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AUDIT

Are the economically active more deserving?

B Gaffney, F Kee

Abstract

***Objective*—To investigate the possibility of an association between the duration of medical treatment before coronary angiography and demographic and non-clinical factors.**

***Design*—A systematic review of a random sample of 500 patients undergoing their first angiographic assessment.**

***Subjects*—500 cases were selected randomly from patients investigated in 1991 at the two catheterisation centres in Northern Ireland.**

***Main outcome measures*—The duration of medical management before angiography.**

***Results*—346 had elective and 154 urgent catheterisation. The duration of medical management was adjusted for both case mix (age at onset, body mass index, angina grade, history of myocardial infarction, history of hypertension, diabetes or hyperlipidaemia, treatment intensity) and other demographic variables (sex, smoking status, an indicator of "deprivation", and distance of the patient's area of residence from the hospital). After this adjustment the mean duration of medical management before angiography was twice as long for economically inactive patients as for those who were economically active. In a multiple regression, the relevant β coefficient was 0·44 (95% confidence interval 0·33 to 0·58, P < 0·0001).**

***Conclusions*—These results suggest that, in making discretionary decisions about when to refer patients with angina for revascularisation assessment, doctors may be influenced by non-clinical factors unrelated to disease severity.**

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Keywords: angiography; referral decisions; non-clinical factors; economic activity

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Coronary revascularisation rates in the United Kingdom are lower than in many European countries and the United States.[1] In 1993 the Clinical Standards Advisory Committee was asked to give advice on the provision of these services. It concluded that district utilisation rates were positively associated with the availability of a local cardiologist and inversely with the distance from a regional centre and the mortality from coronary heart disease. It recommended further enquiry into variations in provision arising from differences in need and the professional judgments of general practitioners (GPs) and hospital physicians.[2] A similar recommendation arose from a recent report by the Scottish Home and Health Department.[3]

There have been several reports from the United States indicating substantial discretionary use of invasive cardiological investigations.[4–6] However, nearly half of a sample of 320 angiographies performed in the Trent region in 1987/88 were judged to have been undertaken for inappropriate or equivocal clinical reasons.[7]

There are wide variations in the rates of angiography between districts in Northern Ireland.[8] One explanation might be that doctors with lower referral thresholds, on average, refer earlier in the clinical course of disease. Other studies have demonstrated that *non-clinical* factors such as the patients' sex and area of residence ("deprived" or "affluent") may influence investigation and revascularisation rates.[9–11] Arguably, routine health service information systems are not best suited to clarifying the role of such factors in the discretionary use of these procedures.[12] To determine the relation between clinical and non-clinical factors at first angiographic presentation we have performed a detailed review of a large sample of patients undergoing investigation. Specifically, we wished to clarify the determinants of the duration of the angina history before angiography.

Methods

Only two hospitals in Northern Ireland (population 1·5 million), which are about one mile apart in Belfast, provide cardiac catheterisation facilities. Each catheterisation laboratory maintains a register of daily activity which gives the patients' names and the types of procedures undertaken. In 1991 these two units undertook 1607 and 860 procedures respectively. We generated a list of random numbers and from this selected a sample of 500 patients from the registers (weighted in proportion to their share of total activity). When the hospital notes indicated that the procedure undertaken was not the first angiography carried out on that patient, the next eligible subject in the register was selected.

We obtained hospital notes for each case and sought a range of items of information including (*a*) age, sex, address (postcode and electoral ward), occupation, "employment"

