

General Practitioners' coronary risk estimates, decisions to start lipid-lowering treatment, gender and length of clinical experience: their interactions in primary prevention

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Aim: We investigated whether the risk estimates of General Practitioners (GPs) and their treatment decisions mutually influence each other and whether factors not related to the patient's risk, such as the gender and length in clinical practice, interact.

Background: The quantitative assessment of the absolute risk of developing coronary heart disease (CHD) and the decision to start treatment with lipid-lowering drugs are crucial tasks in the primary prevention of CHD. **Methods:** Nine clinical vignettes, four rated high-risk and five rated low-risk according to the Framingham equation, were mailed to three groups of 90 randomly selected GPs in Stockholm. One group (R) was asked to estimate the risk of CHD within 10 years on a visual analogue scale. A second group (R + D) was asked to estimate the risk and to specify whether they would recommend a pharmacological lipid-lowering treatment. A third group (D) only to indicate whether they would recommend treatment. **Results:** Response rate ranged from 42.2% to 45.6%. The median risk estimates were higher in the R group than in the R + D group (difference not statistically significant). R + D group showed higher proportions of correct decisions to start treatment compared with the R group (86.2% versus 77.5%, $P = 0.19$). More correct decisions were made by female doctors (OR 1.77, 95% CI 1.19–2.61, $P = 0.004$) and by less experienced doctors (OR 0.97, 95% CI 0.95–0.99, $P = 0.016$). **Conclusions:** The task of making CHD risk estimates and the task of making decisions whether to start lipid-lowering treatment do not seem to influence each other. The gender of physicians and the length of clinical experience seem to affect treatment decisions. Female GPs and less experienced GPs are more likely to make correct decisions. However, the relatively low response rate to the questionnaires may limit the generalizability of these results.

Key words: coronary risk estimates; gender of physicians; general practitioners' length of experience; lipid-lowering treatment; primary cardiovascular prevention

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Introduction

The primary prevention of coronary heart disease (CHD) is based on the assessment of the

individual's absolute risk of developing CHD rather than on the value of any specific risk factor, and preventive treatment should be considered if the patient's absolute risk exceeds a certain cut-off point (Expert Panel, 2001). Therefore, the key factor in proper CHD prevention is combining quantitative risk assessments with decisions about whether or not to treat individual patients.

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Although there is extensive knowledge about how to manage cardiovascular risk, the quality of preventive care is suboptimal, especially in high-risk subjects (Durrington *et al.*, 1999; Grundy *et al.*, 1999; Ford *et al.*, 2003; Erhardt and Hobbs, 2007; Doroodchi *et al.*, 2008).

Risk assessment tools, such as charts or computer programs, have been developed and are recommended in the identification of high-risk subjects, but their use in clinical practice is limited, and clinicians are more likely to make their own assessment subjectively (Graham *et al.*, 2006; Eichler *et al.*, 2007).

We have previously observed that the decision to start pharmacological treatment with lipid-lowering drugs does not come in a straightforward way from the doctor's estimate of the patient's risk (Vancheri *et al.*, 2008). When the relationship between physicians' subjective risk estimates and decisions to treat with respect to a defined cut-off level was investigated using clinical vignettes, we found that in simulated cases with high actual risk level, there was a high rate of decision to treat even when the physicians' own quantitative estimate was below the risk rate defining the cut-off level to start pharmacological treatment. This observation may indicate that in high-risk cases the decision to start pharmacological treatment is to some degree independent from the physicians' own quantitative risk estimate. Therefore, risk estimates and treatment decisions may be partially independent. Other studies have documented a discordance between knowledge and action in medical decision making (Redelmeier and Shafir, 1995; Kaufman *et al.*, 1999). Within studies of physician's risk estimates and treatment decisions, it is not known whether the task of making a decision about treatment influences the quantitative risk estimate and vice versa.

Moreover, although the influences of the gender of physicians and their clinical experience on management of patients at risk for cardiovascular events have been investigated, there is limited information about their role in the area of risk estimates and treatment decisions in primary CHD prevention (Choudhry *et al.*, 2005; Christian *et al.*, 2006; Baguet *et al.*, 2007; Berthold *et al.*, 2008; Baumhäkel *et al.*, 2009; Tabenkin *et al.*, 2010; Southern *et al.*, 2011).

