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A New Clinical Model for the Treatment of Low-Back Pain

GORDON WADDELL, BSc, MD, FRCS

Because there is increasing concern about low-back disability and its current medical management, this analysis attempts to construct a new theoretic framework for treatment. Observations of natural history and epidemiology suggest that low-back pain should be a benign, self-limiting condition, that low back-disability as opposed to pain is a relatively recent Western epidemic, and that the role of medicine in that epidemic must be critically examined. The traditional medical model of disease is contrasted with a biopsychosocial model of illness to analyze success and failure in low-back disorders. Studies of the mathematical relationship between the elements of illness in chronic low-back pain suggest that the biopsychosocial concept can be used as an operational model that explains many clinical observations. This model is used to compare rest and active rehabilitation for low-back pain. Rest is the commonest treatment prescribed after analgesics but is based on a doubtful rationale, and there is little evidence of any lasting benefit. There is, however, little doubt about the harmful effects—especially of prolonged bed rest. Conversely, there is no evidence that activity is harmful and, contrary to common belief, it does not necessarily make the pain worse. Experimental studies clearly show that controlled exercises not only restore function, reduce distress and illness behavior, and promote return to work, but actually reduce pain. Clinical studies confirm the value of active rehabilitation in practice. To achieve the goal of treating patients rather than spines, we must approach low-back disability as an illness rather than low-back pain as a purely physical disease. We must distinguish pain from disability, the symptoms and signs of distress and illness behavior from those of physical disease, and nominal from substantive diagnoses. Management must change from a negative philosophy of rest for pain to more active restoration of function. Only a new model and understanding of illness by physicians and patients alike makes real change possible. [Key words: low-back pain, clinical model, treatment, psychosocial factors]

DURING THE PAST DECADE there has been growing concern about the present epidemic of low-back disability in Western Society.^{25,121,131,148,151,158} It is particularly disturbing that ever-increasing medical and health care resources are com-

pletely failing to alleviate the problem.¹⁷⁴ There is a constant demand from all quarters for more research—both in basic sciences and clinical treatment—but equally, and perhaps more fundamentally, important is the question of our whole approach to low-back pain. Only within the last few years has such a reappraisal really begun.^{100,101,123,148,186} This article analyzes the theoretic and conceptual framework on which any real breakthrough in treatment ultimately depends.

OBSERVATIONS ON THE NATURAL HISTORY OF LOW-BACK PAIN AND DISABILITY

The following are observations about low-back pain and disability:

1. At some stage of their life, 80% of the human race will experience low-back pain. Each year 2–5% of the at-risk population will seek medical attention or lose time from work because of low-back problems.^{11,25,71,73,78,131} As many as 60% of the normal population have experienced some degree of low-back pain in the past year, although they will not necessarily have seen a physician or lost time from work.^{27,28,38,129,179}
2. A total of 80–90% of attacks of low-back pain recover in about 6 weeks, irrespective of the administration or type of treatment, (Figure 1).^{11,24,71–73,143,187}
3. Newly introduced orthopaedic services in a rapidly developing country such as Oman are inundated with patients looking for treatment for low-back pain. As would be expected from the previously cited studies of Western populations, low-back pain appears to be almost universal. The striking observation in Oman is that although low-back pain is so common, there is very little actual disability before the introduction of Western medicine. Patients are crippled by polio, tuberculosis, or thoracolumbar fractures, but virtually no one goes to bed, stops daily life, or is permanently disabled by simple low-back pain.¹⁶⁵
4. Low-back disability has dramatically increased throughout Western society between the 1950s and 1970s (Table 1, Figures 2–4). In view of observations 1 and 5, this statement should not necessarily be interpreted as an increase in low-back pain or even injuries, but more specifically as increased work loss, sick certification, compensation, and long-term disability. There may also be increased use of the diagnosis of disc prolapse.⁸⁰ However, inexorable increase in low-back disability is not inevitable and some of the concepts reviewed here may already be having some impact (Figures 3 and 4).
5. Low-back pain and disability must be distinguished.^{3,5} Both are logically and clinically related to the underlying physical disorder or lumbar impairment, but there may be considerable disproportion in the individual patient (Figure 5).^{166,170} Clinical assessment of pain and disability depends on the patient's subjective report, which is considerably influenced not only by the objective

From the Orthopaedic Department, Western Infirmary, Glasgow, Scotland.

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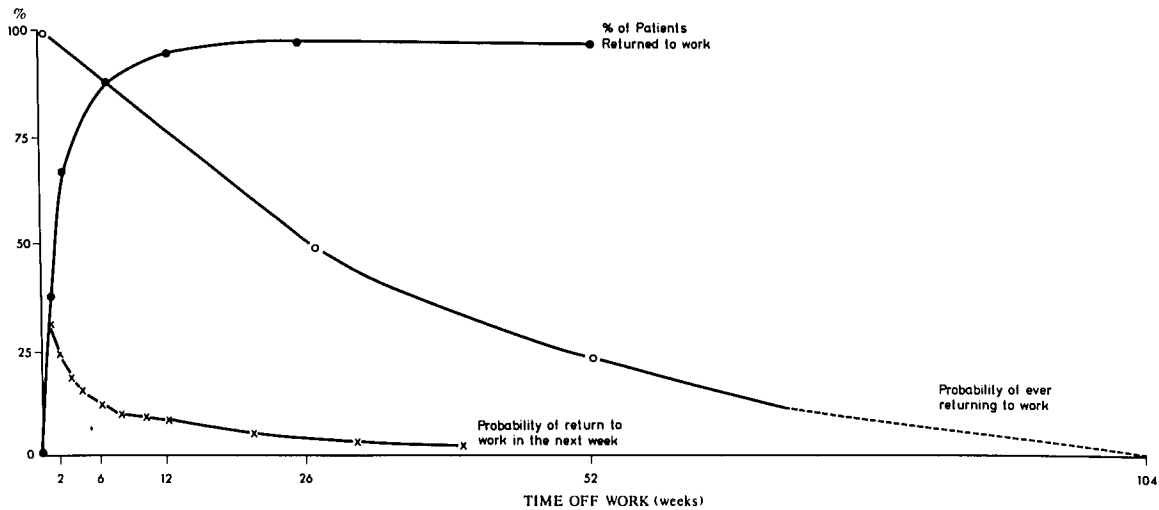


Fig 1. Return to work as a function of time away from work because of low-back pain, showing the proportion of patients returning to work with time^{11,24,71,73,143} and the diminishing probability of returning to work in the short term.^{72,187} or ever.⁹² Based mainly on data from Hrudefy⁷² and the Workmen's Compensation Board of British Columbia.¹⁸⁷

