An Australian study of telegraphists' cramp¹

DAVID FERGUSON
School of Public Health and Tropical Medicine, University of Sydney, New South Wales, Australia

Ferguson, D. (1971). Brit. J. industr. Med., 28, 280-285. An Australian study of telegraphists' cramp. An investigation of telegraphists' cramp in an Australian public service organization attempted to assess the prevalence of the disorder, the degree of its transfer from morse to keyboard operating, and possible contributory influences. From an interview of 516 telegraphists in Sydney, Melbourne, and Brisbane (93% of the available population), 73 (14%) subjects with occupational cramp and 26 (5%) with occupational myalgia were identified. The job, equipment, and work environment were also investigated. The prevalence of both disorders was much greater in Sydney than in Melbourne or Brisbane. Three-quarters (74%) of the cramp subjects had had difficulty with morse before this mode of operating was discontinued, 65% had difficulty with keyboard operating, and 50% with writing. Cramp was strongly associated with neurosis and with several other attributes. Though occupational cramp has been related to neurosis in general, to obsessive and conversion reactions in particular, to ready conditioning in neurotics, and to poor psychomotor ability in neurotics, the cause is not yet known. Work load, seating, equipment, selection, training, responsibility, and supervisory practices may each contribute in particular cases.

Various synonyms of occupational cramp, such as professional, craft or occupational neurosis, indicate recognition of its presumed functional nature and of its association with a specific occupation and with emotional instability (Legge, 1934; Brain, 1951). Hunter (1962) lists 55 occupations with which the disorder has been linked. The best known form of the disorder is probably writers' cramp although the true prevalence of this form is uncertain (Crisp and Moldofsky, 1965) and that of other forms is mostly quite unknown.

Little has been written on telegraphists' cramp since the work of Smith, Culpin, and Farmer (1927), and no reference could be found to any investigation of the disorder in Australia. Yet Australian telegraphists' unions in 1959 claimed that 20% of their Sydney members were affected and that the disorder previously recognized as being characteristic of morse telegraphy was being transferred to the use of keyboard machines as these replaced the morse key. Though a study in 1961 (Ferguson, 1969) showed an increase in sickness absence, of the type described by Hogerzeil (1968) as subjective, among telegraphists, compared with selected other occupational groups in the same organization no absence attributed to cramp was revealed.

The study reported below was therefore undertaken to estimate the prevalence of cramp in Australian telegraphists and the degree of transfer of the disorder from morse to other instruments, and to elicit any possible causal associations. Further study, of the value of physiotherapy in cramp, is in progress and will be reported later.

Material and method
Of all available telegraphists with seven or more years of service in the Sydney, Melbourne, and Brisbane offices of a public service organization, 516 (93%) responded to an invitation to undergo medical interview and examination in 1963-4. The 136 telegraphists examined in Melbourne

were, on the whole, slightly younger, and the 117 in Brisbane slightly older, than the 263 examined in Sydney. All had operated morse for a variable period before its discontinuance between 1958 and 1963 and currently operated teleprinter, teletype or telex keyboards. Of the 516 men, 144 were mainly supervisors of other telegraphists or of automatic equipment; however, all of these had risen from the ranks of telegraphists and still operated keyboards for variable, usually short, periods. For comparison of attributes other than occupational cramp, a control group of 183 employees in another manipulative occupation in the same organization was subjected to the same examination.

Standard forms were designed for the interviews; the purpose and limits of each item on the forms were defined and the wording of the questions was laid down. For the diagnosis of cramp, symptoms had to conform to recognized patterns of the disorder. Symptoms may have consisted in inco-ordination, stiffness, spasm, weakness, tremor, and pain or other disturbance of sensation in the operating limb. Certain letters or sequences of dots and dashes in morse, certain keys on the keyboard, and certain letters in writing may have been stumbling blocks or all activity in the skill may have been difficult. The symptoms may have affected segments of the limb or the whole limb.

Cramp was classed as minimal, mild, moderate or severe. In minimal cases symptoms had been so transient or of such slight degree as barely to constitute disability, or doubt was felt as to the nature of the symptoms; such cases were not included in the series of cramp subjects. In mild cases, subjects had some disability, usually a slight reduction in capacity to operate, without however causing the subject to avoid or give up manipulative duties; symptoms were mild, mostly confined to one limb and one form of activity, and had caused little distress but may have been chronic or recurrent over some years. In moderate cases, subjects were usually affected in more than one activity, had sought to avoid manipulative duties, had multiple symptoms often in both upper limbs, and had reduced operating rates; as a result, they were usually distressed and displayed anxiety, depression or irritability. In severe cases, subjects had usually avoided their difficulty by transferring into non-manipulative duties; operating rates were severely curtailed, and writing was usually affected in addition to other activities.

