
SUMMARY OF RESULTS FROM BREAST CANCER DISEASE STUDY

WHAT IS BEST AND AT WHAT COST?
OECD STUDY ON CROSS-NATIONAL DIFFERENCES OF AGEING-RELATED DISEASES:
CONCLUDING WORKSHOP

To be held at the International Conference Centre, 19 Avenue Kléber, 75016 Paris
from 20 to 21 June 2002, starting at 9h30 on the first day

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1. There is growing concern that we do not completely understand how health care systems are performing in return for the level of human and financial investments made in them. While much of our understanding is based on an abundance of studies comparing aggregate spending on health care as a measure of resources and life expectancy or potential years of life lost as outcome measures, these are often inadequate for understanding a health care system's performance. The OECD embarked on answering this question through a trio of micro-level, disease-specific studies focusing ageing-related diseases -- one of which is breast cancer.

2. Breast cancer is the most common cancer site for women across OECD women and the incidence rate of breast cancer has been increasing steadily, particularly for those women over 50 years of age. There exists variation in standard of care treatment for breast cancer across countries, despite published results from clinical trials. There is also marked variation in five-year survival rates from breast cancer on an international level. These differences in treatment patterns and outcomes are significant among the older populations across the OECD. Along with a variety of clinical factors, economic and regulatory factors may be contributing to the different patterns of care and outcome rates that exist across countries.

3. Two other studies have examined this topic. The first study by the McKinsey Global Institute examined variations in productivity at a disease level and recent trends to variations in incentives and supply constraints for three countries (Germany, the United Kingdom and the United States) (Baily and Garber, 1997). Baily and Garber found that differences in productive efficiency between the US and UK were inconclusive in terms of care for breast cancer; however, the UK did devote fewer inputs for lower outcomes. Screening, in particular, had an effect on the differences in input consumption and overall productive efficiency. In addition, McClellan presents cross-national estimates of differences in high technology related treatment rates that are closely linked to supply side incentives in countries' health care systems (McClellan et al., 2001). A team of European and US researchers have also explored trends in rates of survival in American and European Cancer patients (Gatta, Capocaccia, Coleman, et al. 2000). They found the survival rates to be higher in the United States than in Europe, particularly for those cancers, such as breast cancer, where treatment and screening can make a difference.

4. To examine the possible impact that differences in incentives related to regulatory and economic constraints may have on patterns of breast cancer care and survival rates across countries, we conducted a qualitative and quantitative study of 13 OECD countries. We compiled information on a country's health care system as it relates to breast cancer and registry and/or linked administrative and registry data on treatment and outcomes. We focused primarily on the use of breast-conserving therapy and mastectomy for breast cancer treatment. We then sought to explore whether variations in economic and regulatory factors in the health care delivery and financing systems could explain any differences in treatment use and outcomes.

1. Cross-national patterns of breast cancer care

5. As part of this study, treatment data were obtained using either administrative, cancer registry or linked registry-administrative datasets from the following countries: Belgium, Canada, Canada (Manitoba
and Ontario), France, Italy, Sweden, United Kingdom, and the United States. Registry data collect surgical therapy up until 6 months post diagnosis, but radiation therapy data needs to be interpreted with caution since it is difficult to obtain treatment information if the patient received radiation therapy outside of the hospital setting. Between 1980 and late 1990s (year when most recent data was available), treatment data are presented as 1) proportion of women receiving mastectomies as their definitive surgery; 2) proportion of women receiving breast conserving therapy (BCS) as their definitive surgery; and 3) proportion of women receiving breast conserving therapy and post operative radiation therapy (RT after BCS) according to current standard of care recommendations.

Breast conserving therapy with radiation therapy vs. mastectomy

6. In 1985, randomised controlled trials published in the medical literature reported that most women who were diagnosed with early stage breast cancer could avoid mastectomy by undergoing BCS plus radiotherapy. Both types of treatment demonstrate similar local recurrent-free and overall survival rates, while BCS allows for preservation of the breast (Fisher et al., 1985, Veronesi et al., 1981).

7. The proportion of women over 40 who receive breast-conserving surgery compared to mastectomy as primary surgical treatment varies dramatically across countries (Table 1). Proportion of women receiving mastectomies ranged from above 75 percent of women diagnosed with breast cancer in Japan and Norway to about 20 percent in the United Kingdom. Uptake of breast conserving surgery was faster in France, Belgium, and United States – where BCS was the treatment of choice for more than 50 percent of women diagnosed with breast cancer in 1995. Japan and Norway clearly have adopted BCS at a slower rate than other countries, with only 20 percent of women diagnosed with breast cancer receiving BCS. It should be noted that a significant decline of use in BCS between 1989 and 1994 occurred in Sweden due to a large scale randomised clinical trial undertaken in 1991 that resulted in radiotherapy (RT) being given only to half of the patients undergoing BCS.

| Table 1. Proportion of women diagnosed with breast cancer and received type of treatment. |

8. The proportion of women 70 years and older receiving BCS was lower than younger age groups in the countries included in this study (Table 2). Clearly, younger women are more likely to receive breast conserving surgery treatment. The gap between younger and older age groups’ utilisation of BCS varies widely across countries. Belgium, Canada, France, Italy, Norway, and United States all observe slightly lower levels of BCS utilisation in the older age groups, starting at 70 to 79 years of age, in comparison to the younger age groups. A more significant drop in BCS utilisation across older age groups is evident in Sweden and the UK. Women who are 80 years and older in Sweden and the UK tend to be twice less likely than women 70 to 79 years to receive BCS (about 15 percent vs. 30 percent, respectively) in 1994-1995.

