Breast Cancer Foundation NZ

30,000 voices: Informing a better future for breast cancer in Aotearoa New Zealand

Te Rēhita Mate Ūtaetae
Breast Cancer Foundation
National Register

2003-2020

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Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register 2003-2020

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Thanks most of all to the 30,000 women and 181 men represented in the Register. Without you, this report could not exist.

Foreword

No other cancer has had the impact on New Zealand women that breast cancer has. And nowhere is the scale of that impact better seen than in the story of 30,000 women over 20 years: Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register.

Thanks to the women who have allowed their diagnosis, treatment and outcome data to be collected in the Register, we can trace the history and the current reality of New Zealand's progress in tackling breast cancer. We can dig deep to find accurate answers to what might appear to be simple questions.

How are we doing? Are things getting better? Better for everyone?

Digging deep is essential because, at first glance, the numbers haven't changed. We still have 3,500 breast cancer diagnoses each year. The latest Ministry of Health mortality report shows nearly 700 deaths in 2019. And despite the perception that cancer is an older person's disease, breast cancer is the number one cause of death for New Zealand women under 65.

Thankfully, that's not the whole story. This report of Register data reveals great progress over the years. Breast cancer survival has improved hugely; it is heartening and inspiring to see the significant, often remarkable, gains made across all ethnicities, ages and regions.

The survival gap between wāhine Māori, Pacific and European women has narrowed and in some cases all but disappeared. Our five-year survival appears to be as good as the countries we like to compare against, no doubt thanks to excellent participation in BreastScreen Aotearoa finding cancers earlier, and better treatments lowering the risk of recurrence. New Zealand clinical practice aligns well with Australasian surgical benchmarks.

These exciting findings, laid out in this report, are a cause for celebration. The progress New Zealand has made in breast cancer, and the ability to measure and monitor it through the Register, should be a model for other tumour streams.

But anyone who sees this report as a signal that breast cancer is "done and dusted" must think again.

Every single gain reported from the Register has been hard-won. Each is the result of research and clinical trials, Government investment in health infrastructure for screening and treatment, commitment by clinicians to new and better practice, education and advocacy by NGOs, screening participation by well women, and treatment adherence by those diagnosed with breast cancer.

None of these is a given.

And although we have successes to celebrate, we also have the "stubborn stains" that leave us nowhere near a clean sweep. Take a look at our 10-year survival statistics and it becomes obvious where we need to do better. For younger women. For women who struggle to access screening, particularly wāhine Māori. For Pacific women. For women with higher grade or later stage cancer. For women with triple negative breast cancer. Too many of these women have their breast cancer come back after more than five years, and too many women are diagnosed at a young age for us to be satisfied with five years of life after cancer.

Additionally, we now have a new risk that none of us foresaw: the impact of Covid-19 on New Zealand's exemplary breast screening programme. After two years of Covid-19, screening participation is the lowest it's been in 10 years – logic suggests some of our survival gains will be lost, and our most vulnerable women will be the ones to suffer.

To fail to move forwards is to inevitably slide backwards.

Which brings us to the most important question we can ask: What more can we do?

This report is a start, highlighting areas where survival gains are lagging. It reveals where current practice may be out of step with guidelines – for example, the ratio of breast-conserving surgery to mastectomy. And it identifies where resource constraints could cause life-threatening delays. We look forward to working with Government, Te Aho o Te Kahu the Cancer Control Agency, BreastScreen Aotearoa, clinicians and patients to investigate and address these challenges.

As we work through these challenges, let us remember that our purpose is not merely changing numbers or improving systems. *He aha te mea nui o te ao? He tangata, he tangata, he tangata.* What is the most important thing in the world? It is the people, it is the people, it is the people.

To all the women who have participated in the Register: without you, we'd be in the dark. Thank you for being part of this report. While the Register cannot tell your 30,000 individual stories of pain, courage, triumph and loss, it is an epic in its own right. It is history and truth. Most of all, it is a story of hope.

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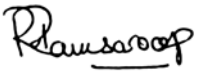

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1. Introduction

1.1 Purpose and Scope of this Report

Breast Cancer Foundation NZ initiated this report to provide the first comprehensive presentation of data from the consolidated Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register. It is also ultimately intended to be a catalyst for change – we do not measure for measurement's sake, and neither breast cancer nor our health system will stand still.

In such a dynamic environment, this report may serve several functions:

- Providing a wide-ranging overview of data pertaining to breast cancer demographics, diagnosis, pathology, treatment and outcomes for women and men diagnosed from 2003-2019 (with some measures reporting diagnoses in 2020).
- Offering insights into current inequities in breast cancer diagnosis, treatment and survival.
- Informing prioritisation and decision-making by clinicians, health planners, the Ministry of Health and any agency that could benefit from data about real-world clinical practice and trends in breast cancer in Aotearoa New Zealand. These include Te Aho o Te Kahu (the Cancer Control Agency), Māori Health Authority, Health NZ, and PHARMAC.
- Identifying key areas for urgent action that could improve outcomes, and areas at risk of decline.
- Informing NGOs' advocacy, education and research programmes.
- Establishing a baseline for future versions of this report, and for comparative studies and local or international benchmarking.
- Provide a foundation for follow-on statistical and epidemiological research, using data from Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register to better understand breast cancer in Aotearoa New Zealand.

Throughout the report, additional context and points of comparison are provided from national data reported by the Ministry of Health, Statistics NZ and other sources, along with expert opinion and studies from peer-reviewed journals.

Out of necessity given the volume of data, this report cannot provide complex statistical or epidemiological analysis of Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register, and makes only limited inferences. Our intention is that future versions of this report will offer more in-depth analysis.

1.2 Purpose and History of Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register

Purpose

Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register (henceforth may be referred to in this report as "the Register or "te Rēhita") collects data to help doctors, health planners and researchers reduce inequities and to continually improve breast cancer diagnosis, treatment, services, care and ultimately survival rates for all New Zealanders. It is a taonga, providing a unique breadth, depth and quality of data for use in clinical audits and de-identified data for use in scientific research, reports and health planning.

"Without breast cancer patient data we don't know how we are doing and where we can improve our practice." Vernon Harvey, Medical Oncologist, Auckland and founding member of Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register.

Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register records breast cancer patient information for all eligible New Zealand invasive and pre-invasive breast cancers.

The Register strives to:

- achieve 100% patient participation to ensure a robust, representative dataset
- provide high-quality breast cancer patient data with breadth and depth
- maximise the use of the data to help reduce inequities and improve outcomes
- provide a biennial Register report to enable continual improvement in breast cancer practices and to monitor progress.