Table 1. United Kingdom Sick Certification for All Forms of Sickness and for Back Incapacities Including Sickness and Invalidity Benefit and Injury Benefit Expressed as the Annual Number of Spells or Episodes of Incapacity and as Total Days Sick Certification per 1,000 Persons at Risk*

| Year | All incapacities | | | | Back Incapacities | | | |
|-----------|------------------|-------|-------------------|--------|-------------------|-------|-------------------|-------|
| | Spells/1000 | | Days/1000 at risk | | Spells/1000 | | Days/1000 at risk | |
| | Men | Women | Men | Women | Men | Women | Men | Women |
| 1953-1954 | 404 | 406 | — | — | 21.7 | 8.0 | — | — |
| 1954-1955 | 432 | 444 | 14,140 | 17,095 | 22.3 | 8.8 | 506 | 329 |
| 1955-1956 | 439 | 444 | 14,107 | 16,807 | 23.8 | 9.5 | 538 | 352 |
| 1956-1957 | 410 | 423 | 13,462 | 16,102 | 25.3 | 9.9 | 545 | 331 |
| 1957-1958 | 536 | 574 | 13,736 | 17,596 | 25.3 | 10.2 | 560 | 365 |
| 1958-1959 | 479 | 489 | 14,549 | 16,927 | 27.4 | 11.2 | 595 | 400 |
| 1959-1960 | 444 | 459 | 14,005 | 16,177 | 29.1 | 11.9 | 638 | 438 |
| 1960-1961 | 488 | 507 | 14,423 | 16,449 | 29.2 | 12.2 | 630 | 422 |
| 1961-1962 | 491 | 526 | — | — | 30.5 | 12.9 | — | — |
| 1962-1963 | 494 | 501 | 15,049 | 15,944 | 31.9 | 13.9 | 720 | 447 |
| 1963-1964 | 484 | 497 | 14,999 | 15,919 | 34.9 | 14.5 | 724 | 530 |
| 1964-1965 | 505 | 518 | 15,418 | 16,135 | 37.3 | 15.3 | 761 | 451 |
| 1965-1966 | 562 | 565 | 16,562 | 16,487 | 39.1 | 14.9 | 791 | 423 |
| 1966-1967 | 512 | 529 | 16,169 | 15,861 | 41.1 | 16.4 | 863 | 479 |
| 1967-1968 | 576 | 600 | 17,704 | 17,237 | 43.8 | 17.3 | 941 | 491 |
| 1968-1969 | 582 | 599 | 17,951 | 16,919 | 43.3 | 18.7 | 976 | 521 |
| 1969-1970 | 627 | 631 | 18,780 | 17,365 | 44.1 | 19.0 | 1051 | 512 |
| 1970-1971 | 509 | 542 | 16,976 | 16,152 | 42.5 | 19.7 | 1054 | 547 |
| 1971-1972 | 504 | 561 | 17,002 | 16,144 | 41.3 | 20.8 | 1032 | 565 |
| 1972-1973 | 554 | 619 | 17,727 | 16,780 | 45.1 | 21.9 | 1097 | 612 |
| 1973-1974 | 553 | 621 | 17,895 | 16,630 | 47.3 | 24.1 | 1133 | 634 |
| 1974-1975 | 534 | 605 | 17,339 | 16,151 | 47.9 | 24.8 | 1150 | 642 |
| 1976-1977 | 535 | 616 | 18,126 | 15,182 | 51.0 | 29.5 | 1254 | 763 |
| 1977-1978 | 571 | 688 | 19,262 | 17,975 | 55.9 | 34.3 | 1432 | 954 |
| 1978-1979 | 589 | 752 | 20,210 | 18,307 | 56.9 | 41.3 | 1455 | 1035 |
| 1979-1980 | 503 | 705 | 19,337 | 17,966 | 56.1 | 44.6 | 1720 | 1330 |
| 1980-1981 | 505 | 690 | 19,314 | 17,433 | 58.2 | 44.7 | 1852 | 1457 |
| 1981-1982 | 468 | 655 | 19,859 | 18,171 | 54.6 | 47.7 | 1882 | 1622 |

*No comparable figures are available from 1982 because of changes in the recording system. Back incapacities include all spinal disorders and diagnoses. Calculated from statistics supplied by the Department of Health and Social Security (DHSS).

