknown reliability.
The majority of data making up the patient profile are of this kind. This includes information about the history of back pain, mechanism of onset, the condition of pain, certain social and vocational factors and also results of the psychological tests. This type of information can be influenced by errors characterizing either the investigator or the investigated individuals themselves (Westrin et al., 1972).

2. Clinical findings.

Objective clinical findings are subject to the investigators judgement and measurement. There is a certain amount of error involved in registering the clinical findings, but as this has been done by one investigator only in this study, the shortcomings will tend to be uniformly distributed.

3. Information from authorities

Information has been obtained from the National Health Insurance Office and from the social welfare authorities. Information from the former has good reliability. Information from the latter has good reliability regarding the presence of the studied factors among those who have been registered by the authority, but not regarding the absence of these factors among those who have not been registered.

The median age of the patients was 34.5 years, which agrees fairly well with what is known about the age distribution of back pain in the general population (Hult 1954, Hirsch et al. 1969, Horal 1969, Kelsey 1975). Back pain is known to be about equally common in men and women (Horal 1969, Kelsey 1975). In this study 13 % of the patients were women, while 20 % of the employees at Volvo are women. The design of the study does not admit prevalence analyses, however.

The median duration of symptoms before entry of the patients to the study was only 9 days, and 43 % of the patients had never had any episodes of back pain before. This is a consequence of the efforts to include only acute and subacute cases without a tendency to chronicity. Anamnestic statements on history of back pain have been shown to be subject to uncertainty, however, and the history is often more extensive than the patient has reported (Westrin et al. 1972).

Almost half of the patients had a sudden onset of pain, often in connection with a specific incident, an observation that is in agreement with several other reports (Seager 1959, Glover 1960). Lifting and bending manoevres have often attracted interest as provoking factors. In this study they were reported in connection with onset of back pain in about 15 % each, and were the most common provoking factors. Hult (1954) found that 15 – 20 % of lumbago patients reported onset of symptoms in connection with lifting. In the present study onset of symptoms occurred slightly more frequently during leisure time than during workinghours.

The subjective symptoms were penetrated by means of questions about the intensity and character of the pain and consequent functional limitation. The questions regarding pain intensity were similar to those used by Horal (1969). In the present series 67 % of the patients thought that their pain was intense, while 84 % of the probands in Horal's study had experienced intense pain in their backs on some occasion. This indicates that the patients in the present study had a severity of pain that at least corresponded to an "average" episode of lumbago. This is also supported by the fact that about half of the patients had continuous pain throughout the day and night, which is similar to what Horal has reported for the probands in his study. The functional limitation was studied by 10 questions with 4 alternative answers to each. The three most common alternatives among the 40 statements describing functional limitation were (Table 12): 1. Participation in sports impossible (85 %). 2. Bending

forwards painful, but could be done (80 %). 3. Sitting painful, but not impossible (73 %). That the sitting posture is so frequently considered painful is consistent with knowledge of the biomechanical loads on the spine in different postures (Nachemson & Elfström 1970).

The frequency of a positive SLR-test is partly a question of definition. In this study a positive SLR-test was defined as pain in the back, when the straight leg was raised. With this definition 62 % of the patients had a positive SLR-test, but only 14 % of the patients had a positive SLR-test below 60 degrees. Magora (1975) reported a positive SLR-test in 20 % of the patients with low back pain.

The range of spinal flexion, extension and lateral flexion was evaluated by objective methods in the sense that the investigator estimated the range of movements by measurements between defined points. Moll and Wright (1971) have confirmed the validity of these methods. Rotation was estimated by a method where-by the deviation of a plane through the shoulders from an imaginary zero line was measured with a goniometer. This method cannot be considered completely objective. The mean values in this study for lumbar extension and lateral flexion were in close correspondence to the mean values that Moll and Wright (1971) have reported for a normal male population of 35 years of age. The mean value for lumbar flexion was lower than the mean value in that normal population, however. This is probably a consequence of the fact that 89 % of the patients had increased pain on flexion, while provocation of pain occurred less frequently in the other planes of movements. In fact, aggravation of pain on lumbar flexion was the most common clinical finding. Pain on palpation and percussion was reported by 60 % and 39 % respectively, while postural scoliosis and muscle spasm occurred in less than 20 %.

Data describing vocational factors consist partly of unequivocal information e.g. category of employment, shift work and length of employment. Information about ergonomic load has been obtained from questionnaires and is not based on objective measurements. This method, with similar questions, has previously been used by Magora (1972, 1973) in an extensive study. Finally there is purely subjective information about the patients' satisfaction with their jobs and their opinions about the physical and psychological strain in their work. The proportion of manual workers among the patients was 73 %, while 65 % of all employees

at Volvo are manual workers. The design of the study does not permit any conclusions about the frequency of low back pain among different categories of employees in industry, but it is interesting that this slight overrepresentation of manual workers is in good agreement with several reports about the occurrence of low back pain in different occupations (Hult 1954, Rowe 1969). The length of employment for the patients was fairly long. 72 % had been employed for more than three years and only 4 % had been employed for less than 1 year. Since we do not know whether the patients in the material are representative of all Volvo employees with back pain, we cannot draw any conclusions about the length of employment and occurrence of back pain on the basis of these figures, but Magora (1970) found a positive relation between years of employment and frequency of back pain. Without drawing any firm conclusions, it is also interesting that shift-work was not more common among the patients than among all manual workers at Volvo.

