

# BMJ Open Do you recommend cancer screening to your patients? A cross-sectional study of Norwegian doctors

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## ABSTRACT

**Objective** Guidelines for cancer screening have been debated and are followed to varying degrees. We wanted to study whether and why doctors recommend disease-specific cancer screening to their patients.

**Design** Our cross-sectional survey used a postal questionnaire. The data were examined with descriptive methods and binary logistic regression.

**Setting** We surveyed doctors working in all health services.

**Participants** Our participants comprised a representative sample of Norwegian doctors in 2014/2015.

**Primary and secondary outcome measures** The primary outcome is whether doctors reported recommending their patients get screening for cancers of the breast, colorectum, lung, prostate, cervix and ovaries. We examined doctors' characteristics predicting adherence to the guidelines, including gender, age, and work in specialist or general practice. The secondary outcomes are reasons given for recommending or not recommending screening for breast and prostate cancer. **Results** Our response rate was 75% (1158 of 1545). 94% recommended screening for cervical cancer, 89% for breast cancer (both established as national programmes), 42% for colorectal cancer (upcoming national programme), 41% for prostate cancer, 21% for ovarian cancer and 17% for lung cancer (not recommended by health authorities). General practitioners (GPs) adhered to guidelines more than other doctors. Early detection was the most frequent reason for recommending screening; false positives and needless intervention were the most frequent reasons for not recommending it.

**Conclusions** A large majority of doctors claimed that they recommended cancer screening in accordance with national guidelines. Among doctors recommending screening contrary to the guidelines, GPs did so to a lesser degree than other specialties. Different expectations of doctors' roles could be a possible explanation for the variations in practice and justifications. The effectiveness of governing instruments, such as guidelines, incentives or reporting measures, can depend on which professional role(s) a doctor is loyal to, and policymakers should be aware of these different roles in clinical governance.

## BACKGROUND

Many cancer screening programmes are controversial. Disagreements are related to the likely harms and benefits and whether

## Strengths and limitations of this study

- The study has a high response rate.
- The sample's characteristics can be compared with the population of doctors.
- Important sample characteristics are representative of the population.
- Self-reports do not necessarily reflect the actual recommendations.
- Using a multiple choice question format to identify concerns with cancer screening recommendations may have restricted the answer options, whereas open questions might have revealed a wider range of concerns.

the cost-effect ratio justifies the implementation of such programmes. Screening is particularly controversial for population groups at low risk of cancer. For example, a 20% relative risk reduction in cancer mortality translates into a negligible benefit if the baseline risk is very low (eg, from 1.0% to 0.8%). Opposing views are often rooted in different interpretations of the available evidence but may also result from differences in values, for example, in the trade-off between positive and negative outcomes. Norway is no exception: here, as in many other countries, there have been heated disputes, especially concerning programmes for breast cancer screening.<sup>1-5</sup>

There is fair-quality evidence that mammography reduces the relative risk of breast cancer mortality in the order of 10%–30%.<sup>6</sup> Sigmoidoscopy or faecal occult blood tests for colorectal cancer screening yield similar results.<sup>7</sup> A systematic review assessing the effectiveness of cervical cancer screening (cytology or human papillomavirus-DNA from a cervical swab) found one large randomised trial in addition to several observational studies.<sup>8</sup> Based on the trial findings, the review authors concluded that there is moderate-quality evidence that screening leads to a 35% (10%–53%) relative reduction of cervical cancer mortality.

Trials of prostate-specific antigen (PSA) tests for early detection of prostate cancer have shown mixed results.<sup>9</sup> Biopsy complications and harms from treatment add to the uncertainty about the net benefit of screening for prostate cancer. Low-dose CT probably reduces lung cancer mortality by 19% (95% CI 9% to 28%), but false positive findings are common, making it unclear whether the benefits of screening outweigh the harms.<sup>10</sup> There is good-quality evidence that ovarian cancer screening (CA125 biomarker and/or transvaginal ultrasound) has little or no effect on ovarian cancer mortality and probably causes harm.<sup>11</sup>

Norway presently has two national screening programmes for cancer: mammography for breast cancer for women between 50 and 69 years of age, and Pap smears for cervical cancer for women between 25 and 69. All women in Norway in the targeted age groups are invited to take part. There is also a pilot programme for colorectal cancer, and it is assumed that the pilot will become a national programme within a few years (Helse-direktoratet, 2019 #549). All types of cancer screening are covered by the national insurance scheme as long as the patient is referred by a doctor.