In the present study, we aimed to assess:

- 1) whether the risk estimates of General Practitioners (GPs) and their treatment decisions mutually influence each other, that is, whether decisions influence ratings and whether ratings influence decisions;
- 2) whether the gender of physicians and the number of years they have been in clinical practice influences risk estimates and treatment decisions.

The answers to the first question are of theoretical interest within the field of decision making in general and should be of importance in the interpretation of previous and future studies in the field of risk estimates and treatment decisions. The second question relates to individual differences in clinical decision making, especially the role of physicians' gender and the length of clinical experience, and may help explain variations in quality of care.

We investigated three groups of GPs confronted with the same series of simulated clinical case descriptions. Each group had one of the following tasks: risk rating only (R group), risk rating and decisions about pharmacological treatment (R + D group) and treatment decision only (D group). To answer the question about whether decisions influence ratings, risk assessments made by R and R + D groups were compared. To investigate whether ratings influence decisions, we compared decisions made by the R + D and D groups. All comparisons were analyzed in relation to gender and length of clinical experience.

Methods

Setting

This study was conducted in Stockholm, Sweden. The data were collected in 2006.

Sample

A random sample of 270 GPs was drawn from the local database of healthcare professionals, which comprised 828 GPs. Only Family Medicine specialists were included in the study.

Design

The study design was a cross-sectional survey. A questionnaire describing nine clinical cases was

mailed to three groups of 90 randomly selected GPs in Stockholm. All physicians received the same set of nine cases in the same order.

One group of GPs (R) was asked to estimate the risk of CHD within 10 years on a visual analogue scale (VAS), between 0% and 100%, without using a risk table or any other decision support. The risk categories currently indicated in the Framingham-based tables (low <5%, mild 5–10%, moderate 10–20%, high 20–40% and very high risk >40%) were provided as anchor points within the scale. We chose the older Framingham risk equation because it is the most widely used method for assessment of cardiovascular risk and is the basis for most other risk prediction methods (Cooney *et al.*, 2009). The cardiovascular risk assessed using Framingham was compared with the SCORE algorithm, recently introduced in Europe (De Backer *et al.*, 2003), producing the same results regarding the relation to the respective cut-off values and almost identical ranking of the cases in terms of risk.

A second group of GPs (R + D) was asked to estimate the risk of CHD within 10 years on a VAS and to specify whether or not they would recommend a pharmacological lipid-lowering treatment for the patient, assuming that lifestyle interventions had been tried for at least six months. Figure 1 provides an example of a case as presented to the R + D group.

A third group (D) was asked only to indicate whether they would recommend a pharmacological lipid-lowering treatment for the patient.

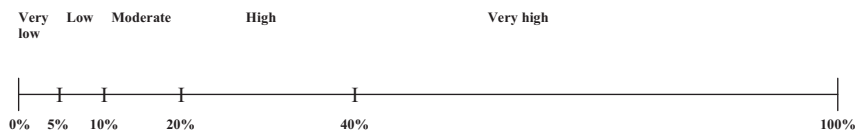
The questionnaires asked for the physicians' age, gender and length of experience, but remained anonymous to increase the likelihood that answers would be given without the use of risk tables or other decision supports (as the instruction to the doctors prescribed). Because the number of years GPs have been in clinical practice is closely related to their age, we included only the length of experience in the analyses.

Clinical cases

We presented each physician with nine patient cases that incorporated a combination of the variables from the Framingham risk tables: age, sex, systolic blood pressure, cholesterol level and smoking. The patient cases were constructed by two of the authors (L.B., L.-E.S.) based on their own clinical experience. The patients had no history of cardiovascular disease or diabetes, as risk assessment for deciding about initiation of lipid-lowering treatment is not relevant for patients with such conditions; in addition, none had systolic blood pressure levels of above 160 mmHg, as higher values might have led the doctors to consider the treatment of hypertension more relevant than the treatment of hypercholesterolemia. The set of cases was constructed to represent a spectrum of patients with a 10-year risk of a fatal

Case 1. The patient is a 53-year old man with no history of previous cardiovascular disease or diabetes. Non-smoker. Systolic blood pressure 140 mm Hg. Recent cholesterol value is 7.0 mmol/l (270 mg/dl).

Mark with a cross on the line your estimate of his risk to have coronary heart disease within 10 years.



Would you recommend a lipid-lowering drug in this case?

