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The Influence of Patient and Doctor Gender on Diagnosing Coronary Heart Disease

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The Influence of Patient and Doctor Gender on Diagnosing Coronary Heart Disease

Abstract

Using novel methods, this paper explores sources of uncertainty and gender bias in primary care doctors' diagnostic decision making about coronary heart disease (CHD). Claims about gendered consultation styles and quality of care are re-examined, along with the adequacy of CHD models for women.

Randomly selected doctors in the UK and the US (n=112, 56 per country, stratified by gender) were shown standardised videotaped vignettes of actors portraying patients with CHD. 'Patients' age, gender, ethnicity and social class were varied systematically. During interviews, doctors gave free-recall accounts of their decision making, which were analysed to determine patient and doctor gender effects.

We found differences in male and female doctors' responses to different types of patient information. Female doctors recall more patient cues overall, particularly about history presentation, and particularly amongst women. Male doctors appear less affected by patient gender but both male and especially female doctors take more account of male patients' age and consider more age-related disease possibilities for men than women. Findings highlight the need for better integration of knowledge about female presentations within accepted CHD risk models, and do not support the contention that women receive better quality care from female doctors.

(195 words)

Introduction

Improving the early detection and management of coronary heart disease (CHD) remains a key health improvement target across the developed world (e.g UK Department of Health (DH) 2005; US National Center for Chronic Disease Prevention and Health Promotion (NCCD) 2005). While evidence suggests that health promotion and screening strategies are having a positive effect (DH 2005, NCCD 2005), the decline in CHD has been greater for men than women (Peltonen et al. 2000). Twice as many women as men aged 45-64 have undetected or 'silent' myocardial infarctions, suggesting later diagnosis (McKinlay 1996, Mikhail 2005); and women also have a poorer post-infarction prognosis than men, even after adjusting for clinical covariates (NCCD 2005, Mikhail 2005). To understand why these gender differences persist, it is important to focus attention on primary care where CHD is first diagnosed. The need for research investigating the dynamics of the initial CHD diagnostic process amongst women is recognised as particularly urgent (Raine 2001, Richards et al. 2000, Mikhail 2005).

One explanation for persistent gender differences in the diagnosis, treatment and management of CHD is that knowledge about female presentations is not yet sufficiently integrated into received medical wisdom about what is 'normal' in CHD (Lorber 2000). Further, Lorber in the US contends that women receive better quality care for CHD at the hands of female compared with male doctors. This is based upon evidence about different consultation styles used by male and female doctors, which have also been identified by others (e.g. Roter, Lipkin & Korsgaard 1991; Hall et al. 1994). This paper re-examines these claims using a novel analytic approach which combines sociological and psychological perspectives. Much previous research has focused on how patient and doctor characteristics affect *outcomes* of clinical decision-making. Arber et al (2006) identified significant gender differences in doctors' treatment and management decisions for patients presenting with symptoms of CHD, finding that doctors had greater diagnostic certainty in relation to male compared with female patients. In this paper we elucidate these findings by an analysis of complementary, qualitative data to determine how patient and doctor gender affects doctors' *cognitive processes* during consultations, to shed light on gendered sources of diagnostic uncertainty and bias.

We have argued elsewhere that different theories of decision-making and approaches to decision analysis can usefully be encapsulated within a psychological model of classification (Buckingham & Adams 2000a, 2000b). This psychological model (described below) is used to analyse primary care doctors' accounts of decision making about older and middle aged patients presenting with symptoms of CHD. It enables us to focus on the micro-processes of doctors' clinical decision making, and explore the effects of patient and doctor gender on them.

First, we review relevant literature on gender and heart disease. The concept of clinical decision making as classification is then introduced, followed by a description of our analytic model and study methods. A number of hypotheses are derived and presented for empirical testing. Findings are discussed in the context of identifying sources of clinical uncertainty and potential gender bias, and in the light of Lorber's (2000) claims about the better treatment of women by female doctors than male doctors.

Patient gender and heart disease

Coronary heart disease is the most common cause of death for women both in the UK and the US (DH 2005, NCCD 2005), killing ten times more women than breast cancer (NHS Confederation Press Summaries 6 September 2005). However, it was only in the mid-nineties that it was recognised by the medical profession as an 'equal opportunity killer' (Wenger 1994), or indeed, as is now suggested, more deadly for women than for men in Europe (NHS Confederation Press Summaries 6 September 2005). Consequently, numerous studies have set out to determine gender effects on the diagnosis, treatment and outcomes associated with CHD, and researchers have found a systematic gender bias in secondary care. In the US and UK women were less likely to be admitted to cardiac units, even though they were generally in a worse condition on admission than men (Clarke et al. 1994), and less likely to be re-vascularised (DeWilde et al. 2003). Similar patterns were found in Australia (Sayer & Britt 1996), Ireland (Bennett, Williams & Feely 2002), Sweden (Agvall & Dahlstrom 2001), and Austria (Hochleitner 2000).