It is up to the individual whether to accept the invitation and participate in a screening programme. Those who are in doubt may consult their doctor. Giving advice in this situation can be difficult. The evidence is ambiguous and the doctors are faced with potentially inconsistent expectations of their roles. They are obliged to be both the patient's advocate and a steward of societal resources at the same time. Further, as a member of a profession, their duty is to act in accordance with professional norms, but as private individuals their obligations extend beyond the professional (eg, they may have conflicts regarding their personal values or time commitments).<sup>12</sup> Knowing which role(s) a doctor is loyal to when making a decision can explain variations in practice and justifications. How do doctors react in these situations, and what do they consider important factors when counselling patients on screening? The present article reports from a study of whether and why doctors recommend cancer screening to their patients.

## MATERIALS AND METHODS

A representative sample of 1545 doctors practising in Norway were surveyed in 2014/2015 by the Institute for Studies of the Medical Profession, a private research institute primarily funded by the Sick Pay and Pension Scheme for Doctors. The fund cooperates with the Norwegian Medical Association (NMA) but is an independent legal entity with its own board.

The sample was part of a panel of doctors<sup>13</sup> who are surveyed biannually about different aspects of their professional life, including working conditions, job satisfaction, and ethical and societal issues.<sup>13</sup> The members of the panel are randomly selected from a register of members of the NMA consisting of a large majority of doctors in

Norway (approximately 90%). The panel is complemented with new members every 4 years, while doctors who retire leave the panel. This secures a continuous representativity of practising doctors. Since participation is explicitly agreed on after invitation, the response rate is normally high: around 70%. No incentives are used.

The 2014 dispatch included questions about whether doctors recommended their patients to be screened for six forms of cancer: colorectal, breast, prostate, lung, ovarian and cervical. The response alternatives were 'Yes', 'No' and 'Not applicable (N/A)'. We also asked the doctors what they considered to be important concerns in their discussions about prostate cancer screening using a PSA test and breast cancer screening using mammography. The specific concerns we enquired about were early detection, reducing anxiety, false positives, radiation dose (for mammograms), needless interventions and waste of resources. The respondents were asked to rate each concern as 'Important', 'Not important' or 'Don't know'. Further, there were questions about working conditions, job satisfaction, priority-setting and patient responsibility; there were also questions about background characteristics, including gender, age, specialty, and work in specialist or general practices. [Figure 1](#) displays excerpts from the questionnaire.

Using SPSS V.25, data were analysed with descriptive methods and binary logistic regression. In each regression analysis, we excluded the respondents with missing data and included only those who responded to all the relevant variables.

## Patient and public involvement

There was no patient or public involvement in the design or planning of the study.

## RESULTS

Of the 1545 who received the questionnaire, 1158 responded (75%). Twenty-five of the respondents returned blank questionnaires; hence, the actual response rate was 74%. The number of missing responses to the relevant questions was between 0 and 11. The sample/population (NMA, 2019 #548) characteristics were 38.2%/44.7% female; mean age 55 years/47.2 years; and 57%/61% employed in hospitals and 23.7%/28% in general practice. The remaining 19.3% included non-clinicians and specialists in private practices. The main findings are presented graphically in [figure 2](#) and [table 1](#).