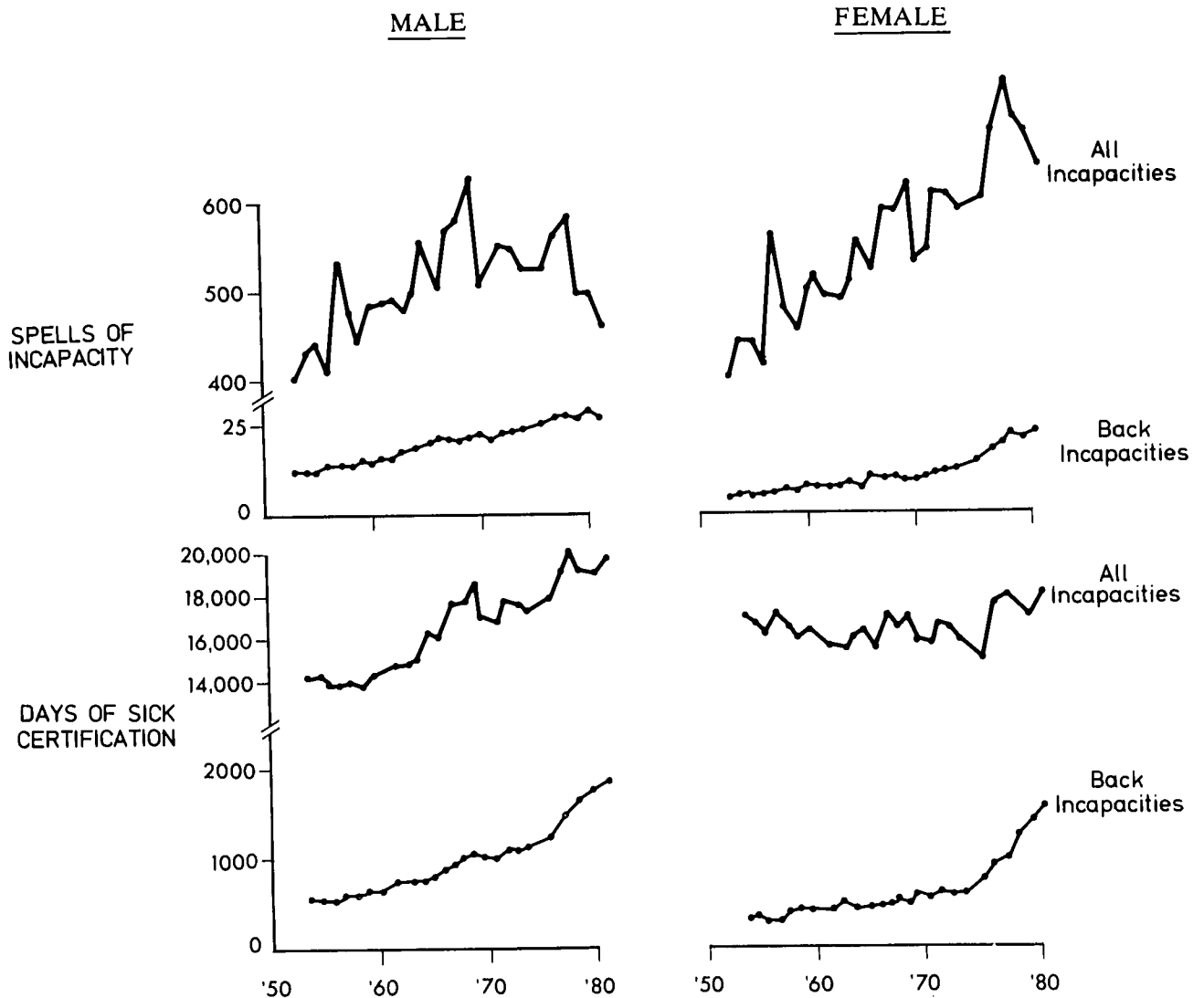


Fig 2. Trends of United Kingdom sick certification: annual statistics for England and Wales based on Table 1. Unpublished statistics supplied by the D.H.S.S.¹⁴⁵

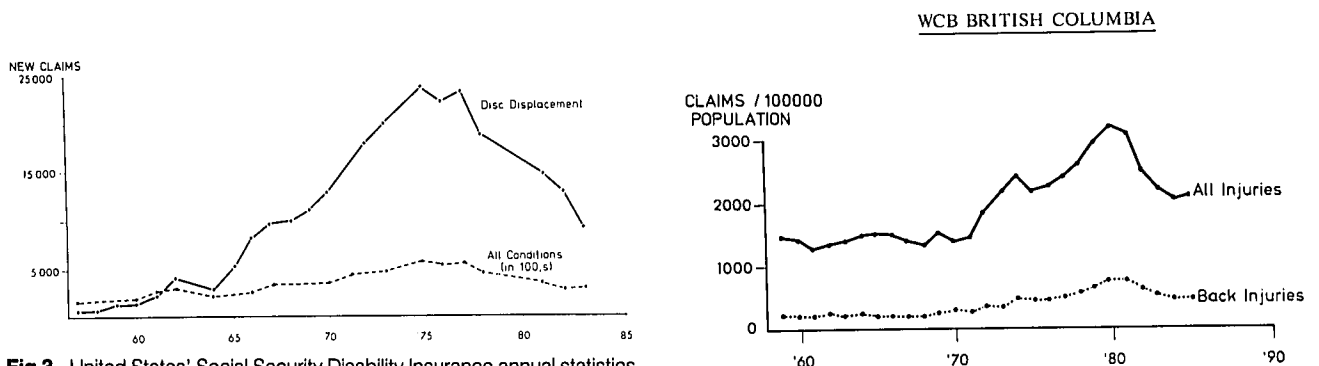


Fig 3. United States' Social Security Disability Insurance annual statistics of awards for permanent and total disability because of displacement of intervertebral disc, based on the Eight Revision of the International Classification of Diseases.¹⁴⁷ During this period there was a 56% increase in the population at risk.

Fig 4. Annual statistics for Workmen's Compensation Board claims for British Columbia expressed as rates per 100,000 total population. Based on data from Hruedy⁷² and the Workmen's Compensation Board of British Columbia.¹⁸⁷

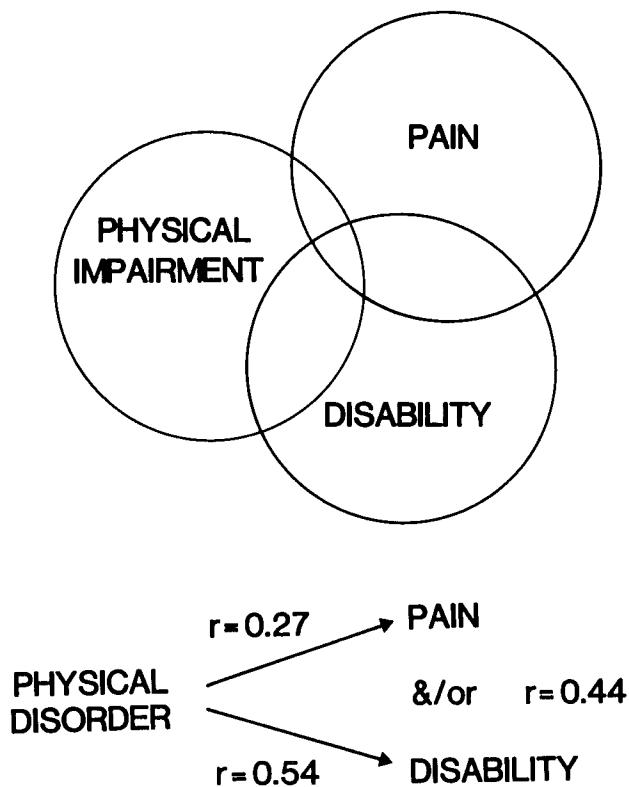


Fig 5. The quantitative relationship between the clinical presentation of pain, disability, and objective physical impairment and the correlation coefficients (r) between them where 0 is no correlation and 1 is complete correspondence.¹⁶⁶

physical abnormality but also by the patient's attitudes and beliefs, psychologic distress, and illness behavior (Table 2).^{110,171} The patient's report of disability based on restriction of activities of daily living may also be regarded as avoidance learning based not only on past experience of pain but also on the patient's individual interpretation of the meaning of that pain, the assumption that pain means tissue damage and medical advice about how to react to, manage, and cope with the pain.^{52,58}

6. Low-back pain causes the greatest problem, at least as judged by health care utilization and time away from work, in the middle working years of life with a peak age of about 40 years.^{25,71,73,78,143} Low-back pain and disability does *not* progressively increase with age and does not correspond to age-related changes of disc degeneration.^{68,162} Eight controlled studies^{60,71,73,81,96,113,152,160} and two reviews^{114,181} have shown surprisingly little relationship between clinical symptoms and radiologic changes of degeneration. It is not clear why low-back disability peaks in middle age.

Table 2. Analysis of the Causes of Disability in Chronic Low-Back Pain¹⁷¹

| Main Elements of Illness | Extent to which these account for disability (%) |
|--|--|
| Physical severity | 40 |
| Psychologic distress and abnormal illness behavior | 31 |
| Total identified* | 71 |

*Because of the inaccuracies of clinical observation, it is unusual to be able to identify such a high percentage of any biologic phenomenon.

