



**Feasibility of developing a
prototype decision aid for initial
medical assessment of work related
upper limb disorders**

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REPORT

**Feasibility of developing a simple prototype decision aid for the initial
medical assessment of work related upper limb disorders**

D T Sinclair, R J Graves, M Watt, B Ratcliffe, S Doherty

FEASIBILITY OF DEVELOPING A PROTOTYPE DECISION AID FOR INITIAL MEDICAL ASSESSMENT OF WRULDS

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Anecdotal evidence from a number of sources indicates that there may be difficulties arising from the diagnostic approach adopted by some General Practitioners (GPs) involved in diagnosing Upper Limb Disorders (ULDs), and in particular assessing whether the patient's occupation is a causative factor. Labelling ULDs as "tenosynovitis", or "RSI" may have far reaching consequences to the patient, especially in terms of treatment and legal issues. For this reason an Aid for the Initial Medical Assessment of Upper Limb Disorders (AIMA-ULDs) covering key points to assist in the diagnosis and management of ULDs was devised by an expert group of occupational physicians, GPs and ergonomists to supplement the existing knowledge and skills of GPs.

The outcome of the AIMA-ULDs project produced the following: (1) tables of collated data on subjective symptoms, objective signs, and risk factors of ULDs; (2) three initial draft checklist diagnostic aids for symptoms in the neck/shoulder, elbow/forearm, and wrist/hand regions; (3) three initial draft flowchart diagnostic aid covering symptoms in the hand/wrist/forearm regions, incorporated into a draft guidance document for GPs.

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University of Aberdeen

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Contents

	Page No.
SUMMARY	S1
1. Introduction	1
1.1 Background	1
1.2 Objective of study	2
2. Approach	2
2.1 Literature review of diagnostic approaches	3
2.2 Identification of diagnostic criteria	3
2.3 Collation of information for assessment	4
2.4 Development of AIMA-ULDs prototypes	4
3. Findings	5
3.1 Diagnostic approach	5
3.1.1 Patient history	5
3.1.1.1 History of symptoms	5
3.1.1.2 History of patient background	7
3.1.2 Differential diagnosis	7
3.1.3 Physical examination	8
3.1.4 Management options	8
3.2 Diagnostic criteria collated from literature	10
3.3 Initial draft diagnostic aids	10
3.3.1 Use of checklists	11
3.3.2 Use of flowcharts	11
3.4 Final prototype draft Diagnostic Support Aid	12
4. Discussion	15
4.1 Use of collated data	16

Contents (continued)

	Page No.	
4.2	Further work with final prototype diagnostic aid	16
4.3	Further work with other flowcharts	16
4.4	Further work with checklists	16
5.	References	17

List of Figures

Figure 1	General procedure for initial medical assessment of upper limb disorders	6
Figure 2	Aide memoire for medical assessment of upper limb disorders	13
Figure 3	Diagnostic decision aid for symptoms of pain in hand / wrist / forearm	14

List of Appendices

Appendix A	Collected data on common disorders with symptoms affecting the wrist / hand region, and related risk factors	A-1
Appendix B	Collected data on common disorders with symptoms affecting the elbow / forearm region, and related risk factors	B-1
Appendix C	Collected data on common disorders with symptoms affecting the neck / shoulder region, and related risk factors	C-1
Appendix D1	Draft version of checklist diagnostic aid for initial medical assessment of symptoms affecting the hand / wrist region	D1-1
Appendix D2	Draft version of checklist diagnostic aid for initial medical assessment of symptoms affecting the elbow / forearm region	D2-1
Appendix D3	Draft version of checklist diagnostic aid for initial medical assessment of symptoms affecting the neck / shoulder region	D3-1
Appendix E1	Draft version of flowchart diagnostic aid for initial medical assessment of symptoms affecting the hand / wrist region	E1-1

List of Appendices (continued)

		Page No.
Appendix E2	Draft version of flowchart diagnostic aid for initial medical assessment of symptoms affecting the elbow / forearm region	E2-1
Appendix E3	Draft version of flowchart diagnostic aid for initial medical assessment of symptoms affecting the neck / shoulder region	E3-1
Appendix F	Draft guidance document incorporating final prototype draft Diagnostic Support Aid to be tested in user trials	F-1

Summary

Two working parties were set up to provide support and guidance in relation to the Aid for the Initial Medical Assessment of Upper Limb Disorders (AIMA-ULDs). The first of these was an expert group (Health and Safety Executive employment medical advisor, GP / consultant rheumatologist, occupational physician, ergonomist) which was generally required to assist in devising the aid documents, by giving guidance on the form, content and structure of the AIMA-ULDs. The second working party was an advisory group comprised of practising occupational physicians which was required to examine the performance and usability of the aid documents, and provide editorial support and operational views in relation to AIMA-ULDs.

The development of the Aid for Initial Medical Assessment of Upper Limb Disorders (AIMA-ULDs) was essentially carried out in four stages. The first was a literature review to examine the general medical assessment approach of GPs in relation to upper limb disorders and difficulties which can arise. This was followed by identification of diagnostic criteria of common upper limb disorders. The information was then collated for assessment by the expert and advisory groups. The information was then used in the development of AIMA-ULDs prototypes under guidance of the groups.

The outcome of the AIMA-ULDs project produced the following:

- a. tables of collated data on subjective symptoms, objective signs, and risk factors of upper limb disorders.
- b. three initial draft checklist diagnostic aids for symptoms in the neck/shoulder, elbow/forearm, and wrist/hand regions
- c. three initial draft flowchart diagnostic aids for symptoms in the neck/shoulder, elbow/forearm, and wrist/hand regions
- d. a final prototype draft flowchart diagnostic aid covering symptoms in the hand/wrist/forearm regions, incorporated into a draft guidance document.

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1. Introduction

1.1 Background

Anecdotal evidence from a number of sources indicates that there may be difficulties arising from the diagnostic approach adopted by some General Practitioners (GPs) involved in diagnosing Upper Limb Disorders (ULDs), and in particular about their judgements on the role of occupation in the causation of these conditions. A standardised approach does not seem to be used by these GPs to assess the factors which may be involved in Upper Limb Disorders and their work relatedness.

It has been suggested (see Davis, 1995), that lax diagnostic criteria are frequently used in the initial medical assessment and that this leads to incorrect diagnoses and labelling of conditions with "pseudo diagnoses." A survey by Diwaker and Stothard (1995), indicated that labels which may be inappropriately used include "tenosynovitis", and "repetitive strain injury" (or "RSI"), since the diagnostic criteria used by a range of experts to make either diagnosis "varied greatly". Davis (op cit.) suggests that incorrect diagnoses and labelling has far reaching consequences to the patient, both in terms of treatment and legal issues (see also Allen, 1993).

Additional difficulties arise from the use of the term "RSI", since this does not necessarily give an adequate diagnostic description of the nature of the problem, but merely an indication of causation. In addition, the indicated cause may be erroneous since the term 'RSI' implies that repetition alone can lead to soft tissue injury, even though there are a number of factors other than repetition which seem likely to increase "risk" (Graves, 1992). According to a number of authors (see Allen, 1993; Diwaker and Stothard, 1995; Hughes, 1990; Macdonald, 1996) use of the term 'RSI' or 'repetitive strain injury' should be discontinued. The term being used by the Health and Safety Executive to describe soft tissue injuries of the arm / hand is upper limb disorders (ULDs). Therefore this term will be used throughout the report to refer to these types of complaints.

Trained occupational physicians will use an occupational history as well as other knowledge of risk factors to make a diagnosis from their medical assessment. In addition there is information available on procedures which may be of benefit in helping a physician to assess and record his or her findings (see for example Putz-Anderson, 1988; Kuorinka and Forcier, 1995). It has been emphasised that it is important for all appropriate investigations to be undertaken at the outset (Mayo, 1991). GPs are unlikely to have the benefit of the above training and experience, and

some type of support aid to help decision making may help them to come to a more considered conclusion. Providing an aide memoir covering key points to be obtained from the patient's history and carrying out a musculoskeletal examination based upon existing knowledge of the literature would be helpful (D'Auria, 1995). This would maintain awareness of the possibility of work contributing to the symptoms but would help avoid attributing symptoms to the working situation without adequate justification.

Clearly the provision of decision aid(s) to support GPs could have benefits in standardising and rationalising the medical assessment process. For example, if it was possible to design a simple proforma which the patient completed in advance of the consultation, perhaps while in the waiting room, then this may save some time and provide valuable information to the GP. Further, having a structured proforma available to the GP during the initial medical assessment would be of benefit in reminding the GP of some of the issues which would help their decision making. It was concluded therefore, that there would be benefit in examining the feasibility of providing an Aid for the Initial Medical Assessment of Upper Limb Disorders (AIMA-ULDs) to act as a decision support aid which would be used by a GP to come to a more considered decision regarding the nature of Upper Limb Disorders and their possible work relatedness.

This report outlines the knowledge used in the development of the prototype version of the AIMA-ULDs and provides a draft version of this for the HSE to take forward as necessary. Possible options include presenting the results as a paper at an appropriate conference, publication as a GP aide memoir, and/or a workshop covering some of the issues in the diagnosis in the medical assessment of these conditions.

1.2 Objective of study

The objective of this study was to develop a simple prototype decision support aid to assist General Practitioners (GPs) in carrying out an initial medical assessment of Upper Limb Disorders, based on a methodology with structured documentation and aide memoirs.

2. Approach

Two working parties were set up to provide support and guidance in relation to the Aid for the Initial Medical Assessment of Upper Limb Disorders (AIMA-ULDs). The first of these was an expert group which was generally required to assist in devising the aid documents, by giving guidance on the form, content and structure of the AIMA-ULDs. The group comprised:- Dr S Doherty, Health and Safety Executive employment medical advisor; Dr B Ratcliffe, GP / consultant rheumatologist; Dr M Watt, occupational physician; and R J Graves, ergonomist.

The second working party was an advisory group which was required to examine the performance and usability of the aid documents, and provide editorial support and operational views in relation to AIMA-ULDs. The advisory group was comprised of practising occupational physicians from various sectors of industry:- Dr M Watt, local government; Dr C Harker, manufacturing; Dr L Wright, service utility; and Dr R Murdoch, new technology.

The development of the Aid for Initial Medical Assessment of Upper Limb Disorders (AIMA-ULDs) was essentially carried out in four stages:

- a. a literature review to examine the general medical assessment approach of GPs in relation to upper limb disorders and difficulties which can arise
- b. identification of diagnostic criteria of common upper limb disorders
- c. collation of information for assessment by the expert and advisory groups
- d. development of AIMA-ULDs prototypes under guidance of the groups.

2.1 Literature review of diagnostic approaches

A literature review was undertaken to bring together knowledge required by GPs as well as key issues in the determination of upper limb disorders and in the development of support aids. This involved an examination of approaches to the determination of WRULDs. Literature was examined to identify where difficulties can arise in the diagnosis and judgement of 'work-relatedness' of upper limb disorders and what improvements could be made by the use of a standardised diagnostic approach which incorporates the knowledge and procedure applied by trained occupational physicians in their medical assessment.

2.2 Identification of diagnostic criteria

Current literature knowledge of diagnostic criteria of ULDs was examined. This included looking at diagnostic criteria which relate specific ULDs to their known symptoms. Procedures and tests used by occupational physicians in the determination of ULDs were also identified. In addition, the literature review involved looking for ergonomic and epidemiological studies detailing current knowledge of possible occupational causes of specific ULDs. Finally, ergonomics literature in relation to knowledge representation, used in developing expert support aids for decision making, and earlier work in the development and implementation of diagnosis aids for ULDs, was examined.

The literature search was undertaken on a database extracted from the University of Aberdeen's 'MEDLINE' facility, using the keyword "diagnosis." The database was explored on 'Reference Manager' using the following search strategies:

- a. **{diagnosis OR diagnoses OR diagnostic} AND {criteria OR criterion OR approach OR technique OR method OR procedure}** - 'All other fields' (i.e. notes and abstracts) searched
- b. **symptom** - 'All other fields' searched
- c. **{diagnosis OR diagnoses OR diagnostic} AND {difficulty OR difficulties OR problem OR trouble}** - 'All other fields' searched
- d. **pain AND {shoulder OR elbow OR forearm OR wrist OR hand OR finger}** - 'All other fields' searched
- e. **{{knowledge AND representation} OR survey} AND {technique OR approach OR construction OR form}** - 'All other fields' searched

References available within the University of Aberdeen libraries were used.

2.3 Collation of information for assessment

The information obtained from the literature review of diagnostic approaches was summarised to produce a representation of the appropriate diagnostic procedure for initial medical assessment of upper limb disorders. In addition, the identified diagnostic criteria were collated into summary tables, so that symptoms, signs and risk factors would be readily accessible for the development of the AIMA-ULDs.

Both the diagnostic procedure representation, and the tables of diagnostic criteria were circulated among the members of the expert group for assessment. A meeting was held with the expert group to assess the diagnostic procedure representation, and this was modified to incorporate suggested improvements, and to correspond with the perceived normal procedure of the GP. In addition, the diagnostic criteria were examined at the meeting, and views were given on their utility and reliability.

The reliability of the diagnostic criteria given in the literature was examined further by comparing the views of various authors. Criteria which were repeated or emphasised in the literature were given more emphasis in the final summary tables.

2.4 Development of AIMA-ULDs prototypes

The diagnostic procedure representation and diagnostic criteria were employed to produce initial draft versions of AIMA-ULDs. These were circulated among members of the expert group, and a meeting was held to obtain views on their form, content and structure. Appropriate modifications were made in the light of these views. The modified draft documents were then circulated to the expert and advisory groups, and further meetings were held and telephone calls made so that views on their form, content, structure, and usability could be used.

As a result of these meetings, a preferred draft version of the AIMA-ULDs was selected and final modifications were made. This final draft document was incorporated into a draft guidance document, which was produced to be introduced to GPs in user trials in order to examine the performance and usability of the AIMA-ULDs.

3. Findings

3.1 Diagnostic approach

A representation of an appropriate procedure for medical diagnosis of suspected ULDs was adapted from Putz-Anderson (1988), Ranney (1993), and Kuorinka, Forcier (1995). Changes were made to the order of steps involved, and details were added as a result of discussions with the expert and advisory groups. The final version of the representation is shown in figure 1.

The general diagnostic procedure is comprised of: taking the patient history (i.e. history of symptoms and history of patient background), formulation of the differential diagnosis, physical examination, and management of the symptoms / syndrome. This is discussed in more detail below.

3.1.1 Patient history

3.1.1.1 History of symptoms

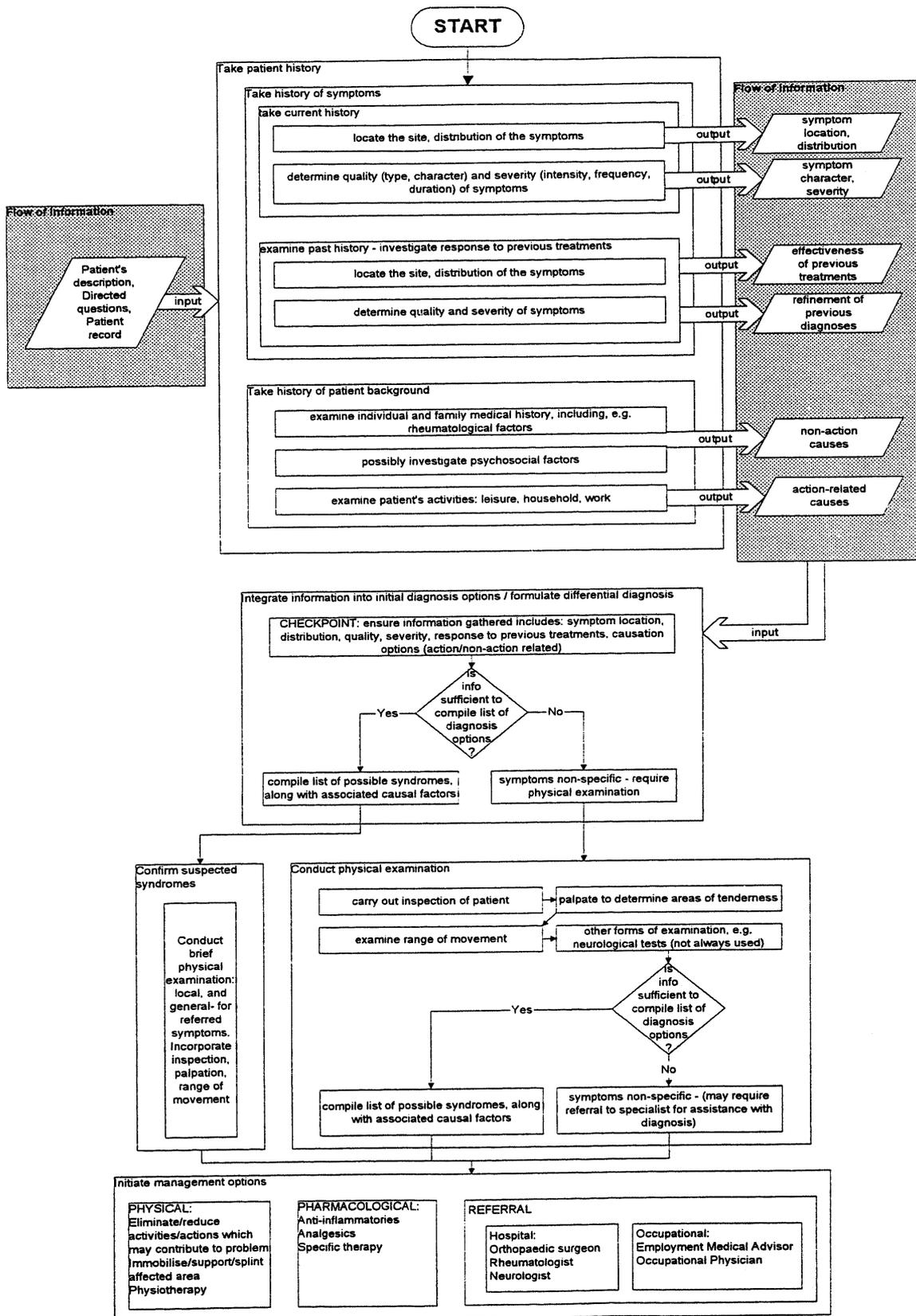
According to Putz-Anderson (op cit.), the first and most important information used in making a diagnosis is the patient's description of what bothers him or her, how the problem started, how it has progressed, and what makes it better or worse. This description is useful in a number of ways.

