Implications of Attendance Patterns in Northern Ireland for abdominal aortic aneurysm screening

Badger, S. A., Jones, C., Murray, A., Lau, L. L., & Young, I. (2011). Implications of Attendance Patterns in Northern Ireland for abdominal aortic aneurysm screening. European Journal of Vascular Endovascular Surgery, 42(4), 434-439. DOI: 10.1016/j.ejvs.2011.03.022

Published in:
European Journal of Vascular Endovascular Surgery

Eur J Vasc Endovasc Surg (2011) **42**, 434–439

Implications of Attendance Patterns in Northern Ireland for Abdominal Aortic Aneurysm Screening

S.A. Badger [a,*], C. Jones [a], A. Murray [b], L.L. Lau [a], I.S. Young [c]

[a] *Vascular and Endovascular Surgery Department, Belfast City Hospital, Lisburn Road, Belfast BT9 7AB, United Kingdom*
[b] *N.I. Clinical Research Support Centre, The Royal Victoria Hospital, Belfast, United Kingdom*
[c] *Centre for Public Health, Queens University Belfast, United Kingdom*

Submitted 10 December 2010; accepted 12 March 2011
Available online 20 April 2011

KEYWORDS
Abdominal aortic aneurysm;
Screening

Abstract *Introduction:* Evidence supports the introduction of an abdominal aortic aneurysm (AAA) screening programme. The aims of this study were to estimate future disease patterns and to determine the effect of the proportion attending on the programme's cost-effectiveness.
Patients and methods: The results of the local AAA screening programme were reviewed. Ultrasonic infrarenal aortic diameter of 30 mm was considered aneurysmal. Projected population numbers from the Department of Health and current disease prevalence were used to estimate future number of potential patients. The Multi-centre Aneurysm Screening Study (MASS) Markov model was used to calculate an incremental cost-effectiveness ratio (ICER) and 95% uncertainty intervals (UI), using a 30-year time horizon and 3.5% per annum discount, to determine the effect of attendance.
Results: Men were recruited from August 2004 to May 2010. 13316 were invited for a scan and 5931 (44.5%) attended. 321 AAA were diagnosed, giving a prevalence of 5.4%, while 27 large AAA (0.46%) were repaired. The annual incidence of AAA until 2021 will range from 441 to 526, with an incidence of 40–48 large AAA, with both showing a gradual increase with time. Using this attendance rate, the ICER was calculated at £2350 per life-year gained (95% UI: £1620–£4290), or £3020 per quality-adjusted life-year gained (95% UI: £2080–£5500).
Conclusions: The prevalence of disease in this local AAA screening was similar to other studies. The low attendance will result in many AAA being missed, but will not impact greatly on the long-term cost-effectiveness.

* Corresponding author. Tel.: +44 28 90263494; fax: +44 28 90263951.
E-mail address: stephenbadger@btinternet.com (S.A. Badger).

1078-5884/$36
doi:10.1016/j.ejvs.2011.03.022

Introduction

Abdominal aortic aneurysm (AAA) is a dilatation of the aorta, with an estimated prevalence of 5% in males aged between 65 and 79 years.[1] The risk of mortality following rupture is high and accounts for 2.1% of all deaths in men aged 65 years and over in England and Wales.[2] The number of patients diagnosed in the United Kingdom with AAA, has increased, with similar trends reported in other countries.[3–9] This is a real age-adjusted increase in incidence, despite more elective AAA repairs being performed, thus providing the impetus for AAA screening.[3,4,6,10] The concept of AAA screening fulfils all the relevant criteria as stimulated by the United Kingdom National Screening Committee and the World Health Organisation.[11,12]

The National Health Service (NHS) AAA Screening Programme was introduced in England in March 2009 and has cost £5,335,809 up to the end of March 2010.[13] For the programme to be considered 'good value for money' (i.e. cost-effective) it must also be effective in reducing the mortality and morbidity associated with AAA. However, both the effectiveness, as measured by survival free from mortality related to AAA within the timeframe, and cost-effectiveness of a screening programme is dependent on a number of variables, including a high attendance rate.[14] A number of randomised controlled trials have provided evidence for screening effectiveness.[15–18] Kim and colleagues arguably provide the most robust evidence to date that the cost-effectiveness of AAA screening improves dramatically over time.[15,19] They constructed a Markov model with a 30-year (or until death) time horizon based on the screening strategy and patient-level data from the Multi-centre Aneurysm Screening Study (MASS). Both AAA related and non-AAA mortality were incorporated into the MASS model, using the UK national mortality statistics. However, the MASS trial achieved a high attendance rate of 80%, which formed a key parameter in the model. This level of uptake is in stark contrast to the 45% attendance observed in Northern Ireland.[20,21] This is disconcerting, considering that the attendance rate in Northern Ireland was also observed to vary with geographical location, with a lower rate found in more socially deprived areas, where prevalence of the disease is higher and a higher risk factor profile is to be found.[20]