7. The majority of the population with low-back pain and even disability cope with the problem themselves without medical treatment. Patients certainly do not go to the doctor simply because of the presence of pain or the severity of pain, and there is surprisingly little difference between patients with low-back pain who see a physician and other people with low-back pain who cope with it themselves (Table 3).^{27,28,129} Many everyday symptoms are interpreted as a minor temporary nociceptive stimulus that generates little anxiety, is managed either by ignoring or resting the affected part in expectation of natural resolution, and causes little interference with life.^{1,2} Seeking health care appears to depend more on the person's perception and interpretation of the significance of the symptoms, on the availability and expectations of treatment, and on learned and cultural patterns of illness behavior.^{1,2,6,70,103-105,134,175,176} The likelihood of making this decision may be increased by anxiety and emotional distress,^{104,107,159} or by life events and stress.^{105-109,116}

8. Once a patient reaches a physician, medical assessment and treatment is influenced more by the patient's distress and illness behavior than by the actual physical disorder.^{104,167} Medical treatment may in theory be prescribed for physical indications, but in practice both conservative¹⁶⁷ and surgical^{118,172} treatment for a poorly understood condition such as low-back pain is determined to a much greater extent than most physicians realize or would like to admit by the patient's distress and illness behavior (Table 4).

9. Despite uncontrolled personal claims for symptomatic success with particular modalities of treatment, every scientific study has

Table 3. Amount and Severity of Back Pain in People Who Have Attended a Physician and Those Who Have Received No Medical Attention in the Past 12 Months*

| | Medical attention in the last 12 months | |
|--|---|--------|
| | Own physician | No one |
| Duration of back pain in the last 12 months | | |
| None | 12 | 211 |
| Part of the year | 132 | 310 |
| All or most of the year | 126 | 79 |
| Severity of back pain in the last 12 months on a scale of 0-10 | | |
| 0-4 | 48 | 190 |
| 4-7 | 111 | 141 |
| 7-10 | 99 | 59 |

*Calculations based on data from the Consumer's Association Back Pain Survey.²⁷

Table 4. Analysis of Those Elements of Illness Influencing How Much Conservative Treatment Patients Received for Low-Back Pain¹⁶⁷

| Main elements of illness | Extent to which these account for the amount of treatment received (%) |
|---------------------------|--|
| Duration of symptoms | 14 |
| Physical severity | 11 |
| Psychologic distress | 9 |
| Abnormal illness behavior | 15 |
| Total identified* | 50 |

*Because of the inaccuracies of clinical observation, it is unusual to be able to identify such a high percentage of any biologic phenomenon.

shown remarkably little difference between every conceivable treatment for low-back pain.^{25,32,61,122,144,174} The few reported effects that have reached statistical significance are usually so small as to be of no practical clinical significance. It is important to distinguish between temporary or symptomatic relief and actual change in the underlying disease or natural history. It is the duty of health care professionals to help every patient in pain. It is entirely ethical to achieve this by unscientific or even placebo means,¹⁰ but this pragmatic need must be recognized for what it is and must not be confused with the demand for strict scientific proof for the effect of treatment. Viewed in this light there is no definite evidence that any treatment for low-back pain is much better than a combination of natural history and placebo effect.¹⁷⁴

10. Chronic pain becomes a completely different clinical syndrome from acute pain.^{43,90,153,154,160} Acute and chronic pain are not only different in time scale¹²⁵ but are fundamentally different in kind. Acute and experimental pains bear a relatively straightforward relationship to peripheral stimulus, nociception, and tissue damage.⁷⁵ There may be some understandable anxiety about the meaning and consequences of the pain,^{153,154} but acute pain, acute disability, and acute illness behavior are generally proportionate to the physical findings. Pharmacologic, physical, and even surgical treatments directed to the underlying physical disorder are generally highly effective in relieving acute pain. Chronic pain, chronic disability, and chronic illness behavior, in contrast, become increasingly dissociated from their original physical basis,^{90,137,185,190} and there may, indeed, be little objective evidence of any remaining nociceptive stimulus.^{57,90,123} Instead, chronic pain and disability become increasingly associated with emotional distress, depression, failed treatment, and adoption of a sick role.^{18,43,128,157,171} Chronic pain progressively becomes a self-sustaining condition that is resistant to traditional medical management. Physical treatment directed to a supposed but unidentified and possibly nonexistent nociceptive source is not only understandably unsuccessful but may cause additional physical damage; failed treatment may both reinforce and aggravate pain, distress, disability, and illness behavior.^{53,54,155,168,172,182} Pain clinics are full of such patients who have undergone failed low-back surgery (Table 5).

11. Time away from work and return to work after treatment are only partly related to physical severity but appear to depend more on socioeconomic and job-related influences (Table 6).^{8,115,172,176} Prolonged time away from work *in itself* makes recovery and return to work progressively less likely (Figure 1).^{39,156} In all Western countries, however, whatever the social or medical system, work loss of more than brief duration depends on sick certification. The medical profession therefore bears the responsibility for not only sanctioning but commonly advising patients with low-back pain to stay away from work.

Preliminary Conclusions

1. Low-back pain by its natural history appears to be a universal, benign, self-limiting condition. Indeed, low-back pain may from one perspective be regarded as normal.

2. Low-back disability, as opposed to low-back pain, appears to

Table 5. Cause of Pain in Patients Admitted to the Johns Hopkins Pain Clinic¹⁸⁹⁶

| | |
|--|-------|
| Total admissions | 1,541 |
| Spinal pain | 1,032 |
| Low-back pain with multiple surgery | 826 |
| Low-back pain with no previous surgery | 52 |

Table 6. A Comparison of Those Elements of Illness Influencing Assessment of Outcome of Surgery, Subjective Disability, and Return to Work after Surgery*

| | |
|---|----|
| Patient's and surgeon's ¹⁷² assessment of outcome of surgery (%) | |
| Postoperative physical impairment | 55 |
| Postoperative pain | 20 |
| Total identified | 75 |
| Disability ¹⁷¹ (%) | |
| Physical impairment | 40 |
| Psychologic distress | } |
| Abnormal illness behavior | |
| Total identified | 31 |
| Return to work ¹⁷² after surgery (%) | |
| Postoperative disability | 28 |
| Few identified social factors† | 22 |
| Total identified | 50 |

*Based on separate regression analyses of each measure.

†Very limited social information was available and this is likely to be an under-estimate.

be a recent Western epidemic that is not explained by any demonstrable change in the physical disorder.

3. Conventional medical treatment for low-back pain has failed, and the role of medicine in the present epidemic must be critically examined.

THE MEDICAL MODEL OF DISEASE

Modern medicine traces its roots to the European Renaissance of the sixteenth and seventeenth centuries. The work of Francis Bacon (1561–1616), Galileo Galilei (1564–1642), and Isaac Newton (1642–1717) epitomized the scientific method of careful observation, systematic collection of information, and mathematical reasoning, which enabled people to unlock nature's secrets without the influence of religious revelation. Paracelsus (1493–1541), Andreas Vesalius (1514–1564), and William Harvey (1578–1657) successfully challenged the authority of Galen and applied the scientific method to the practice of medicine. Studies of human anatomy and physiology provided the basis for careful clinical observation and the application of reason to the understanding of illness. René Descartes (1596–1650), the foremost philosopher of the Renaissance, divided human existence into "mind" and "body" and in this dichotomy characterized pain as a simple reflex response to a physical stimulus.³¹ Practical interpretation of pain could then be used to elucidate disease. "A pain, an ache, a discomfort—these are the common complaint of those who seek the doctor's help. Pain issues a warning with kindly intent. She calls to action and, pointing the way, brooks no delay. And thus the ancient [sic] cycle is served, from pain to cause, to treatment to cure".¹³⁵ But it was only two centuries later when Pasteur (1822–1895) discovered that infectious disease was caused by microbes.¹³⁴ Virchow (1821–1902)¹⁶³ proposed the concept of cellular pathology¹⁶³ so that this philosophical approach could be turned into practical reality according to the following: recognize patterns of illness behavior as symptoms and signs; infer underlying pathology for a diagnosis; relate physical therapy to underlying pathology for treatment; and expect improved illness behavior to achieve a cure.

