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## Expanding access to coronary artery bypass surgery: who stands to gain?

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### Abstract

**Objective**—To determine the perceptions of general practitioners (GPs) about the benefits of coronary artery bypass surgery, in terms of gains in life expectancy, for different groups of patients.

**Design**—A questionnaire survey of all GPs in Northern Ireland.

**Setting**—A survey conducted collaboratively by the departments of public health medicine in each of the four health boards in the province, serving a total population of 1.5 million.

**Main outcome measures**—The median and mean gain in life expectancy perceived by groups of doctors for smoking and non-smoking male and female 55 year old patients. The percentage of 50 year old and 70 year old non-smoking patients considered likely to have their lives extended with bypass surgery. Differences were assessed using the Mann-Whitney *U* test for unpaired samples and the Wilcoxon signed rank tests for paired.

**Results**—541 GPs replied (response rate 56%). The median (and mean) perceived gain in life expectancy after cardiac surgery for non-smoking 55 year old subjects was 120 (104) months for men and 120 (112) months for women ( $z = 6.42$ ;  $P < 0.0001$ ; Wilcoxon signed rank test). For male and female smokers of the same age, the perceived gains were 48 (47) and 60 (52) months respectively ( $z = 6.72$ ;  $P < 0.0001$ ; Wilcoxon signed ranks test), both figures being significantly different than for non-smokers. The median (and mean) percentage of patients that the doctors considered would have their lives extended by bypass surgery was 70 (64) of every 100 "young" patients and 40 (42) of every 100 "old" patients, ( $z = 16.2$ ;  $P < 0.0001$ ).

**Conclusions**—These results point to a significant overestimation of the benefits of coronary artery bypass surgery by GPs in Northern Ireland and to a need to develop guidelines for referral.

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Keywords: coronary artery bypass surgery, access.

The Chief Medical Officer of Northern Ireland issued a report in October 1992 recommending increased provision of cardiac

surgery services but urged local clinicians to agree guidelines for referral for revascularisation.<sup>1</sup> He expressed the view that there may be inequity in access to these services as a result of variations in criteria for referral. This view has been reflected in a recent report from the Scottish Home and Health Department<sup>2</sup> and by the Clinical Standards Advisory Group,<sup>3</sup> which recommended further research into the "professional judgements of GPs and general physicians" about the utilisation of revascularisation services.

The province, until recently, had one of the longest waiting lists (over 1216) for cardiac surgery in the UK with by far the greatest proportion of patients waiting more than 2 years.<sup>1</sup> The CMO advocated a purchasing target for cardiac surgery but acknowledged that health authorities would wish to commission a range of services, including health promotion, to achieve target reductions in deaths from ischaemic heart disease.<sup>4</sup>

Scepticism has justifiably been expressed about the population health gain that is achievable through preventive programmes such as the detection and treatment of hypercholesterolaemia.<sup>5,6</sup> But while it sometimes appears that our surgical colleagues are foremost among the detractors of health promotion in effecting lifestyle or dietary change, there has been relatively little research on what doctors perceive to be the benefits of surgical revascularisation. Perhaps there is all the more need for such studies when there is evidence that many patients on cardiac waiting lists have treatable medical risk factors.<sup>7</sup>

To inform the wider debate about equity of access to these services, we have surveyed the opinion of general practitioners in Northern Ireland to assess what they perceive to be the benefits of revascularisation, in terms of life expectancy, for different types of patients. In particular we wanted to determine how patients' age, gender and smoking habit affected the GPs' perception of benefit from coronary artery bypass surgery.

### Methods

Family practitioner services in Northern Ireland are organised by four health and social services boards, serving a population of 1.5 million. After a pilot study, a questionnaire (available on request) was sent to all GPs providing services in the boards' areas ( $n = 960$ ). The covering letter explained that the purpose of the survey was to address some of the issues raised by the CMO's report, including the

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benefits that they perceived bypass surgery could offer their patients and various aspects of their routine management of patients with stable angina. (The latter is the subject of a separate report.)

The GPs were asked to estimate the average gain in life expectancy that they thought was offered by coronary artery bypass surgery for 55 year old men and women, for both smokers and non-smokers. They were also asked to estimate the percentage of 50 year old and 70 year old patients, on average, who might have their lives extended by the operation. For both of these questions the doctors were asked to consider that the groups had triple vessel disease but were otherwise clinically comparable.