Manual workers were subjected to a greater strain from an ergonomic point of view, with frequent bending and twisting movements, less variation and consequently more back fatigue than the office staff. On the other hand, the level of satisfaction with the vocational situation seemed to be about equal for both categories of employees.

Data describing social conditions were obtained partly from questionnaires and partly from authorities. The reliability of these two types of information has been briefly discussed earlier. The questionnaires penetrated basic family circumstances, psychosomatic symptoms and also the patients' habits as regards physical exercise. Although these questions only give a superficial picture of social conditions, they indicated normal family conditions for the majority of the patients. Psychosomatic symptoms occurred infrequently. Half of the patients took part in physical exercise. Contact with the social authorities since 1974 could be established for 12 % of the patients. The average total duration of sick-leave under various diagnoses was 15.5 days per year for the last two years before entry to the study. This is less than the average for industrial workers in Göteborg (NHIO-statistics). With the reservation that answers to questionnaires and the absence of contact with social authorities does not exclude social problems, the findings indicate that social problems were not prominent in this study. In several other investigations on back pain (Natvig 1970, Westrin 1970, Helander 1973) a lot of social prob-

lems have been present. The present study and the studies referred to deal probably with populations of back pain patients that are somewhat different. The previous studies include chronic cases, while only acute and subacute cases were included in the present study. Furthermore, as this study was performed at a factory only patients who were permanently employed were included.

There are several reports in the literature about the use of the MMPI for evaluation of psychological factors associated with back pain (Hanvik 1950, Beals & Hickman 1972, Sternbach et al. 1973, Timmermans & Sternbach 1974, Wiltse & Rocchio 1975). In groups of patients with long-standing back pain the Hs- and Hy-scales seem to be regularly elevated in comparison with normal individuals. Furthermore, back pain patients have been found to have higher values on these scales than other patients with pain and functional limitation, e.g. fracture patients and patients with rheumatoid arthritis (Phillips 1964, Beals & Hickman 1972, Sternbach et al. 1973). In the present study the Hs- and Hy-scales of the MMPI were modified for Swedish conditions by exclusion of some questions. The scores on the Hs-scale were normally distributed, while the scores on the Hy-scale were shifted towards the lower end of the scale. Since there is little experience of this test in Sweden, and consequently a lack of adequate reference values, and since the scales were modified, no comparisons have been made of the distribution of the scales in this study with that in normal populations. The scales were only used to distinguish between different groups of patients who were compared with regard to the course of the disease. This will be discussed below. There are no reports in the literature about the distribution of the scales of the Eysenck-test among patients with back pain, but the test has been used for several years in Sweden in psychological practice. In this study the Extroversion-scale was normally distributed, while the Neuroticism-scale was shifted towards the lower end of the scale. The distribution of the scales does not differ from the distribution in a normal population (Bederoff-Petersson et al. 1968).

COURSE OF THE DISEASE DURING 1 YEAR

At the follow-up examinations the patients reported whether they had recovered or not, and if they had recovered, they were asked to try to

state on what date the recovery had occurred. The patients were classified as having recovered when they did not have pain every day, evoked by normal, every day exertion. If they only had stiffness or fatigue in the back or pain evoked only by extraordinary exertion, they were defined as having recovered, but as having symptoms of lumbar insufficiency. This demarcation gives some uncertainty as the results might be influenced both by the patient's statements, and by the investigator's judgement. Since there was only one investigator in the study, any errors of judgement will tend to be uniformly distributed among the patients.

35 % of the patients recovered within one month, 70 % within 2 months and 86 % within three months. 6 % had a duration of pain longer than 6 months. The recovery rate within 1 month is a little low in comparison with several other reports (Horal 1969, Nachemsson 1976). This might be explained by the fact that only a minority of patients with very short duration were included in this study. The recovery rate at two months and later is in fairly good correspondence to that in other reports (Horal 1969, Nachemsson 1976).

The information about sick-listing during the initial episode and during relapses has been checked with the National Health Insurance Office. 85 % of the patients were sick-listed during the initial episode, but the duration of sick-leave was considerably shorter than the period of pain. There was a significant relation ($p < 0.001$) between the duration of pain and duration of sick-listing during the initial episode, however. When studying sick-listing it is important to remember that it does not solely reflect the severity of the condition. It is also influenced by various vocational, social and personality-related factors.

The patient's description of pain location was mapped and coded by the investigator. The distribution of pain location among the patients on the different occasions of investigation showed a remarkable uniformity within the group during 6 weeks. The only divergence was a slight increase in radiation of pain at 6 weeks, which may be a consequence of the fact that 8 % of the patients developed rhizopathy during the year of observation.