| Table 2. Proportion of women received BCS |

9. One notable difference in surgical treatment rates is in the UK where both mastectomy and BCS rates for older women of age 80+ are at much lower levels than other countries (Tables 2 and 3). Mastectomy rates tend to increase with age across countries; while the UK reports rates around 10 percent for those over 80 undergoing a mastectomy. While most countries show a wide age differential in use for BCS, across both younger and older age groups, the UK has one of the lowest levels of BCS use with only 15 percent receiving the procedure. Surgery in older patients may be discouraged in the UK, while there might be a greater reliance on tamoxifen to control breast cancer in advanced ages.

| Table 3. Proportion of women received mastectomy |
10. Use of adjuvant breast RT after BCS varies across countries—ranging from 57 percent in Italy to 95 percent in France between 1990-1997 (Table 4). Lower rates of RT after BCS in some countries suggest that many women are not receiving radiation, despite recommended standards of care. Women who choose BCS over mastectomy have likely agreed to proceed with post-operative radiotherapy for their treatment plan, and have already taken into account if RT is not readily accessible or contraindicated. Therefore, the level of receipt of RT after BCS likely reflects more the issue of quality of care rather than the issue of patient preferences.

Table 4. Women receiving radiation therapy after breast conserving surgery

11. Use of radiotherapy among those who received BCS varies dramatically by age, with a sharp decline in use for those over 70 or 80 years of age across countries, though there have been increases in RT use over time. The age gradient is not as pronounced in all countries. Some countries observe a more significant drop at 70 (Canada (Manitoba), Italy, Sweden, and UK) in the use of RT after BCS compared to other countries. However, in Belgium, France, and the US, women aged 70 to 79 years receive RT after BCS at a similar rate on average as the younger age groups and those women 80 years and older receive RT after BCS much less often.

12. Several factors can explain the differences in treatment patterns such as patient age, sociodemographic characteristics, hospital characteristics, geographic area, comorbidity, marital status, physician and patient preferences, type of health care system, availability and proximity to radiation therapy and costs (Farrow et al., 1992, Nattinger et al. 1992, Samet et al. 1994, Lazovich et al., 1991, Barlow et al., 2001). We first examined whether demand or supply side constraints might be a barrier or an influence on breast cancer treatment choice. We then specifically explored possible associations with BCS rates and RT rates after BCS and independent variables such as type of health care system and reimbursement levels and availability of radiation therapy centres.

13. Based on the country reports’ description of their health care systems, there is little evidence of any constraint on the demand for health care related to breast cancer. However, access barriers due to supply side constraints such as payment system, supply of providers, availability of technological resources may exist. For example, many experts in OECD countries are concerned that the number of cancer specialists and resources for RT are too low to meet the current and future demands of cancer care. In several country reports, experts cited serious problems with delays in radiation therapy (e.g. Canada, Norway, Sweden and the United Kingdom) that can be related to resource availability and productive efficiency (Grunefeld et al., 2000, Sainsbury et al., 1995, Royal College of Radiologists, 1991). Data obtained from countries was not comprehensive for supply of cancer specialists such as oncologists so we were unable to explore an association with this independent variable.

14. We were able to test the hypothesis that there is a relationship between the overall proportion of women diagnosed with breast cancer receiving RT after BCS and the availability of radiation therapy machines. Researchers have found lower rates of radiation therapy after breast conserving surgery to be associated with poor distribution and supply of specialised treatment centres with capacity for radiotherapy (Iscoe et al, 1997, Guadagnoli et al., 1998, Nattinger 1990). Rates of radiation therapy machines across countries vary. There has been an increase in the number since 1980s to meet the increasing demands. However, from our data there does not appear to be a strong relationship between the availability of RT machines and proportion of women receiving RT after BCS for those over 40 years of age (Chart 1). When looking more specifically at the 70 to 79 age group (without Sweden) a stronger relationship may exist between the availability of RT machines and rates of RT after BCS (Chart 2).

Chart 1. Patients receiving RT after BCS, and availability of RT machines
Chart 2. Patients aged 70-79 receiving RT after BCS, and availability of RT machines

15. In countries with fixed payment systems there may be a disincentive to pursue more complicated and costly treatments such as BCS and series of subsequent RT. In contrast, in countries with more flexible payment systems such as France, Belgium and US, each patient is seen as a source of revenue so there is more incentive to refer. Interestingly, based on initial review, countries that use global budgets (Norway, Sweden, Canada, and United Kingdom) tend to demonstrate lower rates (generally less than 50%) of BCS utilisation than those that rely on fee-for-service or diagnostic-related group (DRG) payment methods (France, Belgium, and the United States). In the United States, studies have reported that higher reimbursement levels for BCS influenced providers’ propensity to choose breast conserving surgery (Mandelblatt et al. 2001). Recent European studies also found that reimbursement practices varied and influenced the extent of treatment across European countries (Lievens et al. 1999, Norum et al., 1997). In countries, or in hospitals where global budgets or per diem payment are used, the total number of fractions for radiation therapy was lower, and the total dose was lower. On the contrary in countries with fee-for-service systems, treatments tended to be more aggressive and higher dosed.