Table 1

	Elective cases					*Urgent Cases*				
	Tertile 1	2	3			*Tertile* 1	2	3		
	<6 mth % (n)	*6–24 mth* % (n)	*>24 mth* % (n)	*P*	*(Missing data)*	*<1 mth* % (n)	*1–23 mth* % (n)	*>24 mth* % (n)	*P*	*(Missing data)*
Men	73 (84)	67 (67)	69 (86)	NS	(7)	79 (49)	78 (31)	81 (38)	NS	(5)
*Employed	64 (67)	59 (55)	37 (43)	<0·0001	(30)	62 (34)	46 (17)	29 (13)	0·0045	(17)
Current smoker	44 (50)	26 (26)	22 (25)	0·0008	(11)	49 (30)	29 (11)	29 (13)	0·019	(10)
BMI <25	41 (46)	40 (40)	37 (45)	NS	(12)	42 (25)	33 (13)	40 (19)	NS	(8)
+ve Family history	60 (67)	66 (63)	69 (74)	NS	(31)	60 (33)	64 (23)	69 (29)	NS	(21)
History of myocardial infarction	17 (19)	38 (38)	48 (59)	<0·0001	(7)	3 (2)	33 (13)	50 (23)	<0·0001	(6)
Trial of triple therapy	32 (37)	42 (42)	60 (74)	<0·0001	(7)	0 (0)	45 (18)	60 (28)	<0·0001	(5)
Age at onset of angina (% <50)	33 (35)	33 (32)	38 (44)	NS	(26)	36 (22)	21 (8)	31 (14)	NS	(9)
†History of co-morbidity	43 (49)	47 (47)	53 (66)	NS	(7)	37 (23)	50 (20)	47 (22)	NS	(5)
‡Angina severity CCS grade <2	72 (52)	74 (62)	52 (58)	0·0016	(78)	32 (6)	32 (9)	44 (14)	NS	(75)
Area of residence Deprivation quintile:										
1	23 (25)	20 (19)	17 (20)			18 (11)	18 (7)	24 (11)		
2	16 (17)	23 (22)	25 (29)			18 (11)	18 (7)	18 (8)		
3	19 (20)	20 (19)	20 (23)			25 (15)	18 (7)	22 (10)		
4	20 (21)	23 (22)	17 (20)			20 (12)	26 (10)	16 (7)		
5	22 (24)	15 (14)	21 (25)	NS	(26)	20 (12)	21 (8)	20 (9)	NS	(9)
Distance quintile from cath lab:										
1	27 (29)	17 (16)	20 (23)			18 (11)	23 (9)	16 (7)		
2	19 (20)	19 (18)	16 (19)			21 (13)	23 (9)	27 (12)		
3	21 (22)	21 (20)	24 (28)			20 (12)	5 (2)	22 (10)		
4	21 (22)	28 (27)	18 (21)			15 (9)	18 (7)	18 (8)		
5	13 (14)	16 (15)	22 (26)	NS	(26)	26 (16)	31 (12)	18 (8)	NS	(9)

*Employed and self-employed versus unemployed/retired/housewife.
†A history of diabetes, hypertension, or hyperlipidaemia.
‡Canadian Cardiovascular Society Grade.
BMI, body mass index.

status (economically active and employed versus unemployed, retired and housewives); and (*b*) smoking habit, body mass index, family history, co-morbidity (a history of previous treatment for hypertension, diabetes or hyperlipidaemia), age at first onset of angina, angina severity (Canadian Cardiovascular Society Score[13]), type of admission (elective/urgent), and history of previous infarction.

Because in most records the patient's occupation was not given, which made it difficult to code for social class, the usual area of residence was categorised according to the "material affluence" of the respective electoral ward by deriving a Townsend deprivation score.[10] Previous research, commissioned locally by the Department of Health and Social Services had shown significant correlations between this index of area deprivation and various health measures in the Northern Ireland population.[14] The score is calculated as the sum of four equally weighted census variables (which were originally chosen explicitly to act as proxies for various aspects of a lack of control over material resources). These variables are the percentages of the ward population who are unemployed, have no car, live in overcrowded housing, and who are not owner occupiers. The resultant scores for the 566 electoral wards in the province (ranging from −5·63 to 11·07 (affluent → deprived)) were ranked and then divided into quintiles based on this distribution.

Also we used the respective geo-codes to derive the "crow-fly" distance between the patient's address and the catheterisation centre (range 0–90 miles) and we grouped the resultant distances into quintiles (1 to 5).