The pain index is the sum of scores for several indices of pain and functional limitation. The more severe the patient's description of the pain was, the higher was the pain index. Median values for the pain index at the initial examination were compared with median values for the pain

index at the subsequent investigations. There was a reduction of the pain index by 50 % between the initial examination and the 10-days examination, after which the pain index remained almost stable at the following two examinations. It is uncertain whether the change during the first 10-day period represents a true change in the patient's condition or an altered attitude to the questions concerning pain, or a combination of these two factors.

After recovery from the first episode, the patients were followed up by further examinations and asked about relapses. 62 % had one or more relapses, and 18 % had more than two relapses. On an average, the reported relapses were more benign in character than the initial episode. When the relapses for each patient were totalled the median duration was 27 days, which is one week less than the median duration for the initial episode. 50 % of the patients with relapses were sick-listed, while 85 % of the patients were sick-listed during the initial episode.

62 % of the patients had symptoms of lumbar insufficiency either in connection with recovery from the initial episode or later. Hult (1954) reported that 26 % of a group of patients with low back pain also had symptoms of lumbar insufficiency. The discrepancy in the incidence of insufficiency in the two studies might be explained by the prospective nature of the present study. A prospective study allows better possibilities of detecting even transient episodes of back pain and slight symptoms of lumbar insufficiency. Since there are very few prospective studies on low back pain in the literature, the results of the present study are not directly comparable with those of other studies.

INFLUENCE OF CONFOUNDING FACTORS ON COURSE OF DISEASE

Many of the factors contributing to the patients' profile were related to the course of the disease.

History of back pain

Patients without previous episodes of back pain had a shorter duration of recurrences than patients with up to three previous episodes ($p < 0.05$). On the other hand, the 15 patients who had more than 3 previous episodes tended to have a shorter duration of recurrences than patients without previous episodes of back pain. This relationship is very uncertain due to the small number of patients, but it makes it difficult to draw conclusions about the influence of previous episodes on recurrences.

Patients with an insidious onset of symptoms had a longer duration of the initial episode than patients with a sudden onset ($p < 0.05$). The relation was rather weak and cannot be considered conclusive, but might be an indication that back pain with different types of onset is in some respect different. No answer to this question has been found in the literature.

Clinical findings

The severity of symptoms at the initial examination, expressed by the pain index, was related to the duration of sick-leave ($p < 0.05$), but not to the duration of pain. When those patients who still had severe symptoms, expressed by a high pain index, after 10 days, were analysed separately there was a stronger relation to the duration of sick-leave ($p < 0.001$), and also a relation to the duration of the initial episode of pain ($p < 0.001$). Thus, the intensity of the patients' pain at the first visit is no indication of the duration of pain. On the other hand, if severe symptoms have not subsided within 10 days, the duration of the episode will probably be prolonged. Quite logically, sick-listing occurred more frequently if the symptoms were severe.

When other clinical manifestations, such as radiation of pain to the thigh, decreased lumbar flexion, the presence of postural scoliosis, the presence of pain on percussion and a positive SLR-test, were related to the course of the disease it was found that none of them had any influence on the duration of the episode. Neither did any of them affect the length of relapses. The only relationship found was that both patients with a positive SLR-test and those with pain on percussion had a longer duration of sick leave during the initial episode ($p < 0.01$). Consequently, in this study patients with severe symptoms and certain clinical findings had a longer duration of sick leave, but these circumstances did not affect the duration of symptoms or the tendency to relapse. On the other hand, if the patients had severe symptoms and these did not subside within 10 days the duration of symptoms was significantly prolonged.

Vocational factors

The influence of vocational factors on the course of acute low back pain may be interpreted in terms of more or less strong relations to the prognosis of the disorder. The pronounced differences in the course of the disease between the office staff and the manual workers must be of de-

cisive importance when evaluating the relation between vocational factors and the duration of back symptoms and any consequent absence from work.

There are probably other possible explanations apart from vocational differences for the significantly shorter duration of the initial episode and the shorter absence from work among the office staff compared to the manual workers.

However, the vocational factors related to significantly longer duration of symptoms and absence from work were so highly associated with the working conditions of manual workers only that these vocational factors can not be excluded as having played a part in causing the differences observed between the two categories.

Owing to the skewed distributions of vocational conditions and consequent lack of analyses, it is impossible to establish the magnitude of the influence of all the vocational factors on the course of low back pain.

Job satisfaction, bending and twisting could not be analysed in relation to each category of employment and the duration of back symptoms.

Fixed postures, lifting and forceful movements together with a low requirement of concentration and exhaustion after work were all related to either a prolonged duration of symptoms or absence from work, or both, in the analysis of the whole population. These relations were not observed in the separate analysis of manual workers only. There is, therefore, no evidence of a strong relation between these variables and the course of acute low back pain among manual workers. These latterly mentioned working conditions were not common enough in the office staff to be analysed separately.

