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# THE LIFE SAVERS

THE VALUE OF  
MEDICAL AND DIGITAL  
HEALTH TECHNOLOGY  
IN BREAST CANCER CARE

A STUDY OF BREAST CANCER SPECIALISTS ACROSS THE EU

JUNE 2019

SUPPORTED BY



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## IN BRIEF...

In medical history, there are certain key advances that unequivocally have saved lives by the millions. Vaccination, antibiotics, knowledge of hygiene and lifestyle effects are among them. But one, the use of imaging and treatment in breast cancer, is a special case. Over just the past generation, hundreds of millions of women across the EU have entered routine screening programmes. And the results, confirmed by abundant research: early detection and greater awareness have saved millions of lives – cutting death rates by a third to half. These technologies are true life savers.

This report, the result of a year-long programme of interviews and survey across the EU, gathers the evidence – and asks all stakeholders how they think technologies, and how they're applied, could improve outcomes even more. Use of digital mammography, tomosynthesis, magnetic resonance imaging, positron emission tomography and other new scanning and treatment techniques varies across countries and high investment costs limit access across countries. Fast evolution in care is driven by artificial intelligence, Big Data, personalised or targeted therapies, health apps and remote monitoring. Basic parts, such as x-ray mammography and radiotherapy, are ever-improving in effectiveness and accuracy. Others are still on the horizon. Together, they reflect the incremental but inexorable progress that has been the hallmark of medical technology over many years.

Our research focused on five diverse EU member states: the Netherlands, Sweden, Czech Republic, Germany and France. Respondents – from patients to doctors to researchers – see how screening and early-stage detection have transformed care

for breast cancer; but each group has different perspectives, of course. Researchers look forward to more advances in image quality and accuracy, to guide their discoveries. Clinicians want multidisciplinary and digital support to share information, to foster collaboration – to improve the accuracy and efficiency of treatments. Patients, and their associations, see the benefit of early detection through screening programmes, but in treatment they want a more human experience – focused on the patient's needs, fears and hopes. They think digital technologies, far from impersonalising care, could make it better – with smartphone apps, social media empowering patient networks, or remote monitoring to help rural patients.

There is a general consensus that the clinical history of patients, images and medical records should be shared, in a safe manner – avoiding inefficiency, redundancy or, worse, mistakes, in treatment. Another set of challenges: getting enough budget and skilled staff in imaging and oncology/radiotherapy, to be sure every patient gets the treatment she needs when and where she needs it. Often, even after clinical benefit is proven, policy makers and insurers are unable to organise access because of cost. Moving forward implies investment in, and agreeing on a way to value, new technologies and their reimbursement.

# 10 IDEAS FOR BETTER BREAST HEALTH

## FOR THE EU INSTITUTIONS

This research highlights at least two major challenges for EU intervention: The big disparities of care and outcomes for breast cancer around Europe, and the need for more progress in technology and treatment development. The EU has several instruments already to hand, which it can apply during the next Multiannual Financial Framework. It can:

**01** Accelerate ongoing efforts to gather, share and standardise important health data. Through Big Data, artificial intelligence and other advanced analytics, health administrators can spot disparities in care between regions, and improve the quality of care. The EU can help through standardisation of data formats and analytics across the EU, and augment its already significant role as a clearing-house for best-practice information among the member states.

**02** Employ Horizon Europe funding to speed development of new treatments and care techniques, as well as the analytics and methodologies needed to make better use of shared health data. The rapid advance of technology in the field of breast cancer can go even further – and it is a classic Horizon role to accelerate and share R&D across the EU.

**03** Support member states in the development and adoption of better models for assessing the value of new technologies and treatments. This is a complex field for which EU-level information-sharing could help greatly.

**04** Support member states in harmonising their screening programmes. Variance in practice around the EU is high, and outcomes for patients are consequently unequal.

## FOR NATIONAL AND REGIONAL HEALTH ADMINISTRATORS

Reduce inequalities in care, and deploy new technologies faster. We have already seen how the earlier technologies of mammography and treatment have saved lives; today we see an exciting new wave of digital technologies arriving that have vast potential to improve patient outcomes, make better use of scarce clinical time and resources – and make the experience of breast cancer less harrowing for millions of women across the EU. With support from the EU institutions, national and regional health administrators can:

**05** Make greater use of evidence-based systems in breast cancer care delivery. This requires re-engineering the way systems use data, develop treatment protocols and organise care. It requires re-training staff. But it can lead to a more efficient, more equitable distribution of resources and care.

**06** Accelerate the assessment and, where appropriate, uptake of new treatments, tools and technology. For some regions, EU Structural Funds could help finance progress. For all regions, key to progress will be developing consistent, reliable methodologies for valuing new treatments and technology. Also key, for efficiency's sake: making sure new technologies are inter-operable and do not lead to technology "islands".

**07** Step up education and awareness of the importance of screening. Make sure every woman knows to watch for abnormal changes, enters a screening programme at the appropriate age, and – if diagnosed with cancer – understands the necessity of treatment adherence.

## FOR CLINICIANS AND ADMINISTRATORS

As we introduce new technologies, we must use them to improve the concept of care – to make it truly patient-centred, involving patients in their own care, improving hospital quality measures and more. In short, we can improve both the outcome and the experience of being a breast cancer patient. For this, clinic and hospital staff should:

**08** Look for opportunities in which new techniques and technologies can improve the patient experience – from smartphone apps to in-home monitoring. The less time a patient spends in waiting rooms, the better.

**09** Think of the "soft" factors of care more often. Small things – support groups, counselling, even yoga classes – can improve patient compliance and speed healing.

**10** Train constantly. New techniques, new thinking, new technologies need properly trained staff to get the most out of them. This is the responsibility of all in the care continuum.



# 01 BREAST CANCER IN EUROPE



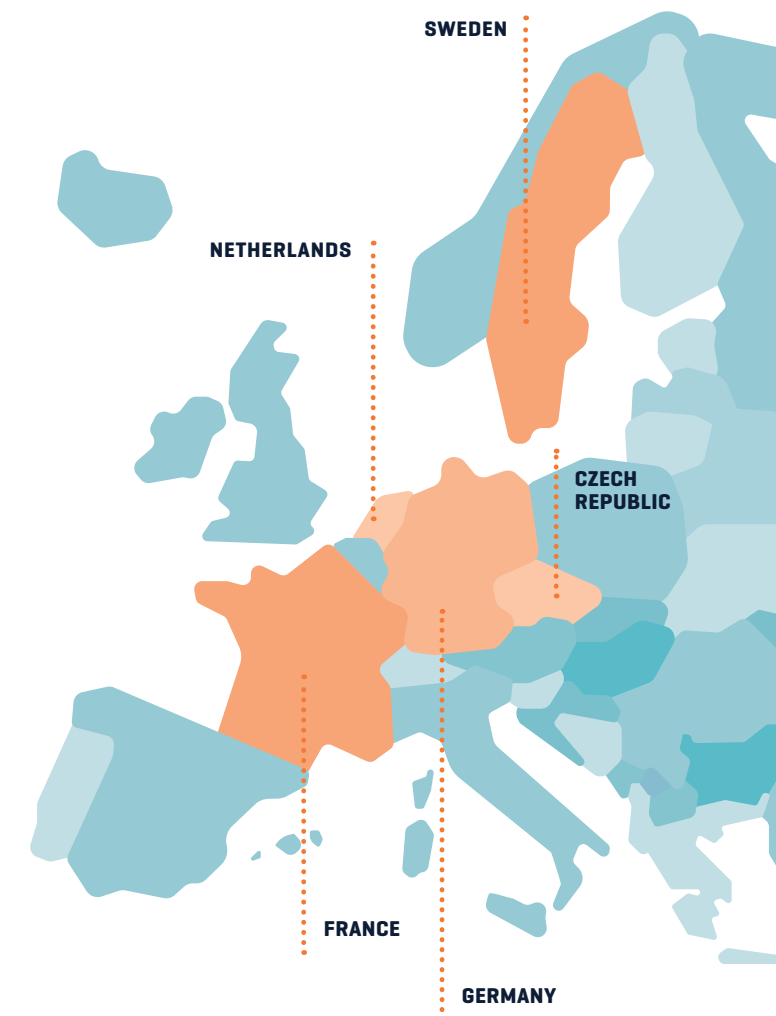
## ABOUT COCIR

COCIR is the European trade association representing the medical imaging, radiation therapy, digital health and electromedical industries. It is a non-profit association, founded in 1959. It commissioned Science|Business to conduct this independent, year-long study.

Cancer is the second largest cause of death in Europe after cardiovascular disease – and for women, breast cancer is the most common type of cancer today. But a diagnosis is not as dire as it once was. Mortality due to breast cancer has declined considerably in most developed countries. This can be attributed to a combination of factors: the introduction of mammography screening programmes in many European countries, greater awareness of the importance of early diagnosis, and significant advances in cancer biology and treatment strategies. Moreover, the advent of artificial intelligence (AI) and personalised care are among many new technologies that offer hope of continued progress in the war on cancer.