The national screening programme is envisaged to be implemented in Northern Ireland by March 2011. Prior to this it is imperative that the impact of low attendance on the cost-effectiveness of the screening be established and potential barriers to uptake be explored. A number of limitations were outlined in the initial study, where a low attendance rate (45%) among invited men was encountered, much lower than that acceptable for a national screening programme.[21] One significant disconcerting feature to participants was that the screening programme was being run as research and vulnerability to possible unstated implications of research was confessed by many non-attendees. Therefore, the local programme was formalised into an official hospital screening programme.

The cost-effectiveness of AAA screening has been shown to be very favourable. The MASS results reported cost-effectiveness at 4 years to be £28,400 per life-year gained, equivalent to £36,000 per quality-adjusted life-year gained (QALY), thus on the borderline of acceptability, according to current National Institute for Health and Clinical Excellence (NICE) thresholds.[22,23] Since costs are accrued in the early years, the cost-effectiveness of AAA screening should improve with time. Indeed it has been observed that the actual 7 and 10 year cost-effectiveness calculations have been reported, with the latter giving an incremental cost-effectiveness ratio (ICER) of £7600 per life-year gained.[24,25] Furthermore, when the results are extrapolated to 30 years, this falls further to £2320 per life-year gained.[19]

The aim of this study was, therefore, to investigate the effect of the attendance at AAA screening on projected future disease detection and management and the long-term cost-effectiveness of such a programme.

Patients and Methods

Patient selection and screening

The methodology and patient selection of the Northern Ireland screening study have been previously outlined in detail.[20,21] In summary General Practioners (GPs) were asked to provide a list of males aged 65—75 years in their practices. Patients who had previous AAA repair or already diagnosed were excluded, as well as those who were considered unsuitable for any surgical interventions, due to medical co-morbidities.

All received a postal invitation to participate in the AAA screening programme, accompanied with an information sheet on the condition. After consent was obtained an ultrasound scan of the abdominal aorta was performed. The diagnostic threshold for AAA was 30 mm infrarenal diameter. The patients were scanned in the supine position and the aorta visualised longitudinally. If aneurysmal, the aorta was measured transversely, with the maximum diameter from outside wall to outside wall recorded. Subsequently, appropriate follow-up or repair was arranged. Those who had a normal (<30 mm) scan were discharged.

Projection of disease prevalence

As it was deemed to be service provision review, ethical approval was not required. Population projections were obtained from the Northern Ireland Statistics and Research Agency website.[26] The projected numbers of men aged 65 years each year until 2021 was obtained. Based upon the calculated prevalence from the screening programme, the total number of AAA in the present population was calculated. In addition, the projected number of aneurysms likely to be detected by a national screening programme in men at the age of 65 years was estimated.

Cost-effectiveness calculations

The Markov model based on the MASS trial was used to investigate the potential impact of the lower attendance on the 30-year cost-effectiveness of AAA screening. The full details of the model's structure, assumptions and parameters are published elsewhere.[22] In brief, men would be invited for a one-off screen at 65 years, with no re-screening for negative results. After diagnosis, small AAA

patients would receive an annual ultrasound scan, with medium sized AAA three-monthly. When the AAA reached 55 mm referral for surgical consideration was made.

The time horizon was 30 years with the principal outcomes being costs and life-years accrued with or without screening. Both these parameters were discounted at a rate of 3.5% per annum. Life-years were adjusted for health-related quality of life using the age-specific population norms for the EQ-5D to calculate QALYs.[27] The impact of uncertainty in the parameter estimates used in the model on the cost-effectiveness of screening was explored by simultaneously varying these values according to their uncertainty distributions.[15] Monte Carlo probabilistic sensitivity analysis (PSA) was used to make 1000 independent draws of new parameter values from each of the uncertainty distributions resulting in different costs and effects for each strategy. Thus an incremental cost-effectiveness (ICER) was calculated and presented with 95% uncertainty intervals (UI) derived from the PSA simulations.