Disabling neurosis may have been present in mild cases, had often occurred in moderate cases, and was invariable in severe cases. However, neurosis was not a prerequisite to the diagnosis of cramp or to an assessment of its degree. A subject was not accepted as neurotic when an emotional reaction was transient or minimal or amounted to an adult situational reaction (American Psychiatric Association, 1952). Few were in an acute neurotic state at the time of examination. Subjects were classed as neurotic if they had suffered neurosis during their employment as telegraphists to a degree in keeping with the definition by the World Health Organization (1960) of a mental ‘case’—a clinically recognizable disturbance of mental function conforming to a standard pattern and severe enough to cause loss of working or social capacity. The symptoms had to constitute an illness clearly to both subject and examiner. Severity referred to the seriousness of the neurosis and was not determined solely by ineffectiveness, to which other characteristics contribute.

The diagnosis of occupational myalgia (Thompson and Sinclair, 1912; Lundervold, 1958) was based on a complaint of regular pain or ache in the neck, shoulder, arm, forearm or wrist after operating for relatively short periods, e.g., 30 minutes, without local disease or deformity of the affected limb and in the absence of more than minimal symptoms of cramp. Neuromuscular fatigue after fast, long-continued operating, myalgic symptoms resulting from cervical spondylosis, and vague or minimal aching were not classed as occupational myalgia.

Trunk myalgia was not necessarily occupational. For acceptance, it had to have been chronic or recurrent over a considerable period and of disabling degree, whether or not the operating or other limbs were also affected. Trunk myalgia secondary to injury or to recognizable disease was excluded.

Ambidexterity was judged as the ability to do a highly skilled activity equally well with either hand (Provins, 1967) or to do certain skills well with one hand and other skills well with the other hand. Criteria were also established for physical dimensions and for categories of habits and attitudes (Ferguson, 1969). Possible stresses in the nature and load of the task, the organization of the work, and the physical and social environment of the workplaces were also studied.

**Results**

**Prevalence and course**

Of the 516 men examined, 73 (14%) were judged to have or to have had telegraphists’ cramp. The differences between Melbourne and Brisbane in prevalence (Fig. 1) were to some extent explained by the relative youth of the Melbourne group, but age could not have accounted for the outstanding prevalence in Sydney ($\chi^2 = 28.83; P < 0.001$). How many had transferred out of telegraphy because of cramp was not known.

Symptoms started within the first year of entering telegraphy, including the period of training, in nine (13% of 73) subjects; in the remainder, onset was spread over many years after entry. Fifteen (21%)
subjects started to get symptoms in the four later war years (1942-5) but in the two years before and in the four years after that period only two (3%) had onset of symptoms. Many men affected on the morse key got relief when, after phasing out of morse began in 1958, they had to operate keyboards only. Others sought supervisory duties or transferred to non-manipulative work in the telegraph office. Nevertheless, 25 men had endured symptoms for over 10 years and one man for 45 years.

Handedness, mode of operating, and part affected
Cramp subjects were more likely than others examined to be ambidextrous (Fig. 2).

Morse in one or other combination caused difficulty in 53 (74%) cramp subjects, the keyboard in 57 (65%), and writing in 36 (50%). Among the 47 (64%) subjects who still had difficulty at interview, in 41 the mode affected was the keyboard (sometimes combined with writing), in five writing only, and in one piano playing only.

In 56 (77%) subjects disability was restricted to the right side and in four (5%) to the left; 13 (18%) had symptoms in both arms.

The fingers involved in cramp varied with the mode affected. In morse the thumb and/or index finger together with the middle in some cases were exclusively involved, whereas in 26 of 30 subjects with finger symptoms in keyboard operating the ring and little fingers were the site of difficulty. In six of these 26, the index or middle finger was also involved, but only in one of the 26 was the ring finger involved to the exclusion of the little finger.

