Looking back: developments in our understanding of the occurrence, aetiology and prognosis of chronic pain 1954–2004

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This article summarizes the work of the Arthritis Research Campaign Epidemiology Unit in the field of pain and soft tissue rheumatism during the 50 years 1954–2004. It reviews the information gathered on the occurrence of symptoms and its causes, which began with Kellgren and Lawrence’s pioneering work during the 1950s in the coalfields and general population of Leigh, Greater Manchester. They studied the roles of posture, mechanical load and the physical environment (dampness) on back pain. This was followed by the Calderdale study in the 1980s examining the prevalence of disability and its causes in the population, which demonstrated the important role of regional pain in causing disability. More recent studies in the 1990s and at the beginning of the 21st century have allowed us to define the relative roles of mechanical (load) factors, individual (psychological) factors and the social environment, and the biological mechanisms by which they may result in symptoms. The further challenge over the coming decade is to use our knowledge of the aetiology and influences on outcome to design management strategies which demonstrate improved outcomes for patients.

The Kellgren and Lawrence era

Lawrence had documented the importance of the rheumatic diseases as a burden to society even prior to the foundation of what is now called the Arthritis Research Campaign (arc) Epidemiology Unit [1] (Fig. 1). Although the types of disease resulting in days lost from work due to illness are very different from the spectrum of diseases that are important in the same context today, rheumatic diseases (in their widest sense) were already the leading cause of days off work.

Pain would have been an important feature of many such rheumatic diseases, and pain was a focus for the study of coal board workers in the Bedford Colliery, Leigh, their families and persons from the local population conducted during the 1950s by Lawrence and Kellgren, from the Centre for Rheumatic Diseases at Manchester Royal Infirmary, and Aitken-Swan from the Centre for Occupational Health. These studies demonstrated that, amongst males resident in Leigh, regional pain syndromes such as shoulder and knee pain were common (>10%), as were pains related to the upper limb and hand (5–10%) (Fig. 2a) but the most common regional pain syndrome was back pain, with pain in the segment D12–L2 reported by just under 1 in 4 men (Fig. 2b). Amongst miners with back pain, Kellgren and Lawrence [2] studied the influence of disc degeneration on symptoms, and there are three notable observations from their data. First, the prevalence of back pain increased with worsening levels of disc degeneration. However, even amongst those with no or little disc degeneration back pain was still common (prevalence ~30%) while amongst those with the most severe levels of disc degeneration, back pain was not inevitable (prevalence ~55%). At every age back and hip pain (and disc degeneration) was more common amongst miners compared with non-miners, and Kellgren and Lawrence investigated the possible aetiology of these excess symptoms. They found that heavy lifting and working in wet conditions were related to back pain, resulting in loss from work (rather than simply the reporting of pain), while low seam roof height was related to the reporting of back pain (rather than back pain resulting in work loss) (Fig. 3).

The role of psychological factors was not a major area of study for Kellgren and Lawrence, but one of their reports does note: ‘Comparison of rheumatic pain did not show any general association with a stability factor…although the two miners with undetermined pain at multiple sites were judged to be relatively unstable’. In summary, the studies by Kellgren, Lawrence and Aitken-Swan in Leigh had demonstrated the magnitude of the problem of pain. They had used a wide grouping of rheumatic conditions, however, and had concentrated principally on radiographic change. They represented an important beginning to the study of the aetiology of low back pain.

The Wood era

In the document produced on the occasion of the site visit to the arc Epidemiology Unit on 5 November 1970, and outlining plans for the quinquennium 1971–75 under the directorship of Dr Philip Wood, there is a change of emphasis proposed, concentrating on the community burden of rheumatic complaints. There would be a focus on (i) joint disease or arthritis, (ii) back troubles, and (iii) soft-tissue rheumatism, and also on the community response to symptoms. Much of the work during this period was using routinely collected data to, amongst other things, document the community burden of symptoms. In a review of the epidemiology of back pain in 1976, Philip Wood [3] documents the burden from presentation to primary care to surgical treatment. From a population of 10 000 adults, 200 would be expected to consult with back pain. These consultants would have an average of three consultations and 33 days of incapacity. From these consulters, just under half (87) would be referred to hospital. Seven of these patients would be admitted to hospital and one would receive surgical treatment. In discussing aetiology in the same paper, there is a paucity of data available, but Philip Wood speculates that the
most important influences would be a lifetime experience of progressive lifting, progressive loss of height with age, osteoporosis and degenerative changes, and that ‘a large part will ultimately be shown to be due to the interplay of a diversity of forces’.