The industrial revolution, increasing material resources, and the explosion of technology after World War II provided the investigative and therapeutic tools that have provided a control of disease. Previous ages would regard this achievement as literally miraculous, but twentieth century Western society has come to take it for granted. This rational physical approach to medicine reached its apogee when the mystery of life itself was unraveled in the deoxyribonucleic acid molecule,²⁶ and it became possible to implant artifi-

cial hip joints²³ and even to transplant hearts.¹⁴² In this mood of medical achievement and euphoria it was possible to assert confidently that the primary role of the physician was the control and, indeed ideally the relief, of all pain.^{43,188}

This physical approach to disease depends on the illness being due to a physical pathology, symptoms and disability being directly related to and proportionate to that physical pathology, and any psychologic element being relatively unimportant or secondary to the physical disorder. Clinical recognition and diagnosis of the underlying pathology then provides the basis for rational physical treatment of the illness.

A BIOPSYCHOSOCIAL CONCEPT OF ILLNESS

Medicine has a much more ancient and richer lineage than science. Since before the time of Plato the relationship between mind and body has been held to be of fundamental importance to human existence and to medicine. Aristotle recognized that people are social animals who live and act—and become ill—in social relationships with other human beings. Hippocrates emphasized the already well-established tradition that physicians' practical roles as healers cannot be separated from their social roles of helping human beings cope with illness and suffering.⁶⁹

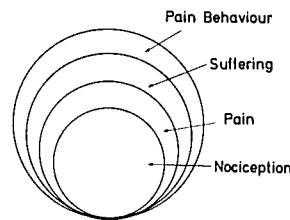
There is no logical reason why scientific treatment of disease should not be combined with human care of the patient.⁴ It is only because of the limitations of human nature that increased time, training, and concentration on the physical aspects of disease has led to neglect of the psychologic and social aspects of illness.⁴⁸ All physicians agree in principle with the need to treat each patient as a human being and then in busy practice too often get on with the practicalities of treating perceived disease. Yet from Claude Bernard¹⁴ to the present day there has been a constant note of concern and criticism both from eminent members of the profession¹⁴¹ and independent observers⁷⁹ that too mechanistic an approach may cure many serious diseases but only deals with one half—and not necessarily the most important half—of medicine's role in society.

Practical application of these humanitarian principles to the daily practice of medicine has fallen behind the physical therapy of disease. Nearly a century ago Sigmund Freud (1856–1939) reaffirmed the importance of psychologic factors in medicine and showed that psychoneurotic symptoms could be assessed clinically and provide insight into emotional processes.⁵⁸ Adolf Meyer (1866–1950) originally developed the concept of "multicausality" in psychiatry but recognized that psychosocial factors influenced the course and outcome of every illness, and that each patient must be seen and assessed as a person.¹¹⁴ Such a holistic view of medicine has been the hallmark, inspiration, and source of pre-eminence of American psychiatry⁸⁷ and it has rightly been claimed that an understanding of the psychosocial aspects of illness is one of the most important contributions that the behavioral sciences can make to medicine.⁸⁶ Because mental illness has never comfortably fit the disease model, psychiatrists have raised fundamental questions about the medical model and proposed an alternative biopsychosocial model, which includes physical, psychologic, and social elements.^{44–47,86–88} This is very much a model of human illness rather than disease and may apply equally well to nonpsychiatric illness (Figure 6).

The gate control theory of pain¹¹² provided the physiologic basis for the biopsychosocial model. Pain can no longer be regarded as merely a physical sensation of noxious stimulus and disease, but conscious experience of pain may be modulated by mental, emotional, and sensory mechanisms and includes both sensory and emotional components.^{75,105,111,161} The major conceptual contribution of the gate control theory is that it replaces the Cartesian

A BIOPSYCHOSOCIAL CONCEPT OF ILLNESS

A Conceptual Model of Pain



A Clinical Model of Illness

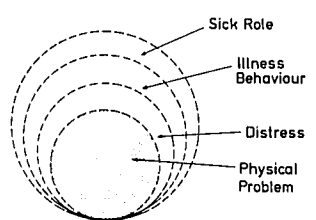


Fig 6. The biopsychosocial concept of illness⁴⁴; Loeser's conceptual model of pain^{80,89} and the Glasgow Illness Model^{167,171} — an operational model for clinical practice.

mind–body dichotomy and allows for the complexity of observed pain phenomena. It explains how psychologic and social influences may indeed modulate individual perception of and response to disease. The gate control theory has stimulated and contributed greatly to the new clinical approach to illness. However, it is important to avoid overemphasis of pain as the single most important element of human illness and even the sole aim of medical treatment.^{43,173} Nor must the theory be misapplied clinically merely to perpetuate the errors of the disease model in a new direction. Pain does not necessarily have to receive physical treatment independent of the ability to diagnose disease or without due consideration of nonphysical factors. The gate mechanism should not be invoked simply to move failed physical treatment to a slightly higher level in the neural pathway. The true clinical application of the gate control theory lies in a fuller understanding of human pain and illness.

Several elements of the biopsychosocial model have been developed further in the behavioral sciences. Early psychologic hopes that personality tests would predict individual response to illness have not been realized^{64,99} but have given birth to a number of simple psychologic questionnaires measuring distress.^{9,97,192} Medical sociology,^{106,108,109} behavioral psychology,^{51,54,161} and psychiatry^{138,139} have combined to develop the concept of illness behavior that has been defined clinically as "observable and potentially measurable actions and conduct which express and communicate the individual's own perception of disturbed health."¹⁶⁷ Sociologists have considered illness as a social phenomenon or sick role.^{102–109,133}

The whole biopsychosocial concept emphasizes human illness rather than disease. This must now be applied to clinical practice.^{83,95}

AN ANALYSIS OF SUCCESS AND FAILURE IN TREATING LOW-BACK DISORDERS

In the past generation we have been able to a large degree to treat and even prevent many serious spinal diseases such as polio, tuberculosis, spinal deformities, and paralysis. Since the identification of the disc prolapse¹¹⁷ surgical relief has become routine for nerve compression that fails to resolve naturally. Disc surgery has survived the test of time for half a century because at least 70–80% of carefully selected patients obtain relief.¹⁴⁹ Such dramatic surgical successes unfortunately only apply to approximately 1% of patients with low-back disorders.¹³¹ Our failure involves the remaining 99% of patients with low-back pain for whom the problem has become progressively worse—despite new investigative techniques and a bewildering variety of treatments (Figures 2–4).