16. Generally, the data available from participating countries appear to show that older patients might be treated less frequently and less intensively than younger patients. Most countries have lower RT utilisation rates among the 80+ age-group, though there have been relative improvements over time in some countries— where utilisation rates have reached the level of their younger counterparts. The lower rates of BCS and RT among older women based on cross-national estimates presented here are consistent with the literature in the US and other countries (Farrow et al., 1992, Samet et al., 1994, Ballard-Barbash et al., 1996, Paszat et al. 1998, Mandelblatt et al., 2000, Tyldesley et al. 2000). Many of these studies have shown that older women do not receive recommended treatments for breast cancer as frequently as younger women, even when controlling for comorbidity. Many hypothesise that older women receive different therapy than younger women for reasons unrelated to their disease, despite findings that older women equally tolerate and benefit from these treatments (Greenfield S., Blanco D., Elashoff R., Ganz P. 1987). Silliman et al. (1989) found that age had a significant impact on the probability of receiving follow-up treatment, such as radiation therapy, after BCS, and adjuvant chemotherapy for patients with a regional disease and undergoing a mastectomy. A more recent study, on a larger cohort of 18 000 patients based on US SEER data linked with Medicare claims (Ballard-Barbash 1996), shows that, after adjustment for multiple clinical and non-clinical factors, chronological age remains an important factor associated with a lower probability of receiving radiation therapy after breast-conserving surgery among women aged 65 years or more who were diagnosed with early-stage breast cancer. Further research is needed to determine what are the reasons behind the fact that older women are getting treated less aggressively – and perhaps, providers are not feeling confident on how to treat the older population effectively due to a lack of clinical evidence on how to treat breast cancer for this age group.

2. Performance: Description of costs and outcomes

2.1 Costs of care

17. Overall, most countries tend to spend about 0.5 to 0.6 percent of total health expenditures on breast cancer. However, when analysing the unit costs for initial treatment, countries’ spending is variable. Initial treatment is defined often as all therapies that occurred six months post diagnosis which typically includes surgery, any preoperative therapies, and sometimes the start of any adjuvant chemotherapy or radiation therapy if no chemotherapy is involved. Cross-national estimates are based on country-specific studies that calculated costs with different methodologies. Unit costs of initial phase of breast cancer treatment are presented as percent of GDP per capita. Norway tends to have the lowest costs among those
observed at 26.4 percent of GDP per capita. Unit costs are slightly higher in France and in Canada for women more than 50 years of age (34.4% and 32.8%), with the US studies presenting the highest unit costs (41% to 62.4%).

18. Costs of breast cancer treatment may also differ by type of treatment. In most cases, breast-conserving surgery associated with radiotherapy appears to be more expensive than a mastectomy, when considering the initial six-month episode of care. It seems that in some countries, such as Norway, the higher costs related to breast-conserving surgery, when compared with mastectomies, might be influencing treatment patterns (Norum, 1997). However, a recent US study found that mastectomy in fact may be more expensive, when a longer time period is analysed (Barlow and Taplin, 2001). When analysed over a five-year period, higher expenses are often incurred for continuing care after a mastectomy, that is likely to include reconstruction surgery and adjuvant therapies. Breast conserving surgery appears to be relatively more cost effective, when examined over a five year period, even when radiation or adjuvant therapy are taken into account.

19. Although results by age groups could not be presented due to the heterogeneity of data, most studies show that costs are higher in the younger age groups. Higher costs for younger age groups have been found in the United States and in Canada (Fireman et al. 1997). In addition, in most countries costs for more advanced stages are higher than for earlier stages. Such data have been obtained for a number of countries. The gradient in costs by stage exists for all countries, but with different patterns. The country rankings from the initial costs comparison remain largely unchanged when examining costs by stage, with the United States spending more than Australia and France, and Canada spending less. Some partial Italian data were available, which suggest that Italy is among the lower spending countries.

2.2 Five-year relative breast cancer survival rates

20. Outcomes data collected as part of this study include relative five-year survival rates, adjusted using the World Standard Cancer Patient Population (Black and Bashir et al., 1998). The majority of countries presenting data are from the EUROCARE project. Similar methods have been used for the countries participating in the EUROCARE project (Berrino et al., 1995; Quinn et al., 1998). Several countries who have not participated in the EUROCARE project have provided survival rate estimates, that are likely to not be comparable to the EUROCARE estimates so cross-national interpretation should be undertaken with caution.

21. Table 5 displays overall five-year relative breast cancer survival rates in the mid-1990s, or latest available data. There are marked variations in breast cancer survival rates, ranging from 72 percent in England to 84 and 85 percent in United Status and Japan. Data from the EUROCARE studies, from 1978 to 1985 and 1985 to 1989 present similar differences (Berrino et al., 1995; Quinn et al., 1998). Survival was above the European average (73 percent in 1985-1989) in Iceland, Finland, Sweden, Switzerland, France and Italy; while Denmark, the Netherlands, Germany, and Spain were around the average and England, Scotland were below average.