A large majority of doctors recommended screening for breast and cervical cancer, with a statistically significant higher proportion among general practitioners (GPs) compared with non-GPs. For ovarian cancer screening, the opposite was true: a large majority recommended against screening, and GPs were significantly more negative than non-GPs. Around 4 out of 10 doctors would recommend screening for colorectal and prostate cancer, with little or no difference between GPs and non-GPs,

| B12   | Cancer screening. Do you recommend your patients to be screened for: | No    | Yes               | N/A |
|-------|--|-------|-------------------|-----|
|       |  | B12.1 | Colorectal cancer | 1   |
| B12.2 | Breast cancer  | 1     | 2                 | 9   |
| B12.3 | Prostate cancer  | 1     | 2                 | 9   |
| B12.4 | Lung cancer  | 1     | 2                 | 9   |
| B12.5 | Ovarian cancer   | 1     | 2                 | 9   |
| B12.6 | Cervical cancer  | 1     | 2                 | 9   |

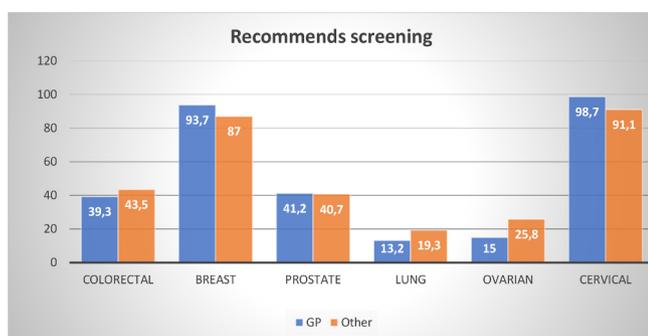
| B13   | In the debate about mammogram screening, these arguments are voiced. What do you consider important? | Important | Not important   | Don't know |
|-------|--|-----------|-----------------|------------|
|       |  | B13.1     | Early detection | 1          |
| B13.2 | Reduce anxiety   | 1         | 2               | 9          |
| B13.3 | Radiation dose   | 1         | 2               | 9          |
| B13.4 | False positives  | 1         | 2               | 9          |
| B13.5 | Needless intervention  | 1         | 2               | 9          |
| B13.6 | Waste of resources   | 1         | 2               | 9          |

| B14   | In the debate about PSA-screening, these arguments are held. What do you consider important? | Important | Not important   | Don't know |
|-------|--|-----------|-----------------|------------|
|       |  | B14.1     | Early detection | 1          |
| B14.2 | Reduce anxiety   | 1         | 2               | 9          |
| B14.3 | False positives  | 1         | 2               | 9          |
| B14.4 | Needless intervention  | 1         | 2               | 9          |
| B14.5 | Waste of resources   | 1         | 2               | 9          |

**Figure 1** Excerpts from the questionnaire. N/A, not applicable; PSA, prostate-specific antigen.

while 13%–20% of doctors reported recommending screening for lung cancer.

Although controlled for age and gender, GP status was still an independent predictor for screening according to guideline recommendations (except for colorectal and prostate cancer) (see table 2) compared with other doctors. Controlled for gender and GP status, older doctors tended to recommend screening for colorectal, prostate, lung and ovarian cancer more than their younger



**Figure 2** Percentages of GPs and other doctors who recommend cancer screening. n=576–650. N/A excluded. GP, general practitioners; N/A, not applicable.

**Table 1** Percentages and 95% CI of doctors (GPs and other doctors) who recommend screening for different cancers

|            | GPs (95% CI)         | Other doctors (95% CI) | Significant difference (non-overlapping CI) |
|------------|----------------------|------------------------|---|
| Cervical   | 98.7 (97.3 to 100.1) | 91.1 (88.5 to 94.1)    | *   |
| Breast     | 93.7 (90.6 to 96.8)  | 87.0 (83.6 to 90.4)    | *   |
| Colorectal | 39.3 (33.1 to 45.5)  | 43.5 (38.3 to 48.7)    |   |
| Prostate   | 41.2 (34.9 to 47.5)  | 40.7 (35.5 to 45.9)    |   |
| Ovarian    | 15.0 (10.4 to 19.6)  | 25.8 (21.1 to 30.5)    | *   |
| Lung       | 13.2 (8.8 to 17.5)   | 19.3 (15.0 to 23.6)    |   |

Statistically significant difference ( $p < 0.05$ ) when there is no overlap in the CIs. n=576–650. N/A excluded. GP, general practitioner; N/A, not applicable.

colleagues did. Finally, we found that female doctors had increased odds of recommending screening for breast and cervical cancer compared with male doctors (see table 2).