For the same reason, daily back fatigue, repetitive and monotonous work could not be related to the course of disease in the office staff only. However, daily back fatigue and repetitive and monotonous work were still significantly related to a longer duration of the initial episode in the separate analysis of manual workers. Moreover, sitting for less than two hours per day was associated with a prolonged absence from work during the initial episode. This prolonged absence from work cannot be explained only by the fact that the patients sat rarely since the patients who stated that they sat for less than two hours per day at the same time reported that their work required standing, bending and twisting postures

most part of the day. These vocational circumstances could also explain the prolonged absence from work.

Since the vocational factors studied are strongly related to each other, the results of this study do not reveal which vocational factor or factors are of greatest importance for determining the course of acute low back pain. The results only emphasize the need for further investigations in this field.

Psychological factors

In the present study the patients filled in a psychological inventory comprising a modification of the Hs- and Hy-scales from the MMPI test before treatment was begun. Six months after entering the study the Eysenck test was administered to the patients. A relation was found between a high score on the modified Hy-scale and a longer duration of the initial episode and also to a longer duration of sick-leave during the initial episode ($p < 0.05$). The Hs-scale showed no relation to the course of the disease. A low score on the Extroversion-scale of the Eysenck test was associated with a longer duration of relapses ($p < 0.05$); while the Neuroticism-scale of this test was not related to the course of the disease. It is quite logical that the Extroversion-scale of the Eysenck test was related to the duration of relapses and not to the duration of the initial episode, since this test was administered to the patients 6 months after their entry to the study.

The relations found are weaker than in several of the studies on the predictive capacity of the MMPI (Beals & Hickman 1972, Wifling et al. 1973, Wiltse & Rocchio 1975) and cannot be considered conclusive. In the previous studies most of the patients had more longstanding back pain than the patients in the present study, and they may differ in respect of the importance of psychological factors. Furthermore, the treatment methods were different and the scales of the MMPI that have been used in this study are not identical with the ordinary scales.

Although the relationships that have been found are not conclusive, they do indicate that psychological conditions may be of importance even in acute cases. To get a definite answer to this, and to elucidate to what extent psychological factors are important, further investigation is necessary.

Social factors

As previously mentioned, there are several reports in the literature of an association between back pain and social problems of different kinds (Natvig 1970, Westrin 1970, Helander 1973), but there are few studies that relate these problems to the result of treatment of back pain. Roslund (1974) found that the result of surgical treatment for herniated disc was related to the occurrence of preoperative social problems. In this study the minority of patients that had a documented contact with the social welfare authorities had a longer duration of the initial episode ($p < 0.01$). The contact with the social welfare authorities mainly took place during the period of the study. This means that it is uncertain whether the relation is an indication that patients with social problems tend to have a poorer prognosis or that patients with longstanding back pain gets social problems. Irrespective of the origin of the relation, patients with a manifest need for support from the social welfare authorities were significantly more often found among patients with longstanding back pain. Considering this fact, it is a little surprising that the occurrence of contact with the social welfare authorities did not influence the duration of sick-leave during the initial episode. However, in this study the reason for contact with the social welfare authorities has in most cases been constant financial problems, which might have influenced these patients to cut their sick-leave as short as possible.

Previous psycho-somatic symptoms

Patients who had reported "psychosomatic" symptoms of different kinds did not differ from patients without these symptoms as regards the course of the disease. This may be compared with Westrin's (1970) findings that psychiatric symptoms were not more common among patients who had been sick-listed for back pain than among controls.

Tendency to report sick

Patients with a high rate of sick-listing under various diagnoses during the two years before entry to the study also had a longer duration of sick-leave during the initial episode ($p < 0.001$). The duration of pain was not longer for these patients, however. Consequently, patients with an extensive history of sick-leave under various diagnoses had a greater tendency to be sick-listed during the episodes of back pain. This is in agreement with the findings of Westrin (1970).

Demographic factors

In this study young patients had a longer duration of the initial episode ($p < 0.05$), and were more often sick-listed during relapses, than older patients ($p < 0.05$). This is contrary to other reports (Horal 1969, Haber 1971, Wood & Leish 1974), in which older patients have a more prolonged disability. The findings regarding the influence of age in this study are probably indirect, however, and can be explained by the fact that while the median age in the total material is 35 years, the median age among the office staff, who in this study proved to have a more benign course, is 42.5 years.

There was no difference between the sexes in respect of the course of the disease. This is in contrast to the findings of Leavitt et al. (1971), who reported a poorer prognosis for women in a study on industrial back injury.

The results indicate that clinical findings, both subjective symptoms and objective findings, are of little prognostic value when determining the course of acute low back pain. On the other hand, the results indicate that certain vocational, psychological and social factors are more important when determining the course. However, the magnitude of the prognostic importance of these factors is not possible to establish from the results in this study.

EFFECTS OF THERAPY

Low back pain is often described as periodic in nature with spontaneous remissions (Rowe, 1969). The natural history of the disorder must therefore be considered when evaluating therapeutic effects.