Table 5. Relative five-year survival rates

22. Older women have lower breast cancer survival rates than their younger counterparts in several countries. For example, England and Wales experience a stable survival rate at around 80 percent in the younger age groups up until 50-59 years, when there is a fairly dramatic decline to 53 percent for those women 80 years and older. Older women in the United States, however, experience fairly equal outcomes as compared to their younger counterparts in 1989-1995 (at around 82 percent).
23. Since the mid-1980s, overall and age-specific five-year relative survival rates improved for breast cancer across countries. Most countries experienced dramatic increases in survival rates among the younger age groups between 40 to 65 years. This differential improvement in survival across age groups may reflect the increased use of mammography and more aggressive treatment in the younger age groups. Sweden and Norway both observed notable increases among female breast cancer patients aged 50 to 59 years.

24. Older women, over time, have been living longer with breast cancer in some countries. Sweden has made the largest relative improvement among its female breast cancer patients aged 80 years and older, increasing their five-year survival rate to the level of their younger female breast cancer population at 87 percent. England and Wales, however, demonstrated no survival improvement between 1986-1990 and 1991-1993 for the oldest age groups (70 percent for 70-79 age group and 53 percent for the 80+ group).

3. Discussion

25. These marked differences in the levels and improvement of the rates of breast cancer survival across OECD countries highlight the need to understand the determinants behind these variations. Possible contributing factors include overall stage distribution, patterns of cancer care utilisation including screening and treatment, and socio-economic factors such as income and education. While much of the survival improvement is mediated through changes in the stage distribution, it is very difficult to disentangle the relative contribution of the remaining factors in influencing access to and availability of appropriate and timely health care. Below, we seek to explore each of these topics separately, based on the data and reports in the country studies for the OECD project.

3.1 Screening

26. Breast cancer screening influences survival rates as it has a direct impact on the stage distribution of cases in a country as well as the number of newly diagnosed cases. Stage distribution across countries – particularly when examined across age groups – is an important explanatory factor when examining estimates of survival rates over time. Based on the data available from country reports, significant increases in the percentage of milder cases are evident in many of the participating countries in more recent years, likely due to the implementation of organised screening programmes and improvements in technology. This trend is coupled with a reduction of the number of cases with more advanced disease over time in the same countries. However, dramatic increases or decreases were not observed in those diagnosed with the most advanced disease with largest tumour size and distant metastases across these countries. Generally, over 50 percent of newly diagnosed breast cancer patients have early stage disease and less than 10 percent are diagnosed with distant metastases across OECD countries.

27. Sant et al., 1998 present findings that suggest that in the UK, advanced stage is an important factor in explaining its low survival rates. Excess risk of death for breast cancer patients within the first six months of diagnosis was higher in the UK than for Europe overall; while after the six-month diagnosis period, the difference in excess risk of death narrowed. Patients with breast cancer who die within six months of diagnosis typically have advanced stage disease. Countries with more severe stage distribution might be experiencing lack of access to mammography screening and other diagnostic services – whether it is the supply of machines or human resources that causes delays in diagnosis.

1 Research is underway to assess the various role of these factors. See Quaglia, project on understanding survival patterns in Europe. Capocaccia, Micheli and others for a US/Europe comparison.
28. The increasing proportion of early stage breast cancer cases has not just shifted the stage distribution observed in countries over time, but also has boosted the overall number of incident breast cancer cases. Cross national variations in survival might correspond to differences in incidence and stage distribution of breast cancer – that in turn reflects the level of screening activity in the country. Therefore, countries with higher incidence tend to have higher survival rates. So-called “minimal breast cancers” such as those less than 5 mm, are being detected more and more frequently mammographically. These are in fact not likely to result in death due to breast cancer, but are included in the numbers of incidence and the calculations of survival rates. Experts argue that real survival rate differences may be due to these type of statistical or registration artefacts, lead time bias due to earlier tumour detection and length bias where screening will pick up indolent cancers that may never become clinically apparent or result in death due to breast cancer. It is difficult, therefore, to draw any significant associations between survival and stage at diagnosis or higher incidence.

29. Age differentials in stage at diagnosis across countries were observed in the data available from countries, where older age groups had a higher likelihood of being diagnosed with advanced disease. These trends are likely to be a key factor behind the lower breast cancer survival rates for the older age groups. Older women may not be receiving timely mammography screening. Most of the country’s organised screening programmes do not target older women over 70 years, and it appears that older women are having a mammogram less often than their younger counterparts. In Canada and the US, sixty-five to 70 percent of women between ages 50-69 surveyed in their national health survey reported receiving a mammogram in the past two years. This percentage dropped to about 44 to 49 percent of women aged 70 years and older in Canada. Wider age differentials were found in countries such as the United Kingdom with only 3.2 percent of women surveyed over 70 years reporting having a mammogram in the past year in comparison to 40 percent of women between 50 to 59 years of age; in Belgium, with only 10.5 percent of women over 70 years old, as compared to 32.2 percent of younger women; and finally, Sweden with 20 percent of women over 70 years old, as compared to 70 percent of women between 50 to 59 years of age. Though these estimates of screening levels in the population are not comparable cross-nationally, the data highlights the infrequent use of mammography in countries such as UK and the possible contribution to the low survival rate in those countries.