We also asked which factors influenced doctors' decisions to recommend screening for breast and prostate cancers. The results are shown in table 3.

The doctors classified several factors as important when deciding for or against screening for breast and prostate cancers. Early detection was considered important for the decision to recommend screening, while false positives and needless interventions were the most important reasons for recommending against. Less than a third of the doctors regarded radiation doses from mammography as important, and reduced anxiety was seen as important to nearly 40% for both breast and prostate cancer screening.

We carried out logistic regression analyses to explore differences based on age and gender among GPs. We found no statistically significant differences for prostate cancer. For breast cancer screening, male doctors more often considered unnecessary intervention and waste of resources as important concerns for their recommendations than did their female colleagues. Older doctors were more concerned than the younger ones about early detection, false positives, unnecessary intervention and waste of resources.

## DISCUSSION

The doctors' responses were generally in line with the Norwegian guidelines and screening programmes: a large majority recommend screening for breast and cervical cancer. That more than 40% of the doctors recommend screening for colorectal cancer despite the lack of national recommendations might be explained by the anticipated introduction of a colorectal screening programme in Norway within a few years. That 40% of the doctors also recommended PSA tests for prostate cancer screening is perhaps a more surprising finding,

**Table 2** Differences in screening recommendations: logistic regression analysis of significance of gender, age and specialty

|            |                 | B      | P value | OR    | 95% CI of OR    |
|------------|-----------------|--------|---------|-------|-----------------|
| Colorectal | Gender (male=0) | -0.207 | 0.266   | 0.813 | 0.565 to 1.171  |
|            | Age             | 0.033  | <0.001  | 1.033 | 1.017 to 1.050  |
|            | GP (not GP=0)   | -0.350 | 0.051   | 0.704 | 0.496 to 1.001  |
| Breast     | Gender (male=0) | 0.744  | 0.017   | 2.104 | 1.142 to 3.877  |
|            | Age             | -0.004 | 0.765   | 0.996 | 0.973 to 1.020  |
|            | GP (not GP=0)   | 0.836  | 0.008   | 2.307 | 1.247 to 4.268  |
| Prostate   | Gender (male=0) | -0.120 | 0.521   | 0.887 | 0.615 to 1.279  |
|            | Age             | 0.023  | 0.003   | 1.024 | 1.008 to 1.040  |
|            | GP (not GP=0)   | -0.114 | 0.522   | 0.892 | 0.630 to 1.264  |
| Lung       | Gender (male=0) | -0.176 | 0.492   | 0.838 | 0.507 to 1.387  |
|            | Age             | 0.023  | 0.016   | 1.026 | 1.005 to 1.048  |
|            | GP (not GP=0)   | -0.599 | 0.015   | 0.550 | 0.339 to 0.891  |
| Ovarian    | Gender (male=0) | -0.001 | 0.996   | 0.999 | 0.631 to 1.582  |
|            | Age             | 0.052  | <0.001  | 1.053 | 1.032 to 1.075  |
|            | GP (not GP=0)   | -0.990 | <0.001  | 0.372 | 0.234 to 0.591  |
| Cervical   | Gender (male=0) | 0.874  | 0.037   | 2.397 | 1.055 to 5.446  |
|            | Age             | -0.012 | 0.461   | 0.988 | 0.959 to 1.019  |
|            | GP (not GP=0)   | 2.132  | <0.001  | 8.431 | 2.528 to 28.114 |

GP, general practitioner.

and it probably reflects conflicting views and ongoing discussions concerning this issue. Perhaps the easiness of the procedure (ie, a simple blood test) also lowers the threshold for recommending the test.

The almost unanimous recommending of screening for cervical cancer is in line with the available evidence. The evidence of screening for breast cancer and colorectal cancer shows similar magnitudes of effect; hence, the observed differences in recommendations between these two cancers could be explained by the fact that only breast cancer screening is included in the current Norwegian scenario, with the country's well-established national programme in place. Recommending

screening for prostate cancer, on the other hand, is less justified on the basis of evidence. This is also the case for ovarian and lung cancer, although fewer doctors recommend them, compared with PSA tests.