Results

Patient recruitment

During the period August 2004 to July 2006 the screening was performed as a research project. The data from August 2006 to May 2010, representing the official hospital screening programme, was included for analysis. During the first phase 15 GP practices in Belfast, 1 in Saintfield and 7 in Lisburn each supplied a list of men in the designated age group. During the second phase, 112 GP practices in Belfast were invited to supply patient details, but only 72 (64.3%) replied.

Attendance and disease prevalence

During the first phase of the screening programme, 3652 men were invited, of which 1659 (45.4%) attended for a scan. A total of 92 (5.5%) were diagnosed with AAA, with 11 having a diameter greater than 55 mm, which is the threshold for surgery. This was 12% of the AAA total and 0.7% of the screened cohort.

During the second phase of the programme, 9664 were invited, of which 4127 (42.7%) attended for scanning. A total of 229 (5.5%) were diagnosed with AAA, with 16 having a diameter greater than 55 mm. This was 7.0% of the AAA total and 0.39% of the screened cohort.

Overall 13316 were invited, 5931 scanned. Attendance was 44.5% and disease prevalence 5.4%, with the large AAA constituting 8.4% of the AAA total, or 0.46% of the screened cohort.

Projected aneurysm numbers

The present population size of Northern Ireland men is shown in Table 1, with the corresponding proportion aged 65 years. Using the 5.4% overall AAA prevalence and 0.46% of large AAA, the corresponding number of aneurysms was calculated for every year until 2021. These figures do not take in account any screening programme or repairs that may be performed in the future. The annual incidence of new large AAA that would be detected by a national screening programme was calculated (Table 1). This does not account for the medium sized aneurysms that would grow after detection to a size that would require surgical repair.

The low attendance rates encountered in this study will have a detrimental effect on the screening programme. The impact of the low attendance on the number of large AAA missed that would not be diagnosed, with potential to rupture are outlined in Table 2. The effect of the attendance rates on the pickup of small AAA, which may continue to grow towards the surgical threshold, is shown in Table 3.

Cost-effectiveness

The Markov model based on the MASS trial was used to investigate the potential impact of the lower attendance observed in Northern Ireland (44.5%) on the 30-year cost-effectiveness of AAA screening. All other modelling assumptions and parameters were retained form the original MASS based model. This was found to be £2350 per life-year gained (95% UI: £1620—£4290), where the incremental costs are £33.22 and the life-years gained are 0.0141 years. After adjusting life-years for age-specific health-related

Table 1 Projected total number of AAA in men in Northern Ireland.

Year	All ages	65 years old	AAA at 5.4%	Large AAA at 0.46%
2008	869,817	8,211	443	40
2009	877,015	8,402	454	41
2010	883,838	8,159	441	40
2011	890,460	8,295	448	41
2012	896,824	8,858	478	43
2013	902,855	8,679	469	43
2014	908,857	8,663	468	42
2015	914,857	8,696	469	43
2016	920,817	8,769	474	43
2017	926,718	8,758	473	43
2018	932,514	9,030	488	44
2019	938,169	9,296	502	46
2020	943,644	9,435	509	46
2021	948,914	9,738	526	48

Table 2 Projected number of AAA detected according to attendance rates.

Year	100%	80%	60%	50%	40%
2008	443	355	266	222	177
2009	454	363	272	227	181
2010	441	353	264	220	176
2011	448	358	269	224	179
2012	478	383	287	239	191
2013	469	375	281	234	187
2014	468	374	281	234	187
2015	469	376	281	235	188
2016	474	379	294	237	189
2017	473	378	284	236	189
2018	488	390	292	244	195
2019	502	402	301	251	201
2020	509	408	306	255	204
2021	526	421	316	263	210

quality of life, the potential results were £3020 per QALY gained (95% UI: £2080—£5500), where the incremental costs were £33.22 and QALYs gained were 0.0110.