The first use of the history is to help determine the severity of the problem through the patient's own assessment (Putz-Anderson, 1988). According to Ranney (1993), 'when' symptoms occur gives clues to the severity of a problem. For example, a typical work-related ULD's symptoms occur at first (when mild) only at work. Later when it has progressed a stage (moderate severity) it lasts more than two hours into the evening. With the next stage of severity, the symptoms are still present to some degree the next morning.

According to Putz-Anderson (op cit.), the second use for the history is to help the examiner determine whether the problem is a nerve, tendon, or other type of disorder. In nerve disorders, for example, cramping pain or numbness and tingling are often reported. This kind of sensation can often be compared with 'pins and needles' which occurs when the hand or arm 'falls asleep'. Tendon problems usually result in dull, aching pain that is often worse in the evening. Also the patient will usually limit the motion of the affected tendon. However, according to the expert group, any diagnostic aid developed for the use of GPs should not be so specialised as to deal exclusively with nerve or tendon disorders. It is difficult to be precise in terms of specific diagnoses especially in the hand, wrist, or forearm. Besides, the GP will generally not form his or her diagnosis on the basis of the soft-tissue types affected, but rather in terms of recognised syndromes.

The third way that the history can be useful is in helping to locate the site of the problem.

Figure 1- General procedure for initial medical assessment of upper limb disorders



In addition, the patient's past history will need to be examined to identify any past symptoms similar or related to the current condition. This will help to assess the effectiveness of previous treatment and allow previous diagnosis options to be refined.

It was indicated by medical advice from the expert group that this would be the appropriate stage at which to take a history of the patient's background.

3.1.1.2 History of patient background

It is recognised (see Travers, 1988) that there are many factors associated with ULDs, encompassing a wide range of both occupational and non-occupational factors. Non-occupational factors include age, acute trauma, rheumatoid arthritis, diabetes mellitus, hormonal factors, and congenital defects, as well as housework and leisure pursuits. It is important to consider such factors when consulting a patient, before proceeding to identify possible occupational causes. It was indicated by Kuorinka, Forcier (1995), and the expert group that the patient background should be designed to pick up such factors and would consist of medical history (both individual and family), psychosocial factors, and an examination of the patient's activities (i.e. leisure, household, and work).

According to Kuorinka, Forcier (op cit.) questions about medical history may reveal, for example, rheumatologic, neuromuscular, or metabolic disease as a contributor to symptoms. Psychosocial factors including job demands, decision latitude, social support, job satisfaction, hysteria, hypochondria, and depression have also been seen to influence symptoms (Kuorinka, Forcier, op cit.). It was indicated by the expert and advisory groups that psychosocial factors would not necessarily be an immediate consideration in the GP's initial medical assessment. However, it was argued that these factors are relevant in some cases and should be included in the representation of diagnostic procedure.

The identification of activities which may be involved in causation of the symptoms may start with asking the patient when the symptoms occur, and what specific actions make it worse. One problem highlighted by the expert group is that many GPs will attempt to assess physical causes of a disorder by examining whether the symptoms could be 'work-related', and not considering that they could also be 'leisure-related' or 'housework-related.' In addition, it appears that some GPs tend to make judgements upon the work-relatedness of symptoms, based merely upon a worker's job title, without considering the specific actions involved. For this reason, the authors have proposed replacing the term 'work-related' with 'action-related.' In this way physical risk factors can be assessed in terms of individual actions rather than using ill-defined job labels, and pre-mature judgement of work-relatedness of symptoms during the initial medical assessment will be discouraged.

From the general practice experience of the expert group, it was felt that the GP will usually have come to some initial conclusions about options for diagnosis at this stage.

3.1.2 Differential diagnosis

Formulation of the differential diagnosis will involve integrating all the information collected from the patient history and arriving at an initial judgement, which will consist of a list of possible syndromes along with possible causal factors. The differential diagnosis will then be followed by the physical examination.

3.1.3 Physical examination

From the general practice experience of the expert group, it was highlighted that the process of taking a history of symptoms comprises a far larger part of a GP's initial medical assessment than the physical examination. On this basis, it appears that the medical assessment aid should play the role of encouraging the GP to use the physical examination, in situations where it may be of value, to confirm a suspected syndrome, or to obtain additional information when the history is inconclusive.

According to Putz-Anderson (op cit.), the first component of the physical examination for a suspected ULD is inspection. This involves observing the patient, by looking for asymmetry between the two sides of the body or for other visible irregularities such as a ganglion or swelling.

The second part of the physical examination is palpation. This involves the examiner pressing with his or her fingers against a part of the body to determine whether there are areas of tenderness. This procedure is used to discover the particular location of the problem.

The third part of the examination is range of motion (ROM) manoeuvres. ROMs include passive, active, and resisted motions. The passive ROM involves the patient allowing the examiner to move the arm through a set of positions. The procedure is particularly useful for determining the presence of a problem within a joint. Passive ROMs generally allow the tendons and muscles surrounding a joint to remain relaxed. The major stress is usually located within the joint, so any pain caused by motion will indicate a joint problem.

Resisted ROMs involve the patient attempting to move his or her arm / hand while the examiner holds it steady. This results in the muscles contracting and the tendons being tensed without joint motion taking place. Therefore, resisted ROMs test the muscle tendon structures, as opposed to the joints. If resisted motions are more painful than the appropriate passive motions, the problem will often involve a tendon (Putz-Anderson, 1988).

In active ROM tests, the patient is freely allowed to move his or her arms, unimpeded by the examiner. Such manoeuvres test both tendons and joint structures in combination, and as a result, are a good screening test for a particular joint.

In the fourth part of the physical examination, the examiner carries out further tests, including testing arterial blood vessels and peripheral nerves of the upper extremities.

At this point, the GP will complete the initial differential diagnosis. However, if the differential diagnosis is non-specific at this stage, then assistance with the diagnosis may be required by referral of the patient to a specialist. Referral is among the options involved in managing the patient's symptoms. Other management options which may be initiated at this stage are discussed below.

3.1.4 Management options

Management options include physical, pharmacological, and hospital or occupational referral. According to members of the expert and advisory groups, some GPs rely more heavily on pharmacological remedies (i.e. anti-inflammatories, analgesics and specific therapy) than other options to manage the patient's symptoms.

Due to the non-detailed nature of the information on physical risk factors collected by some GPs the physical management of symptoms may concentrate on prescribing rest or time off

work. In this way, physical causes are not dealt with, but are merely postponed until a later date when symptoms will be likely to recur. Identification of the specific actions which may be associated with the problem will allow these to be dealt with more effectively and permanently. Physical management options include eliminating or reducing the actions which may contribute to the problem (i.e. ergonomic intervention), immobilisation, supporting, or splinting the affected area of the patient, or physiotherapy.

In addition, it was the opinion of the expert group that some GPs do not refer their patients in the early stages of the disorder, i.e. until the outcome of their own management strategy is known, since many conditions that present to GPs are self limiting and do not require referral. In particular, it appears that early access to such services is often not available. However, there is a need to raise the GP's awareness of the usefulness of specialist referral to assist with a difficult diagnosis, and hence provide the appropriate treatment as early as possible. Meanwhile, it is clear that organisational changes are necessary to make referral services more accessible to GPs.

Where a GP suspects that symptoms could have been caused or exacerbated by physical factors, referral may also be useful in order to establish the role and the source of these factors, and to assist with their management. Employment medical advisors or company occupational physicians are often in a better position to make judgements on the 'work-relatedness' of a condition than the GP. Therefore such referral should be made whenever the GP suspects that work may have been involved in the onset of symptoms.

3.2 Diagnostic criteria collated from literature

Data obtained from the literature included subjective symptoms, objective signs, and potential risk factors associated with a number of syndromes in the following upper limb regions:

- a. hand/wrist
- b. elbow/forearm
- c. neck/shoulder

The recorded data for each region was tabulated and is summarised in Appendices A, B, and C, respectively. The first column lists the syndromes / labels for which diagnostic criteria were obtained. The second column (headed 'references used') contains the list of references which were used to obtain subjective and objective diagnostic criteria as well as risk factors. In the third column ('subjective symptoms'), subjective criteria are summarised. Criteria have been emphasised in **bold** where these have been emphasised or repeated within the literature. Less important criteria were not eliminated from the table at this stage but are listed, without emphasis. Objective criteria ('objective symptoms') are listed in a similar fashion in the fifth column. In the fourth column ('related risk factors'), risk factors are listed within their literature context. The risk factors themselves have been highlighted in **bold**.

Clearly the subjective symptoms can be considered when initially screening a patient for indicators of an upper limb disorder. The risk factors identified from the patient's background history can then be identified in order to examine the causation of the condition. Finally, the objective signs will be used in the clinical (physical and/or laboratory) examination of the patient.

3.3 Initial draft diagnostic aids

From the recorded data, initial prototype diagnostic aid documents were formulated for each of the three above regions. Two separate options were initially proposed for use as diagnostic aids. The first of these took the form of a set of checklists, given in Appendices D1 (hand/wrist), D2 (elbow/forearm), and D3 (neck/shoulder). The second option took the form of a set of flowcharts, as shown in Appendices E1 (hand/wrist), E2 (elbow/forearm), and E3 (neck/shoulder).

The checklists and flowcharts were circulated among members of the expert and advisory groups. Several meetings were held and telephone calls made to obtain views on their form, content, structure, and usability. During this period, the modified draft documents were continuously modified and re-circulated in order to incorporate the views given.

One overall view expressed at all of the meetings undertaken was that the success of the diagnostic aid would depend strongly upon its simplicity (i.e. clearness of presentation, and ease of use). As a result, the flowcharts were modified to include only the more common upper limb disorders.

3.3.1 Use of checklists

Referring to the checklists (Appendices D1, D2, D3), these were designed such that the examiner should tick boxes as appropriate in the upper half of the page, basing the answers on the history given by the patient and obtained by direct questioning. Comparison of the 'symptom profile' obtained with the symptom profiles represented in the grid at the top right of the page should lead the examiner to initial diagnosis option(s), given under each symptom profile. The appropriate box(es) will be ticked, corresponding to each diagnosis option.

Possible causes of the symptoms will then be established by examining the patient's background history. To support this process, the examiner should tick boxes corresponding with risk factors in the lower half of the page, basing the answers on the history of the patient's background activities (work or leisure). Comparison of the 'risk factor profile' obtained with the risk factor profiles represented in the grid at the bottom right of the page should help the examiner to assess whether the patient's complaint is likely or unlikely to be related to activities.

Suspected diagnosis options can be confirmed by physical examination at this stage. The criteria are given on the page attached to the checklist, on the line number indicated at the bottom of the checklist for each syndrome.

On reviewing the developed diagnostic aids, it was suggested by the members of the expert and advisory groups that the checklist approach would be more appropriate for educational/training purposes, and for specialist use by an occupational physician, rather than for use in a GP's surgery. Hence, due to constraints of time and resources, work on the checklist option was halted at this point, so that all efforts could be directed towards the development of more suitable options. Therefore the checklists in Appendices D1, D2, and D3 require further work (beyond the remit of this project). Such work could involve scientific validation of the diagnostic criteria used.

3.3.2 Use of flowcharts

Referring to the flowcharts (Appendices E1, E2, E3), these were designed such that the examiner should proceed through the YES/NO decisions, basing the answers on the history given by the patient and obtained by direct questioning. This will lead the examiner to initial diagnosis option(s), given in **bold** in the first grey box in the lower half of the page. Additional symptoms to be taken from the patient's history are given along with each diagnosis option.

The patient's background history will then be examined to establish possible causes of the symptoms. To support this process, a list of the activities (work or leisure) associated with each syndrome by the literature is given in the second grey box. This should help the examiner to assess whether the patient's complaint is likely or unlikely to be related to activities.

The third grey box down gives criteria to be assessed in a physical examination for confirmation of the diagnosis/diagnoses.

The final grey box gives general prompts to indicate to the GP his/her options to manage the problem. The options are physical, pharmacological, and referral. The latter of these can be subdivided into hospital referral, or occupational referral.

On reviewing the developed diagnostic aids, it was suggested by the members of the expert and advisory groups that the flowchart approach would certainly be more usable and acceptable for the GP. However, it was also stated that it may be unreasonable to expect a

GP to make use of a set of three flowcharts, and that, if possible, it would be more helpful to attempt to produce a single-sheet diagnostic aid so that user trials could be conducted with a higher likelihood of success.

Due to the need to keep the aid document as user friendly as possible, an acceptable flowchart incorporating the information contained within the three flowcharts was not able to be produced on a single sheet. In addition, the members of the expert and advisory groups indicated that symptoms of pain in the hand, wrist, and forearm are more commonly reported than other ULDs, therefore it was decided to concentrate on these for the final diagnostic aid. (However, it would be possible to develop further aids for other ULDs using a similar proforma.)

3.4 Final prototype draft Diagnostic Support Aid

The final prototype draft Diagnostic Support Aid was designed, under guidance of the expert and advisory groups, in relation to aspects of form, content, structure, and usability. The aid was incorporated into a draft guidance document, shown in Appendix F. The guidance document outlines the background to the Diagnostic Support Aid and explains its use. This document was designed to be introduced to GPs in a set of user trials (beyond the remit of this initial project).

The Diagnostic Support Aid is in two parts, shown in Figures 2 and 3. It is intended that Figure 2, '*Aide memoire for medical assessment of upper limb disorders*,' will be printed on an A4 sheet with Figure 3 '*Diagnostic decision aid for symptoms of pain in hand / wrist / forearm*' on the reverse. The suggested approach is for the GP to begin the medical assessment using Figure 2. This will provide points to support the taking of the patient history. At this point, **if** symptoms include pain in the hand, wrist or forearm, the GP will proceed to Figure 3. Otherwise the GP will continue working on the former flowchart, which gives the general procedure for forming a differential diagnosis, conducting a physical examination, and lists management options available to the GP.