30. Overall participation rates of mammography screening are only weakly related to the overall availability of mammography machines. Wide variation in the rate of mammography machines per million women over 40 years of age exists across countries, with France and United States having the highest supply of mammography machines. Countries with explicit regulatory constraints on technology diffusion tend to have lower rate of mammography machines per capita such as Canada, Norway and the United Kingdom. Other countries such as Hungary and Japan also have lower rates of mammography machines when compared to OECD countries. However, when examining the impact of technology availability on participation rates, some countries, and particularly the Nordic countries, achieve a fairly high rate of screening, although they have fewer machines than countries such as France or the United States. It appears that countries with integrated public systems achieve high rates of screening as part of organised programmes, whereas insurance-based countries such as France, do not achieve such a high rate even if they have more machines. In the insurance countries, the primary role devolved to opportunistic screening tends to distribute this screening unevenly and does not necessarily allow for the most cost-effective use of the technological resources available.

3.2 Access and quality of care

31. The second factor that can help explain the cross-national survival differences is access and quality of care of breast cancer-related treatment. However, several factors contribute to the differences in treatment patterns, including the availability of screening and diagnostic examinations; availability of
agreed-upon treatment protocols and rate of adoption of these recommended treatments; provider and patient preferences; and supply of technology and manpower. The relationship between stage at diagnosis and survival is discussed above. Differences in stage distributions across countries are due in large part to the participation rates in screening programmes. Stage at diagnosis determines the type of treatment that can be offered by the provider, the response to treatment, and ultimately the prognosis. In addition, lack of agreed-upon treatment protocols might explain some of the cross-national variations in survival – particularly in the 1980s – when very few consensus statements on therapeutic interventions for breast cancer existed. Since the mid-1980s, more and more consensus statements and treatment protocols have been developed based on recent clinical trial findings on this topic on a national and international level. This movement has encouraged a more unified approach to breast cancer treatment than in earlier years. For instance, there has been much discussion on the positive impact of tamoxifen – once evidence of its effectiveness was published in the literature in the early 1990s -- on survival (EBCTCG, 1992).

32. Further exploration should be given to other possible factors related to the organisation of the health care systems, such as supply of oncologists and other cancer-related specialists as well as RT resources. As an exploratory analysis, we examined above if there is any relationship between the overall proportion of women diagnosed with breast cancer receiving additional radiation therapy after BCS and the availability of radiation therapy machines. There does not seem to be a strong relationship overall. Looking specifically at the 70-79 age group, a stronger relationship between the availability of radiation therapy machines and rates of RT after BCS exists that should be explored once more detailed data are obtained (see Charts 1 and 2).

3.3 Socioeconomic and demographic factors

33. Finally, socioeconomic factors have been researched as a determinant of poor cancer survival (Kogevinas et al., 1997) where these factors have created barriers to access of care – specifically in reports focusing on variations within their country. Several studies have found that low socioeconomic status could explain the differences in survival, after controlling for stage, histological type and type of treatment received. For instance, patients living in affluent areas within specific regions had higher survival than those living less affluent areas of the same region (Coleman et al., 1999). Similar findings have provided supporting evidence that the socioeconomic level of a country is an important determinant of cancer survival – in terms of inequality of access to and availability of health facilities (Sant et al.,1995). However, it would remain to be seen whether these socio-economic factors would differ substantially across countries. Are women aged 50 to 80 and above significantly poorer in some countries and does this impact their health status? The analysis of pension data and micro data for income distribution shows single elderly women may suffer higher poverty rates in countries such as the US (which experiences very high survival rate on average) and in the United Kingdom (which experiences lower survival rate). The evidence suggests that socio-economic factors, although they can play a role within countries and between individuals in a given country, and also play a major role in explaining cross national differences as a whole.

34. The decline in survival among older women is one area of concern, which needs further research. Differences in survival from breast cancer across ages is likely due to several issues covered in this paper such as stage at diagnosis and screening and treatment patterns where we also observed significant age differentials. First of all, stage at diagnosis may prove to be even more important prognostic factor in treatment planning for older women ( Vercelli et al., 1999). There is an even wider age differential in oneyear survival rates than five-year survival rates among older women, suggesting that older women are being diagnosed with much more advanced disease and experiencing a worse prognosis than younger women.
3.4 Mortality rates and screening

35. Mortality rates can be used to provide an additional perspective on health outcomes, particularly given the complexities involved with interpreting survival rates in the presence of lead time and length time biases. However, while mortality rates do not have these biases, they have other limitations (such as they do not control for variations in incidence, and they are more affected by influences outside the health care system). While neither the mortality nor the survival data are able to establish a causal link between screening and mortality, it is nevertheless useful to examine mortality rate levels and trends in the context of differing screening practices.

36. In countries such as Sweden, Italy, Australia, US, and Canada, there have been moderate levels of mortality overall, with strong reductions in levels of mortality for women aged 40 and over in the 1990s (Chart 3). All these countries have aggressive screening programmes, either through organised programmes such as in Australia, Sweden, and Manitoba, or through aggressive opportunistic screening in the United States, or through a mixture of both in Italy and most Canadian provinces. In the United States, a decrease in mortality is observed for all age groups, with modest decreases for the youngest age groups. However, the US also has significant reductions in the 70-79 age group, which may also reflect more aggressive treatment for women in this age group.