The analysis shows a systematic difference between GPs and other clinicians, indicating that GPs' recommendations are more in line with the guidelines. This is surprising, as other studies have found that GPs are less true to guidelines than the rest of the profession.<sup>14</sup> Further, one might have predicted that knowing the patients' worries and expectations would increase the tendency to recommend screening. A close and long-lasting patient–doctor relationship might, on the other

**Table 3** Factors affecting the decision to recommend screening for breast and prostate cancers (percentages)

| Breast cancer screening   |                 |                |                |                 |                       |                    |
|---------------------------|-----------------|----------------|----------------|-----------------|-----------------------|--------------------|
|                           | Early detection | Reduce anxiety | Radiation dose | False positives | Needless intervention | Waste of resources |
| Important                 | 85              | 39.9           | 31.7           | 77.9            | 76.6                  | 57.7               |
| Not important             | 5.9             | 45.6           | 44             | 11              | 11.7                  | 25.6               |
| Don't know                | 9.1             | 14.4           | 24.3           | 11.2            | 11.7                  | 16.7               |
| n                         | 1133            | 1129           | 1126           | 1129            | 1128                  | 1125               |
| Prostate cancer screening |                 |                |                |                 |                       |                    |
| Important                 | 64.9            | 37.1           | –              | 77.3            | 80.7                  | 62.4               |
| Not important             | 21.9            | 47.6           | –              | 10.3            | 8.3                   | 21.9               |
| Don't know                | 13.2            | 15.3           | –              | 12.4            | 11                    | 15.7               |
| n                         | 1133            | 1131           | –              | 1132            | 1129                  | 1129               |

hand, provide a better climate for discussing the pros and cons of screening and thus have reduced the number of unrecommended tests.

Lately, we have seen a growing awareness of the benefit of reducing unnecessary tests and procedures, for the sake of sound stewardship of resources and for the sake of quality of care and reducing the risk of harm to the patient. The Choosing Wisely campaign, launched in the USA in 2012,<sup>15</sup> has received increasing attention worldwide. Currently, gradual implementation of these principles is taking place in Norway, especially among GPs.

The idea behind Choosing Wisely is to reduce unnecessary procedures. There is, in principle, no antagonism between the patient's best interest and societal goals: the patient avoids unnecessary and possibly harmful interventions, and resources are saved for better use. It is, however, unlikely that the campaign has influenced the present data, since it was only recently introduced in Norway.

Around 80% gave false positives and needless intervention as reasons to abstain from recommending screening for breast and prostate cancer. This is similar to the number who considers early detection as the most important reason to recommend screening. It is remarkable that a majority of Norwegian doctors consider the risk of overdiagnosis/needless interventions equally important as early detection. The Choosing Wisely campaign gives the medical community an arena to discuss and promote strategies on how to practically handle these contrasting concerns.

The cancer screening case illustrates how doctors' different roles come into play in professional work. The conflict of interest between patients' wishes to reduce, or preferably remove, uncertainty and anxiety in contrast to spending resources on alternatives of higher value in terms of health improvements is inherent in healthcare. A doctor is frequently positioned between these conflicting goals and roles.

Table 4 provides a schematic description of a doctor's potentially conflicted roles and the accompanying moral norms.

In the role of gatekeeper, the doctor needs to take responsibility for fair distribution and population

health. In the Norwegian system, GPs also have a formalised gatekeeping role with the responsibility of referring patients to specialist care.<sup>15</sup> This could explain why GPs seem to be somewhat more reticent than hospital doctors when recommending screening.

The difference between GPs and other doctors may also be the result of a generalist versus a specialist approach. The generalist pays more attention to the broader picture, including, but not restricted to, stewardship of resources. Further, while the generalist, in principle, is familiar with all the cancer screening guidelines, the specialist is familiar with guidelines in his/her particular field.