Further demonstrating the value of innovations is vital to their uptake. More and more, health administrators and payers want evidence of improved patient outcomes to inform their reimbursement and procurement decisions. The impact of early detection and intervention on patients, healthcare professionals and the wider healthcare system is central to future policy for breast cancer care.

Against this backdrop, the COCIR industry association commissioned an independent, year-long study of how stakeholders view the value of medical and digital technology across the continuum of care. The research focused on breast cancer patient experiences and the role of medical technologies in five selected countries: Germany, France, Sweden, the Netherlands and the Czech Republic. It is built upon a literature review, interviews and a survey. The research addresses key actors and opinion leaders across the complete care continuum in breast cancer in these five countries and in over-arching European organisations. This report delivers key findings for policymakers in the EU and at national level – and speaks to patients, doctors, nurses, administrators and the public at large.



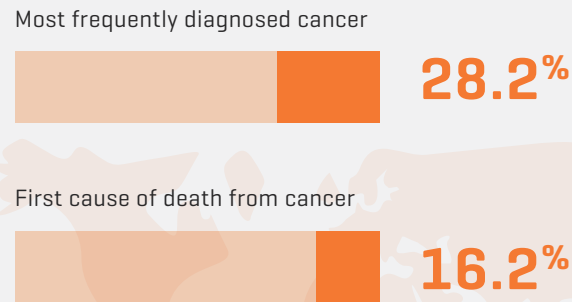
**BREAST CANCER**  
— BY THE NUMBERS

Breast cancer remains by far the most frequently diagnosed cancer [28.2% of the total] and also the first cause of death from cancer in women worldwide [16.2%]. In Europe, there were 523,000 cases of breast cancer in 2018. In that year, an estimated 138,000 women died from the disease. Due to an ageing population, significantly more women will be confronted with this disease in future. Breast cancer incidence continues to rise and the average five-year relative survival rate for breast cancer in women in Europe is 82%. [Ferlay 2018]

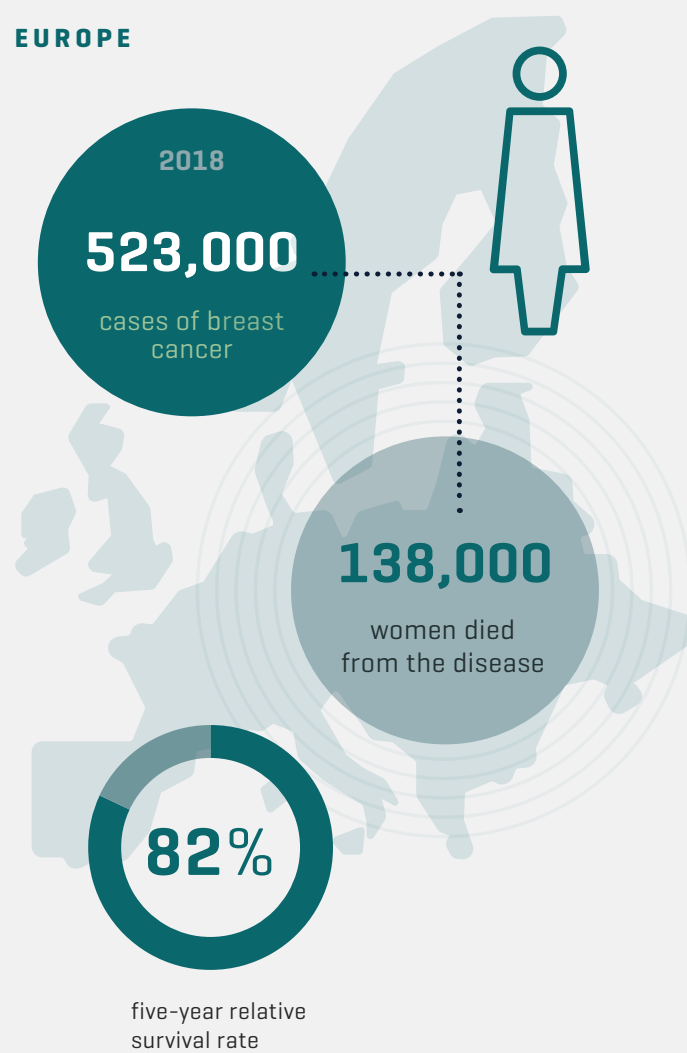
But the averages are misleading: it matters greatly where you live. There are large variations in the estimated incidence rates across Europe, ranging from 60 to 155 per 100,000 people. There is a clear geographical pattern: the highest rates are in western and northern countries. Likewise, death rates vary, from 15 to 32 per 100,000. The geographical pattern: lowest mortality in southern Europe and in the Nordic countries. Behind the differences is a long list of possible factors: variations in cancer biology, prevalence of risk factors, socioeconomic and cultural diversities, use of diagnostic tests, adoption of advanced imaging and digital technology, access to screening programmes, stage at diagnosis, access to high quality care and latest advances, and data collection practices [De Angelis 2014; Baade 2017]. There are also significant differences within countries, particularly where regions have a large degree of autonomy. Big cities tend to be first to benefit from technological advances, making Paris and Frankfurt more alike than smaller regional towns and cities in France and Germany.

**BREAST CANCER**

**WORLD**



**EUROPE**



**EUROPE**

**WESTERN EUROPE**

**SOUTHERN EUROPE**

**NORTHERN EUROPE**

**CENTRAL & EASTERN EUROPE**

Region/Country	Incidence (per 100,000)	Mortality (per 100,000)
<b>EUROPE</b>	100.9	21.8
<b>EU-28</b>	113.6	21.4
<b>WESTERN EUROPE</b>		
Belgium	154.7	24.3
Luxembourg	148.8	23.6
Netherlands	143.8	24.2
France (metropolitan)	133.3	22.7
Switzerland	120.7	18.2
Germany	116.2	23.4
Austria	96.2	21.3
<b>SOUTHERN EUROPE</b>		
Italy	125.4	20.3
Malta	121.0	18.7
Montenegro	116.1	32.0
Cyprus	110.5	24.7
Serbia	101.4	31.9
Spain	101.2	15.4
Greece	94.3	20.2
Portugal	94.0	16.6
Croatia	93.6	27.3
Slovenia	93.4	20.2
North Macedonia	82.9	24.8
Albania	62.0	15.1
Bosnia Herzegovina	60.9	21.1
<b>NORTHERN EUROPE</b>		
United Kingdom	127.7	21.5
Ireland	123.2	26.0
Sweden	122.9	17.2
Finland	122.9	16.5
Denmark	121.1	22.2
Norway	118.7	16.3
Iceland	116.7	25.7
Latvia	85.1	25.5
Estonia	83.1	20.5
Lithuania	80.6	22.7
<b>CENTRAL &amp; EASTERN EUROPE</b>		
Hungary	116.0	26.1
Czech Republic	97.0	17.1
Slovakia	81.8	24.6
Poland	79.5	22.9
Bulgaria	79.3	23.5
Russian Federation	72.3	21.5
Romania	70.3	21.2
Belarus	68.1	18.0
Moldava	66.3	28.3
Ukraine	60.0	23.6

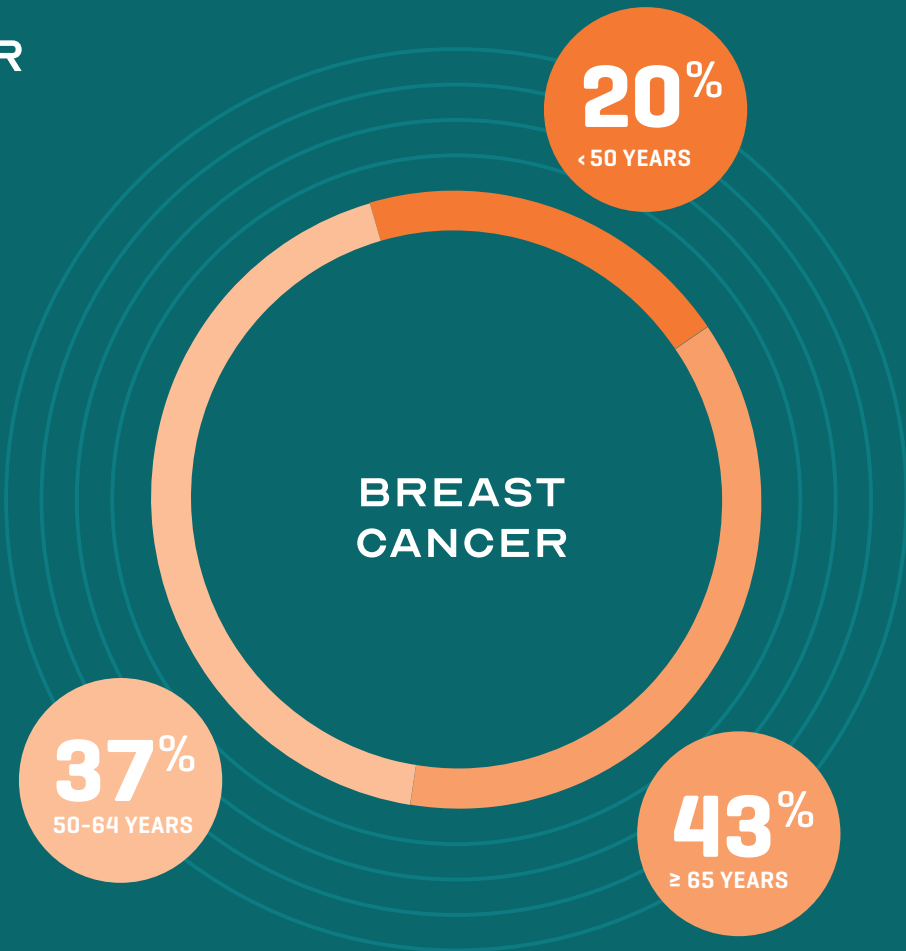


# BREAST CANCER RISK FACTORS



One in eight women will develop breast cancer before the age of 85.