Chart 3. Trends in age-standardised breast cancer mortality

37. The United Kingdom has one of the highest mortality rates, yet at the same time experienced a minor reduction in mortality according to the data available for this study. (For a more detailed earlier account, see Quinn Allen 1995.) The data needs to be updated before making a final conclusion, but it is possible that these reductions reflect the introduction of organised screening in this country at the end of the 1980s following the Forrest report in 1986 (Patnick 2000). Further publications (Moss et al. 1995, Blanks Moss Patnick 2000) provide an account of the NHS Breast Cancer Screening Programme with a majority of targets being met. The programme detected more carcinoma in situ at the beginning of the programme (1988-1993), but fewer invasive cancers than expected. It has been estimated that the programme has been responsible for a third of the fall in the death rate from breast cancer among women aged between 55 and 69 years (Patnick 2000).

38. More definitive observations regarding the link between treatment variations (including screening) and health outcomes would be possible if internationally comparable data were available on survival rates classified by the stage of the cancer. This would allow differences in the stage distribution between countries to be controlled for in the analysis of the data. Thus, the confounding effect of some countries having higher proportions of early cancers detected compared to other countries (because they are better at detecting them either through higher participation rates in screening programs or better screening techniques) could be removed.

4. Conclusion

39. One of the objectives of the ARD project in bringing together information on health policy, epidemiology, treatments, costs and outcomes was to determine which countries were getting the best value for their health care spending. The first objective in determining which countries are getting the best value for their health care spending is to determine the relative performances of their health care systems.

40. In terms of breast cancer, assessing performance is a complex task, which would involve multivariate analysis of variations in survival; however, the data available to us for international comparison is very limited. We attempted to examine the impact of technological inputs (e.g. mammography machines or RT machines) on a variety of outcomes: recommended treatment, screening
rate, and finally survival rates as a preliminary step (Charts 1-2, 4-6). No conclusions can be drawn, except for the UK, with a much lower availability of machines and poorer survival, similar to the findings made by Baily and Garber. Survival rates do not seem to depend on the availability of state-of-the-art technology.

Chart 4. Patients receiving a mammography and availability of mammography machines

Chart 5. 5-year relative survival rate and availability of mammography machines

Chart 6. 5-year relative survival rate and availability of radiotherapy machines

41. This study, however, confirms the variation in treatment patterns that persist, despite protocols for recommended care. Screening seems to be impacting the survival rates of several countries, evident in Europe. However, the UK is one country which clearly stands out, with a poorer survival rate. It would seem, from available evidence that, given the restrictions in terms of the availability of qualified medical staff, screening and radiation treatment equipment, financial constraints in terms of treatment may have had an impact on outcomes.

42. As some essential pieces of the puzzle are still missing, an analysis of this sort, unfortunately, remains highly limited since the data gathered as part of this study is not patient level data linked for all variables under question (e.g; treatment, stage, survival) and the data available on potentially important independent variables (e.g. on economic factors) is fragmented. In addition, some of the country data only reflects portions of the country and therefore, treatment patterns or survival cannot be generalised to the entire country. Studies examining international comparisons face huge hurdles as it is difficult to present available data in a standard manner. To assess the performance rates of health care systems, the present exercise is limited by the availability of current data: several of the key data sources are still in their infancy from a cross national perspective and require further development. In a recent article, Irwig and Armstrong (2000) propose some alternative steps that are likely to provide more information for future debate:

- Further development of registry data, to include standardised data on cancer stage or extent of disease, and also on initial and follow up treatment.

- Further development of infrastructure and a legal climate to encourage links between registry data, hospital separation data and physician claims data as well as death records. Such links are currently available in some countries (the United States, Canada at the Provincial level, and Sweden), but could be developed further as they provide invaluable results.

- A systematic population-based measurement of women's participation in either organised, or timely breast cancer screening.

- Large cost-effectiveness trials assessing the relevance of cancer screening programmes, and the various options for treatment.

43. The "ex post" evaluation allowed by population-based assessment programmes, such as breast cancer registries, is invaluable and should be continued together with further cost-effectiveness trials. These help raise public awareness and, in a number of countries, have played a significant step in the renewal of the general health policy agenda, such as in the United Kingdom.

44. The study has for the first time compiled information on health care system factors, treatment, costs, and outcomes on breast cancer. In addition, the study's preliminary results generate several
hypotheses and identify where further data needs to collected that can then be studied. Better performance seems to be achieved through a mix of rigorously-organised population-based breast cancer screening programmes, combined with treatment protocols that follow the most recent clinical guidelines, and are not unnecessarily limited by economic constraints. However, the availability of up-to-date, state-of-the-art technology appears to be insufficient in itself to achieve high performance rates in OECD’s health care systems.
References


BALLARD-BARBASH R., POTOSKY AL, HARLAN LC et al. (1996) Factors associated with surgical and radiation therapy for early stage breast cancer in older women, Journal National Cancer Institute, 88:716-726.