Less is known about the influence of gender in primary care however, where CHD is first diagnosed. Lorber's (2000) contention about knowledge of female presentations being not yet sufficiently integrated into received medical wisdom about what is 'normal' in CHD may be particularly influential here. Generalist primary care doctors are less likely to be aware of subtle gender differences in presentation than cardiac specialists. This is borne out by evidence that women are less likely than men to receive a diagnosis of CHD in primary care (Wenger 1994, Richards et al. 2000) because doctors are less certain about the accuracy of this diagnosis in women, particularly mid-life women (Arber et al. 2006). As a consequence, women may not be so thoroughly investigated. They are less likely to have CHD risk factors recorded, or to receive secondary prophylaxis; and if they do receive lipid lowering drugs, they are treated less 'aggressively' than men (Hippisley-Cox et al. 2001, Corbelli et al. 2003, Mikhail 2005). This, in turn, leads to difficulty in referral for appropriate tests (see for example Richards et al. 2000, Bennett, Williams & Feely 2002, Arber et al. 2006). In particular, women are less likely to be referred for echocardiography (Agvall & Dahlstrom 2001), or evaluation of left ventricular function (Burstein et al. 2003). When they are referred, women may be further disadvantaged because the exercise ECG, the most reliable diagnostic tool for CHD, functions better in relation to detecting CHD in men rather than in women (McKinlay 1996, Wong et al. 2001).

Prevalent stereotypical conceptualisations of CHD as a male disease also remain important, particularly amongst women themselves (Guilleman 2004, Ruston & Clayton 2002). People generally recall heart disease as being a sudden, dramatic collapse in male relatives, but a slow decline associated with normal ageing in female relatives, with stereotypical male presentations being more readily remembered (Emslie, Hunt & Watt 2001). The observations made by Martin, Gordon & Lounsbury (1998) and Lockyer & Bury (2002), that women are more in danger than men of having their symptoms of CHD interpreted as being of psychosomatic origin, is another indicator of a lack of integration of knowledge about women within prevalent conceptualisations of what is normal in CHD.

Explanations for differences in doctors' decision-making behaviour vary. Lorber's argument (2000) is in part predicated on the fact that there is an andro-centric gender bias that runs throughout much of medical knowledge and practice

(Healy 1991, Hayes & Prior 2003), which pays insufficient attention to the distinctiveness of disease presentation amongst women. For example, women are under-represented in CHD-related medical trials (Rosser 1994, Mikhail 2005); at best they receive a 'gender-neutral' assessment of their symptoms, but care based on the needs of male patients, which could significantly disadvantage them (Borzak & Weaver 2000, Bandyopadhyay, Bayer & O'Mahony 2001, White & Lockyer 2001).

Indeed, there is growing evidence that women often have different clinical presentations of CHD compared with men (e.g. Philpott et al. 2001, Mikhail 2005), which has led others to dispute that an inappropriate gender bias exists (Roeters van Lennep 2000, Wong et al. 2001). For example, women being treated less aggressively than men could rightly reflect real clinical differences in women's CHD profile, where their target lipid levels are different from men's (Wild 2001). Others contend that there is a gender bias in the opposite direction, arguing that men are generally over-treated (Kitler 1994). Unravelling the extent to which inappropriate, stereotypically-gendered thinking affects the diagnosis, treatment and management of CHD is highly important, yet complex to execute. Our study methods (described below) explain how we have sought to understand how this affects diagnosis, by controlling for clinical presentation, social interaction and behavioural differences within consultations.

Gender differences in the treatment of CHD are also confounded by the influence of other variables, such as age, socio-economic status (SES) (Lawlor, Ebrahim & Davey Smith 2002a, 2002b) and ethnicity (Schulman et al. 1999). Our own work (Arber et al. 2004, 2006), has highlighted the importance of age and gender interaction, suggesting significant under-investigation of CHD in middle-aged women in particular. In this paper we examine gender differences amongst mid-life and older patients, while simultaneously controlling for the effects of ethnicity and social class, and compare how doctors locate male and female patients' symptoms according to age-related disease expectations.

The influence of doctors' gender

An apparent lack of awareness of CHD in women amongst many health care professionals has recently been noted as a worrying phenomenon (Mikhail 2005), and is important to examine in terms of doctors' gender. While there is considerable evidence about the impact of *patients' gender* on the treatment and management of CHD (demonstrated above), much less is known about the impact of *doctors' gender*, and particularly about how it affects diagnostic decision-making in primary care.

Available literature about the effects of doctor gender tends to focus on differences in consultation styles and interaction patterns between male and female doctors with their patients. Women doctors encourage patients to talk more and develop fuller history narratives, to be involved in decision making, demonstrate more supportive non-verbal communication, conduct longer consultations and are more likely to perform female prevention procedures (Lorber & Moore 2002, Lorber 2000, Roter, Lipkin & Korsgaard 1991, Hall et al. 1994). Based on her examination of existing research evidence, Lorber (2000) contends that "women patients…do not get the best treatment for heart disease nor do they get good preventive care….unless they have a woman doctor" (p.45). Women use primary care services more than men (Hayes & Prior 2003), and with more women choosing to see female doctors (Franks

& Bertakis 2003), and a steady growth in the numbers of women entering primary care medicine, it is timely to re-examine this claim.

In summary, we aim to investigate the influence of both doctors' and patients' gender on doctors' cognitive processes during clinical decision-making, to identify sources of uncertainty in the diagnosis of CHD. We are particularly concerned with unravelling the extent to which inappropriate, stereotypically-gendered thinking gives rise to inequity in the early stages of women's care, and how this is influenced by patients' age. The next section describes our approach to investigating these cognitive processes for clinical decision making.