Development of Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register

The establishment and development of the Register owe everything to the vision and dedication of breast cancer clinicians, particularly those who have volunteered their time to govern the clinical quality of the data. The value of a register increases over time and it is only recently that we have been able to provide 10-year survival analysis for the original four New Zealand regions of the Register. The collection of this data has only been possible due to the support and funding for over 20 years from Breast Cancer Foundation NZ as part of its "Research for Life" programme.

Regional registers

The Register began as four regional registers operating under regional governance groups with funding from Breast Cancer Foundation NZ. Auckland was the first regional breast cancer register established in 2000 by the Auckland Breast Cancer Research Study Group. Waikato was the second region established in 2005 by the Waikato Breast Cancer Research Trust, with patient data retrospectively added back to 1991. Then, in 2009, the Christchurch register was established by the Christchurch Region Breast Cancer Patient Register governance group, followed by the Wellington register established in 2010 by Wellington Breast Cancer Study Group. These regional groups were pivotal in ensuring that not only was the data collected and maintained to a high standard, but also that it was used. It is thanks to them that the Register became the taonga that it is today.

Regional Registers	Inception date	Participating District Health Board Regions
Auckland Region	1 June 2000	Auckland, Counties Manukau, and Waitematā
Waikato Region	1 June 2005	Waikato with data retrospectively added back to 1991
Christchurch Region	15 June 2009	Canterbury and West Coast
Wellington Region	1 January 2010	Wairarapa, Hutt Valley and Capital and Coast

Table 1.2-1. *Summary of regional register inception dates (prior to National Register formation).*

These four regions covered approximately 63% (since expanded to national 100% coverage) of New Zealand breast cancer patients. The initial ethics approval required individual patient consent for entry to the local register. This led to a proportion of patients being excluded, generally those with a worse prognosis (older, more often of Pacific ethnicity, fewer screen-detected cancers, more metastatic disease, and less frequently had surgery or systemic therapy). As a result, there was favourable bias in the register data: non-consented patients had a five-year survival of 57.1% versus 83.2% for consented patients and 80.8% in all patients [1]. As other registers were started, ethics committees gave differing views on the need for consent and in 2012 Auckland ethics agreed that the local register did not need individual consent, making it opt-out, and backdating this to include earlier exclusions. The overall patient op-out rate for the Register is now less than 1%. For details of historical and current opt-out rates, see Appendix A. Fields in each regional register were based on the first Auckland register.

Today, it is the responsibility of a national Clinical Advisory Group (CAG) to maintain an overview of core data consistency. CAG members commit generous quantities of time to this important task; their guidance and shared vision has been key to the successful expansion of the Register.

National Register inception

In 2015, Breast Cancer Foundation NZ set the goal for the Register to achieve 100% coverage of New Zealand breast cancer patients to ensure a robust, equitable dataset. The Ministry of Health, recognising the value of a national breast cancer register, provided funding to consolidate the four existing registers. Dendrite Clinical systems, a UK-based company with extensive experience in providing medical registries, was contracted to develop, implement and host the new consolidated register. The consolidation of the four regional registers was completed on 1 January 2018. At this time the Breast Cancer NZ Register Trust was established to provide governance to what is now called Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register. The Breast Cancer NZ Register Trust Board is advised by the Register's Clinical Advisory Group which includes representatives from the four regions, breast cancer specialities, scientific research, Pacific Peoples, Māori and consumer (patient).

Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register operates under Health, Disability and Ethics (HDEC) approval reference 16/NTA/139/AM03, privacy and health legislation and Treaty of Waitangi principles. Data collection and reporting ensures patient confidentiality and privacy. A list of national register fields and the data dictionary is available at breastcancerregister.org.nz.

For details of patient consenting, data entry, and data quality, see Appendix A.

National Register expansion

In 2020, Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register expanded to include all DHB regions in Aotearoa New Zealand. This has increased coverage from approximately 63% to 100% of eligible breast cancer patients. The new DHB regions have an inception date of 1 January 2020. The new DHB regions are excluded from this report as the inception date falls outside the breast cancer diagnoses reporting period.

Regional Hub	Pre-2020 - DHBs regions	From 1 Jan 2020 - New DHB regions
Northern	Auckland Counties Manukau Waitematā	Northland
Midland	Waikato	Bay of Plenty Lakes Tairāwhiti Taranaki
Central	Wairarapa Capital and Coast Hutt Valley	MidCentral (Palmerston North) Hawke's Bay Whanganui
Southern	Canterbury West Coast	Nelson-Marlborough South Canterbury Southland

Table 1.2-2. *National Register - Regional Hubs and DHB regions.*

More than 50% of cases reported in this study of the Register were from Auckland (56.5%), with 16.5%, 15% and 12% from Waikato, Christchurch and Wellington respectively (Figure 1.2-1). As of January 2022, the Register holds records for 40,000 unique, eligible patients. This report covers the period 2003-2020 and includes 29,580 unique, eligible patients representing 30,367 cases.

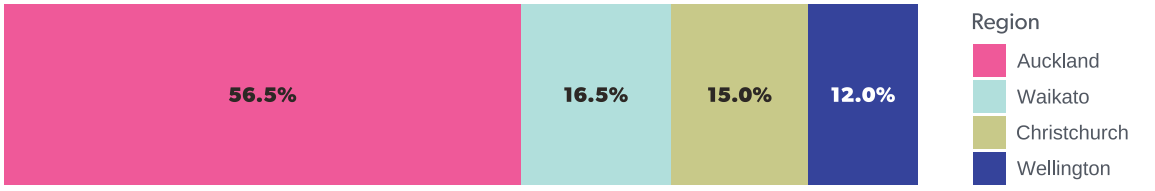


Fig. 1.2-1. *Percentage breast cancer registrations by New Zealand region.*

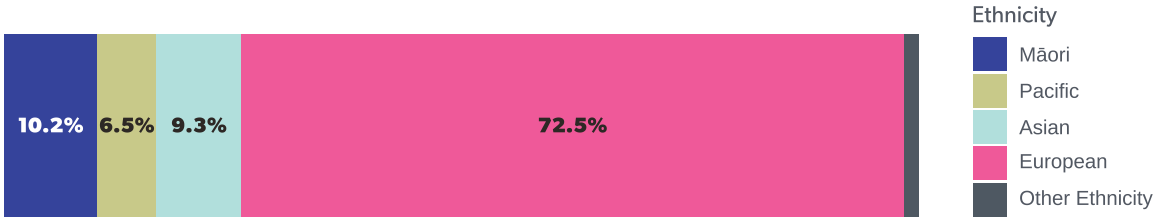


Fig. 1.2-2. *Percentage breast cancer registrations by ethnicity in Aotearoa New Zealand.*

1.2.1 The value of long-term data collection

Maintaining a register of this calibre requires significant and long-term investment, one that will only grow as more patients are added and continue to be followed up for life. But the value will also continue to increase: as the number of patients in the Register grows, the data and insights it affords become increasingly robust.