Many of those affected are in the prime of their lives when they are busy working and raising families.



## TYPES OF RISK

### MODIFIABLE RISKS

Sedentarism & industrialisation

Alcohol abuse

Tobacco use

Body mass index/obesity

### NON-MODIFIABLE RISKS

Age

Sex

Genetics & familial risk\*

Age of menarche & menopause

\*It is known that harmful mutations in some genes [BRCA1 and BRCA2 are two well-known examples] significantly increase the risk of breast cancer.

## TECHNOLOGY GLOSSARY



### MAMMOGRAPHY

An x-ray picture of the breast, used to scan for cancerous abnormalities



### CONTRAST-ENHANCED SPECTRAL MAMMOGRAPHY (CESM)

A type of mammogram highlighting areas of concern, using a special dye injected into veins before an x-ray



### MAGNETIC RESONANCE IMAGING (MRI)

Uses strong magnetic fields to generate images of the body



### ULTRASOUND

Creates images of body structures based on high-frequency sound waves



### DIGITAL BREAST TOMOSYNTHESIS (DBT)

The x-ray system captures multiple images of the breast and computer reconstruction creates three-dimensional images that minimise tissue overlap that could conceal potential cancers



### NEEDLE BIOPSY

A procedure using a needle to take a sample of cells from the body for lab analysis

## EU POLICY RESPONSE TO BREAST CANCER

Breast cancer policies in Europe have been designed to tackle the high incidence and mortality caused by this disease and the impact that it has on society. The EU regulates safe use of ionising radiation in medicine, and requires professional training and adaptation of hospital equipment. It funds research, gathers data, organises networks and generally tries to act as a clearing house for breast cancer policy and information across the EU. Through the publication of European guidelines for quality assurance in screening and diagnosis, the EU has fostered cooperation among national governments, professional organisations and civil society to maintain and improve the health of its citizens.

Prevention campaigns aim to reduce exposure to modifiable risks such as diet, smoking and alcohol consumption, while promoting exercise and a healthy life style. To improve outcomes, early detection is vital. The focus in most member states is on a combination of encouraging women to examine their own breasts for worrisome changes, and getting them to join voluntary screening programmes.

Nevertheless, there is still scope for improvement. Screening services need to be improved to minimise exposure to radiation and avoid false positive results that upset women and risk overdiagnosis and overtreatment. For example, women with dense breast tissue, which makes it harder to interpret test results, can be more accurately screened. An industry-wide innovation pipeline is now delivering improved technologies, such as digital breast tomosynthesis, contrast-enhanced magnetic resonance imaging and ultrasound.

Of course, health services must always strike a balance between demand and supply, between those who need medical attention and those with the budget, health technology and staff to provide it. One way to manage that balance is through tracking the real-world impact of treatments and technology on patients. The idea: measure what works best for the money, and do more of that. By this yardstick, breast screening programmes work.

**SCREENING:  
WHAT DOES THE EVIDENCE SAY?**

A wealth of international research has been published demonstrating the importance of screening programmes. It shows that mammography is the most commonly used imaging procedure, for both early detection and diagnosis. By 2007, it was already the norm throughout the EU, with programmes running or being established in at least 26 member states.

Screening tools have advanced since the introduction of the first programmes. While film-screening still takes place, digital mammography is today the recommended method [Sardanelli 2017]. European guidelines suggest that screening mammography be performed every two years for the general female population from 50 to 70 years of age, although there is significant variation from one country or region to another. If something suspicious is found in the mammography, a growing arsenal of technologies can investigate further.

The result: lower death rates. Several studies have looked at the impact of population-based mammography screening in Europe. An overview of 17 such studies estimated that mortality among women who participate in the screening programmes had been cut by 38% to 48% - or, stated more broadly, somewhere between a third and a half [Broeders 2012]. Similarly, a more recent study estimated a 40% reduction specifically for women aged 50 to 69 years [Lauby-Secretan 2015].

But the impact depends very much on where you live. A report by the Organisation for Economic Cooperation and Development [OECD 2018] found significant variation around Europe on the extent of national screening programmes and their impact. Some countries have made huge strides. Spain cut its breast-cancer death rate to 23.5% in 2015 from 29.6% in 2000; by 2016, an astonishing 80% of Spanish women aged 50 to 69 years old had been screened in just the past two years. In the Czech Republic, the improvement was even more dramatic: In that same 15-year period, as screening jumped to 61.4% of middle-aged women from 35.6% in 2000, the death rate plummeted to 29% from 42.8%.

**WHY ARE THERE GEOGRAPHICAL DIFFERENCES?**

There are many reasons why the effectiveness of screening programmes differs around Europe. In low and middle-income countries, screening programmes are less well organised, spend too little on enlisting women, or have questionable accuracy in the methods used to estimate incidence and mortality [Altobelli 2017].

Studies have shown that educational level plays a crucial role in how many women join screening programmes [Willems and Bracke 2018]. In many regions, not enough women take the time to get screened; they do not feel sick, so they do not act. Education about the fact that breast cancer is curable when treated early is essential to make screening programmes work.

Yet in some countries, the picture is less encouraging. Just across the border, in neighbouring Slovakia, there has been virtually no improvement over the 15 years, with screening rates unchanged at about 30% of middle-aged women, and the death rate stuck at a relatively high 40%. The OECD report notes that persistent geographical disparities point to "room for improvement in early detection and treatment in countries mainly in Central and Eastern Europe".

Managing the recall rate, or the frequency with which screened women are called back for more scanning, is essential. Too high, and you may be wasting time, money and peace of mind. Too low, and you may be missing some cancers. Yet another challenge is the possibility of over-diagnosis. Not all cancers found with screening are aggressive; it is estimated that approximately 6.5% of patients whose screens found cancer would have remained totally free of symptoms because of the slow growth rate of their particular lesions [Lauby-Secretan 2015].

But for health authorities world-wide, such challenges are kept in perspective. Research suggests that the probability of an individual woman's life being saved by screening is double that of being over-diagnosed [Paci 2014].

**DETECTING & TREATING BREAST CANCER**





**NEW TECHNOLOGIES,  
NEW OPPORTUNITIES**

The innovation pipeline hasn't stopped. For instance, digital breast tomosynthesis (DBT) acquires breast images in multiple 3D slices, offering a much clearer picture than traditional two-dimensional mammography. Some studies, reporting comparison of mammography alone with mammography plus tomosynthesis, show DBT can increase cancer detection by up to 30 or 40% [Kopans 2014, Ciatto 2013]. Overall, tomosynthesis raises detection rates while reducing recall rates [Marinovich 2018], suggesting it could become routine in screening programmes. But it's a complex issue. Another study found that, for women with hard-to-scan dense breasts, ultrasound technology actually detected more breast cancers than tomosynthesis – but also caused more false positives. More research is underway.

Meanwhile, magnetic resonance imaging (MRI) is evolving to address all aspects of breast health, from preventive care to monitoring the effectiveness of treatments. For several reasons, including relatively high cost and limited availability, MRI is used mostly to screen high-risk women, evaluate the extent of cancer before surgery, and assess drug-treatment response. A survey by the European Society of Breast Imaging found substantial differences between countries in the use of MRI [Clauser 2018]. For example, in southern countries, preoperative breast MRI is more often performed on all cancer patients rather than only on those with specific lesions; northern countries tend to use it more selectively.

Digital and "connected" health technology is also under constant development. Apps, for instance, can help patients monitor their symptoms, track their physical activity and prompt a timely "recall" to the clinic for more treatment. There is a growing list of these wearable devices and smartphone applications in the medical world, but their use in breast-cancer care is still in its infancy; and there is a need for validation if they are to be incorporated into clinical practice. But the potential benefits are clear: Technology that can track and support patients at home may also reduce pressure on hospital infrastructure, reducing costs for all.

Artificial intelligence (AI) may also become a regular medical tool in both research and care, to predict patient outcomes, help analyse images or suggest treatments that adjust in real time on the basis of patient responses. For instance, one common problem under study: High-risk lesions found in a breast biopsy

do not always develop into cancer – but how can you tell which to treat, and which to leave alone? To answer that, researchers at Massachusetts General Hospital in Boston, working from the case histories of over 1,000 patients, fed their computer 20,000 data elements; it correctly identified 97% of the lesions that did in fact become cancerous. The model, had it been available to those patients, could have avoided a third of the surgeries that were performed on what were later found to be unnecessary, benign cases. This kind of advance may eventually offer enough technical support that doctors can focus more on caring for their patients – a human role that machines cannot replace.