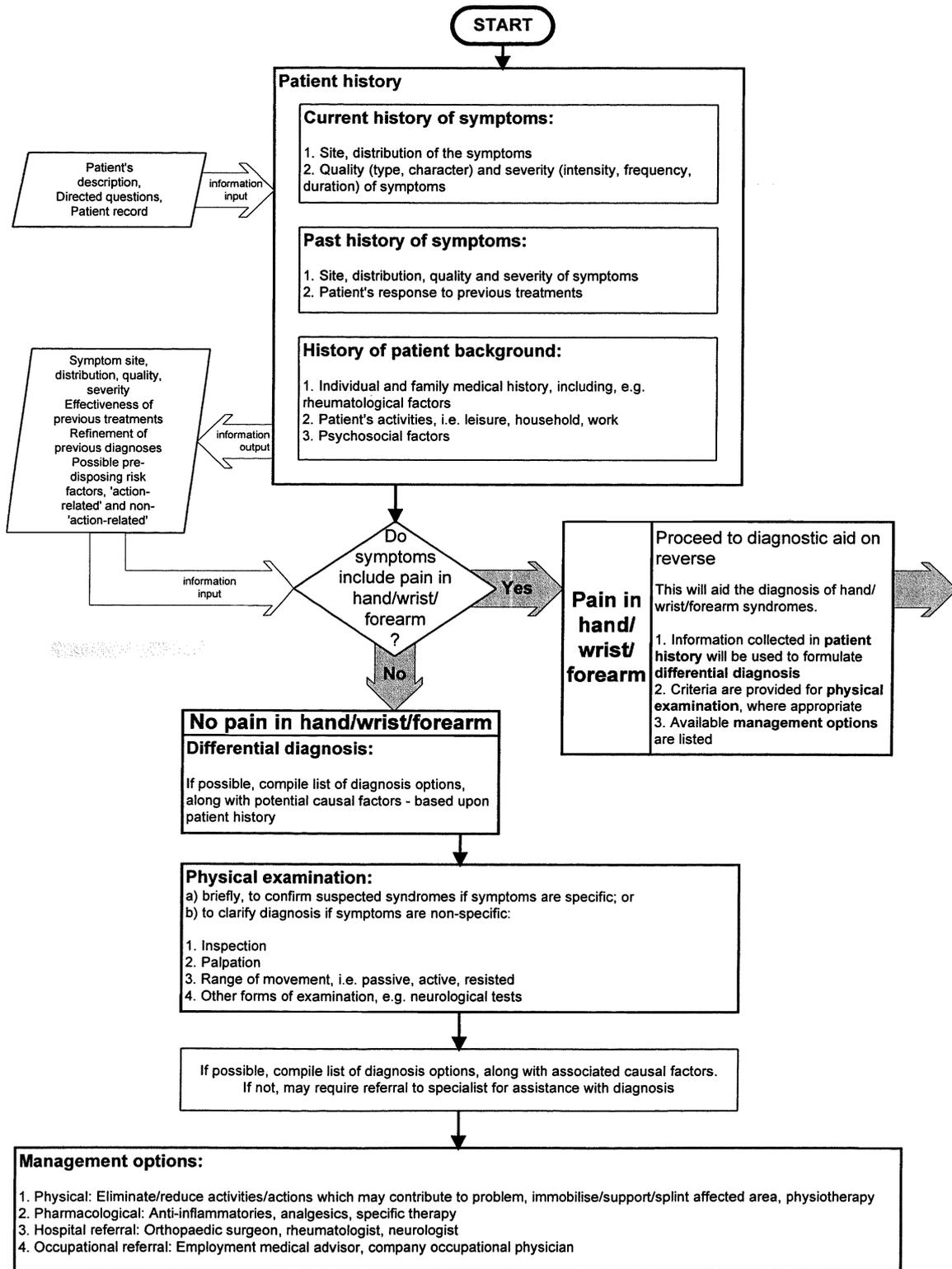


Figure 2 - Aid for Initial Medical Assessment of Upper Limb Disorders

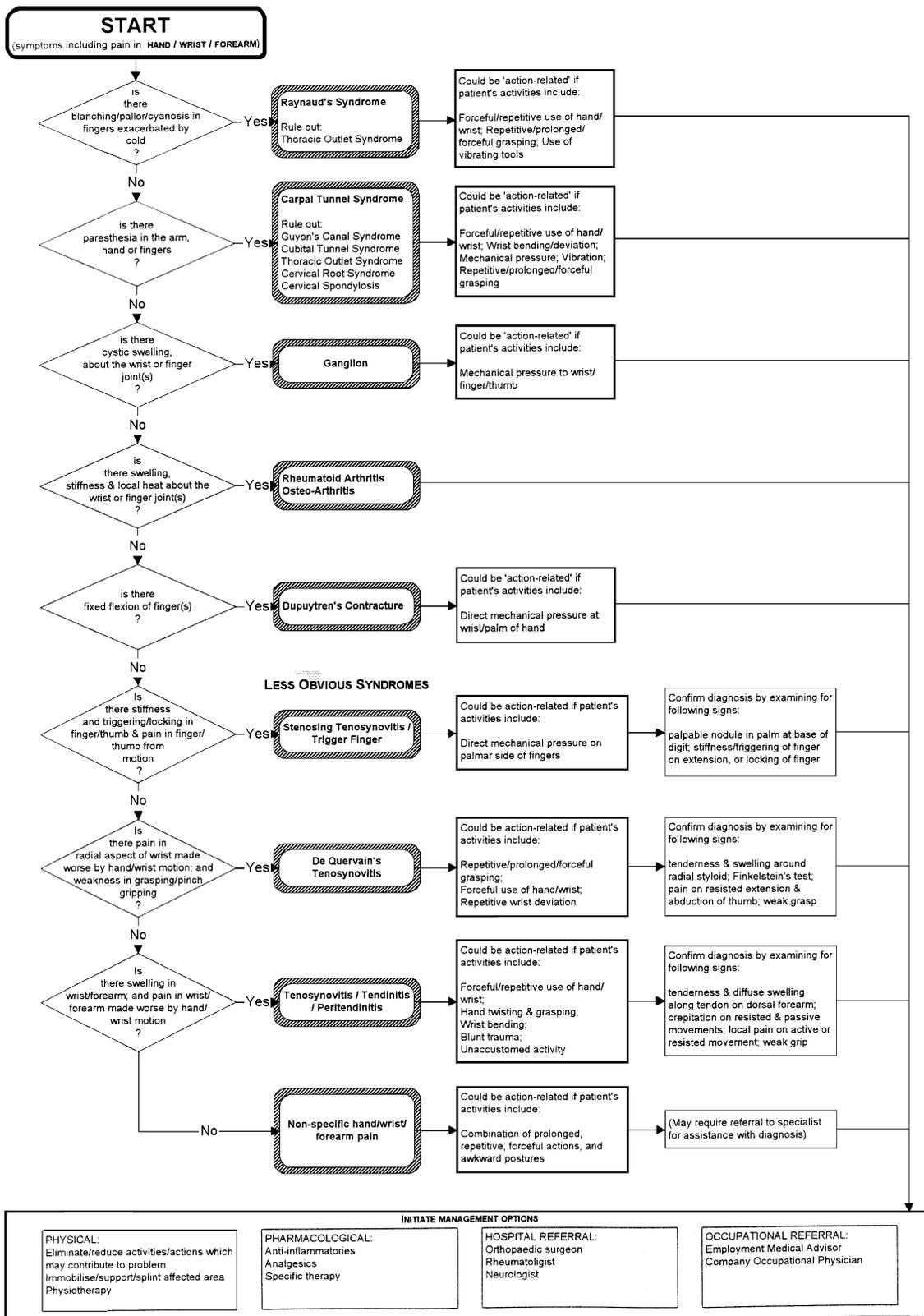


Figure 3 - Diagnostic aid for symptoms of pain in hand / wrist / forearm

Referring to Figure 3, it is intended that the examiner should proceed through the YES/NO decisions, basing the answers on the information obtained in the patient history. This will allow the examiner to rule out the more-easily recognisable syndromes leading to hand/wrist/forearm pain. The less obvious syndromes are given in the light-shaded box.

The patient's background history will then be examined to establish possible causes of the symptoms. To support this process, a list of the activities (work or leisure) associated to each syndrome by the literature is given following each diagnosis. This should help the examiner to assess whether the patient's complaint is likely or unlikely to be related to activities.

For the less obvious syndromes, the next stage in the flowchart gives criteria to be assessed in a physical examination for confirmation of the diagnosis/diagnoses. However, where symptoms are non-specific, it is suggested that specialist referral may be required to assist with the diagnosis. Such referral will be included within the management of the complaint.

The final stage in the flowchart gives general prompts to indicate to the GP his/her options to manage the problem. The options are physical, pharmacological, and referral. The latter of these can be subdivided into hospital referral, or occupational referral.

4. Discussion

The development of AIMA-ULDs involved input from three sources of information:

- a. a literature search covering subjective symptoms, objective signs, and risk factors associated with common upper limb disorders.
- b. the collated views of an expert group consisting of an Health and Safety Executive employment medical advisor, a GP/consultant rheumatologist, an occupational physician, and an ergonomist.
- c. the collated views of an advisory group consisting of occupational physicians from sectors of local government, manufacturing, service utility, and new technology.

These sources of information produced data summarised into forms which included:

- a. tables of collated data on subjective symptoms, objective signs, and risk factors of upper limb disorders.
- b. three initial draft checklist diagnostic aids for symptoms in the neck/shoulder, elbow/forearm, and wrist/hand regions
- c. three initial draft flowchart diagnostic aids for symptoms in the neck/shoulder, elbow/forearm, and wrist/hand regions
- d. a final prototype draft flowchart diagnostic aid covering symptoms in the hand/wrist/forearm regions, incorporated into a draft guidance document.

4.1 Use of collated data

The tables of data could be helpful for the development of further decision aid documents or checklists, for use in fields of occupational medicine, rheumatology, ergonomics (e.g. risk assessment), and law (e.g. personal injury claims). The data has been produced by comparing views given in the literature, some of which have been derived subjectively. Some of the data may need to be assessed more scientifically, according to the requirements of particular specialists.

4.2 Further work with final prototype diagnostic aid

Now that the final prototype has been developed, the next stage will be to conduct a set of user trials with a number of GPs. This would possibly involve an initial pilot study to test for design faults in the diagnostic aid, before re-designing the aid for a wider circulation among GPs. This would be followed by conducting exploratory seminars to test usability of documents and determine training requirements. Possible options for further work include presenting the results as a paper at an appropriate conference, publication as a GP aide memoir, and/or a workshop covering some of the issues in the diagnosis in the medical assessment of upper limb disorders.

4.3 Further work with other flowcharts

On the advice of the expert and advisory groups the prototype diagnostic aid was designed to include symptoms of pain in the hand, wrist, or forearm region. The fact that it did not cover a wider range of ULD symptoms was dictated by the need to keep the aid document as user friendly as possible. However, there is still some scope to develop flowcharts covering symptoms in other areas of the upper limb (i.e. neck, shoulder, elbow regions).

Once the user trials of the prototype aid for the hand/wrist/forearm region have been undertaken, it may be appropriate to develop the other flowcharts and produce another prototype aid, perhaps covering symptoms of pain in the neck, shoulder or elbow. This could also be tested and modified by user trials to the endpoint of a full set of diagnostic aids for the initial medical assessment of upper limb disorders.

4.4 Further work with checklists

It was indicated by the project groups that the set of checklists would be appropriate as an aid for training purposes. These could be used to explain the thinking processes behind the flowchart diagnostic aid(s), as part of a training course run to support their use. This option would be appropriate once user trials have been conducted, and an approved version of the prototype aid(s) has been developed.

In addition, the project groups suggested that the checklist diagnostic aid approach would be more useful to occupational physicians than GPs. Therefore an additional option for use of the checklists would be to develop a diagnostic aid package for occupational physicians. Clearly, this would require further work, and advice from a group of experts, since the work on the checklists was halted before final prototype versions could be completed.

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Appendix A

Collected data on common disorders with symptoms affecting the wrist / hand region, and related risk factors.

Table A1 Common disorders with symptoms affecting the wrist / hand region, and related risk factors.

DISORDER	REFERENCES USED	SUBJECTIVE SYMPTOMS	RELATED RISK FACTORS	OBJECTIVE SYMPTOMS	ANATOMICAL MECHANISM
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<p>Tenosynovitis</p>	<p>Helliwell, 1996; Putz-Anderson, 1988; Viikari-Juntura, 1983; Fine and Silverstein, 1995; Waris et al., 1979; Hamilton, 1990; Hammer, 1934; Kurppa et al., 1991; Stuckey et al., 1982; McRae, 1976; Kuorinka and Forcier, 1995</p>	<p>Localised pain, over affected tendon / muscle- tendon structure - dull ache at rest, greatly exaggerated on motion of the tendon Swelling, over affected tendon / muscle- tendon structure - localised if the condition affects tendons with a definite sheath Crepitation along the tendon is detectable on movement, with intensification of the symptoms, but is by no means found in every case of tenosynovitis Often an associated weakness of the extremity in gripping because of the pain</p> <p>Pain may sometimes be neuralgic in character Swelling that is fusiform in shape appears in more severe cases The swelling may be covered by hot and reddened skin The swelling is edematous in nature Sausage-like thickening along the course of the tendon Burning or numbness in the tips of the fingers which is to be ascribed to direct nerve pressure Disability is pronounced from the outset, and is aggravated upon attempts at activity Away from the area of the tendon sheath this may be called peritendinitis</p>	<p>Repetitions that exceed 1500 to 2000 per hour. Rapid repetitive twisting & gripping movements. Rapid movement. Repeated rapid movements, not necessarily involving heavy loads or of extensive duration. It can occur as a result of overworking the hand in continuous repetitive movements, especially twisting movements of the hand or wrist. Acute frictional tenosynovitis occurs most frequently in the 20 to 40 age group, generally following a period of excess activity. It should not be surprising to find that certain industrial pursuits require the continuous use of special groups of muscles, constituting 'high-speed hand operations' and that such oft-repeated manipulations predispose to the development of tenosynovitis. Where increased speed and the expenditure of muscular energy were demanded, it was noted that tenosynovitis often developed when such laborious effort was persisted in, for many hours daily, over long periods of time. Tenosynovitis crepitans is likely to occur when, from thirty to forty movements of the fingers per minute were needed to accomplish the work. In other words, human tendons will not tolerate more than 1500 to 2000 manipulations per hour. Persistence of strain rather than rapidity of movement is a most important factor favouring the development of tenosynovitis. Particularly troublesome to workers whose jobs demand dexterity and strenuous use of the hands. 3 studies: work tasks strenuous to the muscle-tendon structures of the upper limb. 3 studies: repetition and force used by hands. 1 study: Repetitive arm work (repetitive motions up to 25000 cycles per workday), extreme work positions of the hands and arms. 1 study: grasping with the fingers wide</p>	<p>Tenderness to palpation along the course of the tendon or muscle-tendon junction Swelling to palpation, over affected tendon / muscle- tendon structure - localised if the condition affects tendons with a definite sheath; diffuse if the condition affects the peritendinous tissue of tendons which have no sheath Crepitation along the tendon may be detectable on resisted and possibly passive movements, and is usually palpable, but in some cases it can only be detected during auscultation with a stethoscope Pain over affected tendon / muscle- tendon structure exacerbated by resisted motions Weakness of the extremity in gripping / asymmetric grip strength</p> <p>Pain occurring on passive movements No pain on passive ROM The swelling may be covered by hot and reddened skin Sausage-like thickening along the course of the tendon The swelling is edematous in nature</p>	<p>Sheath stimulated to produce excess fluid, fluid accumulates and sheath becomes swollen.</p>
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Peritendinitis / Peritendinitis Crepitans	Putz-Anderson, 1988; Waris et al., 1979; Thompson, 1951; Kurppa et al., 1991	<p>Local pain at the tendon sheath, in the peritendinous area, or at the muscle-tendon junction -dull ache at rest, greatly exaggerated on motion</p> <p>Swelling, 4-12 cm proximal to the radial styloid on the back of the forearm and well above the upper limit of the tendon sheaths at the wrist - diffuse if the condition affects the peritendinous tissue of tendons which have no sheath</p> <p>Crepitation along the tendon, possibly extending up the forearm as far as the common extensor origin, aggravated by pressure or movement, but is by no means found in every case</p> <p>Often an associated weakness of the extremity in gripping because of the pain</p> <p>Swelling may be covered by hot and reddened skin, without pyrexia Swelling that is fusiform in shape appears in more severe cases Pain may sometimes be neuralgic in character Sausage-like thickening along the course of the tendon Not been able to confirm the often quoted statement that numbness and a burning pain due to nerve pressure occur in the finger tips</p>	<p>Repetitions that exceed 1500 to 2000 per hour. Rapid repetitive twisting & gripping movements.</p> <p>Repetition movements using a stamping mallet precipitated the condition in the radial extensors and abductors of the wrist and thumb. Incidence of tenosynovitis after exertion following an acute or chronic infection. Some occupational changes necessitating unaccustomed work. A return to work after absence. Local 'strain' either repetitive or a single 'strain.' Direct local blunt trauma. Simple repetitive stereotyped movement associated with intensity of effort and speed. A single, sudden, wrenching movement, such as slipping of a spanner, appeared to be responsible in many cases and suggested to us the possibility of a muscle tear at the junction with the tendon on the back of the forearm. Simple repetitive movement such as filing, hammering, spanner or assembly work was an associated factor in 32% of all cases . Particularly troublesome to workers whose jobs demand dexterity and strenuous use of the hands.</p>	<p>Tenderness to palpation along the course of the tendon or on the muscle-tendon junction</p> <p>Swelling on palpation, 4-12 cm proximal to the radial styloid on the back of the forearm and well above the upper limit of the tendon sheaths at the wrist - diffuse if the condition affects the peritendinous tissue of tendons which have no sheath</p> <p>Crepitation along the tendon, possibly extending up the forearm as far as the common extensor origin, may be detectable on movement, and is usually palpable, but in some cases it can only be detected during auscultation with a stethoscope</p> <p>Pain at the tendon sheath, in the peritendinous area, or at the muscle-tendon junction during effort / active movement of the tendon</p> <p>Often an associated weakness of the extremity in gripping</p> <p>Swelling may be covered by hot and reddened skin, without pyrexia Swelling that is fusiform in shape appears in more severe cases Pain may sometimes be neuralgic in character Sausage-like thickening along the course of the tendon Unable to confirm that numbness and a burning pain due to nerve pressure occur in the finger tips</p>	<p>Although true tenosynovitis may occur in other regions, the most commonly affected in simple 'tenosynovitis' is the dorsum of the forearm proximal to the wrist joint. As the lesion responsible is well above the upper limit of the tendon sheaths themselves, the name 'peritendinitis crepitans' is more truly descriptive</p>
Tenosynovitis in Flexors and extensors of forearm	Putz-Anderson, 1988		Extreme flexion and extension of the wrist.		
Intersection Syndrome	Wood and Dobyns, 1986	<p>Localised over the radiodorsal aspect of the distal forearm 4-8 cm proximal to Lister's tubercle</p> <p>Pain</p> <p>Soft-tissue swelling</p> <p>Crepitus, which in some instances may be more like a 'squeak'</p>	<p>Intersection syndrome is frequent in people who row, canoeists, weightlifters (curls particularly), and others who take part in sports that require repetitive wrist activity. This condition may be even more common in industry, particularly in occupations that require constant repetitive wrist motion.</p>	<p>Localised over the radiodorsal aspect of the distal forearm 4-8 cm proximal to Lister's tubercle</p> <p>Tenderness</p> <p>Soft-tissue swelling</p> <p>Crepitus is usually present on both palpation and during wrist motion, may be both audible and palpable</p>	

Tendinitis	Putz-Anderson, 1988; Fine and Silverstein, 1995; Wood and Dobyns, 1986; Cherniack, 1990; Stuckey et al., 1982	<p>Localised aching pain over muscle-tendon structure, aggravated by activity</p> <p>Stiffness Localised swelling over muscle-tendon structure Possibly fine crepitus on passive range-of-motion Decreased grip strength</p>	<p>Repeated tensing of muscle/tendon unit, without rest. Rapid movement. Repeated rapid movements, not necessarily involving heavy loads or of extensive duration.</p> <p>Tendinitis near the wrist is the most frequent sports-related cause of persistent discomfort that requires medical attention. Most cases are associated with overuse or unaccustomed activity.</p>	<p>Pain exacerbated by resisted motions</p> <p>Pronounces asymmetric grip strength Localised swelling over muscle-tendon structure Possibly fine crepitus on passive range-of-motion No pain on passive ROM Pain is accentuated by passive stretch of the affected tendon Tenderness well localised over the involved tendon(s) Radiographs are usually normal but may occasionally demonstrate calcification within the affected tendon sheath</p>	Tendon inflammation, tendon becomes thickened, bumpy, and irregular.
De Quervain's Tenovaginitis / De Quervain's Tenosynovitis	Helliwell, 1996; Putz-Anderson, 1988; Munro and Edwards, 1995; Fine and Silverstein, 1995; Wood and Dobyns, 1986; Ranney, 1993; McRae, 1976; Younghusband and Black, 1963	<p>Pain on dorsal radial aspect of wrist / in anatomic snuffbox which may radiate up the radial side of the forearm or down into the thumb Pain on thumb movement, or on certain movements of the wrist Sometimes swelling at or just proximal to the radial styloid Sometimes crepitus over the first dorsal compartment Grip / pinch grasp is weak</p> <p>Difficult to pull thumb back & away from hand Some cases, swelling, redness, warmth may be seen along the line of the tendon May be palpable thickening, ganglion cyst formation, over the first dorsal compartment, that moves with flexion and extension of the thumb May be interference with sleep because of pain and discomfort</p>	<p>The movements likely to cause this problem are pinching or grasping while the wrist is involved in radial and ulnar deviation movements. Combinations of hand twisting & forceful gripping. Ulnar and radial deviations of the wrist.</p> <p>It is more common in women, perhaps as a result of their greater range of wrist motion. Those who engage in sporting activities that mandate repetitive wrist ulnar deviation are particularly at risk. It occurs in the middle-aged.</p>	<p>Finkelstein's test consists of passive ulnar deviation of the wrist with the thumb held adducted into the palm by the patient: a positive test elicits sharp pain along the line of the aforementioned tendons / region of the radial styloid (To minimise false positive tests, the ulnar deviation stress should be applied to the metacarpal of the index finger, rather than the thumb) Pain on resisted extension and abduction of the thumb Local tenderness on palpation at the radial styloid / over the 1st tendon compartment Sometimes swelling at or just proximal to the radial styloid Sometimes crepitus over the first dorsal compartment Grip / pinch grasp is weak</p> <p>May be a few degrees restriction on full abduction - tested by placing the hands in the praying position and abducting the thumbs simultaneously Some cases, redness, warmth may be seen along the line of the tendon May be thickening, ganglion cyst formation, over the first dorsal compartment Usually a palpable mass can be felt that moves with flexion and extension of the thumb Radiographic examination of the affected area is of no positive diagnostic value but may be helpful in ruling out other conditions</p>	Repetitive excessive friction between tendon sheath & two thumb tendons promotes thickening of the sheath.