Yes No

Figure 1 Example of a case description

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or non-fatal coronary event ranging from high to low, based on the Framingham algorithm (Wood *et al.*, 1998). According to this equation, a 10-year absolute CHD risk of 20% or more is the threshold for pharmacological lipid-lowering treatment. Therefore, 20% was used as the cut-off point for defining high- and low-risk cases in the Results section. The calculated Framingham median score was 17.0 (range 3–45) for all cases combined, 30.5 (range 27–45) for the four high-risk cases and 15.0 (range 3–17) for the five low-risk cases.

To minimize the risk of an anchorage effect, we opened the questionnaire with a medium-risk case and ordered the rest at random.

A summary of the nine cases presented to the doctors is shown in Figure 2, below the box plots.

The study was approved by the regional ethics committee in Stockholm (no. 2005/603–31).

Statistical analysis

To account for the clustering effect of each doctor being represented nine times, we used generalized linear models (linear and logistic

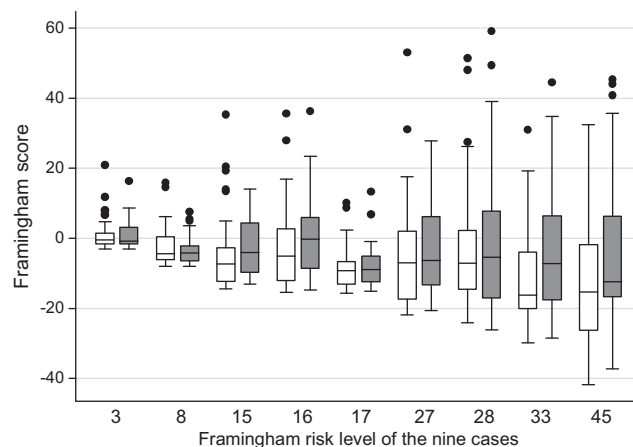
regression) with robust standard errors for all of the analyses, with nine rows for each doctor for each case. We used multivariable models to test for the effect of Framingham score, experience and gender.

Investigation of risk estimate (R + D and R groups)

For the risk estimates, we used the difference between the doctors' estimates and the calculated Framingham risk (Framingham score) because it is approximately normally distributed. A multivariable linear regression model was constructed that included (as independent variables) the actual Framingham risk (in order to ascertain how this affected the score), the group (R and R + D), the gender of the doctor and the number of years of experience.

Investigation of treatment decisions (R + D and D groups)

The effect of making a risk estimate on treatment decisions was first assessed by comparing



Summary of the nine cases

age	39	41	51	52	53	59	68	60	70
sex	F	M	M	F	M	M	F	M	M
smoker	no	no	no	yes	no	no	yes	yes	yes
systolic BP	130	140	120	125	140	160	140	145	160
cholesterol (mmol/L)	6.4	6.1	7.9	7.2	7.0	8.0	8.0	7.2	7.8

Figure 2 Box plot of doctors' risk estimates in the R group (empty bars) and R + D group (filled bars) and summary of the nine cases along with the calculated Framingham risk level. Framingham score is GPs' risk estimates minus Framingham risk levels. The bottom of the boxes is at the first quartile, the top is at the third quartile and the continuous lines across the boxes are at the median value. The whiskers are drawn to the highest and lowest values that are not considered as outliers. Outliers, marked with dots, are estimates outside these limits. The first five cases are low-risk cases, according to Framingham. The others are high-risk cases, eligible for treatment.

the proportion of decisions made in the R + D and D groups, and the *P*-value for difference in the proportion of decisions was assessed using a logistic regression model that included both groups with decision as the outcome.

The effect of group experience, Framingham score, gender and experience on the proportion of correct decisions was investigated using multi-variable logistic regression with correct decisions as the outcome. 'No' decisions were considered correct if the Framingham risk for the case was <20%, and 'yes' decisions were considered correct if the risk was ≥20%.

We tested for interactions between the covariates in both models.

STATA (version 9.2) was used for statistical analysis.

Results

General data

Response rates to the questionnaire were as follows: 41 GPs (45.6%) from the R group (median age 55 years, range 38–69), 38 (42.2%) from the R + D group (median age 54 years, range 43–65) and 41 (45.6%) from the D group (median age 51 years, range 37–63). The percentage of male respondents in each group was 51.2, 41.7 and 50.0, respectively. The median length of clinical experience was similar in the three groups (15 years in the first, range 2–31; 15 years in the second, range 2–30 and 13.5 years in the third, range 1–30).