Their responses were assessed in the light of the relative priority that the GPs considered should be accorded to these types of patients on a waiting list. As the distributions of the responses were non-normal, differences have been assessed using the Wilcoxon signed-rank test for paired and the Mann-Whitney *U* tests for unpaired samples.

### Results

Some 541 GPs replied to the survey, a response rate of 56%. Women doctors and practices with fewer patients living in deprived areas were very slightly underrepresented among the responders but the average prac-

tice size of the responders and non-responders was comparable (data not shown).

Table 1 shows the median gains in life expectancy that GPs perceived was offered by surgery for non-smoking 55 year old subjects. There were significant differences between the benefits perceived for male and female patients, both for smokers and non-smokers. The median gain in life expectancy for male patients who smoked was estimated to be 48 months and for female smokers as 60 months, ( $z = 6.72$ ;  $P < 0.0001$ ; Wilcoxon signed ranks test). Although the median of the perceived gain in life expectancy was comparable for non-smoking male and female patients (120 months), there was again a significant tendency for more doctors to rate the benefit to be greater in women ( $z = 6.42$ ;  $P < 0.0001$ ; Wilcoxon signed ranks test). This difference is better appreciated by inspection of the means: 104 months and 112 months respectively.

The doctors were asked what percentage, on average, of non-smoking patients with triple vessel disease, aged 50 years and 70 years, would be likely to have their lives extended by coronary artery bypass surgery, (table 2). The median (and mean) percentages given by the doctors was 70 (64) of each 100 "young" patients and 40 (42) of every 100 "old" patients ( $z = 16.2$ ;  $P < 0.0001$ ; Wilcoxon signed rank test).

The GPs were categorised according to the relative priority that they considered it reasonable for surgeons to assign to otherwise clinically comparable groups of patients: (i) men *v* women; (ii) non-smokers *v* smokers; and (iii) "young" *v* "old" patients (Tables 3–5).

A total of 381 doctors indicated that they would give priority for surgery to non-smokers. The median (and mean) difference between the estimated gains in life expectancy from surgery for smoking and non-smoking men was 60 (61) months for this group of doctors but 60 (51) months for the group that made no distinction on the basis of smoking habit. Although modest, this difference between the two groups of doctors is significant ( $z = 3.63$ ;  $P = 0.013$ ; Mann-Whitney *U* test).

Doctors who accorded men relative surgical priority over women and those who made no priority distinction based on gender over-rated the benefits of surgery for men and women patients. The median perceived gain in life expectancy was 120 months for both groups. However the median difference in the perceived gains in life expectancy for men and women patients was zero for each group of doctors ( $z = 0.19$ ;  $P = 0.85$ ; Mann-Whitney *U* test).

Some 507 GPs accorded higher surgical priority to "young" patients. These doctors considered that 40% (median) of 70 year old patients would have their lives extended by surgery as opposed to 70% of 50 year olds. Those who made no priority distinction on the basis of age estimated that 50% (median) of 70 year old patients and 70% (median) of 50 year olds would have their lives extended by such treatment. Doctors who accorded

Table 1 Perceived gains in life expectancy after coronary artery bypass surgery for 55 year old men and women (median (inter-quartile range))

	Perceived gain in life expectancy (months) after cardiac surgery		
	Men	Women	<i>p</i> Value*
Smoking patients†	48 (24–60)	60 (24–60)	< 0.0001
Non-smokers‡	120 (60–120)	120 (60–144)	< 0.0001

\*Wilcoxon signed rank test.

†Estimates for women were greater than those for men in 107 cases and less than for men in 32 cases, with 347 ties; missing data = 56;

‡Estimates for women were greater than those for men in 127 cases and less than for men in 48 cases, with 314 ties; missing data = 52.

Table 2 Perceptions of GPs about the percentage of young and old patients (non-smokers) likely to have their lives extended by coronary artery bypass surgery (median (interquartile range))\*

	Non-smokers likely to increase their life expectancy by cardiac surgery		
	"Young" patients	"Old" patients	<i>p</i> value†
	70 (50–80)	40 (20–60)	< 0.001

†Wilcoxon signed rank test.

\*Estimates for the "young" were greater than those for the "old" in 379 cases, less than those for the "old" in 16 cases, with 91 ties; missing data = 55.