Continuous variables were categorised into groups and the χ^2 statistic for contingency tables was used for univariate comparisons. The factors which independently influenced the duration of angina history were determined by least squares multiple regression. Categorical variables (with n categories) were initially fitted as terms for trend and then, when appropriate, using n-1 dummy variables. A regression equation was fitted using backward elimination.

Results

Three hundred and forty six patients underwent elective angiography and 154 had urgent angiograms (identified as urgent by the referring clinician and performed within 7 days of the request). Thus the distribution of the durations of angina history was skewed. Table 1 shows the relation between the duration of the angina history (in tertiles) and the major clinical and non-clinical variables for elective and urgent cases.

For elective cases, patients with a shorter angina history were more likely to be smokers, to be in employment, and to have had less severe angina. They were also less likely to have had a trial of triple therapy or a history of previous myocardial infarction. Urgent cases with a shorter angina history were also more likely to be smokers and in employment and less likely to have a history of myocardial infarction or have had a trial of triple therapy.

Since multiple regression requires data to be normally or near normally distributed the skewed distribution of the durations of angina history was log transformed before we performed multivariate analysis (fig 1). We used stepwise backward elimination in the multiple regression. Attempts were made to fit higher

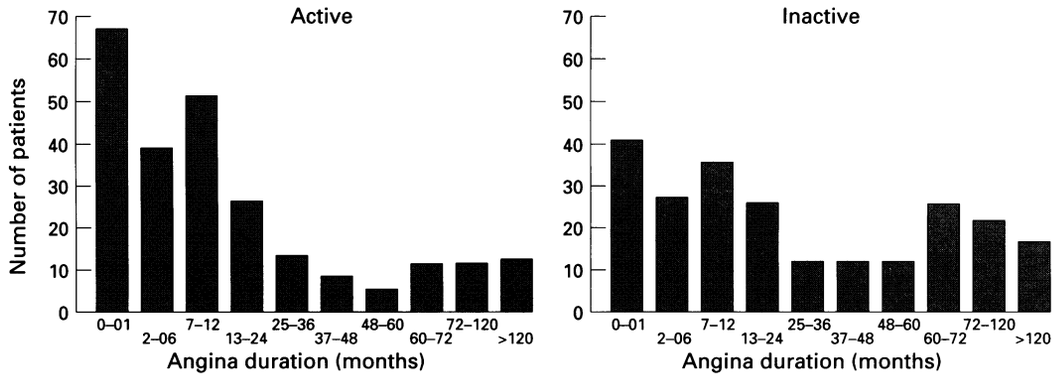

Figure 1 Distribution of duration of angina among the economically active and economically inactive.

order and interaction terms as appropriate.

The final model accounted for 34% of the variation in $\log^{(\text{angina duration})}$: the variables that were independently associated with the duration of angina history are shown in Table 2. Having had a previous history of infarction or a trial of triple therapy was associated with a longer angina history. The duration of angina history before angiography tended to be shorter among those who were older at onset and among the economically active and smokers.

The relation with age at onset was better explained by the inclusion of a quadratic term. (This was fitted after first computing [{age at onset} – {mean age at onset}] to reduce correlation with the quadratic term). Figure 2 shows predicted values of angina duration across a range of ages at onset, both for the economically active and for the economically inactive (unemployed, the retired and housewives). Figure 1 shows the untransformed distribution of angina durations for these two groups. There were no significant interaction terms.

Discussion

These results show that some factors apparently unrelated to the clinical severity of the disease have a significant effect on the period between the first onset of angina and invasive cardiological assessment. Other studies have suggested that such findings may point to a discretionary use of, or referral for, these procedures that may result in inequitable provision.[9 10 15] In fact, published reports are not entirely consistent but it is likely that some differences in results are attributable to differences in study design.