One would expect that the more contested or ambiguous the evidence of screening benefits, the larger the possibility for conflicts between the differing role expectations a doctor is supposed to meet. Guidelines can help reduce possible conflicts between, for example, patient expectations, professional judgement and societal responsibility. On the other hand, if the guidelines are contested in the professional discussion, this can enhance the conflict between roles.

A doctor not only faces potential tension between societal and patient interests, but he or she is also an individual with personal views and values. The data show that such factors also influence the choice of screening recommendations. Being a woman increases the likelihood of recommending screening for breast and cervical cancer. Previous studies have shown that if female doctors themselves follow up on recommended screening programmes for cancer, it is more likely that their patients also will do so.<sup>16</sup> Further, we found that older doctors more often recommend screening for colorectal, prostate, lung and ovarian cancer compared with younger doctors, which might indicate a generational change, with more focus on sound resource allocation.

Cancer screening is regularly debated in Norway and other countries. The evidence for screening has not been agreed on in the medical profession, and criteria for screening have differed. Such professional uncertainty increases the importance of considering other factors when deciding on whether to recommend screening. As we have discussed, such a decision can

**Table 4** Doctors' roles<sup>12</sup>

| Role               | Administrator and gatekeeper   | Professional   | Patient's advocate   | Private individual   |
|--------------------|--|--|--|--|
| Accountable to     | Society and health authorities.  | Medical quality, professional association and peers. | Patient and next of kin.                                   | Self (political views, moral values and personal interests).       |
| Core moral norm(s) | Act in accordance with laws and systemic requirements. Take responsibility for population health and for fair distribution of resources. | Adhere to good practice and professional ethics.     | Ensure care is in line with patients' views and interests. | Do not act contrary to political or personal values and interests. |

be influenced by which role(s) the doctor is loyal to and can therefore vary between groups of doctors. This is important knowledge for policymakers, who should be aware of these different roles in their efforts to govern clinical care. Health authorities should be especially aware of potential inconsistencies between governing measures in, for example, different legal requirements.

### Strengths and weaknesses

The high response rate indicates that the results found in this study are representative of the population of doctors. Recent questionnaire studies involving doctors have often had response rates well under 50%, producing results that cannot be interpreted for the whole group of doctors.<sup>17</sup>

Sample representativity was checked against the membership registry of the NMA, which includes approximately 90% of the country's doctors. The comparison variables were gender, age and specialty. The sample is skewed towards older, male doctors. The proportion of hospital doctors versus GPs in the population was 61% employed in hospitals and 28% in general practice, while the sample included 57% hospital doctors and 24% GPs. The number of doctors who are not employed in hospitals or general practice is a bit higher in the sample than in the population, while the hospital to general practice ratio is comparable.

This means that our results may have overestimated the number of doctors who recommend colorectal, prostate, lung and ovarian cancer screening. Similarly, since more women recommend screening for breast and cervical cancer, our result may be an underestimate. With these modifications, we think our results are generalisable to Norwegian physicians.

Although the data were collected 4 years ago, we think the findings are still valid, with the exception of recommendations for colorectal cancer screening. Colorectal cancer screening was established as a national programme in 2019, which most likely means that more doctors will recommend it today.

The response options did not include 'reduced mortality' among the reasons why a doctor would choose to recommend cancer screening. The rationale behind the alternative 'early detection' is of course to reduce mortality, but this could have been an explicit response alternative.

Health systems and guidelines for cancer screening vary between countries. However, the discussion around the importance of doctors' role conflicts regarding screening recommendations, especially when the medical evidence is debatable, is internationally generalisable.

The data show doctors' self-report regarding their screening recommendations. We do not know whether this is in line with their actual recommendations.

### Unanswered questions and future research

Directly observing consultations via video or tape recording would provide more certain information regarding what doctors really say to their patients, but data collection would need to be extensive in order to collect a sufficient number of encounters related to screening discussions, and such data would be difficult to obtain due to confidentiality issues.

A comparison between actual referrals and the findings in this survey would demonstrate whether the stated and actual practices are similar. Information about the reasons behind doctors' (actual) recommendations is valuable for health authorities in their efforts to make healthcare decisions in accordance with overall goals.