Those insights need not be confined to treatment and survival outcomes. We are entering an era where many people are long-term cancer survivors; we have much to learn about the long-term and late effects of cancer treatment, and ongoing risk of recurrence. For example, a 2021 study showed that breast cancer can recur 30 years after initial diagnosis.[2]

Long-term data collection enables us to further prevent recurrence and extend survival, understand long-term effects, and address post-cancer quality of life.

Robin, Auckland, diagnosed at 48:

"It is wonderful to look back since my breast cancer diagnosis 20 years ago and see the very positive changes that have occurred in breast cancer treatment as a result of Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register. Looking forward, it is a powerful tool from which we could confidently expect new life-saving and improved treatments to come."

1.3 Methods

Analysis for this report was carried out under ethical approval from the Auckland Health Research Ethics Committee (AHREC) reference AH2800. The report is a comprehensive overview of Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register, which during the study period collected data from nine District Health Boards (Auckland, Waitematā, Counties Manukau, Waikato, Capital and Coast, Hutt Valley, Wairarapa, Canterbury, and West Coast), covering approximately 63% of all New Zealanders. Throughout the report, the regions are listed in figures and tables according to their size and start date: Auckland, Waikato, Christchurch, and Wellington. To maximise data use, the data was taken back to 2003 and then split into three-yearly "cohorts" to 2019 in order to examine time trends while smoothing over yearly jumps. The data presented for most variables is until 2019, but for analysis of time to surgery, 2020 data was also used.

There is a separate summary by ethnicity at the start of the report; thereafter, each topic is reported comprehensively by ethnicity, region and age.

Counts of people are based upon a primary diagnosis of cancer. If a person with a previous diagnosis has a new cancer which is of similar histology to the first, it is considered a recurrence of the previous cancer and would then appear only once in a table. Alternatively if the new tumour histology is sufficiently different to be considered a new primary cancer then the person has two primary tumours; these would be considered as separate and the person would be counted twice. This does cause an over-counting of individuals in the overall tables, but is an accurate reflection in the surgery and treatment tables.

This report analyses data for invasive breast cancer and DCIS, two broad sub-classifications within breast cancer that dictate treatment. Herein we have used "invasive" to define ductal and other breast cancer types such as lobular cancer that is stage 1 or higher (AJCC staging system 7th edition [3, 4]). DCIS is ductal carcinoma *in situ*; all other *in situ* diagnoses are excluded from this report.

Ethnicity

Ethnicity data in the Register is sourced from the Ministry of Health through an interactive link with a person's National Health Identifier (NHI) number. The data is updated every time a record is opened in the Register database. The ethnicity fields in the Register allow for up to three ethnicities to be selected. In this report, ethnicity was prioritised using a modified HISO 10001:2017 Ethnicity Data Protocol using the Ethnicity New Zealand Standard Classification. This system assigned a person to a single ethnic group based on self-identified ethnicity. If there were multiple ethnicities indicated, they were prioritised as follows: Māori, Pacific Peoples, Asian, European and Other. "Other" ethnicity (comprising 1.5% of patients in the Register) is included in the population ethnicity graph and in all the general, age and regional reporting, but is not included in the ethnicity-based reporting of diagnosis, treatments outcome.

Age-adjusted data as well as crude data was used to estimate the influence of the differing age distributions of each ethnicity on data tables that include ethnicity as a factor. The type of age adjustment performed was a direct proportional adjustment by age distribution within each ethnic group, as done by Seneviratne et al [5]. This is a first step only, since there are many more complex adjustment factors and cohort effects that this method cannot take into account. However, the age-adjusted percentages shown here allow preliminary comparisons between ethnicities in New Zealand and may indicate those tables where a more sophisticated analysis will be valuable, as well as those tables where age standardisation to an international standard population may be useful to allow international comparisons.

Staging and treatment

To be applicable across the entire Register, analysis of breast cancer staging uses the AJCC staging system 7th edition [3, 4]. However, the reporting of stage throughout the report was changed as appropriate for the context. When overall demographic, diagnosis, pathology and survival statistics are presented, women with all stages of breast cancer are present. However, in the analysis of breast cancer treatment, women with stage 4 disease at initial diagnosis (including the closely associated subset of women with *de novo*

metastatic disease) are excluded from tables and figures unless specifically indicated. These women typically do not have surgery for the primary tumour, and their radiation and systemic therapy is not classified as neoadjuvant or adjuvant (the treatment categories analysed in this report).

Treatment for breast cancer can be complex, especially surgical interventions. A person might have several surgeries to manage their disease and this complicates the reporting of surgical interventions. Unless otherwise stated, we used the most "invasive" or "complete" surgery to define a surgery a person has received. A prioritisation scheme for surgeries is used with the following hierarchy: Mastectomy > Wide Local Excision > Axilla dissection > Other (e.g. Biopsy). This prioritisation is applied to any involved breast, so to both breasts if the tumours involve both.

Survival reporting

Survival and mortality reporting incorporates 2018 provisional verified cause of death and date of death from the Ministry of Health Mortality Collection, date of death from the NHI collection and, from 2019 onwards, cause of death sourced from patient records. Survival time was estimated using the Kaplan-Meier estimate. Categorical data is presented as counts (n) and percent (%). Continuous data is presented as mean and standard deviation and/or median. Figures and tables were created in the R software environment (v. 4.1.1). Unless otherwise stated, survival statistics reported from the Register are breast cancer-specific survival (BCSS).

Cox Proportional Hazard survival models were used in a preliminary exploration of the differences in breast cancer-specific survival between ethnic groups, in both the crude data and after adjusting for age and other factors. Specifically, this analysis compared the breast cancer-specific survival of cohorts of women with Māori, Pacific or Asian recorded ethnicity to the breast cancer-specific survival of the cohort of women with European recorded ethnicity. The results are shown as Hazard Ratios and 95% confidence intervals. A Hazard Ratio (HR) >1 represents an increased risk of death from breast cancer compared to women with European ethnicity. A HR of < 1 indicates a decreased risk of death from breast cancer compared to women with European ethnicity.