Clinical decision making as classification

Insert Figure 1 about here

Building on earlier work (Buckingham & Adams 2000a, 2000b), we have developed a detailed psychological model of clinical decision making within consultations, which interprets it as three linked, iterative classification tasks (diagnosing, assessing potential outcomes and making intervention decisions – see Figure 1). In this paper we focus on the first task of diagnostic decision making only, since the literature review suggests that this is the stage requiring most urgent investigation (Raine 2001, Richards et al. 2000, Mikhail 2005).

When making a diagnosis, the 'raw materials' doctors' work with is a set of patient attributes and those pertaining to the health-care context (e.g. health setting, cost of interventions, availability of tests). Referring to Figure 1, doctors select from this material what they believe to be relevant patient cues (e.g. gender but not eye colour from the whole set of patient attributes), and contextual information for making a diagnosis. The relevant cues then enter the psychological classification process, having been given a psychological interpretation if appropriate (e.g. a specific age might be interpreted as "elderly"). The different cues are then integrated to determine their combined influence on differential diagnostic classes. Each class is paired with the certainty that the doctor believes the patient belongs to it. The classification process is iterative, with cues bringing to mind particular diagnostic classes, which then suggest further cues to be sought, and so on.

By deconstructing the diagnostic processes into constituent parts, a mechanism is provided for revealing the different psychological components of clinical decision making, the potential influences on them, and how they affect resulting diagnostic decisions. It suggests a number of areas where decision making may be prone to gender bias: the number and nature of cues influencing classification; the knowledge structures used by doctors (explained later); and how doctors process cues and knowledge structures to estimate the certainty that the patient has a particular diagnosis. We refer to each of these areas where variation may occur as a decision-making component. The classification model is used to derive hypotheses about the different components that can be tested for gender-related bias, which will be explained below after we describe the study methods that generated the required data.

Study methods

The qualitative data about primary care doctors' decision making analysed in this paper were collected within the context of a large cross-national study with a factorial experimental design (Cochran & Cox 1957), permitting control for the effects of doctor, patient and health service characteristics. The study was conducted simultaneously in the United States (Massachusetts) and the United Kingdom (Surrey/South West London and the West Midlands) in 2001-2002, to estimate the un-confounded effects of patient characteristics on different types of decisions made by primary care doctors. These included diagnostic, test ordering, treatment and referral decisions, when presented with patients manifesting symptoms strongly suggestive of CHD or depression. In this paper, we focus only on decision making related to CHD. A full factorial of $2^4 = 16$ combinations of patient age (55 versus 75), gender, race (white versus black: African American in the US or Afro-Caribbean in the UK) and SES (lower versus higher social class – a cleaner / janitor versus a teacher) was used for the video scenarios. One of the 16 combinations was shown to each physician for each medical problem (2 videos per physician structured such that half saw the CHD vignette last). Eight strata of physician (gender, years of clinical experience [<12 or >22 years]) and country (US/UK) characteristics were defined, to generate a total of 16 x 2 x 8 = 256 physicians required to complete the experimental design.

Insert Table 1 about here

Professional actors were used to create realistic videotaped portrayals of primary care consultations, which incorporated key symptoms for CHD. Such methods have been used successfully by the team in previous research examining primary care decision-making (McKinlay et al.1997, 2002, McKinlay, Potter & Feldman 1996), and by others (e.g. McKinstry 2000). Scenarios were taped repeatedly, systematically varying the 'patient's' age, race, gender, SES and accent (UK v. US, Table 1).

Insert Table 2 about here

Measures were taken to ensure the ecological and external validity of the scenarios for both countries, and to ensure identical clinical information portrayal by each 'patient'. For example, doctors were shown scenarios in their surgeries during normal working hours, were instructed to view video patients as one of their own, and to ground subsequent care decisions within existing local constraints (doctors were also asked at interview how typical scenarios were, and 92% said either 'reasonably' or 'very' typical). The videos were shown to 256 primary care doctors, stratified by country (US v.UK), gender, and years of clinical experience (see Table 2). US doctors were randomly sampled from the Massachusetts Medical Society list and UK doctors from Surrey/South West London and West Midlands Health Authority lists. The sample of 256 doctors represents response rates of 65% and 60% of eligible doctors initially approached in the US and UK respectively.

After viewing each video scenario, doctors were asked about diagnosis and treatment decisions. Then, after viewing both scenarios, they were invited to give a free recall, unprompted account of their decision making processes about the video scenario they saw last (half or 128 physicians saw the CHD scenario last). The doctors' instructions were: "I would like you to think back to the beginning of the second consultation and to describe your thoughts as they occurred during it. I am particularly interested in when a possible diagnosis first entered your mind and how the diagnoses developed on the way to your final conclusions. Starting at the beginning then, can you replay the tape in your mind and tell me what your thoughts were about the patient?”

This approach allows doctors to articulate thoughts based on their chronological genesis, thereby providing information not usually available about what, in their minds, was most significant about the video presentations, and about how their thoughts developed on the way to reaching their conclusions about diagnoses. Analysis of these data, referred to as the 'cognitive' data, is the focus of this paper. This free recall opportunity was followed by semi-structured questions designed to elicit information about uncertainty representation and doctors’ knowledge structures. Due to missing and incomplete data, 112 (out of 128) accounts were analysed. These were provided by 56 doctors in each country, elicited in response to equal numbers (n = 56) of male and female patient presentations, thus constituting a balanced dataset according to the variables of interest.