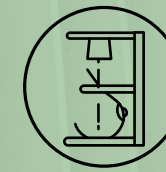
Radiotherapy has also been advancing. Selecting patients by risk factors – the size of tumour, whether it has spread to the lymph nodes, the type of surgery – can guide decisions on which types of radiotherapy are needed. In any case, radiotherapy is an integral component of therapy used in a variety of clinical situations, from precursor lesions to advanced breast cancer. In some cases, it may be possible to skip or limit treatment, such as in low-risk or older women, while in other cases, for example in node-positive tumours, escalation of radiotherapy may be indicated.

The key is to maximise local control and avoid unnecessary toxicity. Today, researchers are working to identify high-precision radiotherapy that can adapt to the specific profile of the tumour and needs of the patient.

Yet this may be only the start. Hitherto, breast cancer has been considered as "immunologically silent" – meaning the normal immune system can't detect and stop it. But some recent data suggest that may not be true for certain breast cancer subtypes. At the 2018 annual meeting of the Radiological Society of North America, researchers discussed the potential of radiotherapy to convert cancer cells into an in situ vaccine. It has been shown that the immune system can sense the effect of radiation; that, in turn, could help the body spot and respond to the cancer [Formenti 2018]. Although these studies were not carried out with breast cancer patients, this newly identified combination of radiotherapy and immunotherapy was shown to leverage both innate and adaptive immunity; it could induce neoantigens that can be recognised in human beings and convert the tumour into a vaccine. Much research remains to be done – but the discovery highlights how much more we can still learn about cancer.



**THE  
30-SECOND  
SUMMARY**



Strong evidence supports screening mammography, now widespread and demonstrably prolonging lives. Overall, screening has cut breast-cancer mortality in Europe by 38% to 48%.



There is wide variation, in both screening and treatment programmes, across Europe despite EU efforts at coordination and standardisation. There is room for improvement in many central and eastern European countries, in particular.



Digital mammography is now preferred by doctors; and further digital imaging technologies, such as 3D tomosynthesis, may become routine.



A range of new digital technologies will transform diagnosis and treatment. Artificial intelligence, personalised screening and treatment (including radiotherapy), smartphone apps, wearable devices and other systems can make health care more effective.



Radiotherapy is continuing to evolve rapidly – and combined with other therapies could produce some startling new treatments.



While the overall effect of these technologies has been profound, the individual innovations have often been step-by-step – a testament to the continuous pipeline of new ideas and products for breast cancer screening and treatment.



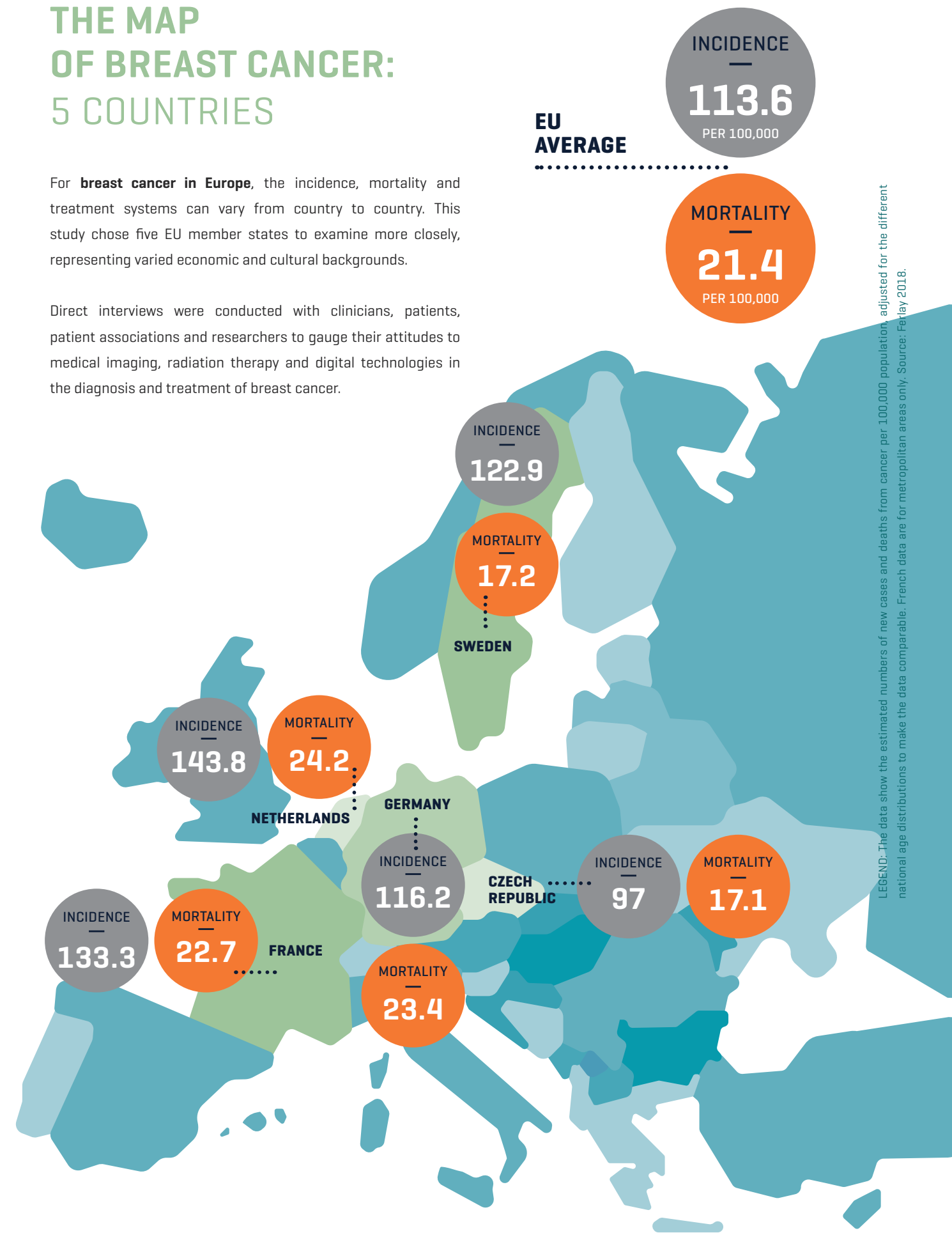
# 02 NATIONAL PERSPECTIVES ON BREAST CANCER CARE

## CANCER MAP

### THE MAP OF BREAST CANCER: 5 COUNTRIES

For **breast cancer in Europe**, the incidence, mortality and treatment systems can vary from country to country. This study chose five EU member states to examine more closely, representing varied economic and cultural backgrounds.

Direct interviews were conducted with clinicians, patients, patient associations and researchers to gauge their attitudes to medical imaging, radiation therapy and digital technologies in the diagnosis and treatment of breast cancer.



LEGEND: The data show the estimated numbers of new cases and deaths from cancer per 100,000 population, adjusted for the different national age distributions to make the data comparable. French data are for metropolitan areas only. Source: Feyley 2018.

# WHAT THE PATIENTS THINK

A breast cancer diagnosis comes as a shock. At the heart of the fear factor that accompanies the 'Big C' is dread of the unknown: a sense of losing control over the future. The scary medicines, the high-tech machinery, the hospital bureaucracy – however good and effective – are still hard for most people to take. So, any report of Europe's breast-cancer care should start at the beginning: with the women and their need for a human, caring experience.

Martine J., a senior French civil servant (she asks that her name not be published), received breast cancer care in Paris. She feels that while her medical care was excellent, some aspects could have been improved. She would have preferred a more comprehensive care with additional features – such as yoga – to help handle the challenges.

She says "the support of friends" helped her find the strength to deal with the disease. Still, the physical aspects of coping with the illness and treatment were tough. Patients encountering secondary effects of treatments (for example, weight gain due to hormone therapy) may be inclined to give up, Martine warns. In such cases, it could help to have digital health technologies available to provide support and guidance. And, in communication with the medical team, these tools could be developed to aid follow-up with patients after treatment.

By contrast, Anna Ledin, treated in Helsingborg, Sweden, had a very different experience. She says she felt "very well informed during the whole care process" and even managed to keep working full time while undergoing treatment. She believes that the Swedish health system is very focused on "good communication, paying a lot of attention to patient satisfaction".

She says the reading material she was provided during her treatment including detailed information about the post-

treatment experience, helping her navigate an unfamiliar path. "They were keen to make it as much of a good experience as possible, with a friendly, positive and safe environment," she says.

However, she notes that there are differences between and within countries: two Swedish cities may have quite different approaches to patient engagement. She says that her experience, as a well-educated patient (she has a PhD) living in the south of Sweden where there is plenty of research going on and access to the latest technologies, was of the best possible care available from a medical and human point of view.