The principal study involving primary data collection during the directorship of Philip Wood was the Calderdale Health And Disablement Survey conducted by Lisa Badley and Alan Tennant in the West Yorkshire area of North-England during 1986 [4]. The aim of the study was to determine the levels of disability in the population with a view to informing service provision, and it involved adults in 21889 households. Without the sort of technology we are used to do today, this was a major undertaking. It also demonstrated the major contribution of musculoskeletal disorders to interference with daily activities: a prevalence of 82 per 1000 population for disability in conjunction with rheumatic disorders. Amongst those with severe disability, rheumatoid arthritis was the leading cause (4 per 1000 population), and amongst those with moderate disability, the two leading causes were osteoarthritis (47 per 1000 population) and back or neck disorders (25 per 1000 population).

The Silman era

Returning to the document of work proposed for the 1971–75 quinquennium, it was stated that, for the study of low back pain, ‘A prospective survey…would appear to be the most feasible method of working. In collaboration with general practitioners in a defined area, a standard routine would be carried out as and when complaints developed’. However, it was not until Alan Silman became director of the arc Epidemiology Unit, working in collaboration with Peter Croft, that such a study was conducted: the South Manchester Low Back Pain (SMLBP) study. This study involved a survey of over 7000 persons registered with two general practices, the monitoring of these persons’ consultations with low back pain over the next 18 months (with follow-up to determine outcome of the episode), and then a resurvey of all non-consulters at the end of the study. This study provided an update on the burden of back pain in the community [5]. Assuming a population of 10,000 adults, approximately 3600 would be experiencing back pain or had experienced back pain in the previous month, and 700 would consult their general practitioner with symptoms over a 12-month period. This is more than three times the figure for consulting episodes estimated by Wood 15 yr previously. Further, it was able to challenge the commonly held belief that most consulting episodes of low back pain resolved quickly. Six months after consulting for low back pain, half of the subjects continued to report pain or disability [6]. Indeed, using the information collected from subjects around the time of consultation, it was possible to identify groups at high risk of persistent symptoms: female gender, those with a recurrent episode of low back pain, pain radiating to the leg, back pain that was part of ‘whole body pain’, restricted movement in one or more planes, and being dissatisfied with work [7].

The study was also able to determine risk markers or potential risk factors for the development of low back pain and their importance in population terms [8]. Amongst persons who did not have back pain, the factors which best differentiated those who would go on to develop low back pain (irrespective of whether it led to a consultation) were those who had other types of musculoskeletal pain, a history of back pain, poor self-rated health and those with high levels of psychological distress. The influence of psychological distress (principally high levels of anxiety or depression) was particularly interesting [9]. Previous studies had shown that persons with musculoskeletal pain had higher levels of distress or mood disorder, but it had been concluded that this may well have been a consequence of having chronic and disabling symptoms. The SMLBP study had demonstrated that distress in the absence of back pain was a predictor of onset: indeed, the higher the level of distress the higher the risk of back pain developing. Amongst the subgroup of the population who were in employment, the previously identified marker of a low back pain history and the report of other musculoskeletal pain were similarly important. In addition, mechanical factors, lifting heavy weights (as suggested previously by Wood) and work involving prolonged periods of standing increased low back pain onset, as did being dissatisfied with one’s work. Karasek [10] had previously proposed a model...
hypothesizing how job demands and control (in particular high job strain, i.e. high demands but with little autonomy) may have adverse effects on health, and the SMLBP study demonstrated that a composite measure—dissatisfaction—did identify those at high risk of developing low back pain. In the working population these factors, when considered together, had a population-attributable risk of approximately 75% [8]. This observation of the potential role of psychological factors and workplace influences was to stimulate further research on the role of psychosocial factors in musculoskeletal pain.