Diagnosis may be substantive or nominal.¹⁹¹ Substantive diagnosis have objective clinical features, and investigations confirm a definite pathologic process, which may permit rational and successful treatment. In most patients with low-back pain, however, we have neither the biomechanical nor pathologic understanding to identify any definite pathologic process nor even the anatomic source of pain.¹²¹ However, human beings dislike uncertainty, fear the unknown, and search for meaning as the first stage to control.¹⁰⁴ Preference for even a nominal diagnosis is clearly demonstrated by the vogue for the diagnosis of disc prolapse (Figure 3). Mixter's¹¹⁷ original insistence on the need for definite clinical and radiologic proof before diagnosis was rapidly forgotten. By 1945 Key⁸⁰ could state dogmatically that 99% of low-back pain, apart from tumor or infection, was due to "lesions" of the intervertebral disc. Of patients coming to our clinic, 60% believe or have been told that they have a disc prolapse, although only 11% have any evidence of nerve root pain or dysfunction.¹⁶⁴ Radiologic changes of degeneration are equally irresistible as a causal explanation of symptoms, ignoring their normal, age-related occurrence (see observation 6). Patients and physicians alike are much happier with even a nominal diagnosis. Unfortunately once such a nominal diagnosis has been made we forget that it was only a convenient label and treat it as if it were substantive. Not unexpectedly, the success rate of treatment based on such a nominal diagnosis is low.¹⁴⁹ Unjustified pseudopathologic diagnosis must be avoided and replaced with a clear, unambiguous term such as simple strain or nonspecific low-back pain.⁴² Physical treatment, particularly potentially harmful treatment such as surgery, should be directed to objective pathologic conditions that it is likely to help. A study of the indications for spinal surgery suggests that decisions to undertake surgery are frequently based on the duration and severity of the patient's pain and disability, the patient's distress and illness behavior, and the failure of conservative treatment; completely unrelated to these factors, the outcome of surgery depends on the accuracy of diagnosis of a surgically treatable lesion.¹⁷² The patient's demand and the physician's desire to help must not confuse logical, rational decisions about physical treatment based on substantive diagnosis.

When the number of low-back operations escalated after World War II it was soon realized that the failures of spinal surgery were catastrophic.^{29,59,66,77,168,172} Every study for the past 30 years has stressed the association of surgical failure with psychologic disturbances.^{65,168,172,182} In 1975 Wiltse and Rocchio¹⁸² first demonstrated that preoperative psychological tests could actually predict how patients would respond to treatment. A number of prospective studies have subsequently shown that psychologic factors influence how patients respond to any form of physical treatment, whether by physiotherapy,^{12,23} rehabilitation,^{8,49} chemonucleolysis,^{91,182} surgical decompression,^{41,132,136} fusion,¹⁸³ repeat spinal surgery⁴⁰ or pain tract surgery.¹⁷ The most important psychologic disturbances associated with low-back pain are anxiety, increased bodily awareness, and depressive symptoms; these are best interpreted clinically as psychological distress.^{104,153,171,172} Distress is largely secondary to the physical disorder and becomes better or worse with the success or failure of treatment.^{155,172} In addition, distress arising from unrelated causes may aggravate and perpetuate physical pain.

Clinical observation should distinguish the symptoms and signs of physical disease from those of distress and illness behavior.^{140,169,171} This is most simply illustrated by the pain drawing.¹⁴⁰ The way that patients draw their pain is influenced by distress, and the patient's apparently straightforward description of pain provides both physical information about the pain and psychologic information about their response to it (Figure 7). Similarly, the adjectives that patients use to describe pain fall into two distinct

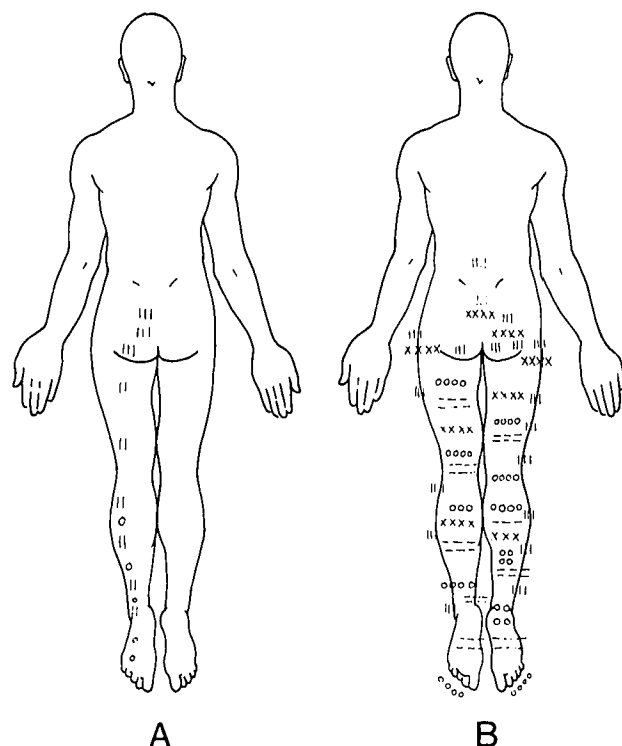


Fig 7. The pain drawing provides clinical information about the physical and emotional characteristics of the patient's pain.¹⁴⁰ Patient A describes the anatomic pattern of S1 pain and paraesthesia from a disc prolapse. Patient B with simple low-back pain does not have cauda equina involvement but is communicating distress. Many patients do both to varying degrees. (||, pain; o, pins and needles; x ache; = numbness). Reproduced with permission from Waddell G, Bircher M, Finlayson D, Main CH: Symptoms and signs; Physical disease or illness behaviour? *Br Med J* 289:739-741, 1984

patterns: those that describe the sensory qualities of pain and other adjectives that are mainly about the emotional qualities of the pain experience.^{82,11} Inappropriate descriptions of symptoms and inappropriate responses to examination have also been described in low-back pain and provide a clinical measure of distress and illness behavior (Table 7).^{169,171}

We have tested the biopsychosocial model in clinical practice by analyzing the mathematical relationship between the elements of illness in chronic low-back pain. We compared pain and disability and physical impairment (Figure 4).¹⁶⁶ We confirmed distress as the most important psychologic disturbance.¹⁷¹ We examined the distinction between symptoms and signs of illness behavior and those of physical disease (Table 7).¹⁷¹ Distress and illness behavior are secondary to the physical disorder and improve or deteriorate with successful or failed treatment.¹⁷² Physical disorder, distress and illness behavior combine to produce disability (Table 2).¹⁷¹ Medical decisions about conservative¹⁶⁷ and surgical¹⁷² treatment are influenced more by distress and illness behavior than by physical indications (Table 3). The interaction between physical and psychologic factors determine the outcome of treatment.¹⁷² Work loss and return to work are determined more by social factors than by physical disease (Table 6).¹⁷² All these analyses confirm that the biopsychosocial concept of illness can be used as an operational clinical model (Figure 6B), which explains many of the observations on the natural history of low-back pain and disability.