Cognitive data were tape-recorded and transcribed verbatim by project support staff in both countries. Analysis was undertaken by one researcher (AA) in the UK, comprising thematic analysis using QSR NVivo 1.4 software, reflecting the components of the classification model of clinical decision making. This involved an iterative process of developing a coding framework that embraced not only all of the important theoretical decision-making components, but also ensuring sufficient flexibility to identify additional concepts arising from the data. (See appendix for a list of codes and examples). Inter-rater reliability of coding (undertaken by AA and CDB) reached 90% agreement when applied to the free recall data.

The next section describes how we investigated gender-related bias and the results. It provides more specific detail about the codes used and how they were applied to the data, with analysis of variance used to test all relationships in the data. The study design consisted of seven factors: four patient factors (gender, age, race, SES), two physician factors (gender, level of experience), and country. The analysis of variance model focussed on gender main effects and interactions. In the absence of missing data, all effects would be orthogonal but due to missing 16 out of 128 responses, Type III sums of squares were used. All analyses were conducted using SAS version 9.1. Least square means (adjusting for the other variables in the model) and associated 95% confidence intervals are given in Tables 3 and 4. Two-tailed tests were used because the mechanisms by which micro-cognitive processes are affected by gender are unknown, and because differences in either direction are of interest.

Testing for gender bias

The 3 components of our classification model of clinical decision making that relate to diagnosis will be investigated with respect to gender effects. Each comprises one or more micro-processes that will be analysed in turn to identify any influences of doctor and patient gender. Interaction effects will also be considered, but only the significant ones will be reported due to the number of potential interactions. Each micro-process is described, and outcomes associated with potential gender bias considered. Results of the analysis are presented in Tables 3 and 4. Table 3 shows independent influences of patient and doctor gender, and Table 4 shows significant interaction effects.

[Put Tables 3 and 4 about here]

Component 1: the number of unique cues considered by doctors

Every mention of a patient cue was coded and the distinct cues counted because the number of clinical, biographical, social or psychological pieces of data has implications for the number and range of diagnostic hypotheses entertained by doctors. Consideration of fewer patient cues may lead to fewer and less well-developed diagnostic hypotheses, with the potential to miss important ones (e.g. CHD). If there are systematic differences in the number considered for either male or female patients, this indicates less attention to their case and the potential for doctors to miss significant influences affecting diagnoses and subsequent care. However, the mean number of cues recalled for male and female patients was 11.02 and 12.02 respectively, which was not significantly different.

We went on to examine differences between the numbers of unique cues recalled by female doctors compared with male doctors, and found the mean number of cues recalled to be 12.6 and 10.6 respectively. This is a statistically significant difference (p=0.037), occurring in the absence of any systematic differences in the lengths of male and female doctors' free recall accounts. It indicates that female doctors may be more open to a wider set of potentially influential factors than male doctors.

These differences could be associated with the direction of reasoning, where forward or data-driven reasoning gathers cues and uses them to suggest a range of diagnoses, whereas goal-driven or backward reasoning tries to find data associated with a particular diagnosis. Consultations always iterate between the two directions, but to varying degrees. If backward reasoning predominates, there may not be enough cues gathered to generate a full set of differential diagnoses and focussing on the most likely ones will tend to generate a smaller set of confirming cues rather than ones suggesting alternative diagnoses. It may even lead to confirmation bias (Klayman 1995), when people try to prove the truth of ideas instead of disproving them. If it was taking place in this study, male doctors should have greater certainty of CHD than female doctors, but quantitative data collected from 256 doctors as part of the wider study did not show a significant difference. It is possible, though, that the type of cue is more influential than the numbers, which we explore next.

Systematic differences in the type of cues considered for either male or female patients may indicate over-sensitivity to some types of information and blindness to others. To test for it, cues recalled by doctors were coded into psychological, social, presentation, and medical history categories, described below.

Psychological cues relate to doctors' comments about a patient's state of mind (see appendix). The overall mean number recalled was 1.4, with 1.7 considered for women and 1.1 for men, which is a statistically significant difference (p=0.036, Table 3, row b). These findings support previous research (e.g. Emslie, Hunt & Watt 2001, Martin, Gordon & Lounsbury 1998, Lockyer & Bury 2002) by indicating that doctors are more likely to tune into psychological cues and to search for psychological explanations for women’s symptoms than they are for men. There was no significant difference between doctor gender for these cues, though, which means both male and female doctors are equally prone to the behaviour.

Presentation cues concern the manner in which patients present their history and symptoms (see appendix). Female doctors were found to recall significantly more presentation cues compared to their male counterparts (mean scores of 1.33 compared with 0.90 respectively, p=0.040, Table 3, row c). A significant interaction between patient gender and doctor gender (p=0.014) shows that the main cause of the difference between male and female doctors is due to how female doctors interact with female patients (Table 4, row a). Women doctors recall more presentation cues for female than male patients (mean cues of 1.72 compared with 0.94), whereas the difference for male doctors is less marked, albeit in the opposite direction, favouring men (mean cues of 0.75 and 1.03 for female and male patients respectively). These findings suggest that doctors are more attuned to the way in which patients of their own sex present their history, and that this is enhanced in the case of women doctors consulting with female patients, as Lorber & Moore (2002) suggest.