In the unadjusted data, breast cancer-specific mortality appears to be lower in Asian women and higher in wāhine Māori and Pacific women, compared to women of European ethnicity. These relationships remain significant after adjusting for age. However, adjusting for additional factors including: stage, detection method, region and receptor status, attenuates the relationship between ethnicity and breast cancer-specific survival (not shown). This indicates that a more nuanced analysis is required to fully understand the potential drivers of breast cancer-specific survival in NZ women.

An obvious observation in the crude data is that patients of all ethnicities appear to have improved outcomes as their time of diagnosis becomes more recent. We have used Cox Proportional Hazards survival models in a preliminary statistical exploration of this observation. Specifically, separate Cox Proportional Hazard survival models were generated using data for each ethnicity to examine time-cohort effects on both five-year and 10-year breast cancer-specific survival. Hazard Ratios were generated relative to the earliest time cohort (2003-2005). In both the crude data and after adjusting for age, for all ethnicities the observation that later time cohorts have significantly decreased risk of breast cancer-specific mortality is generally supported, with Hazard Ratios compared to the 2003-2005 cohort <1. However, when adjusted for additional factors such as age, stage, detection method, region and receptor status, the Hazard Ratios became attenuated (not shown), indicating there are likely to be other more complex adjustment factors and interactions than these preliminary models can take into account. This work highlights where more nuanced analysis is required to fully understand changes over time of breast cancer-specific survival in New Zealand women.

For the lay reader, it is helpful to note that Hazard Ratios are broadly equivalent to relative risk, and for ease of reading they have been expressed in this report as percentage increase and decrease in the relative risk of dying from breast cancer. Readers should remember that relative risk is not absolute risk, and must be interpreted in relation to the point of comparison. For example, if a European woman has a 15% risk of dying, and a wāhine Māori's risk is 33.3% higher, then the wāhine's risk of dying is 20%.

1.4 Limitations

There are three main limitations to this report.

1. The data presented here is the crude data in the Register. After adjustments have been made and statistical analyses performed, some of the differences observed in the data may not be supported. This is especially the situation for regional differences that are seen in this report. When demographics such as population age or ethnicity within each region are accounted for, there may be no differences between regional outcomes. These observations should be followed up in future studies using detailed statistical analyses.

2. The data in the Register is based on people diagnosed in four mostly urban regions of Aotearoa New Zealand. Therefore, this report is potentially a picture of people with breast cancer in urban Aotearoa New Zealand. However, with the Register now covering all regions nationwide from 2020, future reports will present a more comprehensive picture of breast cancer for all New Zealanders.

3. This report provides very limited insight into the demographics, detection and survival of metastatic breast cancer (MBC), analysing only those whose first diagnosis was stage 4 or *de novo* metastatic breast cancer. Around three-quarters of metastatic diagnoses in Aotearoa New Zealand are relapses (recurrences), of a stage 1-3 early breast cancer (EBC); this report contains no data pertaining to relapsed cases. The complexity of the stage 4 treatment pathway for both *de novo* and relapsed patients, and the duration of survival after metastatic diagnosis, are best reported in a separate analysis. Breast Cancer Foundation NZ published such an analysis in 2018 [6], and has plans to update this in the near future.

2. Main Findings

2.1 A Word About Survival

Cancer survival statistics commonly focus on five-year survival as a measure of effectiveness of treatment. Patients (and sometimes their doctors) see "the five-year mark" as an all-clear signal. In many cancers, that is not unreasonable [7]. But it is important to know that breast cancer patients (in particular those with ER+ tumours) experience a much higher proportion of late metastatic recurrences than in some other cancers [8], with a recent study showing that recurrences can occur 30 years after initial diagnosis [2].

In the Register, the median age for invasive breast cancer diagnosis in Aotearoa New Zealand was 58, meaning half of women were diagnosed at that age or younger. It is reasonable for patients to hope and expect to survive much longer than five years after diagnosis.

Breast Cancer Foundation NZ believes that, while five-year survival can be a useful indicator, it is not a surrogate for long-term survival, and is an inadequate measure of effectiveness of treatment for breast cancer.

For these reasons, 10-year survival is reported wherever possible in this report, in addition to five-year survival. This has proven helpful in identifying ongoing inequities and priority areas for improvement.

2.2 Ethnicity and Equity

2.2.1	Ten-year breast cancer survival was 86%, and five-year survival was 91%. This suggests New Zealand's breast cancer survival is at the same level as Australia's and better than England's.	Figure 4.2-1 Table 4.2-1
2.2.2	10-year and five-year breast cancer-specific survival improved over time for all ethnicities. However, survival was lower for Māori and Pacific women, and higher in Asian women, compared to women of European ethnicity. After adjusting for age, wāhine Māori were 33% more likely to die of breast cancer than European women, and Pacific women 52% more likely to die across the 2003-2020 reporting period.	Figures 3.4-4, 3.4-3 Table 3.4-1
2.2.3	However, over time, the gap between Māori / Pacific outcomes and European outcomes has narrowed. Observed 10-year survival for Māori and European women in the most recent diagnosed cohort (2009-2011) was similar at 84% and 87%. Pacific 10-year survival also improved over time, but was lower at 80%. Overlapping confidence intervals suggest the difference between Māori and European is not statistically significant, but for Pacific vs European women, the closeness of the 95% CI indicates the data is trending towards significance.	Figure 3.4-4
2.2.4	Wāhine Māori were more likely to have higher-risk HER2+ breast cancers than European women (17.9% vs 14.6%).	Figure 5.2-5
2.2.5	Pacific women had the highest rate of stage 3 and 4 breast cancers (29.9%) and of HER2+ cancers (24.1%), and more grade 3 tumours (37.2%) than all other ethnicities.	Figures 5.2-12, 5.2-2, 5.2-5
2.2.6	Asian women had better outcomes than all other ethnicities, with 97% five-year survival in the most recent diagnosed cohort (2015-2017) and 92% 10-year survival (women diagnosed 2009-11). These better outcomes occur despite Asian women a high proportion of grade 3 tumours (32.7%), and a higher ratio of symptomatic (58.5%) to screened diagnoses than other ethnicities.	Figures 3.4-4, 5.2-2, 5.2-5, 5.1-1
2.2.7	While low screening participation and larger or later-stage tumours can be a result of equity issues in access to screening and diagnosis, once women have been diagnosed with breast cancer, the treatment pathway and rate of delivery of treatment is very similar across all ethnicities (with the historical exception of the rate of breast-conserving surgery).	Figures 6.2-2, 7.2-1, 7.2-4, 7.3-1 Tables 6.1-1, 6.2-1