Table 7. A Comparison of the Symptoms and Signs of Physical Disease and Abnormal Illness Behavior in Chronic Low-back Pain

| | Physical disease/ normal illness behavior | Magnified or inappropriate illness behavior |
|--------------------------------|---|---|
| Pain drawing ¹⁴⁰ | Localized | Nonanatomic |
| Pain adjectives ¹¹⁰ | Neuroanatomic | Regional |
| Symptoms ¹⁷¹ | Proportionate | Magnified |
| Pain | Sensory | Emotional |
| | localized | Whole leg pain |
| Numbness | Dermatomal | Tailbone pain |
| Weakness | Myotomal | Whole leg numbness |
| Time pattern | Varies with time | Whole leg giving way |
| Response to treatment | Variable benefit | Never free of pain |
| | | Intolerance of treatments |
| | | Emergency admissions to hospital |
| Signs ¹⁶⁹ | | |
| Tenderness | Localized | Superficial |
| | | Widespread |
| | | nonanatomic |
| Axial loading | No lumbar pain | Lumbar pain |
| Simulated rotation | No lumbar pain | Lumbar pain |
| Straight leg raising | Limited on distraction | Improves with distraction |
| Sensory | Dermatomal | Regional |
| Motor | Myotomal | Regional, jerky, giving way |
| General response | Appropriate pain | Overreaction |

REST OR RECOVERY?

Restriction of activity, rest, and even bed rest is now the treatment most commonly prescribed by physicians for low-back pain (Table 8) apart from symptomatic analgesics. Bed rest is now unanimously taught in all standard textbooks as the first line of treatment for "acute attacks," yet it is difficult to discover when or why it became the accepted "conservative" treatment. One of the patients in the original 1934 description of disc prolapse by Mixter and Barr¹¹⁷ had "several months in absolute recumbency on a Bradford frame without relief [sic]" before surgery. As early as 1923 a standard orthopaedic text⁷⁶ suggested that immediate recumbency was required for the most severe cases of back "sprains" but also cautioned against excessive bed rest and advised that "as soon as possible, movement must be encouraged and bed forbidden." Personal experience,⁷ however, suggests that this was very much the exception and only employed for unusual cases before World War II. Even as late as 1966 family physicians could write that "little discussion (of acute low back pain or its treatment) . . . is given in the standard textbooks of orthopaedics."³⁵ As bed rest of more than a few days duration is *ipso facto* associated with work loss, sick

certification statistics suggest that bed rest has been widely prescribed within the last generation only.

The rationale of rest—and particularly bed rest—is not as obvious as might be imagined. It appears to be based on the clinical observation that lying down may relieve pain, although this only applies to one person in two (Table 9). The pathophysiologic argument^{32,61} appears to be a combination of a nominal diagnosis of disc prolapse¹¹⁷ and the biomechanical observation that intradiscal pressure is lowest in the lying position,^{119,120,127} although this was certainly not intended nor interpreted in this way by the original authors. There are moreover a number of completely illogical steps in the clinical application of this argument. Symptomatic relief of pain is not necessarily associated with alteration of the natural history or cure of the pain (compare Tables 9 and 10 based on the same group of patients). Disc prolapse only constitutes a few percent of all low-back pain, and treatment for disc prolapse cannot necessarily be extrapolated to all low-back pain. Because of the difference between acute and chronic pain, treatment directed to the noxious stimulus of acute pain cannot simply be continued into chronic pain.

There is remarkably little scientific or clinical evidence to support the value of bed rest for low-back pain or even sciatica. There are only four controlled studies of bed rest recorded in the literature.^{33,62,84,180} Only the study by Weisel et al¹⁸⁰ showed a clear advantage to bed rest, but this study suffered major methodologic defects.^{61,94} It was done on army recruits and compared admissions to sick bay with continued, albeit modified, duties. No allowance was made for the patient's attitudes to the treatment or to training. In the particular military context there was considerable observer bias in assessing results. Yet this is the only clinical trial suggesting that bed rest is better than continued ambulation. In complete contrast, Gilbert et al⁶² found no statistically significant differences between bed rest, exercise, and no treatment although the results tended to favor early mobilization; Lidstrom and Zachrisson⁸⁴ found little difference between exercise and rest except that exercises improved muscle strength. Deyo et al^{33,34} showed that 2 days of bed rest was better than 7 days or, to put it the other way round, that 7 days of bed rest was proportionately more harmful than 2 days! There is no evidence whatsoever comparing bed rest in hospital with bed rest at home, which makes it difficult to justify the admission of 40–50,000 patients to hospital each year in the United Kingdom for bed rest for low-back pain, permanently occupying 2,000 hospital beds while other patients are kept waiting up to

Table 9. Effect of Activity on Low-Back Pain^{27,28}

| | Relieves pain (%) | No difference (%) | Makes pain worse (%) |
|------------|----------------------|----------------------|-------------------------|
| Lying down | 58 | 30 | 10 |
| Walking | 16 | 45 | 36 |

Incidence reported by 500 patients attending orthopaedic clinics.³⁶

Table 8. Treatment for Low-Back Pain*,†

| Treatment | One course (%) | >One course (%) |
|---------------|-------------------|--------------------|
| Analgesics | 18 | 69 |
| Bed rest | 21 | 27 |
| Corset | 14 | 17 |
| Physiotherapy | 10 | 14 |
| Manipulation | 5 | 5 |

*Incidence reported by 500 patients attending orthopaedic clinics.³⁶

Table 10. Most Effective Treatment/Cure for Low-Back Pain^{27,28}

| Type of treatment | (%) |
|---|-----|
| Analgesics | 35 |
| Local heat, applications, and massage | 30 |
| Exercise, physiotherapy, and manipulation | 20 |
| Rest and lying down | 14 |

*Based on data from the Glasgow Hospital's orthopaedic outpatient clinics³⁶ and the Consumers' Association Back Pain Survey.^{27,28}

3 years for the proven procedure of hip replacement for osteoarthritis.^{130,131}

There is, however, little doubt about the deleterious effects of bed rest, particularly if prolonged.^{18,100,101} Protracted rest leads to a catabolic state with general malaise.¹⁸ There is demineralization of bone¹⁴⁶ and 3% loss of muscle strength per day.¹⁵⁰ There is decreased physical fitness,^{100,101} and rest and inactivity may inhibit healing.¹⁸ More generally, prolonged rest leads to increased psychologic distress and depression, loss of the work habit, increased difficulty in starting rehabilitation, progressive loss of job opportunity, and decreasing probability of ever returning to work (Figure 1).^{72,156} Perhaps the final test is to look at how physicians treat themselves. At a recent meeting¹⁸⁶ 60% of 230 physicians reported personal experience of low-back pain. Only two had stayed in bed for as long as 2 weeks and none for longer periods. Yet physicians continue to treat their patients with prolonged periods of bed rest in a way they would never treat themselves. Some patients with simple low-back pain are actually treated as if they were more seriously ill than patients with myocardial infarction who now routinely receive early ambulation.⁷⁴

