*Terms used in THIN dataset
**Appendix 2 – Selection of conditions to include in the study**
The process that we went through to identify these conditions is described below:

[A] Identification of common symptoms which are commonly referred in order to obtain a large sample from the dataset.

We identified these conditions from four data sources.  These were:

a) Coulter[13] who identified the top 10 problems referred to specialist outpatient clinics from GPs in the Oxford region 1990/1.
- Joint pain
- Hearing problems
- Abdominal pain
- Back pain
- Breast lumps
- Varicose veins
- Poor vision
- Menorrhagia
- Sterilisation or vasectomy
- Depression

b) Hospital Episode Statistics (HES).  Data for 2006-07[14] identifies the specialties with the most referrals to be:
- Trauma and Orthopaedics
- Ophthalmology – (most referrals are not from GPs)
- General Surgery
- Gynaecology
- Ear, nose and throat
- General medicine
- Dermatology

c) Department of Health 18 weeks monthly referral to treatment returns:
April 2008 Commissioner returns for non-admitted patients[15] showed that the top 10 specialties with the most number of referrals were:
- Trauma and Orthopaedics
- Ophthalmology
- General Surgery
- Ear, nose and throat
- Gynaecology
- Dermatology
- General medicine
- Cardiology
- Oral surgery
- Urology

d) The THIN dataset.  We created an ordered list of every medical code in the database, with a count of occurrences.  The count of occurrences represented the number of times the medical code had appeared in the records for every patient who had a referral, either on the visit at which they received a referral or on the previous visit.  From this we could identify those conditions most associated with referral and the specialties which received the most number of referrals.

The 10 most common specialties for referral are:

- Trauma and Orthopaedics
- Ophthalmology

- General Surgery
- General Medicine
- Gynaecology
- Dermatology
- Urology
- ENT
- Neurology
- Rheumatology

The 20 most common symptoms associated with referral are:
- abdominal pain
- backache
- knee pain
- shoulder pain
- chest pain
- asthma
- UTI
- Skin lesion
- Depression
- Headache
- Hip pain
- Dyspepsia
- Breast lump
- Hearing loss
- Haematuria
- Menorrhagia
- Epigastric pain
- Rectal bleed
- Cataract
- Varicose veins

We compared lists (a-d) and found close agreement between the four data sets.

[B] We then created a long list of commonly referred symptoms for discussion with a clinical expert in primary care. Together we identified the symptoms that fulfilled all the following criteria:

i) Symptoms that consistently present to GPs (rather than A&E thus bypassing the GP referral route to secondary care).

ii) Symptoms/conditions where referral is a common outcome.

iii) Symptoms which are specific enough to relate to a particular diagnosis that may require referral (e.g. a symptom "poor vision" may be secondary to refractive errors- which do not require referral to secondary care or to cataracts which do require referral. Because we were unable to distinguish the underlying cause for the poor vision and therefore the appropriateness of referral, we could not include "poor vision" in our list of symptoms for study).

iv) The desirability to include both medical and surgical conditions to widen the representativeness of our findings to both referral to physicians and surgeons.

v) The need to include a 'reference' condition i.e. one for which most patients *should* be referred early to secondary care (to check the quality of the referral data in the THIN dataset)

These criteria produced the following conditions/symptoms:
- Hip pain over 55 years

- Dyspepsia
- Post menopausal bleeding
- Breast lump
- Mole of skin
- Rectal bleeding

We then searched for referral guidance for each of these conditions and reviewed the most recent referral guidelines to identify conditions which varied with respect to the extent to which referral guidance was explicit. The guidelines we reviewed were:

NICE Guidelines Osteoarthritis – February 2008
NICE Guidance on Dyspepsia – August 2004
NICE Referral guidelines for suspected cancer – June 2005

The application of these criteria identified three symptoms/conditions:
- Post menopausal bleeding (our 'reference condition' because all women with PMB should be referred
- Hip pain over 55 years (the majority of such patients are likely to have underlying osteoarthritis and so if referred would see a surgeon; no explicit referral guidance)
- Dyspepsia (if referred would see a physician; explicit guidance for those over 55 years, for those under 55 years guidance advices that routine referral is unnecessary

The other conditions (mole, rectal bleeding, breast lump) were excluded at this stage because the referral guidance varied according to the underlying condition. It was not possible to establish the most likely underlying condition from presenting symptom codes; therefore we could not draw conclusions about the necessity of referral for these symptoms.

Thus, at the end of the selection process we identified three symptoms, all of which were reported on in the original paper.