<p>Stenosing Tenosynovitis / Stenosing Tenosynovitis Crepitans / Trigger Finger</p>	<p>Helliwell, 1996; Putz-Anderson, 1988; Fine and Silverstein, 1995; Quinnell, 1980; McRae, 1976</p>	<p>Stiffness to triggering / clicking / catching of finger on extension to finger locked in either flexion or extension Pain of finger on extension Slight swelling at base of digit, just proximal to the metacarpophalangeal joint may be felt in the palm - although may be an unreliable sign</p> <p>Triggering, particularly in the early morning Finger movement causes a creaking sound</p>	<p>Use of tool or control handles with hard or sharp edges. Manual forces on palmar side of fingers. Rheumatoid arthritis should always be borne in mind as it is one of the few recognised causes.</p>	<p>Stiffness to triggering / clicking / catching of finger on extension to finger locked in either flexion or extension Palpable nodule, at base of digit, just proximal to the metacarpophalangeal joint may be felt in the palm - although may be an unreliable sign</p> <p>Triggering, particularly in the early morning Tenderness anterior to the metacarpal of the affected digit Finger movement causes a creaking sound</p>	<p>Tendon sheath so swollen that tendon locked within sheath.</p>
<p>Rheumatoid Arthritis of the wrist/hand</p>	<p>McRae, 1976; Allander, 1970; Smyth, 1992</p>	<p>Morning stiffness (for at least 1 hour and present for at least 6 weeks) - possibly unreliable criteria Joint pain at rest or on motion, particularly symmetric small joints of the hands Swelling / deformity of wrist, metacarpophalangeal (MCP) or proximal interphalangeal (PIP) joint swelling / symmetric joint swelling Hand function restricted Increased local heat particularly symmetric small joints of the hands</p> <p>Onset is slow, insidious, and intermittent over several weeks or months Onset and exacerbations are more frequent during the winter months Distal interphalangeal joints are seldom involved Rheumatoid nodules Range of motion is restricted Function and muscle strength are diminished Sometimes compound palmar ganglion Effusion Muscle wasting</p>		<p>Joint pain at rest or on motion, particularly symmetric small joints of the hands Swelling / deformity of wrist, metacarpophalangeal (MCP) or proximal interphalangeal (PIP) joint swelling / symmetric joint swelling Hand roentgenographic changes Increased local heat particularly symmetric small joints of the hands Joint tenderness particularly symmetric small joints of the hands</p> <p>Serum rheumatoid factor assayed by a method positive in fewer than 5 percent of normals Rheumatoid nodules Range of motion is restricted Function and muscle strength are diminished Laboratory tests are helpful, but none is diagnostic Sometimes compound palmar ganglion Effusion Muscle wasting</p>	

Osteoarthritis of the hand	Helliwell, 1996; Viikari-Juntura, 1983; Hamilton, 1990; McRae, 1976; Kuorinka and Forcier, 1995	<p>Pain in affected joint stiffness / loss of function, movement, stability bony swelling around joint deformity</p> <p>In most cases they are symptom-free Mucinous cysts</p>	<p>Arthritis, which is common in later life, often develops in the hands through overwork or by constant impacts from tools, etc. The condition is aggravated by working in cold damp conditions, for example, construction and horticultural work. They occur most frequently in women after menopause, and are often familial. They are not related to osteo-arthritis elsewhere. There may on occasion be a history of a previous Bennett's fracture or of occupational overuse. Osteoarthrosis: 1 study: 30 years or more of manual labour requiring the vigorous use of hands.</p>	<p>Pain on palpation and movement of affected joint Herbeden's nodes (bony swelling at either side of distal interphalangeal joint) Bouchard's nodes (bony swelling at either side of proximal interphalangeal joint) Mucinous cysts</p> <p>Early morning stiffness less than 30 min Bony enlargement Radiological criteria are loss of joint space, osteophytes, sub-chondral sclerosis and cyst formation; occasionally erosions (loss of cortical integrity over the surface of the joint) may be seen Early osteoarthritis may manifest as only pain and radiological examination may be normal at this stage In most cases they are symptom-free O-A changes between the thumb metacarpal and trapezium may give rise to disabling pain and impaired function in the hand</p>	
Ganglion	Helliwell, 1996; Putz-Anderson, 1988; Viikari-Juntura, 1983; McRae, 1976; De Orsay et al., 1937	<p>Cystic swelling / bump under the skin about affected joint</p> <p>Most frequent site is the dorsum of the wrist Fluctuations in the size of ganglions Variable shape of ganglions Cysts such as are found on the palm of the hand are not evident on the surface Pain variable, usually dull in character, persistent, and most marked upon motion of the neighbouring joint and tendons May be weakness of the joint</p>	<p>The majority of cases listing trauma state that it is associated with a twisting motion. Repeated lifting of heavy milk cans from a loading platform into a truck. Strain from playing tennis. Repeated lifting of heavy ledgers. the wringing out of wet clothes was given by several housewives as the probable cause. the pressure of the knee against a machine while pushing down a lever with the foot was the cause of a ganglion on the lateral aspect of the knee. A ganglion developed on the dorsum of the foot following the painful trauma of kicking a chair. Another occurred on the flexor surface of the fifth finger from bowling. Trauma plays a part in the etiology of ganglia.</p>	<p>Cystic swelling / bump under the skin about affected joint</p> <p>Most frequent site is the dorsum of the wrist Fluctuations in the size of ganglions Variable shape of ganglions The ganglion may be tense and firm to palpation or soft and fluctuant Small ganglions on the back of the wrist, arising from the radio-carpal joint; local pain, swelling and tenderness may only be obvious when the wrist is palmar flexed Cysts such as are found on the palm of the hand are not evident on the surface Pain variable, usually dull in character, persistent, and most marked upon motion of the neighbouring joint and tendons Ganglia occurring on the flexor sheaths over the metacarpophalangeal joints are painful When pressed upon by a hard object May be weakness of the joint</p>	Excess synovial fluid (joint lubricant) fills tendon sheath, sheath swells.

Carpal Tunnel Syndrome	<p>Helliwell, 1996; Putz-Anderson, 1988; Viikari-Juntura, 1983; Munro and Edwards, 1995; Fine and Silverstein, 1995; Wood and Dobyns, 1986; McRae, 1976; Buch-Jaeger and Foucher, 1994; Corwin, 1987; Kuorinka and Forcier, 1995; Mesgarzadeh et al., 1989; Franklin et al., 1991; Vessey et al., 1990; Stetson et al., 1993; McCracken, 1986; Katz et al., 1991; Schenck, 1989; Phalen, 1966</p>	<p>Pain, paresthesia, numbness & tingling in median nerve distribution of hand - first three fingers and base of thumb (radial 3½ fingers) Symptoms aggravated by activities using the hands, particularly prolonged full active flexion Nocturnal exacerbation of symptoms diminished sensitivity to touch in median nerve distribution Apparent weakness and clumsiness in hand</p> <p>Paresthesia may also radiate proximally to the elbow Symptoms become most marked in the early hours of the morning, often waking the patient from sleep and causing her to shake the hand or hang it over the side of the bed Wasting of the thenar eminence</p>	<p>NIOSH: Work involving repetition, force, awkward position or vibration (Hel). Activities which combine high force & high repetition in use of hands & wrists. Induced more by repetitiveness than force. Extreme flexion and extension of the wrist. Exposure of nerves to hard or sharp edges: external or internal.</p> <p>Any sports-related activity that involves repetitive motion or grasping with the hand or wrist or a singular wrist hyperextension injury may be of etiologic significance.</p> <p>3 studies: High force / high repetition jobs. High-repetition jobs. 1 study: for 20-40 hours / week- wrist flexion, wrist extension. 2 studies: hand-held vibrating tool, repetition of wrist movement. 1 study: repetition and cold. Repetition only.</p> <p>It usually occurs between the ages of 36 and 60 years and is two to five times more common in women than in men. The dominant hand is affected more frequently, and bilateral involvement has been reported to occur in 8%-50% of cases. Findings from a number of recent case-control studies demonstrate a strong association between workplace exposures (High repetition, high force, vibration) and carpal tunnel syndrome.</p> <p>The disorder is much commoner in women than in men, most frequent between the ages of 30 and 60 years, may appear transiently during pregnancy and is often bilateral. Association with oral contraceptive use, diabetes mellitis.</p> <p>An increased risk of CTS has been associated with high force-high repetitive jobs, repetitive wrist motions, repeated or sustained wrist deviation, repeated or sustained pinch grip, and use of hand-held vibrating tools.</p> <p>Wrists involved in repetitious work, wrists exposed to excessive forces or direct pressure, and wrists regularly</p>	<p>Positive Phalen's wrist flexion test Phalen's test consists of the patient holding the forearms vertically and allowing both hands to drop into complete flexion at the wrist for approximately one minute. If positive, the test reproduces or exacerbates the patient's symptoms of pain and paresthesia felt in the distribution of the median nerve.</p> <p>Positive Tinel's sign Tinel's test involves percussing over the carpal tunnel / median nerve at the wrist for about half a minute. If positive, the test reproduces or exacerbates the patient's symptoms of pain and paresthesia felt in the distribution of the median nerve distally</p> <p>Loss of sensation in median nerve distribution may be tested with either pin-prick, vibration, 2 point discrimination or monofilament hairs</p> <p>Weakness of abductor pollicis brevis and opponens pollicis - the opponens pollicis is tested by asking the patient to touch the tip of the thumb to the tip of the 5th finger and then attempting to break the pinch against resistance</p> <p>Direct compression over the median nerve in the distal forearm may reproduce the symptoms and is useful in diagnosis May be subjective weakness or tightness of digit flexion Muscle atrophy may be apparent on the outer half of the thenar eminence in severe cases Electrophysiology is used to confirm the diagnosis of carpal tunnel syndrome, although may be normal in some cases of early disease Positive flick sign: in response to question 'what do you do when your symptoms are worse ?' patient demonstrates a flicking action like shaking a thermometer Imaging of the carpal tunnel has recently been described using the technique of magnetic resonance imaging and the dimensions of the tunnel may be determined by ultrasound scanning A better 'test' is to provide a night resting splint,</p>	<p>Median nerve is compressed as it enters palm due to tendon sheath swelling in the carpal tunnel.</p>
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<p>Raynaud's Phenomenon / White Finger / Vibration Syndrome / Hand-arm vibration syndrome</p>	<p>Putz-Anderson, 1988; Hamilton, 1990; Cherniack, 1990; Boveni, 1986</p>	<p>Numbness and tingling in the affected fingers triggered by exposure to cold Attacks / episodes of Raynaud's phenomenon / fingertip blanching / pallor / cyanosis induced by cold Gangrene & ulceration in fingers in extreme cases</p> <p>Diffuse upper extremity pain - not well characterised Muscle fatigue - not well characterised In the worst cases can lead eventually to gangrene Problems with cold water tolerance or refrigeration may signify disease in warmer climates Perceptual decrements and difficulty with fine control Reductions in hand strength</p>	<p>Forceful gripping and also prolonged use of vibrating tools. The hands of people working for long periods with vibrating tools (pneumatic breakers, chain saws, etc.) are at risk of developing vibration white finger. The presence of Raynaud's phenomenon, pallor, or cyanosis induced by cold with a work or significant recreational history involving the frequent use of pneumatic tools is critical to the diagnosis of vibration-induced vaso-spasm. An average of 1 to 2 hours per day of use is sufficient to produce the symptoms. Small tools that produce vibration may involve forceful manipulations producing injury to the soft tissues of the wrist. Exposure to vibration and forceful repetitive movement. Vibration generated by hand held tools.</p>	<p>Numbness and tingling in the affected fingers triggered by exposure to cold Attacks / episodes of Raynaud's phenomenon / fingertip blanching / pallor / cyanosis induced by cold</p> <p>Problems with cold water tolerance or refrigeration may signify disease in warmer climates Perceptual decrements and difficulty with fine control Reductions in hand strength</p>	<p>Shutdown of arteries to fingers.</p>
<p>Ulnar nerve entrapment at the wrist / at Guyon's tunnel / Guyon Canal Syndrome / Ulnar Tunnel Syndrome</p>	<p>Helliwell, 1996; Viikari-Juntura, 1983; Fine and Silverstein, 1995; Wood and Dobyys, 1986; McRae, 1976</p>	<p>Pain, paresthesia and numbness in the lateral aspect of the 4th and 5th fingers in the hand Weakness in abduction of the fifth finger Diminished sensation in the volar aspect of the fifth finger</p> <p>Clumsiness in fine movements Decreased pinch strength Weakness in the hand Occasionally atrophy or weakness of the interossei muscles</p>	<p>The mechanism of injury is thought to be direct pressure.</p>	<p>Weakness in abduction of the fifth finger Tinel's sign at the Guyon's tunnel possible Diminished sensation in the volar aspect of the fifth finger</p> <p>Tenderness to palpation at the Guyon's tunnel possible Positive Phalen's test in ulnar distribution Weakness on resisted abduction and adduction of digits Clumsiness in fine movements Decreased pinch strength weakness in the hand Occasionally atrophy or weakness of the interossei muscles Confirmation may be made electrophysiologically</p>	

Hypothenar Hammer Syndrome	Helliwell, 1996; Kuorinka and Forcier, 1995	Symptoms especially on exposure to cold Blanching Paresthesia- pins-and-needles, coldness Pain in hand	The hypothenar hammer syndrome is a condition of vascular damage due to repeated trauma to the superficial palmar arch , usually during occupational use. The superficial palmar arch passes over the fusiform bone and may be damaged when the heel of the hand is used to jam against objects . 1 study: habitual hand hammering defined as using the hand to hammer more than once a day. 1 study: plate workers were exposed to vibration mainly during grinding but also used their hands as hammers .	Positive Allen's test. The fist is clenched to blanch the skin, the observer occludes a radial artery at the wrist manually and then the fist is unclenched. If the blood is slow to return to the skin of the hand this test is said to be positive	
Dupuytren's contracture	Helliwell, 1996; Hamilton, 1990; McRae, 1976	Progressive flexion of the affected fingers interferes with the function of the hand and may be so severe that the fingernails dig into the palm Painless thickening of the palmar fascia More severe- extensive palmar thickening and tethering of the fingers, particularly the little finger, in full flexion Ring finger is most frequently affected, followed by the little and middle fingers, the index and even the thumb may be involved	May be related to occupational use . Thought to be the result of working for long periods with the palm of the hand pressed against a hard object , for example, a steering wheel with a knob; or the continuous use of a hand tool . The condition affects men preponderantly over the age of 40 , and in some cases there may be a hereditary tendency , or an association with epilepsy or alcoholic cirrhosis . The condition may appear in either sex at an earlier age precipitated by trauma , and then may pursue a particularly rapid course.	Painless thickening of the palmar fascia Small nodule at the base of the ring finger at the level of the distal palmar crease Ring finger is most frequently affected, followed by the little and middle fingers, the index and even the thumb may be involved	
Mallet Finger	McRae, 1976	Distal inter-phalangeal joint is held in a permanent position of flexion; this may be moderate or complete The patient is unable to extend the distal joint of the finger	The extensor tendon tears close to its attachment to the distal phalanx, or may avulse a fragment of the terminal phalanx as a result of trauma .		
Beat Hand / Subcutaneous Cellulitis of the hand	Hamilton, 1990	Painful inflammation of the palm of the hand	Arduous manual work with tools which subject the hands to frequent jarring or pressure can lead to this complaint which involves a painful inflammation of the palm of the hand. Wet dirty conditions can result in infection through contaminated particles being driven into the skin.		