Ratings

Risk estimates within the R + D group and the R group for each case are shown as a box plot in Figure 2 as differences between the Framingham scores and the GPs' risk estimates. There was a wide range of estimates, particularly for the high-risk cases. In general, the median estimates in the R group were higher than in the R + D group, especially for the high-risk cases, but the difference between the two groups was statistically significant in only one of the cases.

The median estimates of both groups were lower than the calculated Framingham risks for all nine cases, with the greatest discrepancies in the high-risk cases.

The difference between the doctors' risk estimates and the calculated Framingham risk

(doctors' risk estimates minus Framingham risk) was not related to group ($P = 0.27$), gender ($P = 0.74$) or length of experience ($P = 0.57$). However, it was significantly related to the calculated Framingham risk ($P = 0.04$), with the differences getting larger as the Framingham risk increases.

Decisions

To investigate the effect of risk estimates on the task of making a decision, the proportion of decisions to start pharmacological treatment was calculated as the number of 'yes' decisions divided by the total number of decisions for each doctor. Overall, about half (48.3%) of the GPs' decisions in the R + D group were favourable to start a treatment, compared with 44.4% in the D group ($P = 0.62$). For the five low-risk cases, the female GPs were significantly less willing to treat compared with the male GPs (12.6% versus 24.4%, $P = 0.04$; Figure 3).

The proportions of correct decisions, based on the number of doctors to account for clustering, were higher in the R + D group for high-risk cases (86.2% and 77.5%, respectively), but this difference was not statistically significant ($P = 0.19$).

Correct decisions decreased with calculated Framingham score of the case, but this decrease was not significant ($P = 0.12$).

The effect of gender and length of clinical experience on correct decisions was investigated by including both variables as independent variables in the logistic regression model together with Framingham score. Correct decisions were significantly related to gender (being female; OR 1.77, 95% CI 1.19–2.61, $P = 0.004$) and negatively related to years of clinical experience (OR 0.97, 95% CI 0.95–0.99, $P = 0.016$). This indicates that correct decisions were more likely to be carried out by less experienced doctors. Figure 4 shows the predicted proportions of correct decisions as a function of clinical experience and gender. Female GPs made a higher rate of correct decisions (87.3% versus 75.5%, $P = 0.08$).

Discussion

Our results suggest that the task of risk rating and the task of deciding whether or not to start a lipid-lowering treatment do not influence each other.

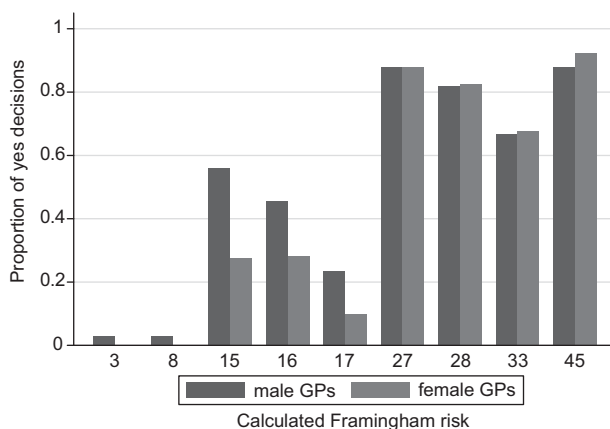


Figure 3 Proportion of 'yes' decisions (R + D and D combined groups) by GPs' gender for each case according to the level of calculated Framingham risk.

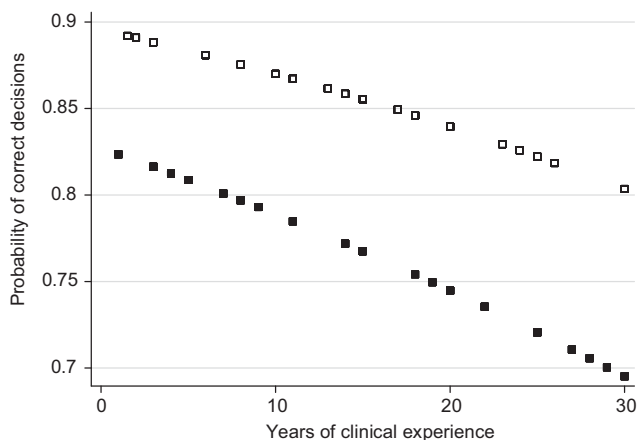


Figure 4 Plot of probability of correct decisions against the length of clinical experience by gender. The squares (empty = female doctors and filled = male doctors) represent the predicted proportions of correct decisions. Each square represents one to six doctors with the same number of years of clinical practice.