This investigation showed that 70 % of the studied group recovered from the initial episode within two months and 86 % within three months, regardless of the treatment given. These figures correspond fairly well with observations by others (Hult 1954, Horal 1969).

The significantly shorter duration of symptoms following the Back School treatment and combined physiotherapy in relation to "placebo" treatment is thus worthy of attention.

Pronounced differences were observed between the group given "placebo" and the two groups given Back School and physiotherapy treatment when using the time following the first treatment as the effect variable.

It was therefore of interest to see whether the differences in the duration of symptoms after the first treatment could be explained by corresponding differences in time between the onset of symptoms and first treatment in the treatment groups.

The results indicate that the treatment groups did not differ significantly in time for applied treatment in relation to onset of symptoms. There is, moreover, a marginal trend indicating that the longer the time elapsing between the onset of symptoms and the start of therapy the longer the time taken after the first treatment until recovery. This observation is evidenced by the inclination of the lines in Fig. 19 on page 73.

The results of the analysis indicate that, with Back School treatment or combined physiotherapy of the type described in this study, patients with acute low back pain recover faster the earlier therapy is instituted.

However, the results do not reveal what kind of effect the two modes of therapy have as compared to the "placebo" alternative. Since very little is known about the causes of back pain and therefore about the specific effect of therapy, there is reason to expect as pronounced a placebo effect in the Back School and physiotherapy groups as in the "placebo" group.

The magnitude of the placebo effect is difficult to measure with present methods. The personality of the patient and of the therapist and the time spent with the therapist are probably important factors when one is trying to assess the placebo effect.

The significant effect of the Back School in relation to the "placebo" group might to some extent be explained by the fact that the patients spend more time with the therapist in the Back School. In both groups the patients are not actively treated and they should therefore be reasonably comparable.

The Back School and the combined physiotherapy are more comparable as regards the time spent with the therapist. This could be one explanation why there is so little difference in treatment results between the Back School and the combined physiotherapy. Physiotherapy as defined

on p. 31-37 in this study is to a great extent directed towards manual contact with the patient. This might also contribute to a further placebo effect. There are other reasons to speculate on the role of the time spent with the therapist. There was no significant difference in duration of the initial episode between the non-treated patients and the "placebo" group. These two groups spend equally short time with the therapist compared to the Back School and physiotherapy patients who spend equally long time with the therapist.

Variation in compliance i.e. the patient's ability and will to comply with directions given is a factor that is as difficult as the placebo effect itself. The Back School consists exclusively of lectures. The effect of the School must therefore be seen in relation to the patient's compliance with instructions given.

No specific investigation of compliance was carried out in this study, owing to the unsatisfactory nature of the methods available. It is possible to determine the retention of theoretical knowledge obtained in the school but this gives no information about the ability of the patients to follow the practical instructions given.

The patient's subjective opinion of the value of the Back School has been presented in a study by Lidström & Zachrisson (1973). 75 % of the patients reported positive experience of the School.

The short duration of symptoms following Back School treatment and physiotherapy in relation to "placebo" must also be elucidated with reference to the previously discussed confounding factors. To avoid undesired effects of the confounding factors in the treatment groups, there are several approaches that may be used. One is to stratify according to factors known to influence the disorder studied. Others (Magora 1970, Sternbach et al. 1973) indicate that vocational and psychological factors are of importance and they were therefore chosen for the stratification in this study. Another way to obtain an equal distribution is to study a sufficiently large group. The appendix indicates the distribution of confounding factors in the treatment groups. It will be seen that the distribution is equal. Thus, the difference in the duration of symptoms following the first treatment in the three groups cannot simply be explained by a skewed distribution of the confounding factors which per se might influence the results.

Variations in placebo effect, in compliance and in distributions must also be considered when evaluating absence from work. The possibility of skewed distribution of the studied confounding factors is eliminated according to the tables in the appendix mentioned above.

The placebo effect and the variation in compliance are factors included, on the other hand, in the significantly shorter absence for the Back School patients. This is perhaps not a surprising result since one of the main aims of the Back School is to teach the patients how to work in pain-free postures when the condition of the back so permits.

The reason for using variables related to recurrences as effect variables was to investigate whether preventive measures in the form of the Back School influenced the incidence and length of relapses or consequent absence from work in relation to the other groups. Such an effect was not confirmed by the results, which showed a lack of difference between the three groups. A possible effect may, however, be masked by the fact that the patients may have received treatment during recurrences.

All the effect variables mentioned so far are quantitative in nature. An attempt was also made to compare the treatment groups qualitatively by investigating whether a more pronounced relief of pain could be observed during the course of the initial episode in the studied groups.

The corresponding median values and mean differences in the groups do not indicate that any of the three therapies are symptomatically superior to the others.

The fact that the patients in the "placebo" group changed occupation because of their back disorders more often than the Back School and physiotherapy patients was a finding which can be subjected to speculative explanations only. Consequently, the differences obtained between the treatment groups in the frequency of changing occupation will not be discussed any further.