Table 3 Perceived gains in life expectancy for 55 year old male patients according to prioritisation of non-smoking by doctors (median (interquartile range))

	Perceived gain in life expectancy (months) after cardiac surgery		
	Doctors according priority to non-smokers ( <i>n</i> = 381)	Other doctors ( <i>n</i> = 138)	<i>p</i> value*
(i) Smoking patients	36 (24–60)	60 (30–60)	0.0003
(ii) Non-smokers	120 (60–120)	120 (60–120)	0.74
(ii) minus (i)	60 (36–84)	60 (24–60)	0.013

\* Mann-Whitney *v* test for unpaired samples. All tests have been corrected for ties.

Table 4 Perceived gains in life expectancy (months) for 55 year old non-smoking patients according to prioritisation of men by doctors (median (interquartile range))\*

	Perceived gain in life expectancy (months) after cardiac surgery		
	Doctors according to priority to men (n = 63)	Other doctors (n = 460)	p value†
(i) Male patients	120 (78–129)	120 (60–120)	0.08
(ii) Female patients	120 (93–180)	120 (60–144)	0.22
(i) minus (ii)	0 (0–24)	0 (0–2.8)	0.85

\*Some doctors omitted this question

†Mann-Whitney *v* test for unpaired samples. All tests have been corrected for ties.

Table 5 Perceptions of GPs about the percentages of young and old non-smoking patients likely to have their lives extended by surgery, according to the doctor's prioritisation criteria (median % (interquartile range))

	Perceived gain in life expectancy (months) after cardiac surgery		
	Doctors according to priority to young patients (n = 507)	Other doctors (n = 19)	p value*
"Young patients"	70 (50–80)	70 (37.5–82.5)	0.62
"Old" patients	40 (20–60)	50 (25–75)	0.17
(i) minus (ii)	20 (10–35)	10 (0–22.5)	0.006

\*Mann-Whitney *v* test for unpaired samples. All tests have been corrected for ties.

younger patients priority for surgery perceived that more of them (rather than older patients) were likely to benefit by having their lives extended ( $z = 2.77$ ;  $P = 0.006$ , Mann-Whitney *U* test).

## Discussion

Overall, these results suggest that the perceived benefits of coronary artery bypass surgery are significantly overestimated by general practitioners in Northern Ireland. This study has attempted only to describe the perceptions of benefit in terms of gains in life expectancy. Clearly revascularisation can dramatically improve the quality of life for many patients but, arguably, one of the greatest concerns of patients on waiting lists (and of their GPs) is that they might die before the operation.<sup>8</sup> If this had not been the case the CMO's report might not have received such wide publicity and debate in the local press. Consequently we chose to focus the study on the perceived capacity of surgery to extend life.

In a seminal paper by Wong *et al.*,<sup>9</sup> the results of the Coronary Artery Surgery Study (CASS),<sup>10</sup> the European Coronary Surgery Study (ECSS)<sup>11</sup> and the Veterans' Administration Co-operative Study (VACS)<sup>12</sup> were summarised to estimate the average gain in life expectancy observed when subjects with chronic stable angina were randomised to receive bypass surgery rather than medical treatment. Thus, based on the results of the major trials, 55 year old patients with triple vessel disease undergoing surgery could gain, on average, between 6 and 12 months of life expectancy if they had severe angina and impaired left ventricular function, while lesser gains would be anticipated for those with only mild angina and normal left ventricular function. (Adjustment for quality of life made

comparatively little difference to the result.) By contrast, in the long term follow up of all patients randomised in the CASS trial, mortality rates in the surgically and medically treated groups were 18% and 21% respectively, implying that, over 10 years, the deaths of three of every 100 patients (who might be clinically comparable to those in the trial) would have been prevented by surgery.<sup>8</sup> The equivalent long term results are six per 100 for the ECSS trial<sup>9</sup> and three per 100 for the VACS.<sup>10</sup>

Admittedly these figures average out the early and late risk reduction and for some patients the hazards of death are greater in the earlier rather than the later follow up period. (Nevertheless they are of comparable magnitude despite a variation in the long term baseline risk in the medically treated trial cohorts of 40% (VACS), 30% (ECSS) and 18% (CASS) respectively.) It is difficult to assess what the actual magnitude of the benefit would be today as both medical and surgical therapy for angina have improved substantially in the past 20 years. Although surgical revascularisation is widely considered to be cost-effective for patients with left main stem or triple vessel disease, programmes of cardiac rehabilitation (which in relative terms are nationally underresourced) have made claim to comparable economic justification,<sup>13</sup> underscoring the value judgements that often underlie investment decisions.