2.3 Demographics

2.3.1	Younger women (<45) represented 13.3% of invasive diagnoses. They had lower 10-year survival than the 45-69 age group: 82% compared to 89%. That means 18% of younger women died of breast cancer within 10 years of diagnosis.	Figures 4.4-1, 4.4-2
2.3.2	A higher proportion of Māori, Pacific and Asian diagnoses occurred before age 45. This probably reflects the age distribution of these populations, which have a considerably younger median age than Europeans and, in the case of Māori and Pacific, may also reflect a higher incidence per 100,000 women <45. More than 20% of Asian and Pacific invasive diagnosis were in women under 45, in contrast to 11% of European women.	Figures 3.1-2, 3.2-2, 3.3-2, 13.2-1
2.3.3	Older women (aged 70+) accounted for 21.6% of all invasive tumour diagnoses and had 80% 10-year survival.	Figure 4.4-1, 4.4-2
2.3.4	The 45-69 age group experienced a significant increase in 10-year observed survival. This is potentially related to increased participation in breast screening.	Figure 4.4-3
2.3.5	Five and 10-year breast cancer survival across the study population was significantly higher in the 45-69 age group (93% five-year, 89% 10-year). The survival improvement was most marked for Māori and European women when comparing women aged 45-69 with other age groups in the same ethnicity.	Figure 4.4-2, 13.2-3
2.3.6	Survival was similar across the regions, though Auckland showed significantly better five-year survival in the latest cohort. For most regions, there was no significant difference in 10-year survival.	Figure 13.2-2

2.4 Detection and Diagnosis

2.4.1	Survival is much better for women with mammogram screened diagnosis, and this applies across ethnicities. Ten-year survival for women diagnosed with invasive breast cancer through screening was 95%, in contrast to 85% of women diagnosed when they presented with symptoms.	Figures 5.1-3, 13.2-4
2.4.2	The proportion of cancers that were screen-detected increased over time, particularly for non-European ethnicities. This likely reflects increased Māori and Pacific participation in BreastScreen Aotearoa, and also the introduction of new detection technologies such as digital mammography.	Figures 5.1-2, 13.2-4
2.4.3	Pacific women experienced the biggest survival benefit for screened vs symptomatic diagnosis, followed by Māori and European women.	Figures 3.2-3, 13.2-4
2.4.4	However, in 2020, outside the study period of this report, the proportion of diagnoses recorded in the Register that were screen-detected decreased by 12%, meaning that a higher percentage of diagnoses were the result of the woman finding a lump or other symptom. Screening participation has declined sharply during the Covid-19 pandemic, particularly for Māori and Pacific women. This may put screening-derived survival gains at risk.	Not shown
2.4.5	Tumour pathology has a major impact on survival. While women with grade 1 tumours had a 99% five-year and 98% 10-year survival across the reporting period, women with grade 3 tumours fared worse (87% five-year and 82% 10-year survival). Grade 3 survival is improving over time; for women diagnosed in 2015-2017, five-year survival with grade 3 was 91%.	Figures 5.2-3, 5.2-4
2.4.6	Over the reporting period, oestrogen receptor-positive (ER+) subtypes had superior five-year breast cancer-specific survival to ER- cancers. HER2 receptor status (positive or negative) also affected survival. Within ER- subtypes, ER+/HER2- did better than ER+/HER2+. However, in the more recently diagnosed cohorts, the survival gap between the two ER+ groups had narrowed, and overlapping confidence intervals suggested no difference. The biggest improvement over time was in five-year survival for the ER-/HER2+ group, with 10-year survival also experiencing a significant improvement. These results are most likely due to the funding of 12 months of Herceptin since December 2008.	Figures 5.2-6, 5.2-7
2.4.7	Women with triple negative breast cancer have experienced significantly improved five-year survival, and there is a trend towards improvement in 10-year survival.	Figure 5.2-7
2.4.8	Stage 1 cancers have a 99% five-year and 97% 10-year survival, compared with 81% and 71% for stage 3. Stage 3 five-year survival has greatly improved since 2003-2005, from 69% to 86%, but in recent years the gains have been modest and not significant. Ten-year survival with stage 3 increased markedly from 56% to 73%. The proportion of cancers diagnosed at stage 3 has decreased.	Figures 5.2-14, 5.2-15, 5.2-13
2.4.9	Nearly one in every 11 Pacific women diagnosed with invasive breast cancer had *de novo* metastatic disease, meaning they are more likely to be diagnosed with incurable breast cancer up-front than other ethnicities.	Figure 5.2-10

2.4.10	While 10-year survival is a more important measure of treatment effectiveness than five-year, there have been marked improvements in five-year survival in several high-risk subgroups (Table 2.4-1), which may indicate an encouraging trajectory in the longer term.	Table 2.4-1

	Proportion of women surviving invasive breast cancer to 5 years after diagnosis in		Number of additional women surviving 5 years per 100 women
	2003-2005	2015-2017	
Wāhine Māori	83%	94%	11
Pacific women	81%	91%	10
Women with stage 3 breast cancer	69%	86%	17
Wāhine Māori with stage 3 breast cancer	57%	86%	29
Pacific women with stage 3 breast cancer	77%	88%	11
Women with stage 4 breast cancer*	16%	40%	24
Women with grade 3 breast tumours	79%	91%	12
Wāhine Māori with grade 3 breast tumours	64%	93%	29
Pacific women with grade 3 breast tumours	81%	91%	10
Women with ER-/ HER+ tumours*	71%	93%	22
Women with triple negative tumours*	76%	87%	11

Table 2.4-1. *Women with marked improvements in five-year survival, in early vs late cohorts.*

*Patient numbers were too small (< 30) in the reported year groups to allow Māori or Pacific ethnicity breakdown.