At the present stage of research there is a lack of methods for establishing a physiological relationship between the therapy given and the reduction of clinical manifestations. Moreover, the magnitude of a possible placebo effect of therapy on low back pain is unknown.

Pending more research in this field, the effect of the Back School and combined physiotherapy should be evaluated with reference to the time and expenses involved in the treatment of low back disorders.

The duration of symptoms following the first treatment did not differ significantly in the two treatment groups. In addition, the significantly shorter absence from work was observed among the Back School patients.

With these findings in mind, there is reason to discuss the demands on resources made by the Back School as compared to combined physiotherapy.

The possibility with the Back School of treating several patients at each lesson is the most obvious advantage over combined physiotherapy, which allows only one patient per treatment session.

The additional effect of the Back School on the absence from work also favours the use of the Back School system.

Judging from the evidence found in this study, relatively small resources in the form of the Back School are sufficient to achieve the same results as therapy requiring more time and personnel.

SUMMARY AND CONCLUSIONS

The aims of this investigation were:

1. to describe a population of patients with acute and subacute low back pain. The patients had to meet the following criteria:
   a. lumbo-sacral pain, with or without radiation to the thigh,
   b. duration of pain before entry to the trial not longer than three months.
   c. a pain-free year before the onset of the current episode,
2. to determine whether various clinical, vocational, psychological and social factors are of any prognostic value when assessing the course of acute and subacute low back pain,
3. to evaluate the effect of
   a. the Back School, based on ergonomic advice,
   b. combined physiotherapy, consisting of mainly manual therapy,
   c. "placebo", by means of low intensity short-wave diathermy,

   on acute and subacute low back pain.

This prospective investigation was carried out at the Medical Department of the Automotive Division of AB Volvo, Göteborg, Sweden.

Of all patients consulting the Medical Department because of low back pain from August, 1974 to May, 1975, 217 fulfilled the criteria for admission to the trial. These patients were all followed for one year. No drop-outs were registered.

The patients underwent a clinical examination and completed a questionnaire about previous back symptoms, current symptoms and their social and vocational situation. The patients also underwent psychological tests comprising the Hs- and Hy-scales of the MMPI. The patients were then randomly allocated, on the basis of the psychological tests and vocation-

al factors, to one of the two treatments or to the "placebo" group given low intensity short-wave treatment. After the completion of treatment, the course of the disease was registered at 5 – 7 fixed control examinations during one year. During this period information was also collected from the social welfare authorities and the National Health Insurance Office. The patients were also subjected to a further psychological test, the Eysenck Personality Inventory, six months after entry to the study.

The average age of the patients was 34.5 years and 13 % were women, as compared to 20 % women among all Volvo's employees in Göteborg. Just over half the patients had previously suffered from back symptoms in the form of one or more attacks of lumbago or sciatica. The duration of the current episode of pain when the patients first attended the medical centre varied between one and 86 days, with a median duration of 9 days. Just over half the patients had a gradual onset of symptoms while the remainder had a sudden onset, often in connection with lifting or bending.

All patients had low back pain. 26 % had radiation of the pain to the gluteal region or thigh. A majority of the patients considered their pain to be intense and half had continuous aching. Coughing and sneezing caused aggravation of the pain in 40 %. Pain when leaning forward and sitting was the predominating functional limitation.

Straight Leg Raising Test was positive in 62 % of the patients, while only 14 % had a positive test below 60°. Almost 90 % of the patients had pain on lumbar flexion, and the mean value for flexion according to a modification of Schober's method was lower than normal. The mean values for extension and lateral flexion were within the normal limits and a minority of the patients experienced pain during these movements. Pain on percussion was noted in 40 % and tenderness on palpation in 60 % of the patients. Less than 20 % of the patients had a postural scoliosis or pronounced muscle spasm.

27 % of the patients were office staff, which means that they were only slightly under-represented compared to the proportion of office staff among Volvo's employees. Sitting predominated as the working posture among office workers and standing among manual workers. A minority of both categories of employees considered that their working posture was completely fixed during most of their working day. Bending and twisting movements during work were reported by the majority of the

manual workers, whereas lifting and forceful movements were less common. A majority of both categories of employees considered that their work required concentration during at least part of the day, whereas variation in the work occurred more frequently among office staff. A majority of the patients considered their work not to be particularly fatiguing. Most of the patients were satisfied with their jobs and with their working environment. 75 % of the patients had been employed at Volvo for more than 3 years.

Of the 217 patients 12 % had had contacts with the social welfare authorities since 1974 owing to financial problems, problems in adjusting or alcoholism. Psychosomatic symptoms were infrequent. The total duration of sick-leave during two years before the study was lower than the average for industrial workers.

The distribution of personality variables in the Eysenck test accorded with the distribution in a normal population. The hysteria and hypochondriasis scales of the MMPI showed low distributions but no comparison with other populations has been carried out.