All groups of GPs tended to underestimate risk compared with the calculated Framingham risk, supporting previous observations comparing the estimates of GPs and medical students in similar cases (Backlund *et al.*, 2004) and comparing GPs in two European areas with different cardiovascular risk levels (Vancheri *et al.*, 2008).

There was wide variability in the risk assessments within each group of GPs. This finding is consistent with the results of other studies that have assessed clinicians' perceptions of cardiovascular risk and the accuracy of their

subjective estimates (Dolan *et al.*, 1986; Friedmann *et al.*, 1996).

Among all the groups of GPs, the largest discordance between the GPs' risk estimates and the calculated Framingham risk, as well as the lowest rate of correct decisions about treatment, were observed in the high-risk cases. This speaks to the uncertainties that doctors experience when estimating risk and deciding the treatment of high-risk patients, the patients for whom preventive efforts are most important. Preventive efforts in high-risk subjects are important, as the benefit of

treatment increases with increased absolute risk. This observation has practical consequences, as the effectiveness of drug treatment in CHD prevention depends on the accuracy with which the clinician estimates risk in individual patients (Durrington *et al.*, 1999; Grundy *et al.*, 1999). Once the risk for a given individual is accurately identified, appropriate interventions exist that substantially reduce cardiac events. This paradigm assumes that decisions about treatment are direct consequences of estimates. However, our results support the opinion that risk assessments and decisions about treatment are complex cognitive processes that involve interactions between doctors' knowledge, risk perception and the task of decision making (Reyna and Lloyd, 2006; Reyna, 2008).

In the present study, the gender of GPs and the length of their clinical experience were shown to influence their decisions about treatment. Female GPs performed better than male GPs and, in particular, were less prone to start treatment in low-risk cases.

Previous research has suggested that male and female physicians differ in the treatment of patients with heart failure (Baumhäkel *et al.*, 2009), in the control of some risk factors in patients with diabetes (Berthold *et al.*, 2008), and in providing preventive care (Henderson and Weisman, 2001). It has been proposed that perception and interpretation of clinical symptoms may be different because female physicians tend to have a more patient-centred communication style (Roter *et al.*, 2002) and to spend more time with the patient (Bertakis *et al.*, 1995). However, our study is based on paper-simulated cases, which eliminates gender differences due to the interaction between the physician and the patient. Therefore, we can speculate that the gender differences in treatment decisions observed in our sample may reflect true differences in the decision-making process that are independent of factors related to the physician–patient relationship.

We also found that the length of time in clinical practice seems to affect decisions. Shorter experience was associated with a higher number of correct decisions. These findings support previous reports of lower quality care with increasing years in practice (Choudhry *et al.*, 2005; Southern *et al.*, 2011).

There are some limitations to this study. First, the 42–45% response rate, although not unusual

for a mail survey of physicians (Castaldo *et al.*, 2005; Christian *et al.*, 2006; Erhardt and Hobbs, 2007), compromises generalizability of the study results to all doctors. In addition, the response rate produced relatively small groups for the statistical analyses. In this case, there may be the risk of a type II error, that is, failing to find a true association between the task of risk assessments and the task of treatment decisions because of the small sample size. Second, case vignettes limited to a few variables may not reflect real-life practice. However, the use of case vignettes has been shown to be an effective method to measure the quality of physicians' practice (Peabody *et al.*, 2004; Veloski *et al.*, 2005). Third, we cannot exclude the possibility that physicians responded to the questionnaire in an manner that does not accurately reflect their practice, and we cannot eliminate the possibility that some doctors may have used risk calculators, even though they were instructed not to. Finally, risk assessments and treatment decisions may be influenced by several other factors than what is included in the case vignettes or attributable to the individual doctors. Such environmental factors may be information campaign from health services, the media or by pharmaceutical industries. The possibility of these influences may further limit the generalizability of our results.

Conclusions

GPs seem to underestimate CHD risk when compared with the calculated Framingham risk. Female GPs are more likely to make correct decisions, and GPs with more experience may paradoxically provide lower quality care. These findings may have practical consequences, as they indicate some level of inappropriate CHD primary prevention. Innovative educational approaches are needed to improve the quality of medical decision making.

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