Patient medical history cues relate to pieces of information about past or present diseases, illnesses, and medical events affecting either the patient or their family, which may influence patients’ current or future health (see appendix). No significant effects of patient or doctor gender were found on the number of medical history cues recalled.

Our previous work showed interesting effects of patient age on diagnostic behaviour (Adams et al. 2006), but without specifically identifying how it influences decision making about male and female patients. To find out whether age is noted more for women or for men, its influence on decision making was recorded as a binary value, 'yes' if age was mentioned at all and 'no' otherwise. This exposed a significant difference between patient genders (p=0.018), with 81% of doctors mentioning age in relation to males but only 63% in relation to females (Table 3, row e). These findings corroborate the influence of age, suggesting it is a more important 'anchor' for doctors in terms of considering potential diagnoses for men than it is for women, and possibly underpinning Healy's (1991) contention that most medical knowledge reflects a male gender bias.

Examination of interactions between doctor and patient gender (Table 4, row b) reveals female doctors mention age more for male patients than female patients (91% of the time versus 50%), whereas male doctors treat them roughly the same (72% versus 75%, male to female). This indicates that the gender effect is really down to the different behaviour of female doctors, suggesting that while female patients' presentation of history and symptoms resonates more with female doctors, female doctors are simultaneously less likely to be attuned to the clinical significance of their age when it comes to making diagnostic decisions.

Component 2: Doctor's diagnostic inferences

Figure 1 shows that the inference process for linking cues to diagnostic classes is an integral part of clinical decision making. Component 2 examines these inferences, which are any inferred attributes of the patient, such as diseases (e.g.

CHD) or non-medical attributes like social isolation (see appendix). Increased inferences indicate a more open mind to different diagnostic possibilities, and an increased likelihood that the correct diagnosis will be present within a doctor's set of differentials. This is especially important during the early stages because Barrows et al. (1982) showed that only 14% of physicians will eventually identify the correct diagnosis if it is absent from the initial differential set.

The mean number of diagnostic inferences was 4.70, showing no significant gender differences, either between doctors or patients (Table 3, row f). However, it was seen above that gender differences were found with respect to mentioning the age cue (Table 3, row e), so it is pertinent to explore whether age is also having an impact on gender with respect to diagnoses, by examining age-related inferences. An example is a doctor saying a patient is just the right age and type of person to have CHD. In this analysis, age has to be explicitly associated with an inference, testifying to its specific influence on decision making rather than simply being noted as a patient attribute (see appendix).

Given that age is more often mentioned with respect to male patients (see above), it is not surprising to see this repeated for the association of age with diagnostic inferences. Male patients received an average of 1 inference associated with age (Table 3, row g), twice as many as the number for females (0.50, p=0.001). Furthermore, the difference is again mostly linked to female doctors (p=0.036, Table 4, row c), whose number of age-related inferences is 1.22 for males and 0.41 for females, compared to the smaller difference of male doctors (0.78 versus 0.59, for male and female patients respectively). These findings underline the importance of age as an influence on gender differences in diagnostic behaviour: it is mentioned more often by female doctors and is more influential on their diagnoses, but only with respect to male patients.

The increased number of age-related inferences for male patients seems to be having a real effect on diagnostic accuracies because there was a significant difference according to patient gender (p=0.031) when the 256 doctors were asked for their certainties of CHD in the quantitative part of this study (reported by Arber et al., 2006). The doctors estimated their certainties of CHD to be 57% certain for men, compared with 47% for women, which correlates with better accuracy because the scenarios were supposed to indicate CHD as the correct diagnosis.

Component 3: Knowledge structures used by doctors

The analysis of gender effects has concentrated so far on cue selection and their relationship to inferences for diagnostic classes. We now turn to how cues relate to each other within the knowledge structures doctors possess.

In terms of psychological classification, there are two fundamental models for representing knowledge about classes (see Hampton 1993): the prototype model, which represents a class by a single, most typical member; and the exemplar model, which represents classes by all their known members. Prototypes do not directly hold information about disease frequencies, whereas the exemplar model does, because it stores all the members, and thus incorporates class sizes. The difference is important because failing to take account of class sizes means that the existing evidence base for prior probabilities of diseases and outcomes is potentially ignored, which, in terms of gender issues, would mean doctors failing to take account of the frequencies of CHD within male and female populations, and over-reliance on matching patients to disease stereotypes when making diagnoses.

The second difference between prototypes and exemplars is that the exemplar representation holds more information on variability amongst class members by retaining all the different manifestations and their particular combinations in each member. This may enable more unusual symptom patterns to be correctly matched to a doctor’s disease representation, such as women’s different descriptions of angina compared with men’s (Philpott et al. 2001, Mikhail 2005), and thus facilitate more accurate diagnoses. If women do not present with typical CHD symptoms, then they may be disadvantaged by doctors’ over-reliance on prototypes.

Our coding scheme (see appendix) enabled us to test three important relationships between gender and the use of knowledge structures, namely, between gender and the use of prototypes; the use of exemplars; and the use of explicit probabilistic information (given by the disease frequency or probability code). Analyses failed to detect any significant gender effects, which means gender differences in diagnostic accuracy are not caused by the way knowledge is structured or how probabilistic information is integrated.