Relation of symptoms to work load
Symptoms came on at the start of a session of operating in 20 (27%) subjects, at any time in 49 (67%), and only after an interval in four (5%). Fatigue may have predisposed to the onset of symptoms; in some subjects, for example, symptoms occurred sooner in sessions starting in the afternoon than in the morning, and on Fridays than on Mondays. In some, the inco-ordination of cramp came on at any time and the ache of muscular fatigue or of occupational myalgia only after a period, suggesting that the muscle spasm and inefficiency resulting from inco-ordination induced muscular ache in time. Thirty per cent of subjects attributed the first onset of symptoms to work overload.

Neurosis and cramp
Of the 73 cramp subjects, 52 (71%) also had or had had disabling neurosis, whereas only 27% of the other 443 telegraphists interviewed had neurosis of this degree ($\chi^2 = 52.87; P < 0.001$). The recognizable onset of neurosis preceded the onset of cramp in 39 out of 52 subjects who had both disorders; in more than half of the 39 subjects the precedence was by 10 years or longer. Three neurotic cramp subjects had symptoms of a conversion reaction, and six others had the obsessional-compulsive 'sentiment d'in-complétude' of Janet (Smith et al., 1927). Eighteen (25%) cramp subjects had or still stammered, 10 (14%) were nail biters, and four (5%) had tics.

Cramp and occupational myalgia
Four out of 73 cramp subjects and 26 out of the 443 other telegraphists interviewed had occupational myalgia. Compared with cramp, myalgia tended to occur in younger men, to be restricted more to keyboard work, and to involve the wrist and arm
rather than the fingers. As with cramp, myalgia subjects commonly had neurosis (50%). Differences between cramp and myalgia were influenced by the criteria adopted and were to some extent differences in degree and not in kind; many with myalgia had minimal cramp symptoms though not severely enough to rate inclusion in the study as cases of cramp. Significant associations of combined cramp and myalgia (99 cases) with other attributes are listed in the Table. All the nine attributes listed were also significantly linked with neurosis.

**TABLE**

**Significant Associations of Cramp/Myalgia**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>$\chi^2$</th>
<th>P less than</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job dissatisfaction</td>
<td>4.47</td>
<td>0.05</td>
</tr>
<tr>
<td>Job insecurity</td>
<td>7.13</td>
<td>0.01</td>
</tr>
<tr>
<td>Adverse attitude to supervision</td>
<td>7.24</td>
<td>0.01</td>
</tr>
<tr>
<td>Adverse attitude to seating and equipment</td>
<td>6.97</td>
<td>0.01</td>
</tr>
<tr>
<td>Tremor</td>
<td>7.45</td>
<td>0.01</td>
</tr>
<tr>
<td>Tendon reflexes increased</td>
<td>3.85</td>
<td>0.05</td>
</tr>
<tr>
<td>Tension headache</td>
<td>8.24</td>
<td>0.005</td>
</tr>
<tr>
<td>Moderate to heavy smoking</td>
<td>6.09</td>
<td>0.02</td>
</tr>
<tr>
<td>Recurrent trunk myalgia</td>
<td>13.46</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Mean grip strength was lower in subjects with cramp/occupational myalgia (41.6 kg) and in neurotics (43.0 kg) than in telegraphists with neither disorder (45.2 kg) (Fig. 4); generally the grip was weaker in myalgia than in cramp.

Evidence of organic disease in the cramp-affected limb was generally lacking. Although in 16 subjects various impairments such as Dupuytren's contracture were also present, in only two did these contribute to disability from cramp.

**Discussion**

This study has established the previously undocumentcd occurrence of telegraphists' cramp in Australia and has confirmed the claimed prevalence of one in five among Sydney telegraphists at the time of the study. The study has also confirmed a considerable transfer of the disorder from morse to keyboard operating and to writing.

Of the many other attributes tested, only those also linked with neurosis were significantly associated with cramp. Whether the associations of cramp/myalgia with adverse attitudes to job, supervision, and equipment represented cause or effect, or merely attribution by subjects to palpable sources, was not clear. Although nearly three-quarters of cramp/myalgia subjects also had neurosis, a relationship between the two types of disorder was otherwise difficult to trace. Little direct temporal connexion was evident between the onset of the two disorders or between episodes of neurotic breakdown and exacerbation of cramp symptoms. Work overload was the only work stress frequently linked by neurotic subjects and cramp subjects with their symptoms.

The fear of not being able to cope, and of consequent supervisory stricture and insecurity, must have been a potent stressor in cramp subjects and as much a source as a result of neurotic reaction.