Discussion

Clear evidence has been provided by four randomised controlled trials for AAA screening to be implemented.[15—18] In Northern Ireland, the success of such screening has been assessed by research with surprising results.[20,21] Although the increase in prevalence in high-risk patients was expected, the lack of influence of a family history was not. In addition, while prevalence was similar to the rest of the literature, the initial study demonstrated a distinct problem of attendance, with only approximately 45% of men willing to attend. Attendance, like prevalence, varied with the degree of social deprivation, but maximal attendance only reached 55%.[20] This present study provided an opportunity to discover if attendance was influenced by the description in patient related literature that the screening programme was research. There was in fact a decrease in attendance, indicating that the reason for failure to come may have been either a deep-seated apathy towards preventative medicine or an ignorance of both the disease and its potential lethal outcome. This was even after the patient information sheet had been provided. In addition, a fear of being given bad news in a new diagnosis, may have contributed towards their rationale and this lack of attendance has similarly been seen in other screening programmes in Northern Ireland, such as breast and cervical cancer.[28]

Table 3 Projected number of large AAA detected according to attendance rates.

Year	100%	80%	60%	50%	40%
2008	40	32	24	20	16
2009	41	33	25	21	16
2010	40	32	24	20	16
2011	41	33	24	20	16
2012	43	35	26	22	17
2013	43	34	26	21	17
2014	42	34	25	21	17
2015	43	34	26	21	17
2016	43	34	26	21	17
2017	43	34	26	21	17
2018	44	35	27	22	17
2019	46	36	27	23	18
2020	46	37	28	23	18
2021	48	38	29	24	19

Another problem encountered in the study was a lack of willing input from primary care physicians. While we were very thankful for the help that was provided, and acknowledge their busy schedule, it proved surprising how some doctors were slow to respond, rather than seizing this as an opportunity to enhance the health care provision. However, this pilot study has highlighted areas where closer co-operation and alternative organisation could provide and better future service. This was interlinked with another problem, in that screening participants expressed a desire to attend for a scan in a more convenient location, such as their GP's health centre. The centralised location, although convenient for the screeners, was more daunting for participants, particularly if they felt well and had no loyalty or affiliation with the hospital, unlike their GP.

The low attendance will pose a significant problem for the official AAA screening programme and must be urgently addressed, otherwise it will negate some of the benefit that it is designed to provide in ruptured AAA prevention. A high level of attendance is required to make the programme effective. The advantage of decreasing the rate of death from ruptured AAA will be lost, even after the ten years required to notice this. There will therefore, be an increase in elective follow-up of small AAA and elective surgery for the large AAA, with possibly no meaningful compensatory decrease in rupture presentation, surgery and the high-cost post-operative care and follow-up.

The present study has some weaknesses. The use of prevalence in the group aged 65—75 years to calculate future incidence is likely to overestimate patient numbers. The other factor that could exacerbate this problem is the recent suggestions that AAA disease is declining in prevalence. In addition, the projection of data based upon 45% of the population may result in inaccuracies, as this proportion may not reflect the overall population disease patterns.

The MASS trial provided evidence in support of the cost-effectiveness of AAA screening. This is not without controversy, as other large studies conclude otherwise.[29] It is also dependent on the selection of an appropriate target population, clinical setting and with a long-term perspective, but attendance rates may not be as crucial as expected.[30—32] However a recent meta-analysis of 8 cost-effectiveness studies concluded that it would probably gain additional life years and quality of life at acceptable extra costs.[33] The majority of studies have concentrated on the short-term cost-effectiveness of AAA screening. They are also weakened by a number of optimistic assumptions, which have been avoided in the use of the present model.[15,34] While the low attendance in Northern Ireland is concerning, it is encouraging that the long-term cost-effectiveness of AAA screening is highly attractive. The ICERs are comparable with the MASS trial, which had 80% attendance. The highly favourable results are due to the low attendance leading to substantially reduced

costs in the screening arm and hence reduced incremental costs, in addition to a reduction of the life-years gained.

Although the results of this study are particularly important in the local context, they are likely to reflect potential problems elsewhere in the UK. Therefore, on reflection of these data, the present authors would put forth some recommendations, so that the national AAA screening programme success is not jeopardised. Firstly, a greater effort must be made by all medical personnel, in both primary and secondary health care to promote prophylactic health measures, such as AAA screening. This is particularly pertinent for the GP, who naturally has a better rapport with these men. Secondly, disease education will prove crucial. This could be achieved as advertisements in local and national media, as well as direct mailing of the target individuals. Thirdly, the screening and education could be integrated into the context of general health promotion and detection and in particular as part of an overall cardiovascular health promotion service. This holistic approach would achieve much more, since the modification of similar risk factors would treat several disease processes concurrently. Fourthly, the location of the Northern Ireland and national AAA screening service needs careful consideration. While central coordination is essential, men are reluctant to travel long distance for screening, as demonstrated before and in this study.[20] This could be achieved by either a mobile unit, or the utilisation of local health centres.