## NO TWO CASES ARE ALIKE

No cancer patient is exactly like another, and the interviewees for this report fit that pattern. Some were diagnosed less than a year ago; others more than a decade ago. Ages ranged from the early 30s to over 70 years of age, representing a similar distribution to the profile of age at time of breast-cancer diagnosis. At the time of diagnosis, more than half did not have symptoms; and the vast majority of cancers were detected by mammography (if not, sonography was used). Digital mammography was widely employed and, in almost half of the cases, patients were told how much ionising radiation was involved. After diagnosis, MRI was often used. In some cases – although this varied considerably – positron emission tomography (PET) combined with computed tomography (CT) were also employed. Collectively they represent some good snap-shots of the life of a breast cancer patient in Europe in 2018.

None of the women interviewed had been given the opportunity by their doctors to participate in a study or clinical trial, but all mention that they would have been happy to do so in order to help breast cancer care advance. The majority of patients felt "well informed about the disease and their therapeutic options and trusted the opinions of their clinicians". While many feel that they

had the opportunity to participate in the decision-making process, others did not play an active role in determining their treatment path. The treatments received included surgery, radiotherapy, chemotherapy and/or hormone therapy according to tumour type, disease stage and experience of medication side effects.

Despite their trauma, several patients express optimism. They expect care to get better and more personalised, thanks to science and technology. Their comments often focus on "speed and accuracy of diagnosis" and there is a strong will to "exploit all available diagnostic options before beginning therapy", in order to reduce exposure to aggressive treatments. There is a strong call for a more holistic vision of the cancer patient to minimise secondary effects.

The potential use of digital tools to support better coordination of the care pathway is welcomed by patients, with some mentioning their potential use during treatment follow-up. One patient suggests the "development of a digital platform that analyses all relevant aspects to ensure a better quality of life during treatments (particularly during chemotherapy)". These could include nutrition, exercise, mindfulness and yoga, according to interviewees.

Several patients call for better access to information and digital tools. These technologies should be at the centre of data-driven, value-based healthcare, it is argued. This would also improve efficiency, facilitating interaction between clinicians and patients.

## DIGITAL DIVIDEND: MONITORING AND SUPPORT

Could digital tools bring support services closer to patients? That's the hope of breast cancer advocates working to help patients cope with the after-effects of cancer treatment.

Eléonore Piot coaches cancer patients at the Institut Curie in Paris, steering them through the post-treatment phase of their journey. "After finishing their treatments, some women may be left with problems – secondary effects that require further support and adaptation as they learn to live with cancer," she says. "Digital technologies may also help during this new period, providing health support, information and about diet, fatigue, secondary effects. It may allow us to follow the development of the disease and help patients communicate with the hospital".

She said this "controlled follow-up" would also reduce patients' growing reliance on online information sources of dubious quality. Websites with unverified medical advice can influence adherence to hormone therapies, for example, "obscuring the positive effects that will be achieved in the long-term."





## HOLISTIC HEALTH: A CZECH PATIENT GROUP MAKES A DIFFERENCE

Patient support groups can help people with breast cancer handle the psychological and emotional traumas.

**Mamma HELP was founded in 1999 in the Czech Republic.** It plays an active role in advancing cancer care. Its members attend conferences and events. Its brochures are in oncology waiting rooms; and it maintains website, social media and a free helpline “The toll-free line is especially important for women in smaller towns and villages,” says Mamma Help’s Jelena Burianová.

Looking ahead, her group is advocating greater harmonisation in care standards across Europe. Burianová says all patients should share the benefits of the technological advances already improving the prognosis for some.



While clinicians and scientists highlight the variation in breast cancer types, patients also speak of their wide range of experiences with the practical and psychological aspects of living with the disease. Some patients managed to continue with their daily routines, aiming to keep life “as normal as possible”. Others say they would have appreciated more time with their oncologist and additional psychological help, emphasising the “need to consider the human factor” – treating patients rather than managing diseases. The psychological burden of a cancer diagnosis is a recurring theme, including from those who declined an interview request rather than relive the stress of their cancer story.

Northern European countries [exemplified by Sweden in this report] appear to afford greater attention to broader aspects of patient wellbeing, in addition to medical and clinical factors. This fits with the universal desire among patients to have more time, closer attention and greater understanding from healthcare providers.

### PATIENT ADVOCATES

Patient associations are often an important part of the cancer experience. They can provide patients and their families with valuable information, psychological support and understanding. They also play a growing role in devising clinical trials, defining outcomes that matter to patients, and pushing for access to medical innovations. Their capacity, however, varies enormously, from volunteer-led local or regional associations to officially supported organisations with the power to participate in international projects.

The European Cancer Patient Coalition [ECPC] is the voice of over 400 cancer patient organisations, covering all types of cancers, including breast cancer. ECPC Director Lydia Makaroff is enthusiastic about her group’s research involvement. For example, one of the clinical trials in which they are currently involved will evaluate the impact of mobile phone-based monitoring for patients receiving chemotherapy for one year. The trial, which includes people with non-metastatic breast cancer [as well as colorectal and haematological cancer], looks at the impact of technology on the outcomes and quality of life of cancer patients.

## WHAT THE DOCTORS THINK

Clinicians, too, have important perspectives on the relation between technology and care. For those interviewed for this report – experienced professionals operating in multidisciplinary teams – a key technological development of the past decade has been digital. For them, digital mammography is now standard, shown in several studies to perform as well or better than screen-film radiography, with the added advantage of improved data storage and communication [Heddsen 2007].

Another advance cited by radiation oncologists is hypofractionation – delivering radiation therapy in large doses over a shorter period of time; for that, a marriage of digital and radiation technologies is required. Potential clinical and practical advantages of hypofractionation were mentioned in several interviews; they include fewer hospital visits and improved tumour control, because cancer cells have fewer opportunities to repopulate the tumour bed.

Nevertheless, challenges remain, such as the need to further reduce radiation doses and increase accuracy. A potential solution, to reduce toxicity and complications to the heart and lungs, is the use of proton therapy, since it deposits most of the energy in the affected breast area rather than scattering broadly. Proton therapy, however, costs a lot more than conventional radiation therapy. In some cases, the benefits are worth considering, according to clinicians. For example, proton therapy may be particularly useful in women with pre-existing heart or lung disease. Other solutions, such as modern photon radiation, are developed to better distinguish target from healthy tissue and treat more specifically risk areas, limiting side effects and late damage risk. Further data from clinical studies is required to determine the benefits, effectiveness and side effects of proton therapy. Further innovation in bridging diagnostic quality imaging to the moment of radiation treatment is currently making it possible to reduce toxicity significantly, excluding safety margins.

Different treatment equipment combining diagnostic CT, MRI, ultrasound and PET scanning are becoming commercially available today. While reducing significantly the exposed volume of the body irradiated, shorter, high dose regimens can be used safely, accelerating the trend to reduce overall treatment times [from 30 to 1-5 sessions], and directly improving patient comfort and access to care. Overall, the less tissue we expose to radiation the fewer side effects we will encounter. At the same time, however, we want to minimise the risk of the cancer coming back. It is a difficult balance to strike – for which more research is needed.

All respondents considered it important to make the clinical history of patients, images and medical records accessible from any health centre across Europe through a secure system. This would be safer and faster for the patient and would improve the practical work of the clinical personnel, it was broadly agreed.

Budget matters, of course. Clinicians do “not always have access to the latest equipment”, respondents agreed. However, another relevant problem was the lack of appropriately trained personnel both in imaging and radiotherapy. Guy Frija, professor emeritus of radiology and consultant at Paris Georges Pompidou European Hospital, argues that investment in new tools must be complemented by investment in training and human resources.

Clinicians expect imaging, radiation therapy and digital health technologies to support personalised medicine and improve treatment and monitoring of patient outcomes. The common hope is that innovative health technologies will help identify smaller cancers, at an earlier stage and lower cost. Early and accurate detection and diagnosis are the priorities, according to respondents. It was hoped that this would translate into patient benefit by reducing recalls and biopsies and improving prognosis and clinical outcome.

## PREDICTIVE POWER: IS MRI UNDERUSED?

Magnetic resonance imaging (MRI) could be deployed more widely, giving clinicians more information on the likely course of a patient's disease, says Dr. Julia Camps, breast radiologist and president of the European Society of Breast Imaging (EUSOBI).

EUSOBI has published recommendations on screening, mammography, ultrasound and MRI in clinical practice. Dr. Camps says breast imaging can help clinicians with cancer staging, treatment monitoring, high-risk screening and problem solving. She highlights its "use in pre-operative practice, where MRI contributes to define the extent of the lesion that needs to be removed". This helps avoid unnecessary secondary interventions.

Dr. Camps hopes MRI and other technologies will push breast cancer care forward. For example, radiomics - the computational analysis of large amounts of imaging data using sophisticated algorithms - could bring new levels of prediction and precision. Together with radiogenomics (or any of the other "-omics"), which combines information cancer imaging with genetic data, these tools can combine to "greatly improve prediction, prognosis, and therapeutic response in breast cancer," Dr. Camps says.