In an earlier study of routine hospital statistics we showed that for equivalent levels of admission for heart disease the number of invasive cardiological assessments in women is roughly half that which would be expected in men.[11] This was consistent with several reports from the United States which used similar methods.[16 17] Subsequently, however, others have shown that after accounting for differences in case-mix and severity, women are not disadvantaged in their access to revascularisation.[18 19] At least insofar as the duration of medical management before angiography might act as a proxy for the tendency to refer, our present results bear out this conclusion. They are also consistent with the apparently more benign course of angina in women.[20–22] In the absence of individual data on social class, we were not able to demonstrate any significant association between angina duration at angiography and the relative affluence of the area in which the patients lived. The sort of analysis used in this study is obviously susceptible to the "ecological fallacy" if it turned out that relatively well-off patients from the poor areas were the ones referred for angiography sooner. Nevertheless the method is regarded as relatively robust[23] and comparable associations between measures of material deprivation and ill-health have been shown both at area and individual levels.[14 24–26]

Table 2 Multiple regression of log $^{(\text{angina duration})}$ on clinical and demographic variables at angiography (constant 1·04).

Variable	*β*	exp *β*	95% *Confidence Intervals*	*P*
Age at onset	–0·021203	0·95	0·94 to 0·97	<0·0001
(Age at onset)^2	–0·000526	0·99	0·997 to 0·999	0·0291
Economically active*	–0·357392	0·44	0·33 to 0·58	<0·0001
Past history of infarction	0·42538	2·66	1·98 to 3·58	<0·0001
Trial of triple therapy†	0·337214	2·17	1·64 to 2·88	<0·0001
Current smoker (versus"never" or "ex" smokers)	–0·277616	0·53	0·37 to 0·74	0·0003

*Employed versus unemployed, the retired, and housewives.
†Patients who have had a trial of β blockers, nitrates, and calcium channel blockers.

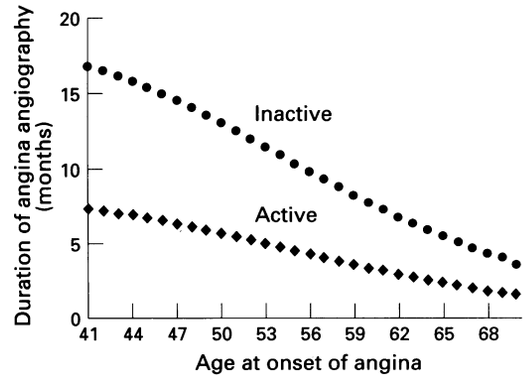

Figure 2 Values of duration of angina predicted by multiple regression. Values are fitted for non-smokers, with no previous history of myocardial infarction who have not had a trial of triple therapy.

In a study from the Lothian region in 1991, Elder *et al* reported that patients over 70 years of age at angiography (n = 134) were more likely than their younger counterparts to have been taking antiangina drugs for more than 5 years.[27] Inclusion of *current age* as an independent variable in our analysis, however, would have been invalid because it would already have been determined by age at onset and the duration of angina history. After we adjusted for age at onset of angina and various other clinical and non-clinical factors, there was no comparable relation and we cannot conclude, as did Elder *et al*,[22] that there might be evidence of agist referral pathways.[27] Several confounders could make it difficult to unravel such associations: is the perception of angina in the elderly blunter than in younger patients?[28]; do older patients have less opportunity for activities that could precipitate symptoms?

In a recent case-control study Shaukat *et al* concluded that the "referral interval" (the period between symptom onset and angiography) is associated with the patients' ethnic group.[15] Those treated medically for more than 11 months were 5·3 times more likely to be of Asian origin.[15] In their published table, however, there was apparently no adjustment made for the clinical severity of angina, for the nature of the admission (urgent versus elective), for a past history of infarction, or for treatment history. Given that for individual patients the culprit coronary artery lesion is difficult to predict, matching on the basis of the results of the angiogram may not have been entirely appropriate for a study designed to describe clinical referral strategies.[29 30] A patient with a single stenosed vessel can have more severe symptoms than those with two or more. Shaukat *et al* were advisedly cautious, however, about inferring that there was evidence of referral *bias*. Since all of our sample were of European origin we could not investigate this particular factor. Although results have not been presented, we found that in our sample the patient's religion (a shibboleth in Northern Ireland for "ethnic group") was not associated with the duration of the angina history before angiography.