Summary and conclusions

Through the use of novel analytic methods combining sociological and psychological perspectives, this paper aimed to provide new insights into sources of uncertainty and gender bias in primary care doctors’ diagnosis of CHD. In particular, it re-examined three important contentions in medical sociological literature: that there are differences in male and female doctors' consulting styles; that knowledge about female presentations is not yet sufficiently integrated into received medical wisdom about what is 'normal' in CHD; and that women receive better quality CHD care from women doctors.

Our findings confirm the importance highlighted by others (Raine 2001, Richards et al. 2000, Mikhail 2005) of investigating gender differences in the initial diagnostic process for CHD. However, we failed to find evidence of differences due to variations in the knowledge structures used by male and female doctor, indicating that doctors diagnoses' were not inappropriately influenced by gender-stereotypical thinking, or failure to integrate probabilistic information. Instead, we found differences in the way male and female doctors respond to patient information**,** particularly in their perceptions of cue relevance and salience for potential diagnoses. Compared with their male colleagues, female doctors recall more patient cues and pay more attention to the way in which patients present their verbal histories, particularly in the case of female patients. These findings confirm differences in male and female doctors' consulting styles, with female doctors being particularly interested in patient narratives, as described by others (e.g. Roter, Lipkin & Korsgaard 1991, Hall et al. 1994, Lorber 2000, Lorber & Moore 2002).

Paying attention to the significance of women's age is not reflected in female doctors' interest in women's histories, though. By contrast, both male and female doctors, but especially females, took particular account of male patients' age when diagnosing, and generated a greater number of age-related diagnostic hypotheses for them than for women. More focus on men's age may, in part, reflect the historical male bias in medical knowledge, arising out of women's under-representation in CHD-related medical research. Our findings therefore support Lorber's (2000) conclusions, that knowledge about female presentations is not yet sufficiently integrated into received medical wisdom about what is 'normal' in CHD. On the other hand, the greater focus on men's age may reflect more documented concern about the higher rates of mortality from CHD associated with increasing age amongst men compared with women (Lawlor, Ebrahim & Davey Smith 2002b).

However, there may be something else going on in addition to clinical uncertainty. It has already been noted that prevalent stereotypical conceptualisations of CHD as a male disease remain important amongst women (Guilleman 2004, Ruston & Clayton 2002), suggesting a reluctance amongst women to accept that they are equally prone to CHD as they get older. This reluctance may translate into female doctors having a higher age threshold over which they will recognise potential CHD amongst women compared with men. Something akin to this is described by Bernard (1998), who examines female nurses' responses to caring for older women compared with older men. She identifies that nurses' discomfort with caring for their own sex, and comparative greater ease in caring for men, is associated in part with wishing to remain 'blind' to their own ageing, and the likely ill-health and role change consequences associated with it. On the other hand, due to the long standing male bias in medical knowledge and clinical research, male doctors may be more accepting of the potential for CHD amongst their own sex.

Whatever is the explanation for less attention being paid to the significance of women's age as a risk factor for CHD, a key question remains: Do the identified gender differences have clinical significance, causing biases with potentially detrimental clinical consequences for patients? To determine this, it is necessary to re-consider population trends for CHD. Although new evidence about a change in trend is coming to light (NHS Confederation Press Summaries, 6 September 2005), to date, the known prevalence of, and mortality from, CHD has been higher amongst men than women (DH 2005, NCCD 2005). Despite standardisation of patient presentations, this received knowledge of population base rates may legitimately affect doctors' diagnostic certainty, as discussed above. Nevertheless, the patient presentations in our video-taped vignettes contained a high number of cardinal symptoms, universally recognised as being strongly suggestive of CHD. This means that doctors' certainty about a CHD diagnosis should have been high, irrespective of patient gender, **raising some concern about the significant difference found between male and female patients in the quantitative part of this study (57% versus 47%, Arber et al. 2006). This was the case for doctors of both genders, casting doubt on Lorber's (2000) contention, that women receive better CHD care from female doctors. Indeed, our study makes this seem more unlikely given that female doctors pay significantly less attention to patients' age for women than men, when male doctors showed no difference. This has significant implications** because: women are greater consumers of primary health care than men; numbers of female doctors are increasing in the primary care workforce; and female patients are more likely to choose to be seen by them (Franks & Bertakis 2003). It highlights the need for better developed risk and diagnostic models of CHD for women, particularly with respect to the influence of age, which was the main source of gender differences between patients.

Compared to female doctors, males work with fewer patient cues and appear to be less influenced by patients' gender when making diagnostic decisions. Results for them demonstrate more similarity in their dealing with information about male and female patients, except where both male and female doctors demonstrate gender bias, in relation to recalling more psychological cues about female patients. However, it may be that the observed gender neutrality of male doctors in diagnostic decision-making disadvantages men, if there are good clinical reasons for treating them differently to women, as suggested by others (e.g. Roeters van Lennop 2000, Wong et al. 2001).

The validity of our results resides in the rigour of our research methods. These involved a meticulously designed factorial experiment, generation of stratified random samples of primary care doctors in each research locality, and the use of ecologically valid video vignettes of simulated patients as stimuli for data collection. Doctors' unstructured ruminations on their thoughts about patients were then analysed according to the component parts of our classification model of diagnostic decision making, through the rigorous application of the associated coding scheme we have developed. We are thus confident that our findings can be generalised.