Conversely, there is no evidence that activity is harmful and, contrary to common belief, it does not necessarily even aggravate the pain (Table 9). With increasing biomechanical understanding, it is possible to avoid specific activities that increase the load on the spine,^{12,115,116,189} and several studies have demonstrated that patients with low-back pain or sciatica can, despite their pain, do selected activities almost normally without increasing their pain.^{13,93,126} There is, indeed, evidence that increased activity may not only promote bone and muscle strength^{18,84,146} as well as improve disc and cartilage nutrition,¹²³ but may also increase systemic endorphin levels and reduce sensitivity to pain.¹²³ There is no evidence that early return to work increases the likelihood of future recurrences. On the contrary, physically fit people have fewer and shorter attacks of low-back pain and are more tolerant of pain.^{16,20,123} Fordyce and other behavioral psychologists have investigated the relationship between chronic pain and physical activity.^{57,85} They suggest that pain behaviors are influenced and modified by their consequences.^{54,56} Exercise to the limit of pain tolerance is strongly influenced by conscious feedback of how much exercise has been done, and, in the absence of such feedback, chronic pain patients do the same amount of exercise as normal, pain-free people.⁵² The exercise tolerance of chronic pain patients is markedly improved by verbal praise and reinforcement from a physiotherapist.²¹ Although patients with chronic low-back pain almost universally report lower levels of activity, careful observation shows that subjective reports of pain are largely unrelated to actual activity levels,^{57,85} and observed pain behavior is actually *inversely* proportional to the amount of exercise done.⁵⁷ Fordyce et al⁵³ compared traditional medical treatment directly with a behavioral approach to the early treatment of acute low-back pain. Traditional treatment consisted of rest, analgesics, and activity prescribed as necessary; the patient was advised to "let pain be your guide" compared with a fixed regimen of incremented activity based on tissue healing times. At 1-year follow-up, patients treated on the traditional basis reported that disability had actually increased, and patients treated on the prescribed regimen had returned to preonset levels of activity. Dolce et al³⁷ independently confirmed that a fixed exercise quota resulted in increased exercise tolerance, increased self-estimate of exercise capability, and decreased anxiety about the effects of exercise. Brentzen and Gotesian¹⁵ confirmed that regular analgesics gave better pain relief than medication prescribed as needed and also reduced drug dependency.

Improved understanding of the relationship between pain and activity has already been tested in clinical practice. For as long as they have existed, industrial physicians and occupational therapists have emphasized the physical, psychologic, and social value of early return to work,^{30,63,178} although this has never been proved scientifically.^{22,94} Improved spinal ergonomics combined with physiotherapy produced the "back school" approach to patient education where improved understanding reduces fear and improves patients' ability to cope with their back problems.^{67,177,189} The goal of most pain management programs is rehabilitative rather than curative and combines improvement in functional capacity with reduction of illness behavior. Patients assume a more active role in which they can share the responsibility and begin to cope with the problem themselves.^{50,98,104} Mayer et al^{100,101} have combined these principles into a sports medicine approach to the clinical rehabilitation of patients with chronic low-back pain. Objective functional capacity measurements were used to guide patients on an active exercise program, with the emphasis on improvement in disability and function rather than solely on pain. This was supplemented by psychologic support and education to help patients themselves better cope with and manage their pain. Despite some temporary increase in pain, in the long-term patients not only improved their objective functional capacity but this was associated with less pain, less psychologic distress, less health care utilization, and 86% return to work. An active approach to illness can indeed be used in clinical practice to treat the whole person.

The evidence is clear. There is a fundamental antithesis between the passive and active approaches of rest or activity. There is no evidence that rest has any beneficial effect on the natural history of low-back pain. On the contrary, there is strongly suggestive evidence that rest, particularly prolonged bed rest, may be the most harmful treatment ever devised and a potent cause of iatrogenic disability. There is clear evidence that, despite general belief, activity is not harmful, and active rehabilitation not only restores function but also reduces pain. It remains to be proved whether a policy of active mobilization and early return to work can be put into widespread clinical practice⁹⁴ but the following questions can no longer be avoided: rest or rehabilitation? rest or restoration of function? rest or recovery?

CONCLUSIONS

Low-back pain is universal but low-back disability is a relatively recent Western epidemic. Modern medicine can successfully treat many serious spinal diseases and persisting nerve compression but has completely failed to cure the vast majority of patients with simple low-back pain. Over-emphasis of pain alone, over-dependence on a nominal diagnosis of disc prolapse, and over-prescription of rest may indeed be a major cause of iatrogenic disability.

We still have a lot to learn about low-back pain. We must relate improved biomechanical understanding to clinical observation in the individual patient. We must develop methods of localizing the exact source of pain. We must differentiate syndromes of low-back pain. And we must conduct proper, controlled trials to determine which treatments are most effective for various types of low-back pain and develop a rational basis for choosing the most effective treatment for individual patients.

Equally and more fundamentally important, we must change our whole approach to low-back disorders. We all agree in principle with the need to treat the whole person. To make this a practical reality, we must consider low-back disability as an illness rather than low-back pain as a disease (Table 11). We all recognize in theory the need to consider the physical, psychologic, and social aspects of illness. In practice, we must distinguish pain and disability.

Table 11. Principles of Treatment for Low-Back Pain and Disability

| |
|--|
| Simple low-back pain is not a disease |
| Distinguish pain, particularly chronic pain, from noxious stimuli or tissue damage |
| Distinguish pain and disability |
| Distinguish the symptoms and signs of distress and illness behavior from those of physical disease |
| Treat the illness, not disease or pain alone |
| Remember that the natural history of low-back pain is to get better |
| Avoid iatrogenic disability |
| Passive or active? Rest or recovery? |

ity, distinguish the symptoms and signs of psychologic distress and illness behavior from those of physical disease, and direct treatment to restoration of function as well as relief of pain. It is unlikely that there will ever be a magic cure for all low-back pain, so the physician's role as healer must be accompanied by his or her more ancient role as counselor, helping patients to cope with their problems. The patient's role must correspondingly change from passive recipient of treatment to a more active sharing of responsibility for his or her own progress. The main theme of management must change from rest to rehabilitation and restoration of function.

This requires change in medicine, patients, and society. Some change must be at a political level. But physicians cannot escape the prime responsibility, both as the final providers of health care and for providing society with a new understanding of illness, which alone makes real change possible.

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Address reprint requests to

Gordon Waddell, BSc, MD, FRCS
*Orthopaedic Department
 Western Infirmary
 Glasgow G11 6NT
 Scotland*

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