The Clinical Standards Advisory report, on the basis of aggregate data for health districts (not adjusted for case mix), suggested that proximity to a regional centre was positively associated with revascularisation rates.[2] In addition, having on site catheterisation facilities is known to be associated with higher levels of angiography.[31 32] We, however, did not find a "distance decay" effect. After adjusting for the type of admission and the clinical characteristics of the patient, we found no relation between the duration of medical management before angiography and the distance between the patient's address and the regional cardiac centre. In an earlier study we found a substantial variation in angiography rates among the 26 district council areas in the province. Indeed with some 17 acute hospitals (providing general medicine or cardiology or both) and approximately twice as many referring physician/cardiologists per capita in Northern Ireland than in the rest of the United Kingdom,[33] we would not be surprised if the clinical "style" of these clinicians confounded any "distance" effect in relation. Consequently the results, in this respect, may not be directly applicable to other Regions.

Nevertheless this study does suggest that some non-clinical factors influence the duration of medical management before angiography. The fact that smokers seem to be treated medically for shorter periods before angiography is difficult to explain but may merely suggest that clinicians have responded appropriately to a disease with a different clinical course and speed of progression. A similar pattern was observed in the study by Shaukat *et al*.[15] Nevertheless, our adjustment for the potentially confounding effects of other co-morbidities may have been inadequate. In other studies, however, co-morbidity data collected from the routine medical notes provided independently useful prognostic information.[34 35]

Even after adjustment for sex and age, we found that patients who were economically inactive (housewives, the unemployed, and the retired) had been treated medically for significantly longer periods before angiographic assessment. A prospective study would be better suited to determine the true nature of this association. Employment status was assessed at the time of angiography from the medical notes and from the nursing care plan and admission slip (both of which had computer generated fields for this variable, which facilitated claims for travel expenses by relatives of the unemployed) and an assumption was made that this reflected the patient's status at angina onset. If some subjects became unemployed because of increasing symptoms after angina onset but before angiography we could have overestimated the extent to which the duration of angina was shorter among the economically active. Given the absence of any association with the clinical angina grade, however, this may be less likely. Loss of employment because of angina was not specifically noted in any of the reviewed notes or GP referral letters.

A further potential shortcoming in this study was that we focused only on a group of patients who had already been referred and were receiving angiography. It is unlikely that death before referral could bias or explain our findings, because the risk of death within two years of angina onset is only about 5%.[36] (If the distributions of angina duration were biased by selective early death then, presumably, the group with higher mortality attrition would have to be the "employed", which is counter-intuitive). On the other hand, our results are consistent with those from a recent survey of angina management by GPs in Northern Ireland in which approximately one in five said that they were more likely to refer for hospital assessment employed patients and those with dependents earlier than unemployed patients or those without dependents.[37]

In a recently reported longitudinal study, patients on low income were almost twice as likely to die within 5 years of angiography.[38] Also the number of individuals dependent on the household income was inversely related to survival.[29] The tendency to refer employed patients sooner for angiography thus seems contrary to the known risks but tends to accord with the views expressed in a survey of Canadian cardiologists and cardiac surgeons who were asked to rank the priority for revascularisation of several types of patients.[27] The mean shift in priority attributable to work status was equal to or larger than the mean shift attributable to clinical factors such as angina severity.[27] Conceivably, clinicians consider that the benefits of early revascularisation assessment could enhance the quality of more than one life if a breadwinner returns to paid employment. Doctors are known to make value judgments such as these.[39] In fact some have argued that the benefits to society should be explicitly considered and that a *Social* QALY, (SQALY) is needed to evaluate health service interventions.[40] Though this approach may have some logic, it raises the underlying question of what constitutes individual need for health care. Harris has argued that the value of life can only sensibly be taken to be that value that those alive place on their lives.[41] It may be that to maximise productivity and therefore the overall amount of social welfare available a greater store should be placed on some people's capacity to benefit from health service interventions. The scrutiny and justification of such decisions, however, cannot and must not be the preserve of doctors alone.[42]

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