A limitation of the study is the timing of the collection of the 'cognitive data', which followed structured questions about the scenarios. In order to capture doctors' dynamic reasoning processes, data should ideally be collected both during, and immediately after, watching video-taped scenarios, thus providing no opportunity for post-hoc justification (Ericsson & Simon 1993). This was not possible in the current study, but we will do this in future work, and compare the results. Another limitation relates to the use of standardised video-taped scenarios for controlling for variation in patient presentation. These inevitably remove naturally occurring variation in the ways in which men and women present during consultations, which may have influenced doctors' decision-making. Furthermore, the use of videos prevents interaction of the doctors with the patients, thereby removing any impact of their particular consultation styles. However, without standardising presentations and controlling for confounding variables, we should not have been able to present our results with confidence: no solution is perfect.

In summary, there may be doubt about whether differences between male and female patients' CHD diagnoses are based on reliable clinical evidence, but there should not be variations in the *process* of clinical decision making simply due to the doctor's gender. Patients are entitled to expect the same quality of care whichever gender attends to them, but our research has demonstrated that this may not necessarily be the case. More research is needed into the causes of these doctor gender differences and how they can be counteracted to ensure equality of care, in addition to investigating disparities in CHD diagnoses between men and women.

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(8,540 words including bibliography and appendix)

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Appendix: Coding Scheme and Examples of Codes

NB: examples of coded text are underlined

I Patient Cues are any descriptive attributes of the patient, (including their age or gender); any symptoms offered by the patient; or any direct observations of a patient's behaviour by the doctor e.g:

she was rather thin

he reported frequent headaches

she seemed very debilitated.

Psychological Cues are a subset of patient cues, where the above attributes, symptoms and observations are of psychological origin e.g:

He seemed very low

She said she felt very depressed.

Presentation cues are also a subset of patient cues, representing doctors' observations about the manner in which patients present their history, e.g:

he doesn't give a very cogent history

She's a passive victim, something about the tone that suggested that

Medical history cues are also a subset of patient cues, and relate to pieces of information about past or present diseases, illness and medical events affecting either the patient or their family, which may influence patients' current or future health e.g:

He has been a <u>diabetic for 2 years</u>

She suffered from <u>depression in the past</u>

His <u>father died of a heart attack at age 50</u>.

II Doctors' Inferences are any inferred attributes of the patient, which may be potential diseases or patient attributes that are being inferred from lower-level data e.g.

I think he is suffering from <u>coronary heart disease</u>

he has no family or friends and no regular social activities which makes me think he is <u>socially isolated</u>.

Age-related inferences are a subset of doctors' inferences, where a doctor says a patient is just the right age and type of person to have a certain condition. Age has to be explicitly associated with an inference, testifying to its specific influence on decision making rather than simply being noted as a patient attribute, e.g:

<u>At 45 she is in the right age group for a gall bladder problem</u>

at his age, cancer has to be considered

III Disease frequency or probability statements relate to doctors' statements about the likelihood and how often a disease may be present within certain groups of people e.g:

there is a higher than average incidence of coronary heart disease in elderly black males

type 2 diabetes is more likely in people over 50.

IV Disease knowledge (prototypical information) is applied to statements that go beyond just the normal association of patient cues with inferences. The code is applied to any statement providing additional information about causal, probabilistic, or other more complex relationships existing between cues and inferences, which are clearly related to those inferences in general, not just how they apply to the particular patient in the consultation. This is akin to a classic textbook description of a disease e.g:

She had all the features of typical angina

insomnia, loss of appetite, early morning waking and general lack of interest in life are all common manifestations of depression.

V Knowledge from **previous patients** (exemplar information) is applied to statements where doctors specifically refer to previous patients they have seen or where the information they are using comes from their experience of treating previous patients e.g:

<u>I have been caught out in the past by missing stomach cancer</u>

<u>A patient I saw last week had exactly these same symptoms of headache and rash</u>.