Further studies of tensions and conflicts in the doctors' roles are required. A deeper understanding of the conflicts that doctors consider or experience in clinical practice could be achieved by means of more qualitative approaches.

**Contributors** BB designed the study, analysed the results, interpreted the data and drafted the article. AF interpreted the data, reviewed the current evidence of cancer screening and revised the article. SN interpreted the data and revised the article. KIR designed the study, analysed the results, interpreted the data and revised the article.

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**Competing interests** None declared.

**Patient consent for publication** Obtained.

**Ethics approval** All participants have given their written consent. The Norwegian Regional Committee for Medical Research Ethics has exempted the survey from review since it does not include patient data (approval no IRB 00001870).

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**Data availability statement** Data are available upon reasonable request.

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### REFERENCES

1. Norway, T.R.C.o. *Research-based evaluation of the Norwegian breast cancer screening program*, 2015 Final report.
2. Kalager M, Zelen M, Langmark F, *et al*. Effect of screening mammography on breast-cancer mortality in Norway. *N Engl J Med* 2010;363:1203–10.
3. Sætnan AR. To screen or not to screen? science discourse in two health policy controversies, as seen through three approaches to the citation evidence. *Scientometrics* 2000;48:307–44.
4. Quanstrum KH, Hayward RA. Lessons from the mammography wars. *N Engl J Med* 2010;363:1076–9.
5. Zahl P-H, Holme Øyvind, Løberg M. Norsk mammografiscreening – mange selvmotsigelser i evalueringen. *Tidsskrift for Den norske Lægeforening* 2016;136:1616–8.
6. Nelson HD, Fu R, Cantor A, *et al*. Effectiveness of breast cancer screening: Systematic review and meta-analysis to update the 2009 u.s. preventive services task force recommendation. *Ann Intern Med* 2016;164:244–55.
7. Lin JS, Piper MA, Perdue LA, *et al*. Screening for colorectal cancer: Updated evidence report and systematic review for the us preventive services task force. *JAMA* 2016;315:2576–94.
8. Peirson L, Fitzpatrick-Lewis D, Ciliska D, *et al*. Screening for cervical cancer: a systematic review and meta-analysis. *Syst Rev* 2013;2:35.

9. Fenton JJ, Weyrich MS, Durbin S, *et al.* Prostate-Specific antigen-based screening for prostate cancer: evidence report and systematic review for the US preventive services Task force. *JAMA* 2018;319:1914–31.
10. Humphrey LL, Deffebach M, Pappas M, *et al.* Screening for lung cancer with low-dose computed tomography: a systematic review to update the US preventive services Task force recommendation. *Ann Intern Med* 2013;159:411–20.
11. Henderson JT, Webber EM, Sawaya GF. Screening for ovarian cancer: Updated evidence report and systematic review for the us preventive services task force. *JAMA* 2018;319:595–606.
12. Bringedal B, Isaksson Rø K, Magelssen M, *et al.* Between professional values, social regulations and patient preferences: medical doctors' perceptions of ethical dilemmas. *J Med Ethics* 2018;44:239–43.
13. Rosta J, Aasland OG, Rosta J. Doctors' working hours and time spent on patient care in the period 1994 - 2014 2016:1355–9.
14. Carlsen B, Bringedal B. Attitudes to clinical guidelines-do GPs differ from other medical doctors? *BMJ Qual Saf* 2011;20:158–62.
15. Nilsen S, Malterud K. What happens when the doctor denies a patient's Request? A qualitative interview study among general practitioners in Norway. *Scand J Prim Health Care* 2017;35:201–7.
16. Frank E, Rothenberg R, Lewis C, *et al.* Correlates of physicians' prevention-related practices. findings from the women physicians' health study. *Arch Fam Med* 2000;9:359–67.
17. Cunningham CT, Quan H, Hemmelgarn B, *et al.* Exploring physician specialist response rates to web-based surveys. *BMC Med Res Methodol* 2015;15:32.