The relationship of telegraphists' cramp to work load, usually tacitly assumed, remains ill defined. There was some indication that overload and fatigue, to which relatively poor grip strength probably contributed, influenced the initial onset and recurrence of symptoms. The increased onset of cramp in the late war years and the close concurrence of the part affected and the part most loaded suggest that manipulative load induces some central or peripheral neuromuscular change. Excessively exerted muscles tend to go into contraction, sometimes into spasm, more readily than rested ones (Welford, 1965), implying that repeatedly fatigued muscles are left hypersensitive.

The physical load in telegraphy is not inconsiderable. At 20 words per minute, each word of five letters, a morse operator in one minute made 515 different muscular contractions (Departmental Committee, 1911), more than twice as many movements per minute as a typist. In keyboard operating at 60 telegrams per hour, an average message of 30 words each of five letters requires 204 separate actions per minute. The constancy of keyboard operating is less relieved for the right hand than the left; the right ring and little fingers have many extra
unsatisfactory practices of selection and promotion. However, the influence of work space design on posture at the machines probably also contributes. Bench height was such that abduction of the shoulders was required, with overloading of the deltoid and scapulocervical muscles. Consequent ulnar deviation at the wrist places the ring and little fingers in an inefficient position to strike the keys, a difficulty which could be overcome by angulation and separation of the keyboard halves (Kroemer, 1964). Writing difficulty may be related to the absence of an adequate writing surface at the work bench.

The use of standard equipment and methods of selection and training suggests that the relatively high prevalence of telegraphists' cramp in the Sydney group did not result from particularly unsatisfactory practices in these respects in that city. However, in a recent year training results in Sydney (41% failures) were unfavourable compared with the training schools in Melbourne (20%) and Brisbane (6%). There was some evidence that only the less apt pupil was available for selection in Sydney (Department of Social Work, 1969), and that, both personally and socially, telegraphists examined in Sydney were more poorly adjusted than those in Melbourne or Brisbane, and than employees in the control group in Sydney. Opportunity for transfer and promotion within the organization was greater in the Melbourne office than in Sydney, with resultant occasion for dissatisfaction and frustration in the latter office.

Were cramp and associated neurosis determined largely by the work and its environment which the great majority of telegraphists entered early in adult life or could the cramp type be predicted at selection? Muscio (1921) found that aptitude for telegraphy correlated with muscular co-ordination and mental tests, not necessarily with tests of intelligence. Smith and her colleagues (1927) found it possible, from tests for neurosis and muscular ability, to differentiate learners who approximated to the cramp type. However, they found no difference in predisposition to neurosis between entrants to telegraphy and entrants to equivalent occupations. Progression in the organization in the present study could follow one of several main streams after a common post-school entry. There has been no reason to suggest that emotional instability may have determined self-selection into telegraphy although no personality tests were undertaken at entry. On the evidence of the present study, psychological rather than physical factors within both the work and social environments in Sydney contributed to the outstanding prevalence of cramp and neurosis in that office.

The frequency among telegraphists' cramp subjects of writers' cramp and speech defect, and the disproportionate occurrence of ambidexterity, tend to confirm the analogy seen between stammering, or difficulty in vocal speech, and writers' and telegraphists' cramp, or difficulty with the written, printed or coded symbols of speech; that is, occupational cramp in these forms is a manual stammer (Andrews and Harris, 1964).

Conversion and obsessive reactions (Noyes and Kolb, 1958), psychomotor inadequacy (Yates, 1960), and ease of conditioning (Liversedge and Sylvester, 1955; Mayer-Gross, Slater, and Roth, 1960; Eysenck and Rachman, 1965), consequent often on neurotic predisposition and overarousal (Malmo, 1957), have all been suggested as contributory factors, as have various neurological lesions (Crisp and Moldofsky, 1965; Siegfried, Crowell, and Perret, 1969). But whether the undoubted link with neurosis supports the hypothesis that cramp is a conditioned response or whether other mental mechanisms apply, neuromuscular load on the forearm was probably the precipitating stress. Other contributory factors may include selection, training, responsibility, security, seating, equipment, supervision, and work organization. However, other than neurosis no single factor was evident or invoked by the subjects in more than a minority of cases.

This study was carried out under the general direction of Dr. Gordon C. Smith, head of the Occupational Health Section of the School of Public Health and Tropical Medicine, University of Sydney. Mrs. V. J. Sadler and Miss B. Zitek assisted with data transfer and sorting. The Computer Centre, Commonwealth Scientific and Industrial Research Organization, under Mr. C. H. Gray, was responsible for much of the calculation.

References
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