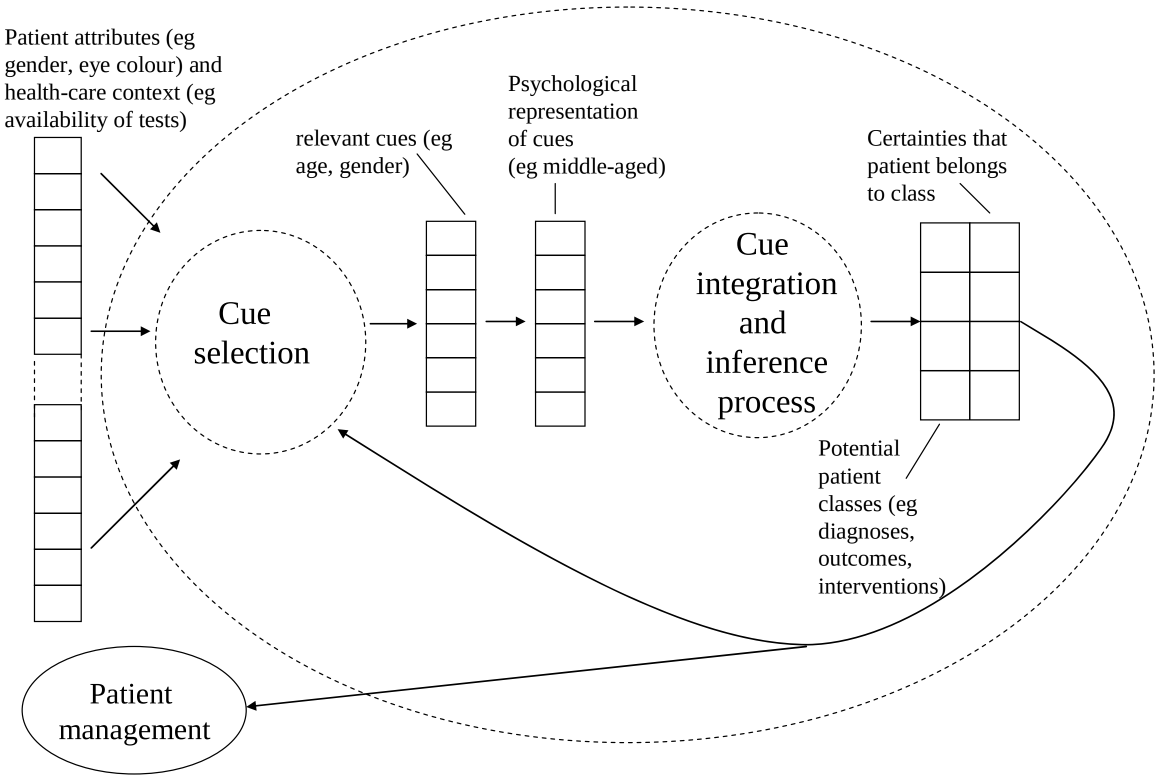

Figure 1: Psychological model of clinical decision making (CDM) based on classification. The same process applies to all three CDM tasks: classification of diagnoses, potential outcomes, and interventions. The arrow from the classes and certainties leading back to the cue selection process illustrates the cyclical nature of CDM: the outputs of each stage can be input to the next stage, with iteration of stages as required.

Table 1: Combination of Patient Characteristics in the Experiment

Patient Characteristics	Values	
Age	55 years	75 years
Gender	Male	Female
Race	White	Black (Afro-Carribbean)
Social Class/ Occupation	Janitor/ Cleaner	School Teacher

$2^4 = 16$ Videos (combinations of patient characteristics)

Table 2: Number of Primary Care Doctors in the Experiment by Gender, Year Completed Medical Training and Country

	Location			
Doctor characteristics	**Massachusetts, USA**	**Surrey & South East London**	**Midlands**	**Total**
Male				
Older (1965-1979)*	32	16	16	64
Younger (1989-1996)*	32	16	16	64
Female				
Older (1965-1979)*	32	16	16	64
Younger (1989-1996)*	32	16	16	64
Total	128	64	64	256

* Year completed medical training

Table 3: Results of testing differences between patients' and doctors' gender.

Decision-making component	**Patient Gender (mean scores)**			**Doctor Gender (mean scores)**		
	Male	**Female**	**Sig. level**	**Male**	**Female**	**Sig. level**
Component 1: number of cues considered						
(a) Unique general patient cues of all types	11.02	12.02	ns	10.61 (9.28-11.94) [b]	12.61 (11.28–13.94) [b]	p=0.037
(b) Psychological cues	1.09 (0.67-1.52) [b]	1.72 (1.32-2.11) [b]	P=0.036	1.22	1.60	ns
(c) Presentation cues	0.98	1.20	ns	0.90 (0.60-1.90) [b]	1.33 (1.03-1.62) [b]	p=0.040
(d) Medical history cues	0.42	0.63	ns	0.50	0.55	ns
(e) Age cue mentioned for patients	0.81 (0.70-0.92) [b]	0.63 (0.52-0.73) [b]	p=0.018	0.73	0.70	ns
Component 2: diagnostic inferences						
(f) All inferences	4.73	4.70	ns	4.81	4.63	ns
(g) Age-related inferences	1.00 (0.79-1.21) [b]	0.50 (0.30-0.70) [b]	P=0.001	0.69	0.81	ns
Component 3: knowledge structures used by doctors						
(h) Use of prototypes	1.38	1.86	ns	1.44	1.80	ns
(i) Use of exemplars	0.44	0.56	ns	0.55	0.45	ns
(j)Use of probabilistic information	0.30	0.55	ns	0.58	0.27	ns

Table 4: Significant Interaction Effects between Patients' and Doctors' Gender

Doctor Gender	**Male (mean scores)**		**Female (mean scores)**		**Significance Level**
Patient Gender	**Male**	**Female**	**Male**	**Female**	
Component 1: number of cues considered					
(a) Presentation cues	1.03 (0.60-1.46) [b]	0.75 (0.34-1.16) [b]	0.94 (0.50-1.38) [b]	1.72 (1.32-2.11) [b]	p=0.014
(b) Age cue mentioned for patients	0.72 (0.56-0.88) [b]	0.75 (0.60-0.90) [b]	0.91 (0.75-1.07) [b]	0.50 (0.35-0.65) [b]	p=0.007
Component 2: diagnostic inferences					
© Age-related inferences	0.78 (0.48-1.08) [b]	0.59 (0.30-0.88) [b]	1.22 (0.91-1.52) [b]	0.41 (0.13-0.68) [b]	p=0.036

[b] 95% confidence intervals
ns = p>0.05