The episodes of pain lasted less than one month in 35 % and less than 3 months in 87 % of the patients, while 4 % of the patients still had pain after one year. The median duration of pain was 35 days. During the initial episode of pain 86 % of the patients were sick-listed with a median duration of sick-leave of 21 days. The location of the pain did not alter during the first 6 weeks except that there was a slight increase in the number of cases of radiation of pain at the end of this period. The intensity of pain decreased markedly during the first few weeks, after which it remained relatively constant during the following month in those patients who still had symptoms. Just over 60 % of the patients had a recurrence during the first year, the mean number of recurrences being 1.3 per patient. The recurrences were generally less severe and the median total duration of recurrences was 28 days. 50 % of the patients with recurrences were sick-listed, the median duration of sick-leave being 16 days.

Symptoms of lumbar insufficiency occurred during the follow-up period in 60 % of the patients, while 8 % of the patients developed rhizopathy.

The history of back pain, the clinical manifestations and the vocational, psychological, social and demographic factors characterizing the group

of patients studied were all related to the course of acute low back pain during one year. The course of back pain has been characterized by 1) the duration of symptoms during the initial episode of pain, 2) the duration of sick-leave during the initial episode, 3) the total length of recurrences of pain in one year and 4) the total duration of absence from work due to recurrences in one year.

The number of previous episodes characterizing the history of pain was related to the course of low back pain. The duration of recurrences was longer among those patients who had reported up to three previous episodes of pain compared to patients with no previous episodes. However, this relationship was not observed among the patients who had had more than three previous episodes of pain. These findings indicate that the number of previous episodes of back pain does not play an important part in determining the course of acute low back pain.

Patients who reported an insidious onset of pain had a longer duration of the initial episode of pain than the patients who had a sudden onset. Back pain may therefore vary in some respect depending on the type of onset.

The severity of pain was expressed by a "pain index" based on several questions regarding pain. The scores for the "pain index" on the various occasions of examination were related to the course of back pain. A longer duration of sick-leave was observed among the patients who had a high "pain index" score at the initial examination, while the duration of pain initially was not influenced. Patients who at the ten-day examination still had an elevated "pain index" score were found to have both a prolonged initial episode and longer absence from work. Severe pain mainly predisposes to prolonged sick-leave.

Other clinical manifestations, such as radiation of pain to the thigh, decreased lumbar flexion, the presence of postural scoliosis, the occurrence of pain on percussion and a positive SLR-test, were not related to the duration of any of the episodes of pain in one year. The only relationship found was a longer duration of sick-leave among patients who had a positive SLR-test and pain on percussion. A positive SLR-test and pain on percussion may also be regarded as an expression of pain intensity. Consequently, patients with severe symptoms, in terms of both a "pain index" and certain clinical findings, have a longer duration of sick-leave

while the duration of the episodes of pain are not influenced unless the severe symptoms persist.

Vocational factors in terms of working postures required, vocational fatigue, variation, satisfaction and need to concentrate at work, were related to the course of acute low back pain. Frequent bending and twisting, fixed postures, lifting and forceful movements, general fatigue, daily back fatigue, repetitive work, no needs of concentration and discontent at work, were all related to either a longer initial episode of pain or a longer absence from work or both when all the patients were analysed together.

A comparison between manual workers and office staff revealed pronounced differences in the duration of symptoms and sick-leave in the two groups. The manual workers had both a longer initial episode of pain and a longer duration of sick-leave during both the initial episode and the relapses.

Separate analyses of manual workers and office staff were then performed to determine whether the same relationships were observed between the vocational factors and the course of low back pain as in the analysis of the whole group of 217 patients. However, working conditions differed so much between the two groups of employees that the separate analyses did not justify any firm conclusions as to which vocational factor or factors are of the greatest prognostic importance for determining the course of acute low back pain.

Patients with high values on the Hy-scale in the MMPI had longer episodes of pain and a longer duration of sick-leave than other patients, while the Hs-scale showed no relation to the course of the disease. Patients with low values on the Extroversion-scale in the Eysenck test had a longer total duration of recurrences during one year than those with high values, while the Neuroticism-scale was not related to the course of the disease. The findings support previous observations that psychological factors are of importance for the course of back pain. No firm conclusions about the importance of psychological factors or the mechanism of the causal association can be drawn from the results of this study, however.

Patients who had had contacts with the social welfare authorities had a longer initial episode of pain than other patients. This finding accords with previous reports of an association between pronounced back symptoms and social problems, but no conclusions can be drawn as to whether the social problems are a result or a contributory cause of the prolonged course.

Patients who had previously had long periods of sick-leave for different reasons showed a pronounced tendency to have a longer duration of sick-leave during the current episode of pain. The occurrence of certain psychosomatic symptoms was not related to the course of the disease. The patients who regularly engaged in physical training did not differ from the other patients in respect of the course of the disease.

The effect of three different methods of treatment on acute low back pain was evaluated. The Back School was compared with combined physiotherapy and "placebo".

The effect of the treatments was estimated by relating the treatments to 1) the duration of symptoms following the first treatment, with special reference to the time elapsing from the onset of symptoms to the first treatment, 2) the length of absence from work during the initial episode, 3) the change of pain during the initial episode and 4) the number and length and duration of sick-leave owing to recurrences of pain during one year.