2.5 Treatment: Surgery and Radiation Therapy

2.5.1	The median time to surgery has increased over time, with the percentage of surgeries performed within 31 days substantially decreasing (from 55.7% to 36.8%). Initial local reports and international studies suggest that the Covid-19 pandemic will have exacerbated this situation. Studies show that delays to surgery have an impact on survival for some patients.	Figure 6.1-1
2.5.2	The rate of axillary node dissection has decreased (<20% of women by 2019), in line with best practice.	Figure 6.1-16
2.5.3	Breast-conserving surgery (BCS) has increased in inverse proportion to mastectomy, but at a lower rate than might be expected. The overall proportion of breast-conserving surgery is lower than it should be, given that many of the traditional reasons for avoiding breast-conserving surgery can be mitigated with new oncoplastic techniques.	Figure 6.1-7
2.5.4	Approximately 20% of patients having breast-conserving surgery require a re-excision or completion mastectomy. This is comparable with other countries (and better than some), but still represents an opportunity for improvement, given the distress this causes patients and the additional health system resources required.	Figures 6.1-17
2.5.5	Radiation therapy after breast-conserving surgery is delivered to most eligible patients, with only a small number of patients declining this treatment.	Figures 6.2-2, 6.2-3
2.5.6	New Zealand surgeons met nearly all of the Royal Australasian College of Surgeons (RACS) Key Performance Indicators (KPIs) over the entire reporting period. The exceptions were endocrine therapy referrals (met since 2015) and high-risk chemotherapy referrals, which fell slightly short in some years.	Tables 11.1-1, 11.1-2, 11.1-3, 11.1-4, 11.1-5, 11.1-6
2.5.7	Rates of locoregional recurrence are low: 3% at five years and 5% at 10 years in the most recent diagnostic cohorts. This suggests that local treatments for breast cancer – surgery and radiation therapy – are serving patients well.	Figure 6.3-1
2.5.8	Overall survival (OS) was significantly higher for women having breast-conserving surgery and radiation therapy vs mastectomy, and this benefit holds up when data is adjusted for demographics and pathology. This is in line with international studies.	Figure 6.3-2, Table 6.3-1

2.6 Treatment: Systemic Therapy

2.6.1	Almost all women with hormone receptor-positive breast cancer commenced endocrine therapy, in line with best practice guidelines, though local and international studies suggest that only half may have high adherence to this treatment over the duration prescribed.	Figure 7.1-1
2.6.2	Chemotherapy referrals and uptake varied by region, with the differences more apparent when viewed over time. The biggest divergence over time was between Auckland and Waikato. The reasons for this variation may relate to patient demographic factors or to clinician preference. This is an area for further investigation.	Figures 7.2-1, 7.2-2
2.6.3	European women had the lowest rate of chemotherapy, likely reflecting their higher proportion of screen-detected and early stage cancer, lower-risk tumour profile, and greater proportion of elderly patients (who are less likely to receive chemotherapy).	Figure 7.2-1
2.6.4	Three-quarters of women under 45 had chemotherapy, compared with 9% of women over 70. Younger women had a much higher proportion of grade 3 and stage 3 tumours, which are more likely to require chemotherapy, but the younger and older populations do share some other high-risk features: a high proportion of symptomatic diagnosis and higher rate of triple negative breast cancer than women aged 45-69.	Figure 7.2-1
2.6.5	Around 15% of patients who were recommended chemotherapy declined it; the rate was similar across all ethnicities except Asian. This percentage has grown over time, with a slight decrease in 2018-2019.	Figure 7.2-3
2.6.6	The rate of neoadjuvant chemotherapy (chemotherapy before surgery) has increased, with 23% of younger women <45 (7% of all women) having neoadjuvant chemo since 2013.	Figure 7.2-4

2.7 Where to From Here?

The whakataukī (proverb) "Ka mua, ka muri", meaning "walking backwards into the future", says we must look to the past to inform our future. This report into Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register describes the past as it relates to breast cancer treatment and survival in Aotearoa New Zealand.

The next step is to take this wealth of data into the future. In considering how these findings can be used, Breast Cancer Foundation NZ finds the advice of Rami Rahal, vice president for cancer systems performance and innovation at Canadian Partnership Against Cancer, to be pertinent. Mr Rahal gave a keynote address, *Improving outcomes through evidence-based policy and performance measurement*, at the Cancer Care at a Crossroads conference, Wellington, 2018[9].

The first piece of advice he offered – "Measure what you intend to change" – guided the selection of final content for this report. The challenge then becomes moving from data into action that enables change. Mr Rahal had some practical suggestions:

- Focus on indicators that are relatable to decision-makers or practitioners; have calls to action matched with each indicator.
- Follow up with knowledge mobilisation efforts, such as system-level changes and individual clinical practice changes.
- To achieve changes, set a target, enable local healthcare providers to achieve it, and monitor performance.
- Embed a patient perspective in all measurement (not just token content).

Breast Cancer Foundation NZ has identified five priority areas that could benefit from this kind of approach, and some suggested actions the health sector might consider (defined here at only a high level). We hope these will spark conversations across the sector and will lead to even greater advances in breast cancer treatment and survival in Aotearoa New Zealand.

Priority #1 – Pacific women

Action	When
Inform health planners, healthcare providers, Pacific advisers and advocates – Breast cancer must be seen as an urgent issue for Pacific health. Informing advocates, planners and providers will empower them to drive change.	Now
Restore Pacific participation in BreastScreen Aotearoa to pre-Covid-19 levels (>70%) – this will require significant investment in BreastScreen Aotearoa (including addressing the shortage of radiologists and medical imaging technicians), Pacific-targeted communications, and innovative approaches to screening (ultramobile screening, new technologies).	Now
Increase participation of Pacific patients in clinical trials – clinical trials provide access to new treatments, and participating in trials improves individual patient outcomes. Clinicians to consider every Pacific patient for a clinical trial.	Ongoing

Priority #2 – Younger women (aged under 45)

Action	When
Educate young women about breast cancer signs, checking their breasts, and starting mammograms from age 40 if possible.	Now
Improve understanding of young women's cancer, using New Zealand data where possible, enabling more informed treatment decisions – Breast Cancer Foundation NZ is funding the four-year Helena McAlpine Young Women's Breast Cancer Study (Universities of Auckland and Otago), and a fellowship focusing on ER+ cancer in young women. Both studies aim to identify biomarkers and tests that will improve survival. Keeping up with international advances will also be important; we are not aware of New Zealand participation in the Young Breast Cancer (BCY) guidelines conference.	2022-2025
Investigate young women's treatment and survival data in the Register – further, multivariate analysis of Register data will enable benchmarking and identify areas to achieve best practice.	2023
Increase participation of young women in clinical trials – clinicians to consider every young woman for a clinical trial.	Ongoing
Consider any emerging evidence for post-treatment surveillance – studies from the 1990s showed that monitoring patients for recurrence did not improve survival. Recently there has been renewed interest in post-treatment surveillance; New Zealand needs to watch for new developments.	Ongoing