Future research should concentrate on the reasons for non-attendance and to assess if the recommendations above are accurate and effective. Qualitative research, through questionnaires and focus groups may help to elucidate the rationale behind a lack of attendance that makes it stand in marked contrast to other AAA screening programmes. A similar approach with GPs would highlight their concerns and ensure fuller co-operation, as the success of the national programme requires complete participation of the multidisciplinary team.

In conclusion, AAA screening has proven its importance by detection of undiagnosed disease. However, the low rates of attendance consistently encountered over the past 4 years, may endanger the overall success of the screening programme, but it will remain cost-effective.

Acknowledgements

The project concept was originally conceived by the late Prof Chee Soong, whose further input and valuable guidance the authors sadly miss.

The authors would like to thanks Dr Lois Kim, of the London School of Epidemiology and Population Health, in her help in the calculation of cost-effectiveness, using the MASS Markov model.

Conflict of Interest

None.

Funding

None.

References

1 Vardulaki KA, Prevost TC, Walker NM, Day NE, Wilmink AB, Quick CR, et al. Incidence among men of asymptomatic abdominal aortic aneurysms: estimates from 500 screen detected cases. *J Med Screen* 1999;**6**:50–4.
2 *UK National Screening Committee annual report, April 2008–March 2009*. UK NSC; July 2010.
3 Fowkes FG, MacIntyre CC, Ruckley CV. Increasing incidence of aortic aneurysms in England and Wales. *Br Med J* 1989;**298**:33–5.
4 Samy AK, MacBain G. Abdominal aortic aneurysm: ten years' hospital population study in the city of Glasgow. *Eur J Vasc Surg* 1993;**7**:561–6.
5 Bickerstaff LK, Hollier LH, Van Peenen HJ, Melton 3rd LJ, Pairoero PC, Cherry KJ. Abdominal aortic aneurysms. The changing natural history. *J Vasc Surg* 1984;**1**:6–12.
6 Norman PE, Castleden WM, Hockey RL. Prevalence of abdominal aortic aneurysm in Western Australia. *Br J Surg* 1991;**78**:1118–21.
7 Pleumeekers HJ, Hoes AW, van der Does E, van Urk H, Grobbee DE. Epidemiology of abdominal aortic aneurysms. *Eur J Vasc Surg* 1994;**8**:119–28.
8 Van Wairaven C, Wong J, Morant K, Jennings A, Jetty P, Forster AJ. Incidence, follow-up and outcomes of incidental abdominal aortic aneurysms. *J Vasc Surg* 2010;**52**:282–9.
9 Dillavou ED, Muluk SC, Makaroun MS. A decade of change in abdominal aortic aneurysm repair in the United States: have we improved outcomes equally between men and women? *J Vasc Surg* 2006;**43**:230–8.
10 Castleden WM, Mercer JC. Abdominal aortic aneurysms in Western Australia: descriptive epidemiology and patterns of rupture. *Br J Surg* 1985;**72**:109–12.
11 Wilson JM, Jungner YG. Principles and practice of mass screening for disease. Public health paper. *Bol Ofcina Sani Panam* 1968;**65**:281–393.
12 United Kingdom National Screening Committee. *Second report of the National Screening Committee*, 2000. Department of Health, London, England. Available at: http://www.nsc.nhs.uk [accessed 26.11.07].
13 http://www.publications.parliament.uk/pa/cm200910/cmhansrd/cm100304/text/100304w0019.htm [accessed November 2010].
14 Jepson R, Clegg A, Forbes C, Lewis R, Sowden A, Klejinen K. The determinants of screening uptake and interventions for increasing uptake: a systematic review. *Health Technol Assess* 2000;**4**:1–133.
15 Kim LG, Thompson SG, Briggs AH, Buxton MJ, Campbell HE. How cost-effective is screening for abdominal aortic aneurysms? *J Med Screen* 2007;**14**:46–52.
16 Scott RA, Wilson NM, Ashton HA, Kay DN. Influence of screening on the incidence of ruptured abdominal aortic aneurysm: 5-year results of a randomized controlled study. *Br J Surg* 1995;**82**:1066–70.
17 Lindholt JS, Juul S, Fasting H, Henneberg EW. Hospital costs and benefits of screening for abdominal aortic aneurysms. Results from a randomised population screening trial. *Eur J Vasc Endovasc Surg* 2002;**23**:55–60.
18 Jamrozik K, Norman PE, Spencer CA, Parsons RW, Tuohy R, Lawrence-Brown MM, Dickinson JA. Screening for abdominal aortic aneurysm: lessons from a population-based study. *Med J Aust* 2000;**173**:345–50.
19 Ashton HA, Buxton MJ, Day NE, Kim LG, Marteau TM, Scott RA, et al. Multicentre Aneurysm Screening Study Group. The Multicentre Aneurysm Screening Study (MASS) into the effect of abdominal aortic aneurysm screening on mortality in men: a randomised controlled trial. *Lancet* 2002;**360**:1531–9.