## Table 1. Proportion of women diagnosed with breast cancer and received type of treatment.

<table>
<thead>
<tr>
<th></th>
<th>Breast conserving surgery</th>
<th>Mastectomy</th>
<th>Breast conserving surgery and radiotherapy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>as a proportion of women diagnosed with breast cancer</td>
<td>as a proportion of women receiving breast conserving surgery</td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td>na</td>
<td>46</td>
<td>64</td>
</tr>
<tr>
<td>Canada</td>
<td>(c)</td>
<td>39</td>
<td>46</td>
</tr>
<tr>
<td>Canada (Manitoba)</td>
<td>39</td>
<td>57</td>
<td>70</td>
</tr>
<tr>
<td>Canada (Ontario)</td>
<td>(b)</td>
<td>34</td>
<td>43</td>
</tr>
<tr>
<td>France</td>
<td>na</td>
<td>58</td>
<td>65</td>
</tr>
<tr>
<td>Italy</td>
<td>na</td>
<td>31</td>
<td>na</td>
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<tr>
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<td>(a)</td>
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<td>na</td>
<td>23</td>
<td>24</td>
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<tr>
<td>Sweden</td>
<td>na</td>
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<td>43</td>
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<td>49</td>
<td>47</td>
</tr>
<tr>
<td>United States</td>
<td>26</td>
<td>40</td>
<td>51</td>
</tr>
</tbody>
</table>

Notes: Reflects most invasive surgical procedure.

(a) crude proportion for breast conserving surgery and mastectomy; standardised for breast conserving surgery and radiotherapy.
(b) for the "Breast conserving surgery and radiotherapy" column only: one clinic with incomplete radiation treatment information was excluded; it represents the number of women diagnosed with breast cancer, receiving a breast conserving surgery and a radiotherapy as a proportion of only women diagnosed with breast cancer.
(c) For the 1995-1997 data, breast conserving surgery number is underestimated since day surgeries are not included.
Table 2. Women receiving breast conserving surgery as a percentage of women diagnosed with breast cancer

<table>
<thead>
<tr>
<th>Country</th>
<th>Age 40-49</th>
<th>Age 50-59</th>
<th>Age 60-64</th>
<th>Age 65-69</th>
<th>Age 70-79</th>
<th>Age 80+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium (1997)</td>
<td>67</td>
<td>69</td>
<td>64</td>
<td>59</td>
<td>51</td>
<td>44</td>
</tr>
<tr>
<td>Canada (1995)</td>
<td>45</td>
<td>45</td>
<td>42</td>
<td>42</td>
<td>38</td>
<td>29</td>
</tr>
<tr>
<td>Canada Manitoba (1995-98)</td>
<td>71</td>
<td>75</td>
<td>67</td>
<td>71</td>
<td>62</td>
<td>54</td>
</tr>
<tr>
<td>Canada Ontario (1995)</td>
<td>53</td>
<td>56</td>
<td>56</td>
<td>53</td>
<td>51</td>
<td>44</td>
</tr>
<tr>
<td>France (1997)</td>
<td>66</td>
<td>71</td>
<td>65</td>
<td>65</td>
<td>53</td>
<td>39</td>
</tr>
<tr>
<td>Italy (1990-91)</td>
<td>38</td>
<td>26</td>
<td>31</td>
<td>26</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Norway (1995)</td>
<td>26</td>
<td>30</td>
<td>19</td>
<td>17</td>
<td>13</td>
<td>23</td>
</tr>
<tr>
<td>Sweden (1994)*</td>
<td>49</td>
<td>51</td>
<td>43</td>
<td>na</td>
<td>32</td>
<td>13</td>
</tr>
<tr>
<td>United Kingdom - England (1995)</td>
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<td>56</td>
<td>55</td>
<td>45</td>
<td>34</td>
<td>14</td>
</tr>
<tr>
<td>United States (1995-97)**</td>
<td>na</td>
<td>54</td>
<td>52</td>
<td>50</td>
<td>48</td>
<td>43</td>
</tr>
</tbody>
</table>

Notes:

* Sweden estimates for 60-64 years reflect 60-69 years.
** United States estimates are not available for 40-49 years.
Table 3. Women receiving a mastectomy as a percentage of women diagnosed with breast cancer

<table>
<thead>
<tr>
<th>Country</th>
<th>Age 40-49</th>
<th>Age 50-59</th>
<th>Age 60-64</th>
<th>Age 65-69</th>
<th>Age 70-79</th>
<th>Age 80+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium (1997)</td>
<td>52</td>
<td>46</td>
<td>51</td>
<td>57</td>
<td>62</td>
<td>66</td>
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<tr>
<td>Canada (1995)</td>
<td>39</td>
<td>39</td>
<td>40</td>
<td>39</td>
<td>42</td>
<td>40</td>
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<tr>
<td>Canada Manitoba (1995-98)</td>
<td>57</td>
<td>50</td>
<td>57</td>
<td>57</td>
<td>57</td>
<td>42</td>
</tr>
<tr>
<td>Canada Ontario (1995)</td>
<td>33</td>
<td>30</td>
<td>29</td>
<td>31</td>
<td>33</td>
<td>29</td>
</tr>
<tr>
<td>France (1997)</td>
<td>31</td>
<td>26</td>
<td>32</td>
<td>33</td>
<td>43</td>
<td>49</td>
</tr>
<tr>
<td>Italy (1990-91)</td>
<td>56</td>
<td>69</td>
<td>58</td>
<td>67</td>
<td>68</td>
<td>47</td>
</tr>
<tr>
<td>Norway (1995)</td>
<td>74</td>
<td>70</td>
<td>81</td>
<td>83</td>
<td>88</td>
<td>77</td>
</tr>
<tr>
<td>Sweden (1994)*</td>
<td>47</td>
<td>45</td>
<td>51</td>
<td>na</td>
<td>60</td>
<td>58</td>
</tr>
<tr>
<td>United States (1995-97)**</td>
<td>na</td>
<td>42</td>
<td>43</td>
<td>45</td>
<td>46</td>
<td>42</td>
</tr>
</tbody>
</table>