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Appendix B

Collected data on common disorders with symptoms affecting the elbow / forearm region,
and related risk factors

Table B1 - Common disorders with symptoms affecting the elbow / forearm region, and related risk factors

DISORDER	REFERENCES USED	SUBJECTIVE SYMPTOMS	RELATED RISK FACTORS	OBJECTIVE SYMPTOMS	ANATOMICAL MECHANISM
Lateral Epicondylitis / Tennis Elbow	Helliwell, 1996; Fine and Silverstein, 1995; Viikari-Juntura, 1983; Waris et al., 1979; Farr, 1982; Chard and Hazleman, 1991 Boyd and McLeod, 1973; McRae, 1976; Putz-Anderson, 1988; Stuckey, 1982; Luopajarvi et al., 1979; Murley, 1975; Kuorinka and Forcier, 1995	<p>Pain localised to the lateral epicondyle during rest</p> <p>Pain localised to the lateral epicondyle during active motion of wrist and fingers</p> <p>Pain and/or weakness in gripping (shaking hands / holding heavy objects)</p> <p>Pain may radiate down to the dorsum of the wrist</p> <p>Pain may spread up and down the upper limb</p> <p>The range of movement of the elbow is usually normal but loss of a few degrees of extension is found in some severe and chronic cases</p>	<p>Movements with impact to arm. Jerky throwing motions of arm. Overuse of finger extensor muscles attached to the elbow. Extreme rotation of the forearm. Inward or outward rotation of the forearm while the wrist is bent. Rapid movement injury caused by repeated rapid movements, not necessarily involving heavy loads or extensive duration.</p> <p>May be connected with the constant overstrain of flexors in work.</p> <p>Pain is aggravated by those activities that cause the disorder. Predisposing factors are those activities that involve repeated flexion and extension of the wrist against resistance, or repeated pronation and supination of the forearm with the elbow extended.</p> <p>More common in the fourth decade of life.</p> <p>Whilst common at all ages from end of the second decade, most common in the fourth and fifth decades.</p> <p>Mostly caused by process of degenerative changes.</p> <p>Usually in the 35 to 50 age group. There may be a history of recent excessive activity involving the elbow.</p> <p>3 studies: work tasks strenuous to the muscle-tendon structures of the upper limb. 1 study: overstrain of the extensors and flexors of the wrist and fingers while cutting frozen meat.</p>	<p>Local tenderness on or just inferior to lateral epicondyle, at the origin of the common extensor tendons(during palpation)</p> <p>Pain over the lateral aspect of the elbow reproduced / made worse by resisted extension of wrist (and fingers) with elbow fully extended</p> <p>Pain and/or weakness in gripping (particularly at arm's length)</p> <p>Local swelling at the elbow</p> <p>Tenderness over the radiohumeral joint</p> <p>Pain on resisted extension of wrist with fingers flexed</p> <p>Symptoms may be precipitated by extending the elbow with the wrist palmar flexed and by extending the middle finger against resistance</p> <p>Pain on resisted radial deviation</p> <p>The range of movement of the elbow is usually normal but loss of a few degrees of extension is found in some severe and chronic cases</p> <p>No pain or limitation on full passive ROM</p> <p>Muscle atrophy</p> <p>Radiographic changes at the epicondyles</p>	<p>Overused muscles irritate unsheathed tendons in elbow, inflaming tendon on outside of elbow.</p>

<p>Medial Epicondylitis / Golfer's Elbow</p>	<p>Helliwell, 1996; Fine and Silverstein, 1995; Viikari-Juntura, 1983; Waris et al., 1979; McRae, 1976; Putz-Anderson, 1988; Stuckey, 1982; Luopajarvi et al., 1979; Murley, 1975</p>	<p>Pain localised to medial epicondyle during rest Pain localised to medial epicondyle during active motion of wrist and fingers Pain during resisted flexion of the fingers and wrist</p> <p>Pain at the common flexor origin on the medial side of the elbow</p>	<p>Repeated or forceful simultaneous forearm rotation & wrist bending. Extreme rotation of the forearm. Inward or outward rotation of the forearm while the wrist is bent. Rapid movement injury caused by repeated rapid movements, not necessarily involving heavy loads or extensive duration.</p> <p>May be connected with the constant overstrain of flexors in work.</p> <p>Whilst common at all ages from end of the second decade, most common in the fourth and fifth decades.</p>	<p>Local tenderness on the medial epicondyle at the common flexor origin on palpation Pain over the medial aspect of the elbow reproduced / made worse by resisted flexion of the wrist (and fingers)</p> <p>swelling at the medial epicondyle Pain on resisted forearm pronation No pain on passive ROM</p>	<p>Irritation of tendon attachments of finger muscles on inside of elbow.</p>
<p>Cubital Tunnel Syndrome / Ulnar Nerve Entrapment at the Elbow / Ulnar Neuritis / Ulnar Tunnel Syndrome</p>	<p>Helliwell, 1996; Viikari-Juntura, 1983; McRae, 1976; Putz-Anderson, 1988</p>	<p>Pain, paresthesiae and numbness in fourth and fifth fingers of hand Decreased sensation in fourth and fifth fingers of the hand Weakness of the interossei</p> <p>Weakness of the interossei and the third and fourth lumbricales possible</p> <p><i>Small muscle wasting</i> <i>Sensory impairment in the hand</i></p>	<p>Extreme flexion of the elbow. <i>May occur as a complication of local trauma at the elbow or at the wrist. In a number of cases no obvious cause for ulnar neuritis may be found.</i></p>	<p>Decreased sensation in the fourth and fifth fingers of the hand Weakness of the interossei Positive Froment's sign (wasting of the 1st dorsal interosseous muscle and inability to maintain adduction of the thumb so that hyperflexion of the inter-phalangeal joint occurs while pinching between the thumb and 1st finger) Tenderness to palpation at the cubital tunnel</p> <p>Weakness of the third and fourth lumbricales possible Positive Wartenberg's sign (inability to abduct the little finger) Positive Tinel's sign (percussion over the cubital tunnel causing shooting symptoms in the distribution of the ulnar nerve) may be present</p> <p><i>Small muscle wasting</i> <i>Sensory impairment in the hand</i> <i>Nerve conduction rate studies are often most helpful</i></p>	<p>Entrapment of the ulnar nerve at the elbow.</p>

<p>Pronator Teres Syndrome</p>	<p>Helliwell, 1996; Fine and Silverstein, 1995; Viikari-Juntura, 1983</p>	<p>Pain in the medial / proximal volar aspect of the forearm Aching in the proximal forearm associated with activities which require use of the elbow and require pronation and grasping Diminished sensation / paresthesia / burning pain in three and a half fingers on the radial side of the hand, the thenar eminence, median nerve distribution in hand, volar side of the forearm</p> <p>Pain in median nerve distribution in hand Minimal motor changes Decreased strength of pronation Weakness of the short abductor of the thumb possible Decreased flexion strength of the wrist and/or of the distal phalanges of the fingers Nocturnal paresthesiae are less frequent</p>	<p>principal symptom aching in the proximal forearm associated with activities which require use of the elbow and require pronation and grasping.</p>	<p>Increased pain in forearm by resisted pronation with clenched fist and flexed wrist (Mills's test) Diminished sensation in the forearm, the median nerve distribution of the hand, three and a half fingers on the radial side of the hand, the thenar eminence Electrical studies / electrophysiological testing is often inconclusive</p> <p>Local tenderness over the edge of the pronator teres muscle Aching in the proximal forearm associated with use of the elbow or pronation and grasping Symptoms increased by forearm supination and elbow flexion or flexion of the middle finger at the proximal interphalangeal joint Positive Tinel's sign when percussing the nerve in the forearm Decreased strength of pronation Decreased flexion strength of the wrist and/or of the distal phalanges of the fingers Weakness of the short abductor of the thumb</p>	
<p>Anterior Interosseous Syndrome</p>	<p>Helliwell, 1996</p>	<p>Dull aching pain on the volar aspect of the proximal forearm / antero-medial forearm Weakness of the hand, pronator quadratus, flexor pollicis longus and/or flexor digitorum profundus</p> <p>Paresthesiae on the volar side of the forearm Symptoms and signs of median nerve entrapment in the hand Anterior interosseous nerve syndrome is not associated with sensory complaints Loss of distal flexion of thumb and index finger</p>		<p>Weakness of pronator quadratus, flexor pollicis longus and/or flexor digitorum profundus Loss of distal flexion of thumb and index finger - unable to make an 'O' sign by pinching the thumb and index finger together</p> <p>Symptoms and signs of median nerve entrapment in the hand Anterior interosseous nerve syndrome is not associated with sensory complaints since this is purely a motor nerve</p>	

Posterior Interosseous Syndrome / Frohse's Syndrome	Helliwell, 1996; Viikari-Juntura, 1983	Pain distal to lateral epicondyle during rest Weakness of extension of middle finger Radiating pain downward or upward		Tenderness distal to elbow, at the edge of the superficial portion of the supinator muscle (the arcade of Frohse) Weakness of extension of middle finger The rest of the neurological examination normal	
Radial Tunnel Syndrome	Helliwell, 1996; Chard and Hazleman, 1991 Verhaar and Spaans, 1991	Diffuse pain in the elbow at the site of the entrapment during rest No weakness or sensory loss Weakness on supination Decreased strength of ulnar deviation of the wrist Sensory signs and symptoms distal to the lateral epicondyle Muscle weakness	Studies of patients who had radial tunnel syndrome noted that most had jobs that elicited high cyclic strain with rotatory movements of the forearm.	Some tenderness along the radial nerve about 5-7cm distally to the lateral epicondyle / where it passes under the arcade of Frohse No weakness or sensory loss Weakness on supination Decreased strength of ulnar deviation of the wrist Pain around lateral aspect of the elbow reproduced / made worse by resisted extension of the fingers Rotation of the forearm may elicit the pain Sensory signs and symptoms distal to the lateral epicondyle Electromyography may be helpful Nerve conduction studies might not show abnormalities	
Olecranon Bursitis	Fine and Silverstein, 1995; Viikari-Juntura, 1983; McRae, 1976; Murley, 1975	Swelling at olecranon Usually painless unless there is an associated bacterial infection within the bursa Pain at olecranon No pain on passive or resisted ROM Nodular masses in the proximal part of the forearm	Swelling in response to irritation, movements. Leaning on the elbow. Swelling of the olecranon bursa is common in carpet-layers and others who repeatedly traumatise the posterior aspect of the elbow joint. Swelling of the bursa is also common in rheumatoid arthritis.	Swelling at olecranon Palpable painful olecranon bursa Usually painless unless there is an associated bacterial infection within the bursa No pain on passive or resisted ROM Nodular masses in the proximal part of the forearm	
Osteo-arthritis / <i>Rheumatoid-arthritis of the elbow joint</i>	McRae, 1976	Formation of loose bodies Restrict movements Locking of the joint <i>May affect either one or both elbows If both elbows are involved, the functional disablement may be great</i>	Primary osteo-arthritis of the elbow joint is not uncommon in heavy manual labourers. O-A is also seen secondary to old fractures involving the articular surfaces; it may also follow osteochondritis dissecans.	Formation of loose bodies Restrict movements Locking of the joint <i>May affect either one or both elbows If both elbows are involved, the functional disablement may be great</i>	

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Appendix C

Collected data on common disorders with symptoms affecting the neck / shoulder region,
and related risk factors

Table C1 - Common disorders with symptoms affecting the neck / shoulder region, and related risk factors

DISORDER	REFERENCES USED	SUBJECTIVE SYMPTOMS	RELATED RISK FACTORS	OBJECTIVE SYMPTOMS	ANATOMICAL MECHANISM
Calcifying (Supraspinatous) Tendinitis	McRae, 1976; Nevasier, 1983; Uhtoff, 1990	Spontaneous, sudden onset of severe incapacitating pain in shoulder Splints arm close to body Motion is excruciatingly painful. No symptoms in chronic stage Difficulty sleeping Similar to those of painful arc or impingement syndrome Catching sensation when arm is abducted Considerable loss of active function of shoulder joint	Degenerative changes in the shoulder cuff may be accompanied by the local deposition of calcium salts. Incomplete tear attributable to process of degeneration . Tendinitis giving rise to impingement syndrome attributable to overuse or inadequate subacromial space . Calcifying tendinitis tends to peak in the fifth decade , whereas degenerative rotator cuff lesions occur predominantly in older age groups.	Considerable loss of active / passive function of shoulder joint, since motion is excruciatingly painful Shoulder / subdeltoid bursa / over the deposit is acutely tender Appearance of the amorphous calcium deposit in roentgenograms Catching sensation when arm is abducted between 60 and 120 Shoulder is often swollen and warm to the touch Radiographic changes are obvious	
Rotator Cuff Tear	McRae, 1976; Zlatkin, 1988; Uhtoff, 1990	Pain primarily over anterolateral and superior aspect of shoulder Exacerbated by use of arm at or above shoulder level Patient has difficulty in initiating abduction of arm Painful arc of movement Many cases ultimately indistinguishable from frozen shoulder Change in shoulder strength Muscle atrophy	Shoulder cuff may suffer substantial tear as a result of sudden traction to arm . This occurs most readily in the middle-aged , where degenerative changes in the shoulder cuff have become established. Tear is most often a consequence of degenerative changes in the tendon fibres and the fibrocartilaginous Sharpey's fibres.	Pain primarily over anterolateral and superior aspect of shoulder / painful arc of movement during abduction of arm Patient has difficulty in initiating abduction Limitation of passive rotation may supervene Change in shoulder strength Muscle atrophy	

<p>Rotator Cuff Tendinitis / Supraspinatous Tendinitis / Subdeltoid Bursitis / Subacromial Bursitis / Partial Tear of Rotator Cuff</p>	<p>Helliwell, 1996; Putz-Anderson, 1988; Waris et al., 1979; Hagberg and Wegman, 1987; Viikari-Juntura, 1983; Fine and Silverstein, 1995; Rowe, 1987; Uhtoff, 1990; Kuorinka and Forcier, 1995</p>	<p>Local pain in the shoulder region, exacerbated by a glenohumeral movements / abduction or elevation of the arm Symptoms become more severe and there may be pain at rest, especially in bed at night Limited active abduction of the arm (possibly not necessary for diagnosis)</p> <p>Dull ache localised to the deltoid area without neck or arm radiation Discomfort on rotation of the arm from the shoulder as in reaching into a hip pocket or fastening bra Restriction of rotation of the arm Normal passive movements Reduced stability & mobility of shoulder Reflectory splinting of the humerus No symptoms of distal paresthesia 'Catch' on movement Weakness is uncommon Inflammation, either in the tendon or bursa, may be superimposed at any time</p>	<p>Work that requires habitually reaching and working with the arms above shoulder level. Machine-paced assembly work where repetitive motions of the hands reach 25000 cycles per workday. Impingement of the rotator cuff tendons under the coracoacromial arch have been suggested as the main cause of rotator cuff tendinitis. The exposure giving impingement is a work task demanding raising of the arms. Work at or above shoulder level had significantly high odds ratio. Incomplete tear attributable to process of degeneration. Tendinitis giving rise to impingement syndrome attributable to overuse or inadequate subacromial space. Activities that are performed with the arms raised away from the sides and involve some degree of rotation of the arm from the shoulder increase the static loading already present in the rotator cuff tendons, tend to hasten and increase the attritional changes already occurring, and may precipitate symptoms which are variously diagnosed as rotator cuff tendinitis, supraspinatous tendinitis, or bursitis of the shoulder. 3 studies: Elevated arms, with hands at or above shoulder level. 1 study: degenerative joint disease. 1 study: high demands on wrists and hands in terms of force and/or repetition. 1 study: repeated forward flexions (15/min for 1hr) of shoulder. 1 study: repetitive overhead arm movements. 1 study: repetitive arm work (25000/workday), extreme work positions of hands and arms, shoulders subject to static muscle</p>	<p>Painful arc on active/resisted /isometric abduction becomes severe as the arm approaches the horizontal position Pain on resisted internal/external rotation possible Local tenderness in the rotator cuff / on the supraspinatous tendon during palpation, especially over the humeral head and lateral to and just below the bony acromion process Limited active abduction of the arm (possibly not necessary for diagnosis)</p> <p>Normal passive movements Discomfort on rotation of the arm from the shoulder as in reaching into a hip pocket or fastening bra Limited abduction range of motion of the shoulder Restriction of rotation of the arm, especially when tested in the position of 90 degrees of abduction with the elbow raised to shoulder level X-ray occasionally reveals cystic changes and flattening in the greater tuberosity Inflammation, either in the tendon or bursa, may be superimposed at any time Impingement test for supraspinatus tendinitis: with patient seated observer stands behind patient and elevates the arm forward while keeping the scapula fixed. If pain is produced in the shoulder and is relieved by 10 mls of 1% xylocaine beneath the subacromial area / anterior edge of the acromium then the test is regarded as positive</p>	<p>Rotator cuff inflamed from excessive raising of elbow leads to stressed shoulder tendons & bursae causing tendons to fray or tear</p>
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SLAP lesion	Cartland et al., 1992		<p>Most common mechanism eliciting a SLAP injury is a compressive force applied to the shoulder with the shoulder positioned in abduction and slight flexion, as may occur during a fall. A second mechanism is sudden traction to the arm and forceful contraction of the biceps muscle, such as may occur as a result of throwing an object.</p>		
Bursitis	Putz-Anderson, 1988; Rowe, 1987		<p>Excessive tendon overuse. Activities that are performed with the arms raised away from the sides and involve some degree of rotation of the arm from the shoulder increase the static loading already present in the rotator cuff tendons, tend to hasten and increase the attritional changes already occurring, and may precipitate symptoms which are variously diagnosed as rotator cuff tendinitis, supraspinatous tendinitis, or bursitis of the shoulder.</p>		<p>Overuse of tendon roughens tendon which irritates & inflames bursae (flat fluid-filled sacs which cushion & reduce friction when tendons slide over bone)</p>