Peter Croft left the unit in 1994 to take up the chair in Primary Care Epidemiology at Keele University, and Gary Macfarlane arrived to take over the research programme in soft tissue rheumatism (later the pain research programme). Results were now beginning to emerge from the initial studies which had been conducted in low back pain, shoulder pain and fibromyalgia, which suggested that, from an epidemiological perspective, these different symptoms may not be distinct, but part of a musculoskeletal pain spectrum (Fig. 4) which at one end had pain which was regional, tended to be acute and hypothesized to be related, in the main, to mechanical/injury factors. At the other end of the spectrum was pain which was more widespread, tended to be more chronic and hypothesized to be probably related more to psychological and social factors [11]. There was growing research interest at this time in the fibromyalgia syndrome: classification criteria had been published—namely chronic widespread pain and tender points [12]—but data from a Unit study demonstrated that there was nothing unique about the co-occurrence of chronic widespread pain and tender points. Each occurred with and without the other [13]—this is the reason why future studies were of individual components (i.e. chronic widespread and tenderness) rather than fibromyalgia. In order to investigate chronic widespread pain in more detail, the Altrincham Pain Study was conducted, a prospective study of 3000 adults to identify the psychological, social and behavioural influences on the onset of chronic widespread pain. This confirmed the role of psychological distress: those with high levels were twice as likely to develop chronic widespread pain. The symptoms appeared to be one manifestation of somatization, although the formal diagnosis of somatization disorder in subjects with chronic widespread pain was rare, and aspects of past illness behaviour were an important marker of future risk [14].

It has been hypothesized that we are currently experiencing an ‘epidemic’ of pain, and indeed there is some evidence to suggest that while chronic disabling pain has not become more common, people have become more likely to report pain of lesser severity [15]. This observation has not, however, been supported by other studies [16]. Comparison of data from the Leigh and Altrincham studies, conducted almost half a century apart, allow us to address this issue. However, one must be cautious because the way in which information is collected on pain can strongly influence the resulting prevalence rates. Nevertheless, it does seem from these data that there has been an important increase in the prevalence of pain over this period, of both regional pain syndromes and, particularly, widespread pain [17].

The current work of the pain research group within the arc Epidemiology Unit is concerned with investigating the antecedents of the high-risk state for onset. One area that has been hypothesized as being important is adverse events in early life. Patients with fibromyalgia, in comparison to those without, are more likely to report adverse events in childhood, such as

![Fig. 3. Relation of Spinal Symptoms to roof height in workers aged 40-50 years [24]. Adapted and reproduced with permission from the BMJ Publishing group.](https://academic.oup.com/rheumatology/article-abstract/44/suppl_4/iv23/2899233)

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abuse. Most of these studies have been retrospective and may be strongly influenced by recall bias (i.e. those with an adverse outcome are more likely to remember prior adverse events as a possible ‘cause’). Indeed, data from the Altrincham Pain Study confirmed that when evaluating the role of early life events, subjects with chronic widespread pain were more likely to self-report events in childhood than those without symptoms, while, based on medical records (for events such as operations or hospitalizations), there was either no or little difference [18]. This bias was caused not by subjects with chronic widespread pain reporting events that were not in the medical records but rather those without symptoms who frequently did not report documented events. Data from a prospective study of approximately 1000 children in the USA confirmed that, with respect to bothersome pain, those whose parents had been prosecuted for victimization did not differ in their subsequent experience of pain from those whose parents had not. However, those who did and did not develop pain did differ in their recalled perception of childhood care [19]. Study of the role of early life experiences is currently being undertaken using a local cohort study of school children [20] and a national birth cohort study.

Even amongst subjects who have all the risk markers or risk factors for the development of chronic widespread pain, only approximately 25% will go on to develop symptoms over the subsequent 12 months. What are the influences on symptom development in this high-risk group? One possibility is that constitutional factors may be important. Indeed, there is evidence from clinical studies that patients with regional pain and particularly fibromyalgia exhibit altered function of the hypothalamic-pituitary-adrenal axis [21, 22]. Further, preliminary data from our population studies confirm that those with chronic widespread pain exhibit altered aspects of function [23], and ongoing studies will determine whether aspects of function, given a high-risk state such as psychological distress, are an important influence on symptom development.

So, in summary, what have we learnt about the epidemiology of pain during the past 50 years? Firstly, we have learnt about the burden of musculoskeletal pain and that the prevalence may have increased during the past half-century. Secondly, starting with the studies of Kellgren and Lawrence [24] in Leigh and continuing through today’s studies, we are learning about the aetiology of regional and widespread pain. These are part of a spectrum rather than individual disorders with a unique aetiology. Early studies focused on mechanical injury factors. These are important, but not as important as originally thought. More recent studies have emphasized the even greater influences of individual psychological factors and the social environment on the onset and outcome of these symptoms. Recent data on the role of constitutional factors provide exciting new prospects for understanding the biological mechanisms leading to chronic pain in adulthood. The further challenge over the coming decade is to use knowledge of the aetiology and influences on outcome to design management strategies which demonstrate improved outcomes for patients with pain.

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References