## WHAT THE RESEARCHERS THINK

Science advances medicine; we all know that. But the tools we use - the x-ray machines, MRIs, AI systems, smartphone apps and more - are also important.

Our interviews found breast cancer researchers from the five countries unanimous that technology is a catalyst for medical progress. They suggested, for instance, that further improvement of cell imaging techniques could advance understanding of the molecular, cellular and tissue organisation involved in normal breast development and in breast cancer. A French researcher pointed to a decade-old technique used in animal models to study cells: known as bioluminescence, it allows scientists to use imaging technologies to detect light produced in mouse cells that have been genetically manipulated to develop breast cancer. That way, tumour cells can be examined in 2D and 3D, paving the way for detailed study of how cancer develops and responds to potential treatments.

Likewise, most researchers said they expect technological advances to support personalised medicine. In particular, there are high hopes that imaging and digital health technologies can help doctors "stratify" their patients - categorising them by their molecular idiosyncrasies, and tailoring treatments to match. A Dutch researcher, for instance, foresees using scanners and gene sequencers to profile patients by a combination of data from their tumour genetics, their clinical histories and 3D imaging; at the least, that would help doctors choose the right medicines, saving time and pain. A Czech researcher said progress depends on "observing processes in living cells and tissues" that would be impossible without new imaging technologies.

### BIOMARKERS: THIS TIME IT'S PERSONAL

Biomarkers - tell-tale signs of disease and biological responses to illness - can help to find cancer and monitor progression of the disease. Molecular and genetic biomarkers are already helping to predict which drugs patients are likely to respond to, paving the way for a new era of stratified and personalised medicine.

Now imaging technologies are getting in on the act. Imaging biomarkers are biological features detectable by MRI scanners and other medical imaging devices.

Vincent Dousset, a professor at the Institute of Bio-Imaging at the University of Bordeaux, says imaging biomarkers are becoming increasingly relevant as "objectively measurable indicators that can be used for the prediction of patient outcomes and responses to specific therapies."



## THE 30-SECOND SUMMARY

Everybody wants more, better care, of course. Respondents to our research - from patients to doctors to researchers - see how screening and early-stage detection have transformed care for breast cancer; and steady improvements in the related technology, and how it's used, have been instrumental. Many clinicians said they are already embracing the newest tools such as digital breast tomosynthesis, while patients seek wider access that will deliver better outcomes. But each group interviewed puts the emphasis on what's needed next somewhat differently:



### RESEARCHERS

Focus on image quality and technical developments helping to advance knowledge



### CLINICIANS

Multidisciplinary and digital support for sharing information; to foster collaboration, increased resources (both technical and human); further development and innovation; accuracy and efficiency (personalised and value-based)



### BREAST CANCER PATIENT ASSOCIATIONS

Support for patients/participation in clinical trials



### BREAST CANCER PATIENTS

Focus on early detection (effective and accurate screening and diagnosis); expecting personalised treatments, and patient-centred care, while embracing the potential for digital technologies further supporting patient participation and empowerment.

There is a general consensus that the clinical history of patients, images and medical records could be shared, in a safe manner, to improve healthcare, the use of resources and patient safety across Europe. The two challenges to achieving the best possible outcome and improve breast cancer care were budget and skilled staff in imaging and oncology/radiotherapy.

The thread running through the interviews of all stakeholders is the need to use advanced technologies to achieve continued advances in breast cancer care, without forgetting the economic implications and the human factor.



## 03

DEFINING  
VALUE IN BREAST  
CANCER CARE

As the population in Europe ages and health budgets strain to keep up, the health profession is increasingly focused on the benefits and costs of treatments. For policymakers and payers, securing value-for-money while optimising clinical outcomes has become a priority. This is essential to the sustainability of universal health systems in Europe and promises to reduce disparities by shining a light on patient outcomes.

The rising cost of treatment is a clear policy problem. From 1995 to 2014, the direct cost of treatment of all types of cancer across the EU has climbed to €83.2 billion from €35.7 billion (Jönsson 2016). In some countries, breast cancer is the most expensive type: in the Netherlands, it comprised 15% of cancer costs in 2011 and in Germany, 11% in 2008. But, as indicated earlier, these numbers reflect the rising incidence of breast cancer; not treating would have a higher cost – and one, obviously, that society will not tolerate.

So how do you define the value of these, or any, medical treatments? It is now more than a decade since economists at Harvard University inspired a greater focus on “value-based healthcare” (Porter and Teisberg, 2006). This approach defines value as outcomes that matter to patients, divided by the cost of achieving those outcomes. Proponents argue that focusing on value will ultimately deliver greater efficiency, making healthcare providers perform better for their patients. By measuring defined standard patient outcomes in a given hospital, the true costs and benefits of a single episode of care or drug therapy can be measured and evaluated.

Sounds simple – but it’s far from being so. For starters, most European health systems are publicly funded. Where the private sector-led US system may look at value for individual patients or in individual clinics, in Europe the equation must also take into account a broader public-health perspective: how would you allocate value among different treatments, for different groups of patients, across entire societies and economies?

The key question: “*value for whom?*” The European Commission is asking an expert panel to give a scientific opinion on the definition of value. It notes that, by and large, health systems are still paying for services in terms of “inputs” such as procedures carried out or volume of goods purchased, rather than “outputs”. It says that what patients may value can differ from what physicians consider valuable. Payers, providers and industry may also have diverging views.

The Commission has also been working on the problem with the OECD, the International Consortium on Healthcare Outcome Measurement (ICHOM) and others on a project called the Patient-Reported Indicators Survey (PaRIS). This ambitious project aims to develop and apply common outcome metrics which will allow for comparisons between countries (OECD 2018). Cancer, elective surgery and mental health are the focus of the initial phase of the project, but other conditions will be included over time. The Commission could ultimately integrate these health data outcomes into the European Semester process, in which it regularly reviews how member states are doing on key policy indicators – including healthcare. The Commission hopes to use outcome data, along with information on health spending, to find best practices in securing value in healthcare. This will also require investment in digital health infrastructure (hardware, human resources and data security) to support the collection and sharing of outcomes data.

## HEALTH MEASURES

What are the outcomes that matter to patients? The International Consortium on Healthcare Outcome Measurement (ICHOM) was established to answer this question. Their approach is simple: ask patients.

ICHOM establishes panels of experts and patients to define Standard Sets of outcomes for disease areas. Their work has frequently highlighted quality of life issues which were relatively underrated by clinicians. The ICHOM Standard Set for breast cancer, for example, focuses on survival, pain and recurrence of disease, but also on fatigue, body image, sexual dysfunction and depression.

## VALUE OF MODERN CANCER CARE

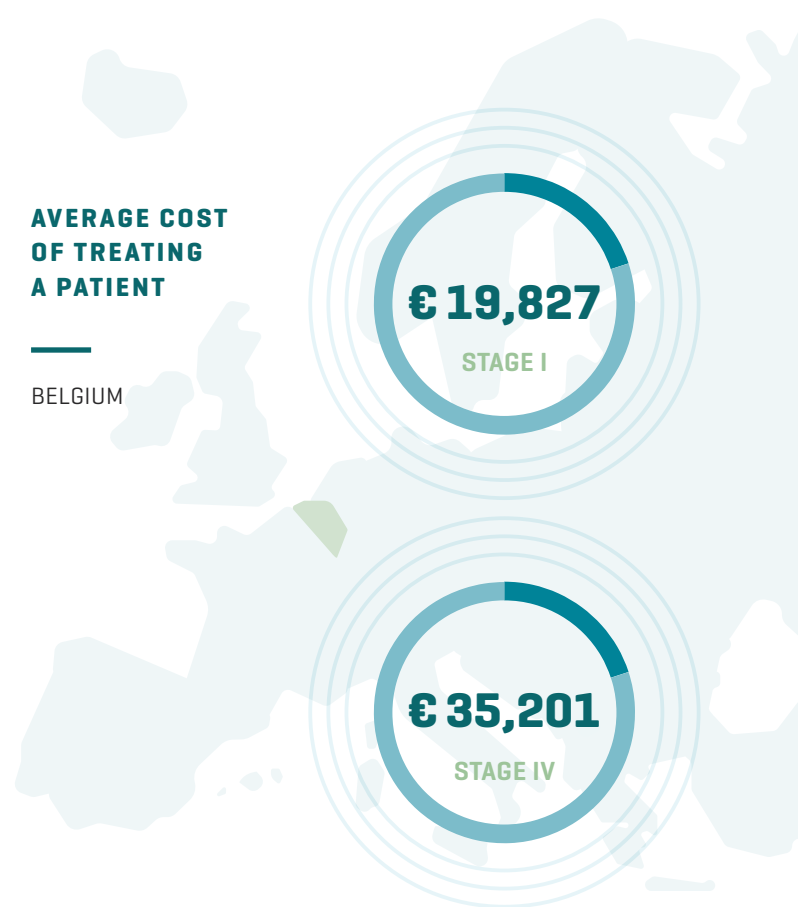
A special problem in such work is assigning value to diagnostic tools; it is harder than measuring the impact of getting an operation or taking a pill. Medical imaging provides information at several steps of the care continuum. For example, it can be used to screen apparently healthy people. For many, no further action will be required; for others, diagnosis may trigger a long series of treatments. The same imaging tools can be used to support clinical decisions on treatment options, to monitor patient responses to interventions and to follow-up with patients in remission. How to calculate the value?