<p>Bicipital (Humeral) Tendinitis</p>	<p>Helliwell, 1996; Waris et al., 1979; Munro and Edwards, 1995; Viikari-Juntura, 1983; Rowe, 1987; Putz-Anderson, 1988; Kuorinka and Forcier, 1995</p>	<p>Local pain in the shoulder region which seems to radiate more commonly to the anterior aspect of the arm, exacerbated by a glenohumeral movements / abduction or elevation or supination of the arm Limited movement / abduction of the arm</p> <p>Local pain that is often bothersome at night Reflectory splinting of the humerus</p>	<p>Machine-paced assembly work where repetitive motions of the hands reach 25000 cycles per workday. The long head of the biceps may become inflamed and painful with the same activities which stir up rotator cuff symptoms and, in addition, may be affected by activities involving constant or repetitive forward elevation of the arm at the shoulder.</p> <p>1 study: degenerative joint disease.</p>	<p>Yergason's sign- pain over the long head of the biceps in front of the shoulder on resisted supination of the forearm with the elbow flexed at 90 Painful arc on active/resisted /isometric abduction of arm Local tenderness anteriorly, on the bicipital tendon / in the intertubercular sulcus during palpation, almost over the maximum convexity of the humeral head</p> <p>Normal passive movements Abduction with the arm in external rotation compresses the tendon of the biceps and is painful or limited in some cases Speed's test - resisted flexion of the shoulder with a supinated arm Discomfort on raising the arm in front</p>	
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<p>Bicipital Tenosynovitis</p>	<p>Nevasier, 1983; Fine and Silverstein, 1995</p>	<p>Pain localised to the bicipital groove area, (about the tuberosities) may radiate anteriorly along the course of the long head of the biceps Slight restriction at extremes of abduction, and rotation, due to discomfort Pain on abduction and rotation</p> <p>Pain is gradual in onset Pain is worse with or shortly after use No pain at night unless arm has been used vigorously during day No distal paresthesia Normal passive and active range of motion</p>	<p>These patients are usually young or middle aged. They have occupations that require overhead lifting or reaching, or they engage in such recreational activities as tennis, swimming, golf, and callisthenics.</p>	<p>Positive Yergason's test (resisted supination)</p> <p>Pain is also produced on the biceps resistance test Pain on abduction and rotation Positive Speed's test (resisted wrist flexion) Normal passive and active range of motion Slight restriction at extremes of abduction, as well as of internal and external rotation, but this is due to discomfort rather than true capsular contracture Tenderness is noted over the cuff and, even more so, over the long head of the biceps in the groove Roentgenograms may be normal, but often show degenerative changes in the acromioclavicular joint, encroachment into the subacromial space by the outer end of the clavicle, and a shallow bicipital groove Arthrography provides definitive information</p>	
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<p>Frozen Shoulder Syndrome / Adhesive Capsulitis</p>	<p>Helliwell, 1996; McRae, 1976; Putz-Anderson, 1988; Waris et al., 1979; Uhtoff, 1990; Nevasier, 1983; Viikari-Juntura, 1983; Kuorinka and Forcier, 1995</p>	<p>Pain in shoulder, which is often severe and worse at night Gradual onset of stiffness and pain, during last three to four months Limitation of movements in the shoulder, often severe with virtually no gleno-humeral movements possible In milder cases rotation and abduction, are especially affected</p> <p>Thickening and inflammation of the shoulder joint (gleno-humeral) capsule Pain often referred to the insertion of the deltoid Pain, often related to activity Chronic stage the shoulder is relatively painless when immobile Painful shoulder, often during rest atrophy of the shoulder muscles</p>	<p>Repeated overhead motions. Condition affecting middle-aged, in whose shoulder cuffs degenerative changes are occurring. Frequently a history of a minor trauma. In some cases, a preceding episode of a silent or overt cardiac infarct. Frozen shoulder attributable to fibrosis. Clinically the patient is usually female, with the non-dominant arm involved. 1 study: degenerative joint disease.</p>	<p>Restriction of active and passive motion in three planes: abduction, and internal and external rotation, particularly external rotation- diagnosis with passive glenohumeral abduction less than 90 or passive internal rotation less than 45 or passive external rotation less than 45 Radiographs are usually normal unless there is an associated condition Pain during active and passive movements of shoulder joint, resisted movements non-painful</p> <p>Arthrography is important because it helps to differentiate the true adhesive capsulitis from the stiff and painful shoulder without capsular contracture Atrophy of the shoulder muscles Gradual onset of stiffness and pain, often referred to the insertion of the deltoid Thickening and inflammation of the shoulder joint (gleno-humeral) capsule In the initial phase both muscle spasm and anterior capsular tenderness No specific point tenderness, although occasionally there will be some tenderness over the long head of the biceps Loss of axillary fold / cutaneous lateral folds when inspected from behind</p>	<p>Repeated overhead motions contributes to thickening of tendons and bursa</p>
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Acromio-clavicular Syndrome	Waris et al., 1979; Viikari-Juntura, 1983	<p>Local pain at acromioclavicular joint in the shoulder region</p> <p>Pain during movement, especially during abduction / adduction / elevation</p> <p>Sometimes pain radiation proximally to the neck or distally to the deltoid area Crepitation of the joint Pain during the telescoping of the clavicle Often symptomless</p>		<p>Pain during movement, especially during abduction / adduction / elevation</p> <p>Local tenderness during palpation or percussion of the joint</p> <p>Pain during the telescoping of the clavicle Crepitation of the joint local pain during percussion on the clavicle while the examinee pushed straight downward against resistance Diagnostic anaesthesia as an important part of examining the shoulder joint, both for tendinitis and other clinical entities</p>	
Osteoarthritis of Acromio-clavicular Joint	McRae, 1976; Nevasier, 1983; Munro and Edwards, 1995; Fine and Silverstein, 1995	<p>Joint prominence may be noticed</p> <p>May be confused with painful arc syndrome</p> <p>Generalised prolonged shoulder pain exacerbated by motion</p> <p>Bony swelling Sometimes pain on full elevation of the arm Worse as day progresses Limitation in range of motion Discomfort is with mild abduction Pain on shoulder shrug</p>	It is often observed in the third decade of life and later , but can even present in the late teens.	<p>Tenderness localised over superior and anterior aspects of joint</p> <p>Pain associated with shoulder movements: abduction / elevation</p> <p>Joint prominence / bony swelling may be noticed</p> <p>Limitation is similar on active and passive ROM Diagnosis can be established by radiographic evaluation Crepitus is common</p>	
Osteoarthritis of Glenohumeral Joint	Fine and Silverstein, 1995; Hagberg and Wegman, 1987		Mechanical stresses may be one aetiological factor in osteoarthrosis. It should be noted that osteoarthrosis of the glenohumeral joint is rare before the sixth decade in the general population.		
Tumour of Thoracic Outlet	Nevasier, 1983		Patients may have a history of smoking .		

<p>Thoracic Outlet Syndrome</p>	<p>Helliwell, 1996; Putz-Anderson, 1988; Brown, 1983; Waris et al., 1979; Hagberg and Wegman, 1987; Beyer and Wright, 1951; Fine and Silverstein, 1995; Kuorinka and Forcier, 1995</p>	<p>Symptoms exacerbated by abduction of arm Paresthesiae, pins and needles, numbness, and diminished sensation in median or ulnar distribution, more often the latter / in the distribution of the C8/T1 nerve roots, first noticed in the finger tips and progressing centripetally to involve more of the hands and arms Pain that is of varying consistency, aching to severe, constant or intermittent; radiating from the cervical spine area, supraclavicular space, or shoulder; and extending into the arm, forearm, or hand in the distribution of the ulnar nerve - over the supraclavicular space, medial aspect of the forearm to the ulnar aspect of the hand Fatigability / weakness of grip / intrinsic muscles of the hand and forearm / in the distribution of the C8/T1 nerve roots Pale, cold, or numb fingers</p> <p>Drooping shoulders Symptoms may be worse when carrying heavy objects Symptoms can be exacerbated by actions such as combing the hair, painting walls, or hanging pictures Problem holding small objects / clumsiness of the hands Atrophy / wasting of the thenar, hypothenar and intrinsic muscles of the hand Upper extremity claudication Cyanosis and swelling of the distal parts of the extremity may occur</p>	<p>Pulling shoulders back & down. Frequent reaching and working above shoulder level. Repeatedly reaching behind. Short cycle repetitive arm work gives a static load on the neck and shoulder that may promote a thoracic outlet syndrome. Significant odds ratio of an exposure-effect relation. 1 study: repetitive arm work (25000/workday), extreme work positions of hands and arms, shoulders subject to static muscle work. 1 study: Arm in half-abduction and elevation, demanding continuous contraction of the muscles of the shoulders, neck, and back. (3 studies: tasks performed in awkward positions. A history of recent strenuous exercise is not uncommon.</p>	<p>Positive Roo's test - three minutes of abduction and external rotation of the shoulder causing pain, early fatigue and paresthesiae in the ulnar nerve distribution - sensitive indicator even though the specificity of the test is low Positive Allen's hyperabduction or costoclavicular compression test - more non-specific of tests Diminished sensation in median or ulnar distribution, more often the latter / in the finger tips Fatigability / weakness of grip / intrinsic muscles of the hand and forearm / in the distribution of the C8/T1 nerve roots Positive Adson's test - diminution of the (radial) pulse with the patient's arm dependent and the patient's head turned towards the affected side whilst performing a Valsalva manoeuvre (forcible exhalation against the closed glottis, increasing intrathoracic pressure and impeding venous return to the heart) - considered to be unreliable and unspecific Positive Morley's sign - tenderness in the scalenic pouch / over the brachial plexus in the supraclavicular fossa</p> <p>Drooping shoulders Diminution in the radial pulse volume on abduction of the arm - of low sensitivity and specificity Positive elevated arm stress test - pins and needles occurring in the median or ulnar nerve distribution with the arm elevated above the level of the shoulder</p>	<p>Compression of nerves & blood vessels, starving tendons, muscles & ligaments of oxygen & nutrients</p>
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<p>Tension Neck Syndrome / Cervicobrachial Syndrome</p>	<p>Helliwell, 1996; Waris et al., 1979; Hagberg and Wegman, 1987; Viikari-Juntura, 1983; Fine and Silverstein, 1995; Kuorinka and Forcier, 1995</p>	<p>Pain in region of the neck or shoulders during rest Constant feeling of fatigue or stiffness, or both, in the neck Headache radiating from the neck Muscle pain or tightness upon neck movement</p> <p>Muscle weakness Numbness and paresthesia in an upper limb Shoulder stiffness No history of herniated cervical disk, injury, or ankylosing spondylitis</p>	<p>Exposure causing tension neck syndrome is static tension (contraction) of the neck and shoulder-neck muscles. Low selection of the workforce. High work pace.</p> <p>1 study: Repetitive arm movements. 3 studies: constrained head and arm posture. 1 study: Grasping with fingers wide open and use of force. 1 study: repetitive upper limb tasks (work cycle 2.5-5 secs). 1 study: manipulations every 3.5-12 secs, repetitive arm movements. 1 study: gender. 1 study: repeated forward flexions (15/min for 1hr) of shoulder.</p>	<p>Tenderness in the upper part of the trapezius / descending trapezius muscle by palpation - is unreliable At least two tender spots / trigger points and/or palpable hardenings in muscles / in the insertion or along the margin of the muscle Feeling of fatigue / weakness or stiffness in the neck, muscle tightness in neck movements Pain on resisted neck lateral flexion and rotation</p> <p>Tender cervical muscle tenderness threshold of the upper trapezius muscle up to 1.50 kg/cm² Muscle-wasting in the neck Shoulder stiffness numbness and paresthesia in an upper limb Vertigo, tremor and insomnia Muscle spasm Postural changes such as drooping shoulder or straightening of the cervical spine- although common in healthy persons also Tendomyotic pressure pains in shoulders and neck</p>	
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<p>Cervical Syndrome / Radiculopathy / Cervical Spondylosis / Cervical Osteoarthritis / Cervical Spondylarthrosis / Cervical Root Syndrome</p>	<p>Helliwell, 1996; McRae, 1976; Waris et al., 1979; Hagberg and Wegman, 1987; Fine and Silverstein, 1995; Kuorinka and Forcier, 1995; Viikari-Juntura, 1983</p>	<p>Pain in the neck during rest may be felt centrally in the neck, or at the side of the neck, quite sharply localised, or in the supraclavicular region Pain radiating down to one or both shoulders / upper extremities Numbness in one or both hands / upper extremities Paresthesia in an upper extremity Neck pain during movement Limited neck movement Radiating pain provoked by movements of neck</p> <p>Occipital headache which may be confused with migraine Neck stiffness Autonomic symptoms such as vertigo, tinnitus, or diplopia Myelopathy Muscle spasm Radiating pain provoked by test movements, Diminished muscle force of the deltoid, triceps and biceps muscles Pain radiating along the distribution of a spinal root at some time Pain in the neck radiating to the arm with a segmental distribution Pain exacerbated by cough</p>	<p>The condition may in fact never attract attention, but unfortunately in many cases symptoms do occur, sometimes being triggered off by minor trauma. Hypothesis of the exposure causing cervical spondylosis is that of a high load on the cervical spine - could occur for miners due to helmet or extreme positions of cervical spine. Frequent extreme positions of cervical spine for dentists. Finding of less cervical spondylosis among cotton workers compared with general population is obscure. Exposure hypothesised to give cervical syndrome is extreme forward flexion of the cervical spine. Osteoarthritis of the cervical spine is one of the most frequent causes of upper extremity pain in middle-aged persons.</p> <p>1 study: repetitive arm work (25000/workday), extreme work positions of hands and arms, shoulders subject to static muscle work.</p>	<p>Pain radiating from neck into arm(s) / region of the lower scapulae on movement of neck Limited passive and active ROM - may be difficult to detect clinically as it is masked by persisting mobility in the joints above and below Decreased sensation / pinprick in dermatome of the affected cervical roots</p> <p>Exaggeration of the pain /symptoms by coughing Radiating pain on passive motions Pain on movement is more significant than restriction of movements Absent arm reflexes Cervical spondylosis is only diagnosed radiographically with either a reduced disc height or osteophyte formation - disc space between the 5th and 6th cervical vertebrae is most frequently involved Muscle weakness of the deltoid, triceps and biceps muscles Local tenderness at the site of muscle motor points Positive foraminal test Absence of joint findings</p>	
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Shoulder ailments	Putz-Anderson, 1988; Hagberg and Wegman, 1987		Work that requires the elbow to be in an elevated position. Repeated reaching behind the body. Throwing parts over the shoulder into a bin behind the body. Repetitive work that requires the elbow to be held straight and the arm extended. Highly repetitive contractions in the shoulder muscles, work at or above shoulder level, static contractions, and possibly head posture indicated as causative factors in shoulder-neck disorders.		
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Appendix D1

Draft version of checklist diagnostic aid for initial medical assessment of symptoms affecting the hand / wrist region.