Notes:
* Sweden estimates for 60-64 years reflect 60-69 years.
** United States estimates are not available for 40-49 years.
Table 4. Women receiving breast conserving surgery and radiation therapy as a percentage of women receiving a breast conserving surgery

<table>
<thead>
<tr>
<th>Country</th>
<th>Age 40-49</th>
<th>Age 50-59</th>
<th>Age 60-64</th>
<th>Age 65-69</th>
<th>Age 70-79</th>
<th>Age 80+</th>
<th>All ages (standardised)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium (1997)</td>
<td>87</td>
<td>92</td>
<td>91</td>
<td>94</td>
<td>98</td>
<td>56</td>
<td>90</td>
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<td>Canada Manitoba (1995-98)</td>
<td>71</td>
<td>82</td>
<td>83</td>
<td>81</td>
<td>64</td>
<td>18</td>
<td>74</td>
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<td>Italy (1990-91)</td>
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<td>65</td>
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<tr>
<td>Sweden (1994)*</td>
<td>73</td>
<td>73</td>
<td>62</td>
<td>na</td>
<td>38</td>
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<td>60</td>
</tr>
<tr>
<td>United Kingdom - England (1995)</td>
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<td>74</td>
<td>76</td>
<td>79</td>
<td>65</td>
<td>28</td>
<td>72</td>
</tr>
<tr>
<td>United States (1995-97)**</td>
<td>na</td>
<td>71</td>
<td>72</td>
<td>71</td>
<td>66</td>
<td>36</td>
<td>43</td>
</tr>
</tbody>
</table>

Notes:
* Sweden estimates for 60-64 years reflect 60-69 years.
** United States estimates are not available for 40-49 years.
### Table 5. Relative five-year survival rates (percent)

<table>
<thead>
<tr>
<th>Country</th>
<th>Age 40-49</th>
<th>Age 50-59</th>
<th>Age 60-64</th>
<th>Age 65-69</th>
<th>Age 70-79</th>
<th>Age 80+</th>
<th>Adjusted overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada (Manitoba) (1985-89)</td>
<td>78.5</td>
<td>76.5</td>
<td>76.9</td>
<td>82.1</td>
<td>77.7</td>
<td>79.4</td>
<td>78.4</td>
</tr>
<tr>
<td>Canada (Ontario) (1985-89)</td>
<td>79.4</td>
<td>75.7</td>
<td>75.9</td>
<td>80.9</td>
<td>77.5</td>
<td>68.4</td>
<td>76.5</td>
</tr>
<tr>
<td>France (1985-89)</td>
<td>82.6</td>
<td>79.6</td>
<td>88.0</td>
<td>81.2</td>
<td>83.2</td>
<td>78.4</td>
<td>82.0</td>
</tr>
<tr>
<td>Italy (1985-89)</td>
<td>82.2</td>
<td>75.8</td>
<td>77.6</td>
<td>78.6</td>
<td>82.2</td>
<td>75.7</td>
<td>79.0</td>
</tr>
<tr>
<td>Japan (1992)*</td>
<td>90.5</td>
<td>85.9</td>
<td>86.3</td>
<td>na</td>
<td>81.4</td>
<td>76.4</td>
<td>84.9</td>
</tr>
<tr>
<td>Norway (1990-94)</td>
<td>80.5</td>
<td>79.2</td>
<td>75.2</td>
<td>79.8</td>
<td>74.1</td>
<td>74.6</td>
<td>77.9</td>
</tr>
<tr>
<td>Sweden (1989)*</td>
<td>81</td>
<td>79</td>
<td>88</td>
<td>na</td>
<td>85</td>
<td>73</td>
<td>82.2</td>
</tr>
<tr>
<td>United Kingdom - England (1993-95)*</td>
<td>79.5</td>
<td>81.7</td>
<td>77.5</td>
<td>na</td>
<td>69.6</td>
<td>53</td>
<td>74.1</td>
</tr>
<tr>
<td>United States (1989-95)**</td>
<td>82.6</td>
<td>82.5</td>
<td>84.7</td>
<td>na</td>
<td>82.7</td>
<td>na</td>
<td>83.8</td>
</tr>
</tbody>
</table>

Notes:
* Estimate for 60-64 years reflects 60-69 years.
** United States’ estimates for 40-49, 50-59, 60-64, and 70-79 reflect 45-54, 55-64,65-74, 75+ respectively.
Chart 1. Proportion of women diagnosed with breast cancer and treated with BCS, who also received RT and availability of RT machines (1995-99)

Note: a corrected point has been inserted for the US (+ 16 %). See Du and Freeman, 1999.

Chart 2. Proportion of women aged 70-79 diagnosed with breast cancer and treated with BCS, who also received RT and availability of RT machines (1995-99)

Note: a corrected point has been inserted for the US (+ 16 %). See Du and Freeman, 1999.
Chart 3. Trends in age-standardised mortality rates for breast cancer (rate per 100 000)

Chart 4. Proportion of women receiving a mammography and availability of mammography machines

(1) For United Kingdom, proportion of English women aged 50 to 64 receiving a mammography in the past years
Chart 5. 5-year relative survival rate and availability of mammography machines in a recent year

Chart 6. 5-year relative survival rate and availability of radiotherapy machines in a recent year