It's clear that earlier, effective and efficient diagnosis is likely to reduce downstream treatment costs. In Belgium, the average cost of treating a patient with stage I breast cancer is almost half of the cost of treating a patient with stage IV disease: €19,827 versus €35,201 [Gentile 2018]. But even that doesn't settle the question. More work is needed to determine the contribution of diagnostic information to outcomes where a number of technologies and interventions played a role in patient care. Further, the monetary value of using imaging tools to stratify patients – thus getting better value from medicines – is also difficult to define. Investing in outcomes data can help to measure the impact of diagnostic tools on clinical outcomes. And surely, there is value, particularly for patients, in understanding the likely course of the illness. For good or ill, the value of knowing is something that matters to patients. It allows them to plan if the prognosis is poor and offers relief if the future is bright.

Indeed, interviewees taking part in this study – from clinicians to patients – emphasised the importance of considering the overall health of a person diagnosed with cancer, including physical, mental, social and spiritual wellbeing. Digital and imaging technologies can improve care for patients and make services more efficient. However, as technological advances are often incremental, it is the culmination of many steps forward that deliver the giant leaps in patient care.

### AVERAGE COST OF TREATING A PATIENT

BELGIUM



There are several barriers to assessing the monetary contribution of these for screening, prevention, diagnosis, monitoring and communication. Systems for collecting and analysis should be more widely adopted and technical barriers, such as interoperability, must be addressed. Healthcare financing systems – such as reimbursement and procurement – need an overhaul if they are to take a value-based approach. In procurement, for example, the tendency has historically been to choose the lowest-cost option that meets a minimum set of criteria rather than factoring in the full impact on patient care – such as patient preference and number of visits required, in addition to clinical results.

Some patients felt that the time that the doctors spend with them is limited because too little value is assigned to this. In addition to valuing information and convenience, patients would like to see greater appreciation for the value of human interaction. Interviewees also questioned whether technologies found to be of value to an advanced health system, for example in a large city of a high-GDP country, might not perform so well in less well-equipped smaller hospitals where human and financial resources might be thinner.

## THE ECONOMICS OF RADIOTHERAPY

Techniques for breast irradiation are constantly improving. For instance, it matters exactly where the beam strikes. Too broad a treatment, and there can be collateral damage – to the functioning of heart, lungs or other vital organs. Technology can help. Digitally monitoring the patient's body position – so-called surface-guided radiotherapy – helps the radiation stay on target; it can trigger the beam at exactly the right moment. Other techniques, such as intensity-modulated radiotherapy and volumetric-arc modulated radiotherapy, aim to shape the radiation beam to closely fit the area of the cancer and minimise toxicity to other tissues or organs. Radiotherapy lowers the risk of the cancer coming back and it is a key component of the continuum of care. Due to its relevance, radiotherapy has been the subject of several health economics studies. A leading example is the Health Economics in Radiation Oncology (HERO) project, which launched in 2010. This initiative aims to develop a knowledge base and a model for health economic evaluation of radiation treatments at the European level. The project has been carried out in close collaboration with the European national societies of radiation oncology.

A taskforce was formed, consisting of international specialists in the field. Since then, several publications have reported results about radiotherapy equipment, staffing and departments in European countries, guidelines for radiotherapy facilities, and analyses of the radiotherapy capacity across Europe. Their analysis showed that most European countries do not have the quantity or quality of radiotherapy facilities required to provide an adequate service to their populations, while some had more than enough. For instance, France, Germany and the Czech Republic were under capacity, while the Netherlands and Sweden were over capacity [Beishon 2013].

Other researchers [Charalambous 2013] concluded that, in terms of cost, centralisation of services leads to an increase in the number of patients treated per radiotherapy centre, which allows for efficient use of linear accelerators [the key

technology for delivering radiotherapy]. The experience of the Netherlands, which boosted radiotherapy capacity from the late 1990s while maintaining the same number of centres, suggests centralisation can permit other gains: By 2010 it had cut waiting lists and allowed for the rapid introduction of new technologies and subspecialisation of staff. That's important, because the technology continues to advance rapidly: Newer techniques permit therapists to "sculpt" the dose distribution to target the right tissue accurately, or to position the patient correctly so each fractional dose hits the same place from one session to the next.

In addition, centralisation also affects patient outcomes. Consistent evidence shows that the more experience doctors or health-care systems have with a procedure, the better the results [Smith 2003]. At the same time, some argue the benefits of a "hub and spoke" treatment system, in which the clinical centre or hub handles the biggest volumes and most difficult cases, while regional centres connect to the hub to handle local patients. This debate has led many experts to conclude that the value equation, however calculated, should factor in the way we organise our clinics and care, not just the euros and pounds from procurement budgets.

## AT WHAT COST?

Some interviewees agreed that policymakers should "do what's best for the patient, regardless of cost". From that perspective, all healthcare facilities treating cancer patients should have the latest technologies, tools and medications – along with sufficient staffing and expertise – to deliver state-of-the-art care to all.

The current reality, it was acknowledged, is quite different. Economic challenges make it difficult for some hospitals to acquire new imaging equipment and digital technologies, and the competitive labour market for scarce human resources make it hard to get the full value from these investments. Patients and clinicians argued that better technologies would deliver better results, saving money in the long term.





## THE 30-SECOND SUMMARY

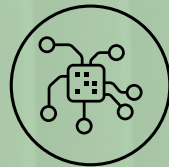
### EARLY DETECTION, CONTINUOUS TREATMENT = VALUE

So what can we conclude about the value of different screening, diagnostic, treatment and follow-up procedures? Well, one obvious statement: overall, the costs of care are rising. That is partly because, for the demographic and other factors already mentioned, breast cancer is becoming more common generally.



As the European population ages and cancer incidence rises, healthcare costs go up. And, rightly, that makes health administrators focus on the value of the treatments they provide. But measuring value is difficult.

But another key conclusion: Early detection helps manage costs. As mentioned previously in this report, several factors have contributed to the reduction in mortality, including advances in treatment and screening for breast cancer. In this respect, several studies have shown that cost differences based on tumour stage at diagnosis are largely driven by the cost of chemotherapy and of treatment for other problems not directly related to the cancer. In particular, chemotherapy has been found to be responsible for the highest percentage of total costs for advanced cancer [stage IV] and the lowest percentage of costs for early-stage cancer [stage 0]. And treatment costs are higher for patients whose cancer is more advanced at diagnosis. Another study, while noting the difficulty of measurement, concluded that it costs more than twice as much to treat an advanced cancer [which may have spread] than an early-stage cancer.



Valuing specific technologies is complicated by the fact that a device often has multiple uses: an imaging system can be used in screening, diagnosis, treatment and follow-up – so which application are you measuring? Further research on valuing technologies is urgently needed.



Patients, while valuing the technology for its results, also tend to value less tangible things, such as the amount of time they get with their doctor.

So, health budgets are rising – but due to the deployment of ever-improving screening and diagnostic technologies, so is early detection of breast cancer. Early detection, in turn, dramatically reduces the death rate; moreover, it lowers the cost of treatment. The bottom line, for health authorities: these technologies have been proven to save lives and control costs. If that isn't valuable, what is?



How we organise care matters. Ample clinical evidence supports the idea of concentrating expertise in central clinics, especially for difficult cases. But there is also value in permitting treatment close to the patient, in regional clinics. One clear conclusion: It costs more to treat a patient whose cancer is discovered late, than one caught early – and that requires extensive screening and accurate diagnosis programmes. So, while the value equation in medicine can often be complicated, in this case it's a simple matter: Money spent today on screening and early diagnosis can save money on treatment tomorrow. And for those women who receive treatment, digital monitoring can catch any possible recurrence.

## THE INNOVATION PIPELINE FOR BREAST CANCER CARE

Breast cancer care has advanced dramatically. But none of this happened overnight. Instead, improvements have come thanks to incremental innovation underpinned by better understanding of genetics, cell biology, optics and other sciences.

### XIX CENTURY



Development of cytology and **discovery of X-rays**

1900

1910

1913



**ALBERT SALOMON**, a German surgeon, was the first physician to study x-rays of breast tissue.

1920

1930-1940



Groundwork for development of **mammography protocols**.

1930



**First published evaluation** of periodic breast cancer screening with mammography by researcher Sam Shapiro and colleagues

1940



**ROBERT L. EGAN** produced detailed live images of breast tissue using special films

1950

1956

1960

1966



US researcher **PAUL C. LAUTERBUR** published the first MRI image of the thoracic cavity of a mouse and, together with **PETER MANSFIELD** of Britain, was awarded the **Nobel Prize in 2003** for their discoveries concerning magnetic resonance imaging.



1970

1974



**AMERICAN CANCER SOCIETY** recommended that mammograms should be used as screening tool for breast cancer.

1976

1980

1985



Launch of the **'Europe against Cancer' program** in 1986 by the Committee of Cancer Experts of the European Community. It was decided that systematic population-based screening should be implemented for those cancers for which such a strategy had been shown to reduce mortality.