One of the reasons why the benefits of surgery may have been overestimated may be that trial results seldom make their impact in terms of the absolute reduction in death rates<sup>14–16</sup> and doctors perceive rather less frequently the numbers needed to be treated to prevent one death. Indeed a recent study demonstrated that clinicians were more inclined to offer new treatment when trial results were presented in terms of relative rather than absolute benefit.<sup>17</sup> The present study, which focused on average life expectancy, forced the respondents to estimate the experience of a treated group as a whole.

As expected, doctors anticipated that the gains in life expectancy would be less in smokers. There is some evidence that smoking accelerates graft occlusion<sup>18,19</sup> and that the benefits of surgery in this group are smaller.<sup>20</sup> What evidence there is has generally not come from primary analyses of the original randomised controlled trials. Indeed assessment of the benefit directly attributable to surgical treatment can be partially confounded by the fact that smoking cessation rates are generally higher among patients treated surgically.<sup>21,22</sup>

It might have been expected that GPs who accorded patients who smoke a lower priority differed from other doctors because they considered the benefits conferred by surgery to be less for smokers than for non-smokers. Although this was the case, the actual difference was modest (at least in terms of life expectancy). A fuller explanation for the stated propensity to accord non-smokers a

higher priority may lie elsewhere<sup>23 24</sup> and merits further study.

A majority of doctors believed that 70 year old subjects had substantially less chance of having their life extended by surgery than younger patients with otherwise comparable triple vessel disease. This was the case irrespective of whether or not they would have afforded younger patients priority for revascularisation. There is little evidence that older subjects are less likely to benefit than younger subjects<sup>25</sup> and in fact in the ECSS trial older subjects did better.<sup>9</sup> While predicting an individual's risk of death or infarction on the basis of angiographic results is difficult,<sup>26</sup> the absolute risks of adverse events in older subjects are generally higher and one wonders if these responses reflect a form of ageism.<sup>27</sup> It has been convincingly argued, however, that the chronological age of a patient is an inadequate criterion on which to base decisions regarding medical care.<sup>28 29</sup>

Although about 12% of doctors would have accorded men a higher priority for surgery than women, both this group and those who made no distinction based on gender estimated the gains in life expectancy to be greater for women. In fact, while women are considered to experience higher operative risks,<sup>7</sup> there is also some evidence of systematic differences between male and female patients in referral for surgery.<sup>30</sup> It is not known whether this reflects bias or can be accounted for by differences in the clinical presentation and spectrum of disease in women.<sup>31</sup> Certainly, both male and female doctors in our sample overestimated the gains in life expectancy attainable with surgery and we can only speculate on the other factors that may have been taken into account by the GPs who gave men higher priority; some 85% of these doctors were men.

In summary our results point to a significant overestimation of the benefits of coronary artery bypass surgery by GPs in Northern Ireland. We qualify this with two principal caveats. First, our response rate was only 56%; however, this was twice the response rate of a recent national survey of GP referrals for angiography<sup>32</sup> and we consider it unlikely that non-responders would have been better informed about the average benefits offered by surgery. Second, in this study at least, we have not actually measured the referral rates of GPs. By contrast, we have previously documented substantial area variation in coronary angiography rates for different parts of the province.<sup>33 34</sup> It is unlikely that variation among GPs in the perceptions of benefit from revascularisation accounts for the majority of the variation in angiography rates throughout Northern Ireland and it would be useful to assess the perceptions of hospital physicians in this regard. Indeed, the CMO's report found that the number of angiograms performed in the province in 1991 (3087 for a total population of 1.5 million) was twice that which would be predicted on the basis of a recently devised "population needs" algorithm.<sup>35</sup> Although death rates from heart dis-

ease are higher in Northern Ireland than in the rest of the UK, the prevalence of angina is comparable.<sup>36</sup>

In the past year the occasional public debate in the province (and probably in other regions) about cardiac surgery has too often focused on the risks of death while on the waiting list.<sup>37</sup> But not every such death represents one that would be prevented by surgery. It must be remembered that waiting lists are now the ultimate responsibility of the purchaser and coronary artery bypass procedures are included in the budget of GP fundholders. Therefore, in view of our results concerning the effects of gender, smoking habit and age on the perceptions of benefit and priority, perhaps it is time to look closely at which sorts of patients will reap the benefits of expanding the service. The results of this study are now being used to inform the discussions of the Regional Clinical Resource Efficiency Support Team<sup>38</sup> which will advise on the development of local referral criteria.

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