20 Badger SA, O'Donnell ME, Sharif MA, Boyd CS, Soong CV. The risk factors of abdominal aortic aneurysm and the influence of social deprivation. *Angiology* 2008;**59**:559–66.
21 Badger SA, O'Donnell ME, Sharif MA, Boyd CS, Soong CV. Advantages and pitfalls of abdominal aortic aneurysm screening in high-risk patients. *Vascular* 2008;**16**:201–6.
22 Multi-centre Aneurysm Screening Study Group. Multicentre aneurysm screening study (MASS): cost-effectiveness analysis of screening for abdominal aortic aneurysms based on four year results from randomised controlled trial. *Br Med J* 2002;**325**: 1135–8.
23 National Institute for Health and Clinical Excellence. *Social value judgements: principles for the development of NICE guidance*. 2nd ed., www.nice.org.uk/media/C18/30/SVJ2PUBLICATION2008.pdf; 2008 [accessed November 2010].
24 Kim LG, Scott RAP, Ashton HA, Thompson SG. A sustained mortality benefit from screening for abdominal aortic aneurysm. *Ann Intern Med* 2007;**146**:699–706.
25 Thompson SG, Ashton HA, Goa L, Scott RA, Multicentre Aneurysm Screening Study Group. Screening men for abdominal aortic aneurysm: 10 year mortality and cost effectiveness results from the randomised Multicentre Aneurysm Screening Study. *Br Med J* 2009;**338**:b2307.
26 Northern Ireland Statistics and Research Agency website. http://www.nisra.gov.uk [accessed November 2010].
27 Rabin R, de Charro F. EQ-5D: a measure of health status from the EuroQol Group. *Ann Med* 2001;**33**:337–43.
28 http://www.wrda.net/breast-and-cervical-screening-awareness.php [accessed November 2010].
29 Ehlers L, Overvad K, Sorensen J, Christensen S, Bech M, Kjolby M. Analysis of cost effectiveness of screening Danish men aged 65 for abdominal aortic aneurysm. *Br Med J* 2009;**338**: b2243.
30 Wanhainen A, Lundkvist J, Bergqvist D, Bjorck M. Cost-effectiveness of different screening strategies for abdominal aortic aneurysm. *J Vasc Surg* 2005;**41**:741–51.
31 Mani K, Alund M, Bjorck M, Lundkvist J, Wanhainen A. Screening for abdominal aortic aneurysm among patients referred to the vascular laboratory is cost-effective. *Eur J Vasc Endovasc Surg* 2010;**39**:208–16.
32 Wanhainen A, Lundkvist J, Bergqvist D, Bjorck M. Cost-effectiveness of screening women for abdominal aortic aneurysm. *J Vasc Surg* 2006;**43**:908–14.
33 Schmidt T, Muhlberger N, Chemelli-Steingruber IE, Strasak A, Kofler B, Chemelli A, et al. Benefit, risks and cost-effectiveness of screening for abdominal aortic aneurysm. *Rofo* 2010;**182**: 573–80.
34 Ehlers L, Sorensen J, Jensen LG, Bech M, Kjolby M. Is population screening for abdominal aortic aneurysm cost-effective? *BMC Cardiovasc Disord* 2008;**8**:32.