The time elapsing from the onset of back pain to the first treatment did not differ significantly in the three treatment groups.

The duration of symptoms following the first treatment was 14.8 days for the Back School group, 15.8 days for the physiotherapy group and 28.7 days for the "placebo" group.

The patients attending the Back School were observed to have a shorter duration of sick-leave during the initial episode than the other two treatment groups. The median absence from work was 20.5 days for the Back School patients, 26.5 days for the physiotherapy group and 26.5 days for the "placebo" group. The change of pain during the initial episode was equal in all the treatment groups. Neither the number, nor the length of absence from work owing to recurrences differed in the three treatment groups.

Patients in the "placebo" group changed occupation more often because of back pain (27 %) than the physiotherapy (10 %) and the Back School patients (14 %).

There is enough evidence in this study to conclude that Back School and combined physiotherapy are superior to "placebo" treatment in acute low back pain. The Back School program also reduces the absence from work.

The Back School, teaching several patients at a time, must be regarded as an advantageous mode of therapy as relatively small recources are needed to achieve the same effects as with physiotherapy.

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APPENDIX

DISTRIBUTION OF CONFOUNDING FACTORS IN THE TREATMENT GROUPS

Group A = Back School
Group B = Physical therapy
Group C = "Placebo"

Demographic factors

Age

	<30	30–50	> 50 years
Group A	23	32	15
B	21	41	10
C	31	34	10

Sex

	male	female
Group A	64	6
B	60	12
C	65	10

History of back pain and clinical factors

Earlier episodes of back pain

	0	1–3	> 3 episodes
Group A	33	28	9
B	33	30	9
C	30	36	9

Onset of symptoms

	Sudden	Insidious
Group A	26	44
B	37	35
C	34	41

"Pain index"

	Median values p
Group A	43
B	42
C	42

p = points

Vocational factors

Category of employment

	office staff	manual workers
Group A	23	47
B	18	54
C	16	59

Sitting posture

	> 4 hours/day	2–4 hours/day	< 2 hours/day
Group A	20	9	41
B	21	11	40
C	16	14	45

Standing posture

	> 4 hours/day	2–4 hours/day	< 2 hours/day
Group A	43	10	17
B	45	10	17
C	46	19	10

Stooped posture

	often	regularly	rarely
Group A	41	12	17
B	46	13	13
C	53	10	12

often = > 10 times/hour
regularly = < 10 times but regularly
rarely = 1 – 2 times/week

Rotated posture

	often	regularly	rarely
Group A	40	15	15
B	49	10	13
C	50	12	13

often = > 10 times/hour
regularly = < 10 times/hour but regularly
rarely = 1 – 2 times/week

Lifting (⩾ 5 kg)

	often	regularly	rarely
Group A	18	21	31
B	26	15	31
C	23	25	27

often = > 10 times/hour
regularly = < 10 times/hour but regularly
rarely = 1 – 2 times/week

Lifting (⩾ 20 kg)

	often	regularly	rarely
Group A	8	17	45
B	7	12	53
C	10	9	56

often = > 1 hour
regularly = < 1 hour, regularly
rarely = 1 – 2 times/week

Forceful movements

	often	regularly	rarely
Group A	6	12	52
B	8	15	49
C	11	12	52

often = > 10 times/day
regularly = < 10 times/day but regularly
rarely = 1 – 2 times/week

Fixed posture

	fixed	semi-fixed	not fixed
Group A	17	12	41
B	19	25	28
C	17	32	26

Pauses

	often	sometimes	rarely
Group A	16	26	28
B	14	39	19
C	14	32	29

often = every hour
sometimes = several times/day
rarely = occasionally

Variation of work

	variation	some variation	no variation
Group A	14	25	31
B	19	31	22
C	17	23	35

Concentration

	much concentration	little concentration
Group A	32	38
B	35	37
C	29	46

Satisfaction with working tasks

	satisfied	not satisfied
Group A	56	14
B	52	20
C	49	26

Satisfaction with working environment

	satisfied	not satisfied
Group A	36	34
B	39	33
C	41	34

Relations to colleagues

	good	fair
Group A	63	7
B	63	9
C	67	8

Tiredness in the back

	never	occasionally	daily
Group A	28	37	5
B	28	33	11
C	27	37	11

Nervousness after work

	rarely	often
Group A	69	1
B	71	1
C	73	2

Fatigue after work

	not tired	tired	very tired
Group A	9	54	7
B	13	53	6
C	13	53	9

Wish to change work

	yes	no
Group A	19	51
B	21	51
C	23	52

Contact with social welfare authorities

	number of individuals
Group A	7
B	9
C	9

Psychological factors

Hy-scale

	0 p	1–5 p	5–10 p	10–20 p
Group A	16	37	12	5
B	11	44	13	4
C	13	42	15	5

p = points

Hs-scale

	0–5 p	5–10 p	10–20 p	> 20 p
Group A	2	10	52	6
B	0	9	59	4
C	2	11	58	4

p = points