Priority #3 – High-risk cancers (large, high-grade and late-stage tumours; high-risk subtypes such as triple negative and HER2-positive; many Māori and Pacific patients)

Action	When
Inform healthcare providers about 10-year survival challenges.	Now
Invest to restore participation in BreastScreen Aotearoa (BSA) to pre-Covid levels, and to extend to age 74 – the most effective way to prevent large and late-stage tumours is to find breast cancer early. Māori and Pacific women's screening were hardest-hit by the Covid-19 pandemic; achieving BSA's 70% screening target will require significant investment. Setting breast screening participation as a Health System Indicator will ensure a focus on areas of lagging survival.	Now
Secure PHARMAC funding for new drugs for neo/adjuvant treatment in high-risk early breast cancers. Examples could include T-DM1 (Kadcyla), pertuzumab (Perjeta) and neratinib (Nerlynx) for HER2+ breast cancer, abemaciclib (Verzenio) for ER+ breast cancer, and pembrolizumab (Keytruda) for triple negative breast cancer.	2022 onwards
Every high-risk early breast cancer patient to be offered a clinical trial – high-risk patients need access to trials no matter where they live. This means not only increasing the number and range of trials available, but also implementing a tele-trial structure to make sure women don't miss out if they live in the "wrong" place.	Ongoing
Investigate systemic therapy uptake and delivery – this Report showed regional variation in chemotherapy use, and increasing number of patients declining chemo. Further investigation is needed to understand the level of best practice and opportunities to improve, plus barriers to chemo uptake for patients.	2022-2023
Improve support for patients on endocrine therapy – with half of patients not completing their five-year course of endocrine therapy, often due to side effects, there is a clear need for more support for patients over the duration of treatment. With more than 17,000 women currently taking these therapies (source: PHARMAC, 2021), the challenge is enormous and requires a coordinated approach that is highly likely to be dependent on tele-health technologies.	2022-2023

Consider any emerging evidence and technologies for post-treatment surveillance – as with young women's cancers above, developments in surveillance of high-risk cancers should be assessed for relevance to Aotearoa New Zealand. Technology may play a valuable role in monitoring endocrine therapy adherence.	Ongoing

Priority #4 – Address the ratio of breast-conserving surgery (BCS) to mastectomy

Action	When
Educate patients about outcomes for breast-conserving surgery vs mastectomy – Breast Cancer Foundation NZ has a key role to play in educating patients directly through online and printed materials, as well as our nurse support line. Healthcare providers may need materials to use with patients.	Now
Inform clinicians about their institutional and individual ratios of breast-conserving surgery to mastectomy – while there can be good reasons for performing a mastectomy on patients eligible for breast-conserving surgery, awareness of performance against guidelines can provide an opportunity to reflect on practice.	2022
Hospitals to set targets for rate of breast-conserving surgery – with a target in place, hospitals would need to understand barriers to improving BCS rates and address these to enable change. Progress will need to be measured and reported frequently.	Now
Where needed, upskill surgeons to latest oncoplastic techniques – oncoplastic techniques enable patients who would otherwise require mastectomy to have breast-conserving surgery.	2022-2024

Priority #5 – Tackle delays to surgery and re-excision rates

Action	When
Invest in health system infrastructure and people resources to enable achievement of the 31-day treatment target – significant investment is urgently required to enable breast cancer surgery to take place in a timely fashion. Clinicians report anecdotally that operating theatre time and nurse FTE are major constraints.	Now
Hospitals to pilot and implement new technologies for tumour localisation and intraoperative margin assessment, to reduce re-excision rates – the recent ROLLIS trial (in which Waikato Hospital participated) showed that improved tumour localisation can increase the rate of clear margins and reduce re-excisions. Technologies such as MarginProbe (proof-of-concept study underway in New Zealand) and OncoRes (clinical trial likely in 2022) provide intraoperative margin assessment, with the aim of reducing re-excisions by 50-90%).	2022-2024

3. Ethnicity

In brief

- Wāhine Māori were more likely to have higher-risk ER- and / or HER2+ breast cancers. Size and stage of their tumours decreased over time. Wāhine received and declined treatment at the same rate as European women. Survival improved significantly in recent years.
- Pacific women had the highest rate of stage 3 and 4 breast cancers and of HER2+ cancers. They had more large tumours and more grade 3 tumours than all other ethnicities. The rate of screen-detected cancer increased over time, but these gains are at risk, with screening participation declining sharply during the pandemic.
- Asian women had better outcomes than all other ethnicities, despite having a higher proportion of symptomatic vs screened diagnoses.
- All ethnicities experienced significant improvements in age-adjusted five- and 10-year survival.

Breast cancer incidence in Aotearoa New Zealand varies by ethnicity, and past studies have shown that survival outcomes also vary. Outcomes of breast cancer for Māori and Pacific women have historically been worse than for European women, while Asian women have had better outcomes.

This section of this report into Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register separates out the diagnosis, treatment and outcome data for three ethnicities: Māori, Pacific and Asian. This data is then further expanded and compared across ethnicities in topic-specific sections throughout the report.

There is no section specific to breast cancer in European women; however, the general commentary largely pertains to these women, as they comprise 74% of patients in the Register. European-specific data is included in all the ethnic breakdowns throughout the main body of the report.

In this section, we have mostly allowed the data for each ethnicity to stand alone, rather than comparing each point to European or other ethnicities. However, all of these data points are compared across ethnicities in the general sections (Section 4 onwards).

This section ends with survival breakdowns by ethnicity. We provide crude and age-adjusted outcomes for each ethnicity; age-adjustment helps to compare across ethnicities with differing age distributions.

Ethnicity breakdown within the Register

	Invasive breast cancer (N=25,346)
Māori	2,709 (10.7%)
Pacific	1,736 (6.8%)
Asian	2,175 (8.6%)
European	18,726 (73.9%)

Table 2.7-1. *Proportion of registrations by the four main ethnicities in the Register.*

	Auckland (N=13,624)	Waikato (N= 3,925)	Christchurch (N= 3,619)	Wellington (N= 2,972)	Total (N=24,140)
Māori	1,302 (9.6%)	710 (18.1%)	210 (5.8%)	339 (11.4%)	2,561 (10.6%)
Pacific	1,291 (9.5%)	74 (1.9%)	47 (1.3%)	161 (5.4%)	1,573 (6.5%)
Asian	1,682 (12.3%)	92 (2.3%)	128 (3.5%)	194 (6.5%)	2,096 (8.7%)
European	9,349 (68.6%)	3,049 (77.7%)	3,234 (89.4%)	2,278 (76.6%)	17,910 (74.2%)

Table 2.7-2. *Proportion of registrations by ethnicity and region in the Register.*

In line with regional population profiles, Waikato has the highest proportion of wāhine Māori (18% of diagnoses), followed by Wellington (11.4%) and Auckland (9.6%). The highest proportion of Pacific women is in Auckland, comprising 9.5% of diagnoses. Wellington has the only other substantial Pacific cohort (5.4%). As might be expected given general population distribution, the Asian breast cancer patient population is highest in Auckland (12.3% of diagnoses), then Wellington (6.5%). Auckland has the lowest proportion of European cases (68.6%) and Christchurch the highest (89.4%).