1986



**First breast screening trial** [Swedish] to show a reduction in breast cancer mortality from screening with mammography alone, finding a 30% reduction in breast cancer mortality among 40–74-year-old women invited to screening.

1990

2000

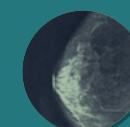
2007



Breast cancer screening based on mammography as a **public health policy and programmes** were running or being established in at least 26 member states.

2010

2011



**US Food and Drug Administration (FDA)** approved digital breast tomosynthesis for use in breast cancer screening.



## 04 PARTING WORDS

Everybody likes a success story – and, the overwhelming evidence suggests, the treatment of breast cancer in Europe is a dazzling one. Breast-screening programmes have saved millions of lives, cutting death rates by a third to half.

This progress is in large measure due to a productive partnership among health authorities at EU, national and regional levels, among doctors and nurses and hospital administrators and payers, among patients and their organisations, among researchers and universities – and among the many enterprises, large and small, that develop and bring the necessary technologies into the clinics.

These were not one-off gains. In fact, progress has continued steadily since the introduction of the first breast screening programmes. Today, new diagnostics, imaging and monitoring tools continue to be developed. Digital breast tomosynthesis has been shown to increase detection rates, presenting opportunities for more timely intervention. Magnetic resonance imaging is increasingly used to give clinicians a detailed picture of their patient's breast tissue. Personalised medicine, stratified therapies and a range of exciting new gene-based treatments – combining “omics” with new medicines and x-ray and other high-precision medical technologies – show great promise. Both surgery and radiotherapy are changing to become less radical, or mutilating; and here personalisation is key.

Driven by better histological and image guidance, our clinicians can treat the individual patient. They can decide to spare more normal tissue; they can limit operations and irradiation to the high-risk areas. Better risk analysis, among clinicians working in multidisciplinary teams, makes it possible to decide attack one patient's tumour aggressively – or skip surgery entirely for another. Artificial intelligence can improve treatment logistics, imaging and risk estimations. Various smartphone apps and other innovations are starting to spread, and we can only guess at how they may one day transform clinics and what it feels like

to get a dreaded cancer diagnosis. Embracing these technologies can help make clinics more efficient at sharing and scheduling resources, and faster at spotting and acting on a patient's problems before they end up in the emergency ward. But access to these technologies is far from universal. Nor is it always joined up in a comprehensive, interconnected system of care.

There are significant differences around the EU, in breast cancer detection and intervention. There is also a divide within countries: citizens in larger, urban centres typically access the latest technologies earlier than those dependent on smaller, regional or rural services. This is a major source of frustration for patients and clinicians. Considering the incidence and prevalence of cancer can help decision makers in allocating technologies within a country; therefore, updating that kind of information across countries seems necessary. Despite the efforts of many, today it still matters where you get sick – and that, to many, seems unfair.

Our research found disquiet, from patients to clinicians, about this problem of fairness: As better tools come on stream, the risk of widening the gap between the haves and have-nots rises. Uptake of newer and emerging technology has already and will further shape breast cancer care in Europe. These technologies can improve overall outcomes, but the timeframe in which they are deployed will determine whether they reduce or increase inequalities of outcome. Addressing these inequalities is vital not only to patients, but also to social stability. In this regard, health apps, in-home monitors and other digital tools can help patients without easy physical access to healthcare systems benefit from controlled and high quality monitoring.





## THE 30-SECOND SUMMARY

But how does one decide, at a time of rising budget pressure, which medical investments are needed? We see the hard data that the technologies save lives – but which use of the technologies, over which timeframes and which populations? These are difficult questions, that require evidence-based answers and – critically – input from everybody involved in the care continuum. This includes policymakers, enterprises, doctors, patients, health researchers, care providers and insurers. Patients must be central to defining value. This study has highlighted how patients value technologies that improve outcomes, but they also value time with their clinician and the support of patient advocacy groups and personal networks. Here too, technologies can play a supporting role in connecting people and ensuring that scarce resources – such as doctors' time – are used in a way that meets patient need.

### WHAT IS TO BE DONE?

So what should EU institutions and national governments do to make the best possible use of our existing, and emerging, imaging and digital health technologies? Interviewees in this study, drawn from five EU countries and with a variety of backgrounds, highlighted some recurring themes.

First, as mentioned above, there is widespread concern about reducing all the inequalities – in the reach of screening programmes, the availability of old and new imaging technologies, the quality of training and clinical organisations, and the uptake of promising new technologies. In short, there is just too much difference between and within countries across Europe.

Second, the European institutions – especially their research, innovation and harmonisation functions – can help. As AI and Big Data take centre stage, European collaborative research projects in medical and digital health technologies can make a big difference: not only can they speed innovation, but the mere process of EU-level cooperation can be a force for harmonising health systems – “levelling up”, as some might put it. For starters, the European Commission has stepped up its pan-EU gathering and analysis of health data from the member states

### THIS STUDY HAS HIGHLIGHTED HOW PATIENTS VALUE TECHNOLOGIES THAT IMPROVE OUTCOMES, BUT THEY ALSO VALUE TIME WITH THEIR CLINICIAN AND THE SUPPORT OF PATIENT ADVOCACY GROUPS AND PERSONAL NETWORKS.

– so it will become easier to spot the inequalities. With a series of new “reference networks”, it has been bringing clinicians together across the EU, the better to compare notes and agree on best practice. Then, it has proposed a big rise in health-research funding: €7.7 billion is slated for life sciences R&D in its next, long-term Horizon Europe budget. This will stimulate more innovation, from both member states and the private sector. In these collaborative projects, European and national authorities can also have a role in validating digital communication tools – essential to their spread. And they can help solve some of the bottlenecks for these emerging technologies – such as how or when researchers are allowed to include patient data in their studies, or incorporate it into their AI systems.

Third, also needed is a better understanding of the value of new technologies, and how to measure it. The evidence shows early-stage detection pays off – but that evidence has been several years in coming. New technologies, biological and digital, are fast arriving: how can we do a better job at weighing the relative merits of each, and choosing which to deploy when and where? The problem is particularly difficult for preventive, diagnostic and prognostic tools, so essential for the increasingly personalised treatments that – all the signs suggest – will produce the next step-change in healthcare quality. Answering these questions about value will require all actors, from doctor to insurer to patient to entrepreneur, to come together – in conferences, in patient and other representative organisations, in collaborative research projects and cross-disciplinary networks, and at the level of local, regional, national and EU government. Healthcare matters to everybody, and all must have a voice.

### CHANGING CULTURES

Bit by bit, byte by byte, a legion of new digital technologies – from apps to AI – is already starting to transform the experience of being a patient, working in a clinic, or managing a health system. One challenge is already obvious: How to get hold of them quickly and affordably? With better methods of valuing them, and greater European coordination, we can put the emphasis on rapid deployment. And this will create a virtuous circle: The digital technologies themselves can provide the evidence we need to better organise our health systems. They will reshape how we screen, diagnose, treat and monitor breast cancer for the next generation of women at risk. They will free up stressed clinicians to spend more time with their patients. Getting these new digital technologies, and getting them quickly, matters.

Because of these new technologies, what it's like to be a breast cancer patient – feeling frightened, alone, confused or even angry – can change for the better. Smartphones, remote monitors and online consultation can minimise time spent in the clinic, while also providing better and more data to the doctor. Online services, social media and other tools can help patients connect with one another, and grow patient organisations – building solidarity. The key point: even as we deploy these new technologies, we must use them in such a way that they help the people in the system work better together, engage with one another better.

Change is never easy, particularly for our huge, complex health systems. Clinicians will need to see the concrete benefits that will flow from changing how they work. Nurses will be asked to use new tools and routines. Patients will see the range of technologies they encounter continue to expand – but the outcome improve. All of this requires political leadership.

The story of breast cancer care so far has been remarkable – a record of rapid progress and collaboration between man and machine. But the future is even brighter. Through wise use of our new technologies, in partnership between private and public sector, that battle can be won.

### FOR THE EU INSTITUTIONS

1. Accelerate ongoing efforts to gather, share and standardise important health data.
2. Employ Horizon Europe funding to speed development of new treatments and care techniques.
3. Support member states in the development and adoption of better models for assessing the value of new technologies and treatments.
4. Support member states in harmonising their screening programmes.

### FOR NATIONAL AND REGIONAL HEALTH ADMINISTRATORS

5. Make greater use of evidence-based systems in breast cancer care delivery.
6. Accelerate the assessment and, where appropriate, uptake of new treatments, tools and technology.
7. Step up education and awareness of the importance of screening.

### FOR CLINICIANS AND ADMINISTRATORS

8. Look for opportunities in which new techniques and technologies can improve the patient experience – from smartphone apps to in-home monitoring.
9. Think of the “soft” factors of care more often – support groups, counselling, the human touch.
10. Train constantly. New techniques, new thinking, new technologies need properly trained staff to get the most out of them.

# 05 REFERENCES

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