		Carpal Tunnel Syndrome	Tenosynovitis	Peritendinitis	Tendinitis	De Quervain's Tenosynovitis	Stenosing Tenosynovitis	Wrist Rheumatoid Arthritis	Hand Rheumatoid Arthritis	Hand Osteoarthritis	Ganglion	White Finger Syndrome	Guyon's Canal Syndrome	Dupuytren's Contracture
Does Symptom Profile recorded match any given? Tick Box		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
Checklist for possible action-related risk factors affecting the hand / wrist region	<i>high force in use of hand / wrist</i>	<input type="checkbox"/>	R	R	R	R				R		R		
	<i>high repetition in use of hand / wrist</i>	<input type="checkbox"/>	R		R	R						R		
	<i>extreme wrist bending</i>	<input type="checkbox"/>	R		R									
	<i>direct mechanical pressure at wrist / palm of</i>	<input type="checkbox"/>	R										R	R
	<i>repetitive / prolonged / forceful grasping</i>	<input type="checkbox"/>	R				R					R		
	<i>prolonged vibration- from hand-held tools</i>	<input type="checkbox"/>	R									R		
	<i>cold or damp conditions</i>	<input type="checkbox"/>	R							R				
	<i>repetitive wrist deviation</i>	<input type="checkbox"/>	R											
	<i>repetitive hand twisting & gripping</i>	<input type="checkbox"/>		R	R									
	<i>unaccustomed activity</i>	<input type="checkbox"/>		R	R	R								
	<i>blunt trauma to wrist / forearm</i>	<input type="checkbox"/>			R									
	<i>repetitive wrist deviation (& grasp)</i>	<input type="checkbox"/>					R							
	<i>direct mechanical pressure on palmar side of</i>	<input type="checkbox"/>						R						
<i>constant impact to hand</i>	<input type="checkbox"/>								R					
<i>mechanical pressure to wrist / finger</i>	<input type="checkbox"/>									R				
To confirm with physical examination, proceed to next page, Line		↓ 1	↓ 2	↓ 3	↓ 4	↓ 5	↓ 6	↓ 7	↓ 8	↓ 9	↓ 10	↓ 11	↓ 12	↓ 13

.Table - Common disorders affecting the wrist / hand region, with objective signs

DISORDER	INSPECTION	PALPATION	RANGE OF MOTION	OTHER
1 Carpal Tunnel Syndrome		Positive Tinel's sign Tinel's test involves percussing over the carpal tunnel / median nerve at the wrist for about half a minute. If positive, the test reproduces or exacerbates the patient's symptoms of pain and paresthesia felt in the distribution of the median nerve distally	Positive Phalen's wrist flexion test Phalen's test consists of the patient holding the forearms vertically and allowing both hands to drop into complete flexion at the wrist for approximately one minute. If positive, the test reproduces or exacerbates the patient's symptoms of pain and paresthesia felt in the distribution of the median nerve. Weakness of abductor pollicis brevis and opponens pollicis - the opponens pollicis is tested by asking the patient to touch the tip of the thumb to the tip of the 5th finger and then attempting to break the pinch against resistance	Loss of sensation in median nerve distribution may be tested with either pin-prick, vibration, 2 point discrimination or monofilament hairs
2 Tenosynovitis		Tenderness to palpation along the course of the tendon or muscle-tendon junction Swelling to palpation, over affected tendon / muscle- tendon structure - localised if the condition affects tendons with a definite sheath	Crepitation along the tendon may be detectable on resisted and possibly passive movements, and is usually palpable, but in some cases it can only be detected during auscultation with a stethoscope Pain over affected tendon / muscle- tendon structure exacerbated by resisted motions	Weakness of the extremity in gripping / asymmetric grip strength
3 Peritendinitis		Tenderness to palpation along the course of the tendon or on the muscle-tendon junction Swelling on palpation, 4-12 cm proximal to the radial styloid on the back of the forearm and well above the upper limit of the tendon sheaths at the wrist - diffuse if the condition affects the peritendinous tissue of tendons which have no sheath	Crepitation along the tendon, possibly extending up the forearm as far as the common extensor origin, may be detectable on movement, and is usually palpable, but in some cases it can only be detected during auscultation with a stethoscope Pain at the tendon sheath, in the peritendinous area, or at the muscle-tendon junction during effort / active movement of the tendon	Often an associated weakness of the extremity in gripping
4 Tendinitis			Pain exacerbated by resisted motions	

5	De Quervain's Tenosynovitis		Local tenderness on palpation at the radial styloid / over the 1st tendon compartment Sometimes swelling at or just proximal to the radial styloid	Finkelstein's test consists of passive ulnar deviation of the wrist with the thumb held adducted into the palm by the patient: a positive test elicits sharp pain along the line of the aforementioned tendons / region of the radial styloid (To minimise false positive tests, the ulnar deviation stress should be applied to the metacarpal of the index finger, rather than the thumb) Pain on resisted extension and abduction of the thumb Sometimes crepitus over the first dorsal compartment	Grip / pinch grasp is weak
6	Stenosing Tenosynovitis		Palpable nodule, at base of digit, just proximal to the metacarpophalangeal joint may be felt in the palm - although may be an unreliable sign	Stiffness to triggering / clicking / catching of finger on extension to finger locked in either flexion or extension	
7	Wrist Rheumatoid Arthritis		Swelling / deformity of wrist Increased local heat Joint tenderness	Joint pain on motion	
8	Hand Rheumatoid Arthritis		Swelling / deformity metacarpophalangeal (MCP) or proximal interphalangeal (PIP) joint swelling / symmetric joint swelling Increased local heat particularly symmetric small joints of the hands Joint tenderness particularly symmetric small joints of the hands	Joint pain on motion, particularly symmetric small joints of the hands	Hand roentgenographic changes
9	Hand Osteoarthritis	Mucinous cysts	Pain on palpation and movement of affected joint Herbeden's nodes (bony swelling at either side of distal interphalangeal joint) Bouchard's nodes (bony swelling at either side of proximal interphalangeal joint)		
10	Ganglion	Cystic swelling / bump under the skin about affected joint	Cystic swelling / bump under the skin about affected joint		

1 1	White Finger Syndrome	Attacks / episodes of Raynaud's phenomenon / fingertip blanching / pallor / cyanosis induced by cold			Numbness and tingling in the affected fingers triggered by exposure to cold
1 2	Guyon's Canal Syndrome		Tinel's sign at the Guyon's tunnel possible	Weakness in abduction of the fifth finger	Diminished sensation in the volar aspect of the fifth finger
1 3	Dupuytren's Contracture		Painless thickening of the palmar fascia Small nodule at the base of the ring finger at the level of the distal palmar crease		

Appendix D2

Draft version of checklist diagnostic aid for initial medical assessment of symptoms affecting the elbow / forearm region.

Patient history - symptoms affecting the elbow / forearm region

Key: Y = likely symptom
 P = possible symptom
 R = possible action-related risk factor

**Symptom Profiles
 for possible initial diagnosis options**

Checklist for symptoms / disorders affecting the elbow / forearm region	Tick Box	Symptom Profiles for possible initial diagnosis options								
		Lateral Epicondylitis	Medial Epicondylitis	Cubital Tunnel Syndrome	Pronator Teres Syndrome	Ant. Interosseous Sndrme.	Radial Tunnel Syndrome	Post. Interosseous Sndrme.	Olecranon Bursitis	
<i>pain around lateral epicondyle</i>	<input type="checkbox"/>	Y					Y	Y		
<i>pain around lateral epicondyle from motion of wrist</i>	<input type="checkbox"/>	Y								
<i>pain around lateral epicondyle from gripping/ motion of fingers</i>	<input type="checkbox"/>	Y								
<i>weakness in grasping / gripping</i>	<input type="checkbox"/>	Y				Y				
<i>pain in dorsum of wrist</i>	<input type="checkbox"/>	Y								
<i>pain around medial epicondyle</i>	<input type="checkbox"/>		Y						P	
<i>pain around medial epicondyle from motion of wrist</i>	<input type="checkbox"/>		Y							
<i>pain around medial epicondyle from gripping/motion of fingers</i>	<input type="checkbox"/>		Y							
<i>weak interossei</i>	<input type="checkbox"/>			Y						
<i>pain in 4th & 5th fingers</i>	<input type="checkbox"/>			Y						
<i>paresthesia / numbness / low sensation in 4th & 5th fingers</i>	<input type="checkbox"/>			Y						
<i>pain in volar forearm</i>	<input type="checkbox"/>				Y	Y				
<i>pain in volar forearm from motion of elbow / forearm</i>	<input type="checkbox"/>				Y					
<i>pain in volar forearm from grasping</i>	<input type="checkbox"/>				Y					
<i>paresthesia / low sensation in radial 3½ fingers</i>	<input type="checkbox"/>				Y					
<i>paresthesia / low sensation in volar forearm</i>	<input type="checkbox"/>				Y	P				
<i>weakness of extension of middle finger</i>	<input type="checkbox"/>							Y		
<i>swelling at olecranon</i>	<input type="checkbox"/>								Y	
Does Symptom Profile recorded match any given?		Tick	Box	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Checklist for possible action-related risk factors affecting the elbow / forearm region	<i>movement with impact to arm</i>	<input type="checkbox"/>		R						
	<i>jerky throwing motions of arm</i>	<input type="checkbox"/>		R						
	<i>extreme rotation of forearm</i>	<input type="checkbox"/>		R	R					
	<i>forceful/repetitive rotation of forearm while wrist bending</i>	<input type="checkbox"/>		R	R					
	<i>forceful/repetitive rotation of forearm</i>	<input type="checkbox"/>		R	R			R		
	<i>repeated rapid movement</i>	<input type="checkbox"/>		R	R					
	<i>constant overuse/overstrain of finger extensors</i>	<input type="checkbox"/>		R						
	<i>forceful and repetitive flexion/extension of wrist</i>	<input type="checkbox"/>		R						
	<i>repeated rotation of forearm with elbow extended</i>	<input type="checkbox"/>		R						
	<i>constant overuse/overstrain of finger flexors</i>	<input type="checkbox"/>			R					
	<i>extreme flexion of elbow</i>	<input type="checkbox"/>				R				
	<i>local trauma at elbow or wrist</i>	<input type="checkbox"/>				R				
	<i>forceful/repetitive use of elbow</i>	<input type="checkbox"/>					R			
	<i>pronation and grasping</i>	<input type="checkbox"/>					R			
<i>leaning on elbow</i>	<input type="checkbox"/>								R	
<i>repetitive trauma to posterior aspect of elbow</i>	<input type="checkbox"/>								R	
To confirm with physical examination, proceed to next page, Line		↓	↓	↓	↓	↓	↓	↓	↓	↓
		1	2	3	4	5	6	7	8	

Table - Common disorders affecting the elbow / forearm region, with objective signs

	DISORDER	INSPECTION	PALPATION	RANGE OF MOTION	OTHER
1	Lateral Epicondylitis / Tennis Elbow		Local tenderness on or just inferior to lateral epicondyle, at the origin of the common extensor tendons(during palpation)	Pain over the lateral aspect of the elbow reproduced / made worse by resisted extension of wrist (and fingers) with elbow fully extended Pain and/or weakness in gripping (particularly at arm's length)	
2	Medial Epicondylitis / Golfer's Elbow		Local tenderness on the medial epicondyle at the common flexor origin on palpation	Pain over the medial aspect of the elbow reproduced / made worse by resisted flexion of the wrist (and fingers)	
3	Cubital Tunnel Syndrome / Ulnar Nerve Entrapment at the Elbow		Tenderness to palpation at the cubital tunnel	Positive Froment's sign (wasting of the 1st dorsal interosseous muscle and inability to maintain adduction of the thumb so that hyperflexion of the inter-phalangeal joint occurs while pinching between the thumb and 1st finger)	Decreased sensation in the fourth and fifth fingers of the hand Weakness of the interossei
4	Pronator Teres Syndrome			Increased pain in forearm by resisted pronation with clenched fist and flexed wrist (Mills's test)	Diminished sensation in the forearm, the median nerve distribution of the hand, three and a half fingers on the radial side of the hand, the thenar eminence Electrical studies / electrophysiological testing is often inconclusive
5	Anterior Interosseous Syndrome			Loss of distal flexion of thumb and index finger - unable to make an 'O' sign by pinching the thumb and index finger together	Weakness of pronator quadratus, flexor pollicis longus and/or flexor digitorum profundus
6	Radial Tunnel Syndrome		Some tenderness along the radial nerve about 5-7cm distally to the lateral epicondyle / where it passes under the arcade of Frohse		
7	Posterior Interosseous Syndrome / Frohse's Syndrome		Tenderness distal to elbow, at the edge of the superficial portion of the supinator muscle (the arcade of Frohse)		Weakness of extension of middle finger
8	Olecranon Bursitis	Swelling at olecranon			

Appendix D3

Draft version of checklist diagnostic aid for initial medical assessment of symptoms affecting the neck / shoulder region.

Taking patient history - symptoms affecting the neck / shoulder region

Key: Y = likely symptom
 P = possible symptom
 R = possible action-related risk factor

**Symptom Profiles
 for possible initial diagnosis options**

		Tick Box	Symptom Profiles for possible initial diagnosis options						
Checklist for symptoms / disorders affecting the neck / shoulder region	<i>pain in shoulder</i>	<input type="checkbox"/>	Y	Y	Y	Y	P	Y	Y
	<i>pain in shoulder from motion of shoulder</i>	<input type="checkbox"/>	Y	Y	P	Y			
	<i>limitation of shoulder motion</i>	<input type="checkbox"/>	Y	P	Y	P			
	<i>visible swelling in shoulder</i>	<input type="checkbox"/>	P			P			
	<i>pain in neck</i>	<input type="checkbox"/>				P	P	Y	Y
	<i>pain in neck from motion of neck</i>	<input type="checkbox"/>						Y	Y
	<i>pain in shoulder / arm / hand from motion of neck</i>	<input type="checkbox"/>							Y
	<i>limitation of neck motion</i>	<input type="checkbox"/>							Y
	<i>headache</i>	<input type="checkbox"/>						Y	P
	<i>fatigue in neck</i>	<input type="checkbox"/>						Y	
	<i>nocturnal exacerbation of symptoms</i>	<input type="checkbox"/>	P	P	Y		P		
	<i>pain in hand / arm</i>	<input type="checkbox"/>		Y			P		Y
	<i>paresthesia in hand / arm</i>	<input type="checkbox"/>					Y	P	Y
	<i>fatigue in hand / arm</i>	<input type="checkbox"/>					Y		
	<i>pale / cold fingers</i>	<input type="checkbox"/>					Y		
			Supraspinous Tendinitis / Tear	Bicipital Tendinitis / Tenosynovitis	Frozen Shoulder Syndrome	Acromioclavicular Syndrome / O-A	Thoracic Outlet Syndrome	Tension Neck / Cervicobrachial Syndrome	Cervical Syndrome / Spondylosis
Does Symptom Profile recorded match any given?		Tick Box	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Checklist for possible action-related risk factors affecting the neck/shoulder region	<i>sudden traction to arm / shoulder</i>	<input type="checkbox"/>	R						
	<i>forward elevation of shoulder</i>	<input type="checkbox"/>		R					
	<i>pulling shoulder back and down</i>	<input type="checkbox"/>					R		
	<i>repeatedly reaching behind</i>	<input type="checkbox"/>					R		
	<i>repeated forward flexion of shoulder</i>	<input type="checkbox"/>						R	
	<i>prolonged abduction and elevation of arm</i>	<input type="checkbox"/>	R	R			R		
	<i>high loading / static posture of arm / shoulder</i>	<input type="checkbox"/>	R	R			R	R	
	<i>repeated / prolonged overhead / over-shoulder actions</i>	<input type="checkbox"/>	R	R	R		R		
	<i>extreme positions of hands / arms</i>	<input type="checkbox"/>	R	R			R		
	<i>repetitive arm movements</i>	<input type="checkbox"/>	R	R			R	R	
	<i>forceful grasping</i>	<input type="checkbox"/>					R		
	<i>repeated / prolonged extreme postures in neck / cervical spine</i>	<input type="checkbox"/>						R	
	<i>high loading / static posture of neck / cervical spine</i>	<input type="checkbox"/>					R	R	
			↓	↓	↓	↓	↓	↓	↓
To confirm with physical examination, proceed to next page,		Line	1	2	3	4	5	6	7

Table - Common disorders affecting the neck / shoulder region, with objective signs

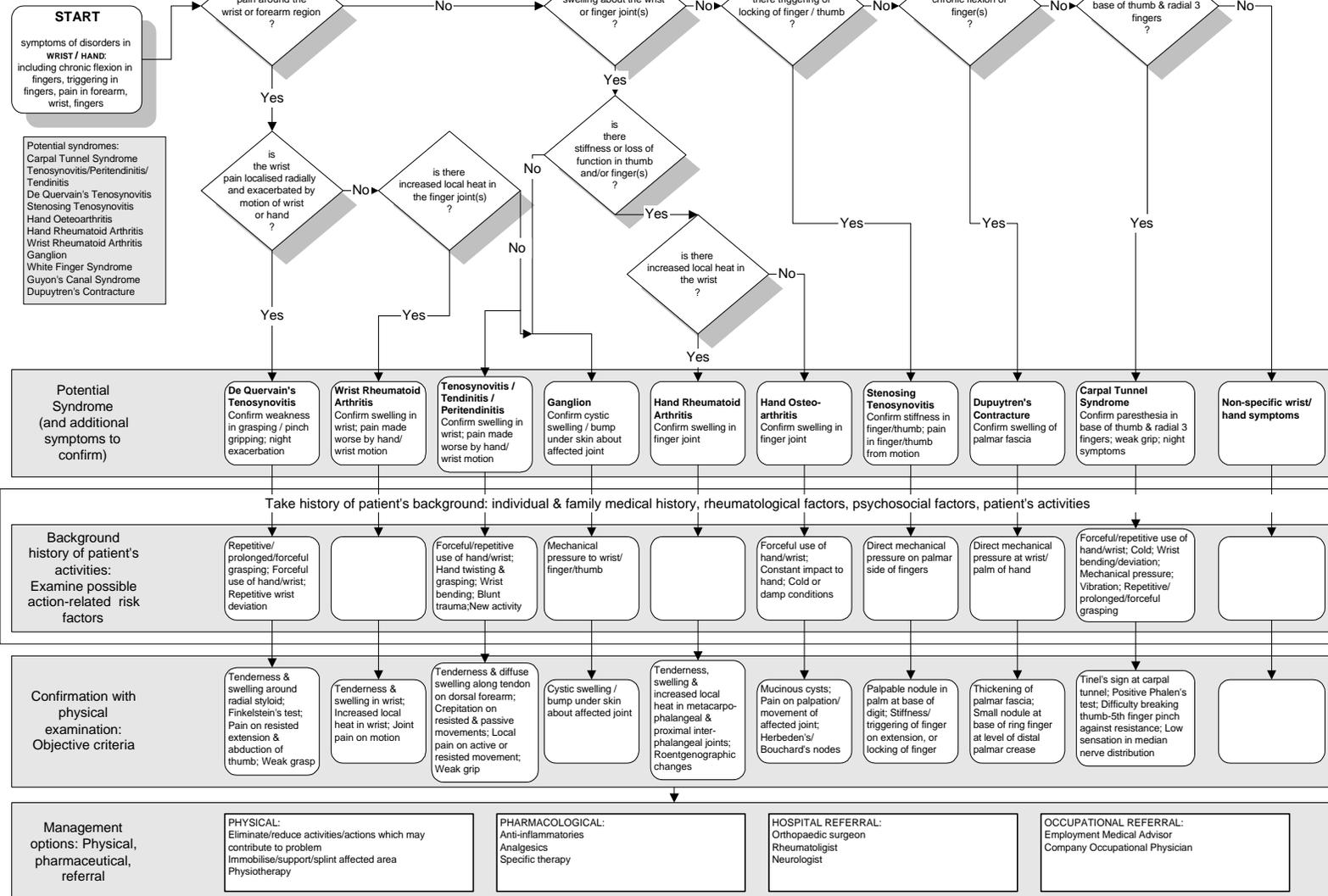
DISORDER	INSPECTION	PALPATION	RANGE OF MOTION	OTHER
1 Supraspinous Tendinitis / Tear		Local tenderness in the rotator cuff / on the supraspinatous tendon during palpation, especially over the humeral head and lateral to and just below the bony acromion process	Painful arc on active/resisted /isometric abduction becomes severe as the arm approaches the horizontal position Pain on resisted internal/external rotation possible Limited active abduction of the arm (possibly not necessary for diagnosis)	
2 Bicipital Tendinitis / Tenosynovitis		Local tenderness anteriorly, on the bicipital tendon / in the intertubercular sulcus during palpation, almost over the maximum convexity of the humeral head	Yergason's sign- pain over the long head of the biceps in front of the shoulder on resisted supination of the forearm with the elbow flexed at 90 Painful arc on active/resisted /isometric abduction of arm	
3 Frozen Shoulder Syndrome			Restriction of active and passive motion in three planes: abduction, and internal and external rotation, particularly external rotation- diagnosis with passive glenohumeral abduction less than 90 or passive internal rotation less than 45 or passive external rotation less than 45 Pain during active and passive movements of shoulder joint, resisted movements non-painful	Radiographs are usually normal unless there is an associated condition
4 Acromio-clavic ular Syndrome / Osteo-arthritis	Joint prominence / bony swelling may be noticed	Tenderness during palpation or percussion of the joint localised over superior and anterior aspects of joint Joint prominence / bony swelling may be noticed	Pain during movement, especially during abduction / adduction / elevation	
5 Thoracic Outlet Syndrome		Positive Morley's sign - tenderness in the scalenic pouch / over the brachial plexus in the supraclavicular fossa	Positive Roo's test - three minutes of abduction and external rotation of the shoulder causing pain, early fatigue and paresthesiae in the ulnar nerve distribution - sensitive indicator even though the specificity of the test is low Positive Allen's hyperabduction or costoclavicular compression test- more non-specific of tests Positive Adson's test - diminution of the (radial) pulse with the patient's arm dependent and the patient's head turned towards the affected side whilst performing a Valsalva manoeuvre (forcible exhalation against the closed glottis, increasing intrathoracic pressure and impeding venous return to the heart) - considered to be unreliable and unspecific	Diminished sensation in median or ulnar distribution, more often the latter / in the finger tips Fatigability / weakness of grip / intrinsic muscles of the hand and forearm / in the distribution of the C8/T1 nerve roots

6	Tension Neck / Cervicobrachial Syndrome		Tenderness in the upper part of the trapezius / descending trapezius muscle by palpation - is unreliable At least two tender spots / trigger points and/or palpable hardenings in muscles / in the insertion or along the margin of the muscle	Feeling of fatigue / weakness or stiffness in the neck, muscle tightness in neck movements Pain on resisted neck lateral flexion and rotation	
7	Cervical Syndrome / Spondylosis			Pain radiating from neck into arm(s) / region of the lower scapulae on movement of neck Limited passive and active ROM - may be difficult to detect clinically as it is masked by persisting mobility in the joints above and below	Decreased sensation / pinprick in dermatome of the affected cervical roots

Appendix E1

Draft version of flowchart diagnostic aid for initial medical assessment of symptoms affecting the hand / wrist region.

**Taking patient history:
Symptoms of wrist/hand**

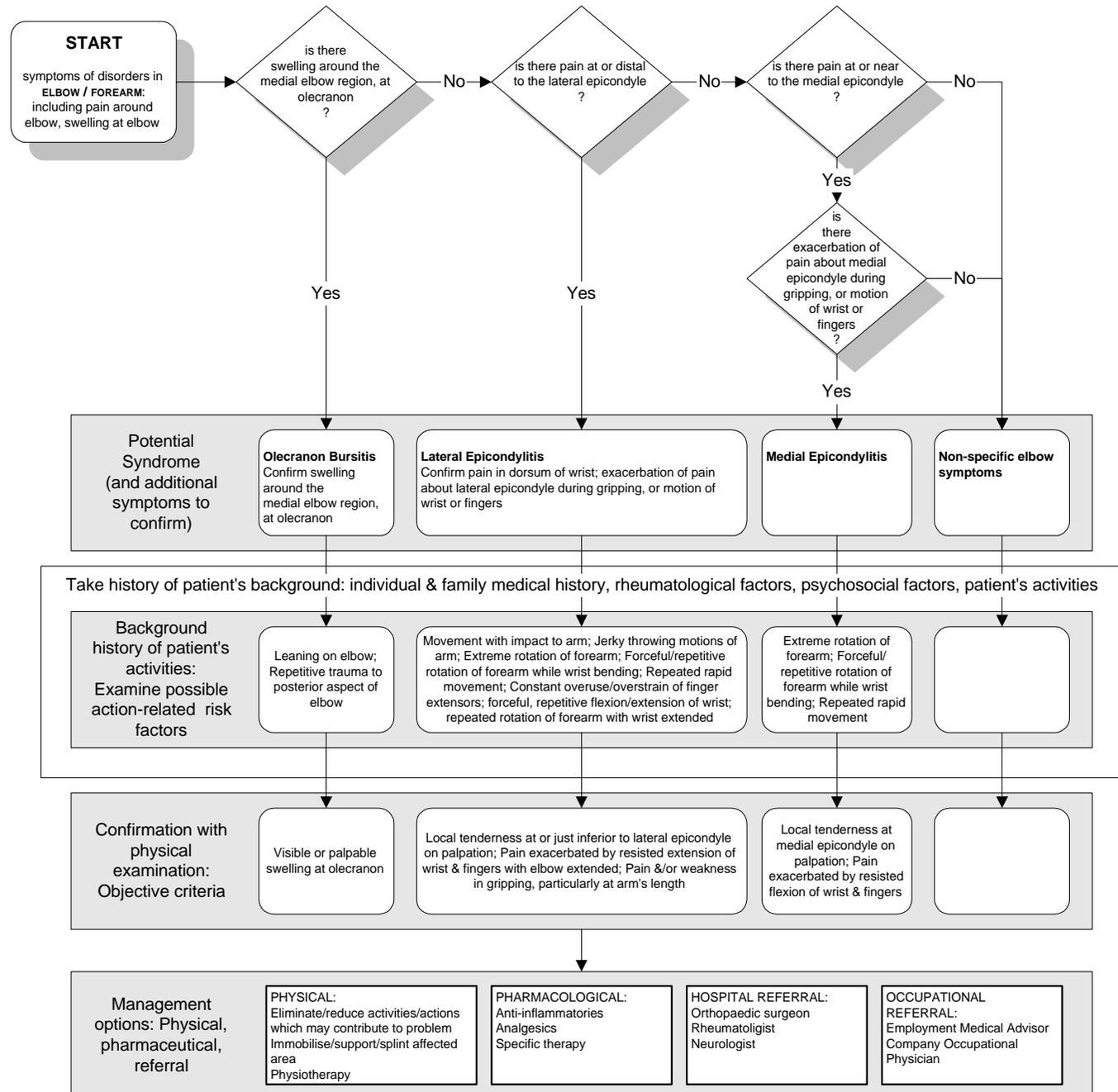


Appendix E2

Draft version of flowchart diagnostic aid for initial medical assessment of symptoms affecting the elbow / forearm region.

Taking patient history: Symptoms of elbow/forearm

Potential syndromes:
Lateral Epicondylitis
Medial Epicondylitis
Olecranon Bursitis



Appendix E3

Draft version of flowchart diagnostic aid for initial medical assessment of symptoms affecting the neck / shoulder region.

Appendix F

Draft guidance document incorporating final prototype draft Diagnostic Support Aid to be tested in user trials.

DIAGNOSTIC SUPPORT AID FOR UPPER LIMB DISORDERS

Introduction

Due to the workload and available resources of General Practice, there appears to be some difficulty in diagnosing so-called “RSI” (also known as “Upper Limb Disorders” or “ULDs”), and in particular assessing whether the patient’s occupation is a causative factor. Labelling ULDs as “tenosynovitis”, or “RSI” may have far reaching consequences to the patient, especially in terms of treatment and legal issues. For this reason a Diagnostic Support Aid covering key points to assist in the diagnosis and management of ULDs have been devised by an expert group of occupational physicians and General Practitioners (GPs). It is intended to supplement the existing knowledge and skills of GPs.

The Diagnostic Support Aid is in two parts. Part A consists of an Aide Memoire which is intended to support a user’s approach to medical assessment of ULD’s. It provides a flowchart which covers key elements in a patient history, differential diagnosis, physical examination, and management options. Part B is a Diagnostic Decision Aid consisting of a supplementary flow chart which has been designed specifically for helping to assess symptoms of pain in the hand, wrist of forearm. It covers diagnostic criteria which need to be identified from the patient history, and provides a structured approach for making an initial diagnosis.

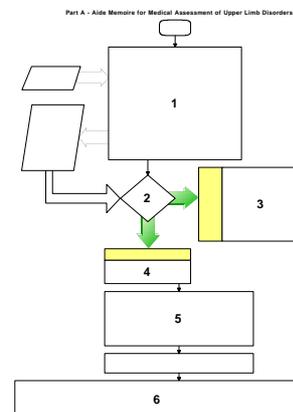
Guidance on using the Diagnostic Support Aid

The user should begin the medical assessment by following the steps in the Aide Memoire. An overview of these steps is provided below. It is expected that the user will refer to the relevant part of the detailed Diagnostic Support Aid while reading the overview.

Part A - Aide Memoire for Medical Assessment of ULDs

The following steps provide a checklist covering key areas of the medical assessment. Step numbers are indicated on the figure opposite.

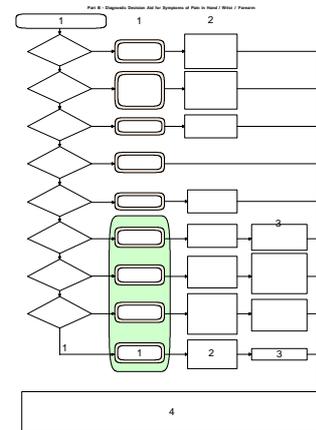
- Step 1 Take patient history referring to highlighted subjects.
- Step 2 Consider whether symptoms include pain in hand, wrist or forearm.
- Step 3 If symptoms include pain in hand, wrist or forearm, proceed to Part B (Decision Aid).
- Step 4 If symptoms do not include pain in hand, wrist or forearm, continue working on Part A (Aide Memoire), and form an initial differential diagnosis.
- Step 5 Carry out physical examination to confirm or clarify diagnosis.
- Step 6 Initiate management of complaint referring to highlighted options.



Part B - Diagnostic Decision Aid for Symptoms to Pain in Hand / Wrist / Forearm

The following steps provide a structured approach to assessing symptoms of pain in the hand, wrist, or forearm. Step numbers are indicated on the figure opposite.

- Step 1 Identify possible syndrome by process of elimination. This will involve proceeding through the YES/NO decisions, using the information obtained in the patient history. The less obvious syndromes are given in the light-shaded box.
- Step 2 Examine whether the patient's background history includes activities (work or leisure) which include those listed for the identified syndrome to help assess whether the patient's complaint is likely or unlikely to be related to activities.
- Step 3 For less obvious syndromes, carry out physical examination using criteria provided to confirm diagnosis.
- Step 4 Initiate management of complaint referring to highlighted options.



Part A - Aide Memoire for Medical Assessment of Upper Limb Disorders

START

Patient history

Current history of symptoms:

1. Site distribution of the symptoms
2. Quality (type, character) and severity (intensity, frequency, duration) of symptoms

Past history of symptoms:

1. Site, distribution, quality and severity of symptoms
2. Patient's response to previous treatments

History of patient background:

1. Individual and family medical history, including eg rheumatological factors, diabetes mellitus, etc
2. Patient's activities, ie leisure, household, work
3. Psychosocial factors

Patient's description, directed questions, patient record

information input

Symptom site, distribution, quality, severity.
Effectiveness of previous treatments.
Refinement of previous diagnoses.
Possible pre-disposing risk factors, 'action-related' and non-'action-related'

information output

information input

Do symptoms include pain in hand/wrist/forearm?

Yes

No

Pain in hand/wrist/forearm

Proceed to diagnostic aid on reverse

- This will aid the diagnosis of hand/wrist/forearm syndromes
1. Information collected in patient history will be used to formulate differential diagnosis
 2. Criteria are provided for physical examination, where appropriate
 3. Available management options are listed

No pain in hand/wrist/forearm

Differential diagnosis:

If possible, compile list of diagnosis options, along with potential causal factors - based upon patient history

Physical examination:

- a) briefly, to confirm suspected syndromes if symptoms are specific; or
- b) to clarify diagnosis if symptoms are non-specific:

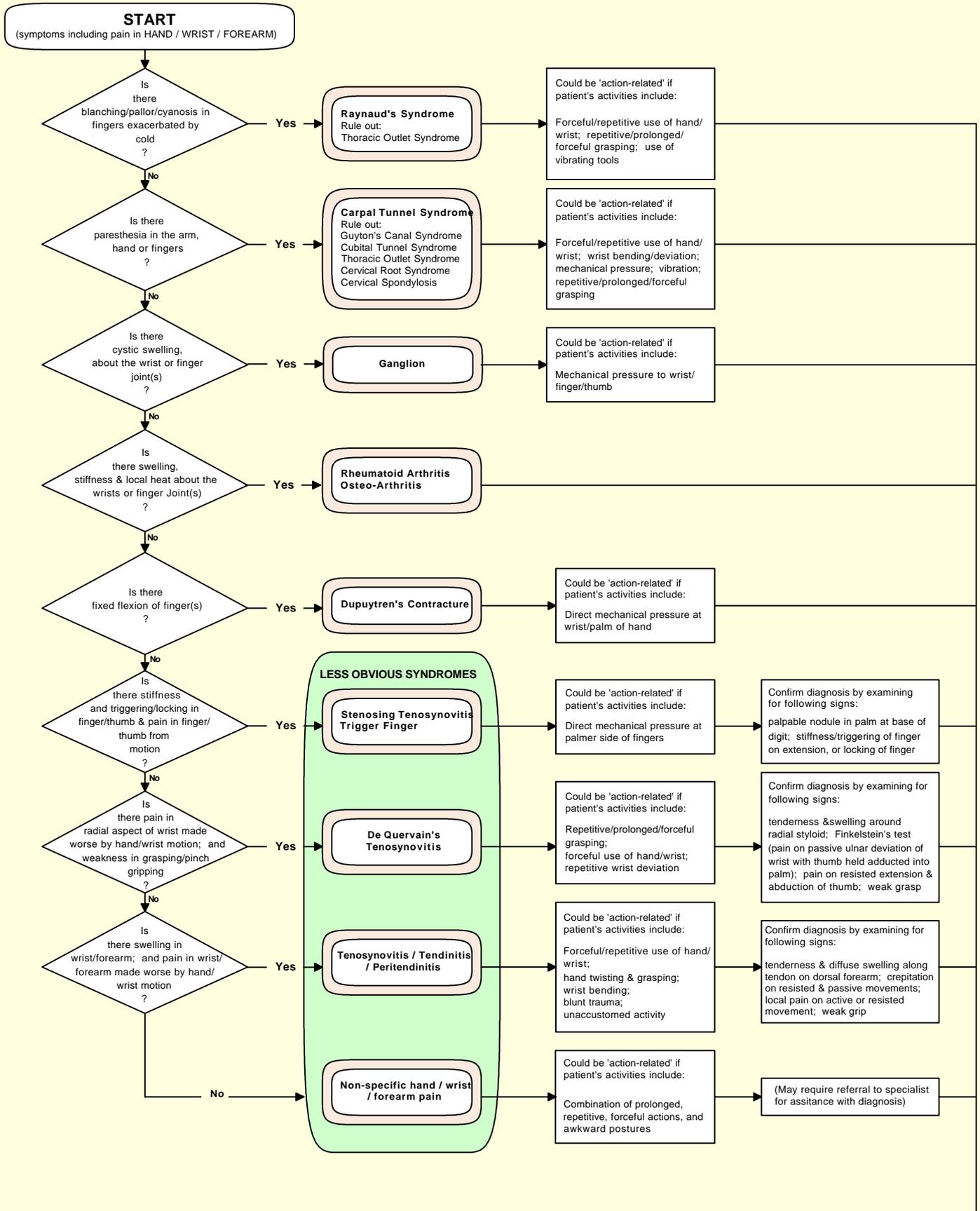
1. Inspection
2. Palpation
3. Range of movement, ie passive, active, resisted
4. Other forms of examination, eg neurological tests

If possible, compile list of diagnosis options, along with associated casual factors. If not, may require referral to specialist for assistance with diagnosis

Management options:

1. Physical: Eliminate/reduce activities/actions which may contribute to problem, immobilise/support/splint affected area, physiotherapy.
2. Pharmacological: Anti-inflammatories, analgesics, specific therapy.
3. Hospital referral: Orthopaedic surgeon, rheumatologist, neurologist.
4. Occupational referral: Employment medical adviser, company occupational physician.

Part B - Diagnostic Decision Aid for Symptoms of Pain in Hand / Wrist / Forearm



MANAGEMENT OPTIONS

PHYSICAL:
Eliminate/reduce activities/actions
which may contribute to problem
Immobilise/support/splint affected area
Physiotherapy

PHARMACOLOGICAL:
Anti-inflammatories
Analgesics
Specific therapy

HOSPITAL REFERRAL:
Orthopaedic surgeon
Rheumatologist
Neurologist

OCCUPATIONAL REFERRAL:
Employment Medical Adviser
Company Occupational Physician