3.1 Wāhine Māori and Breast Cancer

Māori women have one of the highest rates of breast cancer incidence in the world [10]. Local studies show Māori having a 37% higher incidence of breast cancer than non-Māori [11-20] and 46% higher than European/Other women [21].

3.1.1 Demographics

Region

Māori are more likely than other ethnicities to be under-represented in Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register's urban-dominated population, as the proportion of Māori living in small urban areas (14.7%) and rural areas (18%) is higher than among the total population (10% and 16.3% respectively) [22].

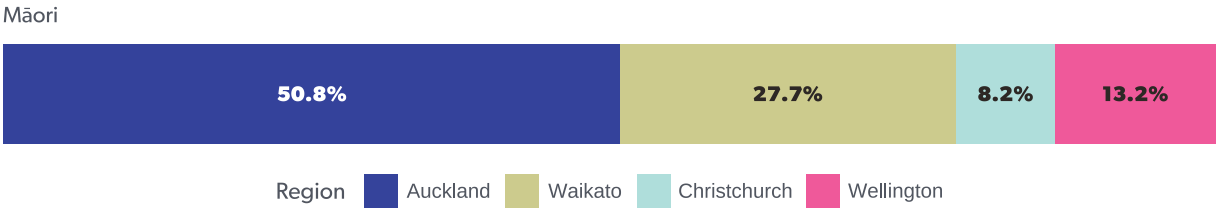


Fig. 3.1-1. *Region of diagnosis for Māori in te Rēhita.*

Half of Māori breast cancer diagnoses in te Rēhita occurred in Auckland, and just over a quarter in Waikato (Figure 3.1-1).

Age

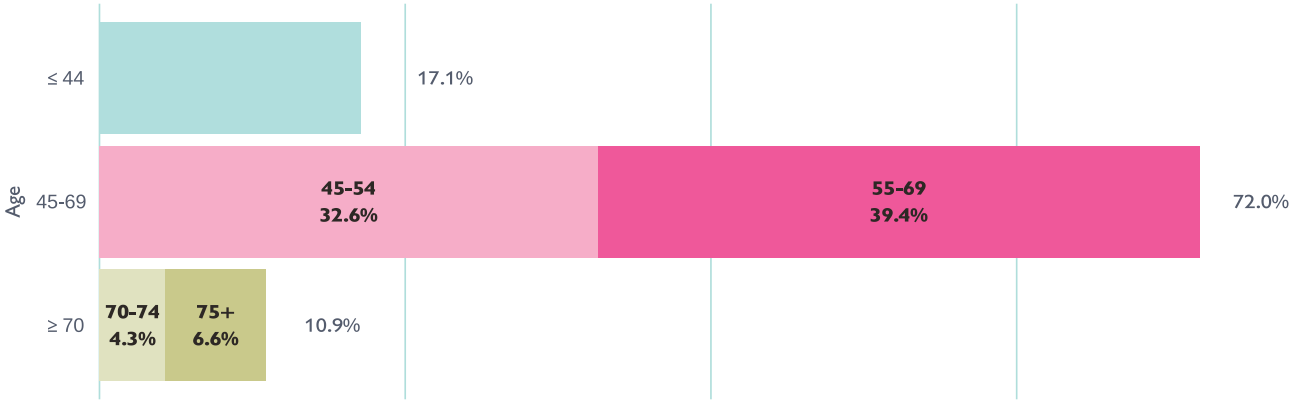


Fig. 3.1-2. *Proportion of wāhine Māori diagnosed with invasive breast cancer by age group.*

17.1% of wāhine Māori (Figure 3.1.2) with breast cancer were diagnosed under age 45. This high proportion can be explained partly by higher age-standardised rates of breast cancer per 100,000 women reported in most years for Māori vs non-Māori aged <45. However, the small numbers (nationally, 50-60 wāhine per year aged <45) can mean the rate fluctuates considerably [11-20, 23-25]. In addition, the Māori population structure skews younger than European and Asian ethnicities; shorter life expectancy means that a smaller proportion of Māori breast cancer diagnoses occur at age 70+. For these same reasons, the median age of diagnosis for wāhine Māori is younger than for European women (54 vs 60).

As with all ethnicities, most Māori diagnoses occurred between the ages of 45-69.

ETHNICITY & AGE AT DIAGNOSIS		5-YEAR SURVIVAL	10-YEAR SURVIVAL
Māori	⩽ 44	82% (78-85)	75% (70-79)
	45-69	92% (90-93)	87% (85-89)
	⩾ 70	83% (79-88)	77% (71-84)

Table 3.1-1. *Breast cancer-specific survival for Māori women by age.*

Viewed over the entire study period, 10-year survival for young Māori women was only 75%. See Section 3.4.4 for a full comparison by ethnicity.

Breast cancer-specific survival over time

Breast cancer survival for Māori has improved over time: past studies have varied in their conclusions, but some analyses of data from the early 2000s found that Māori women were twice as likely to die as European women [21, 26]. Māori women diagnosed from 2007-2016 were 37% more likely to die of their breast cancer than non-Māori women, with the risk remaining substantial even in the absence of comorbidities. The survival disparity remained consistent across levels of deprivation [27].

This analysis from te Rēhita found significant improvements in Māori survival, reported both as crude data (Table 3.1-2) and adjusted for age (Table 3.1-3). How these improvements compare with other ethnicities is seen in Section 3.4.4.

ETHNICITY	5-YEAR SURVIVAL	10-YEAR SURVIVAL
Māori		
2003-2005	83% (78-88)	77% (72-83)
2009-2011	87% (84-90)	84% (81-87)
2015-2017	94% (92-96)	

Table 3.1-2. *Five- and 10-year BCSS (95% CI) for wāhine Māori by time cohort.*

	5-year survival			10-year survival		
	HR	**95% CI**	**p-value**	**HR**	**95% CI**	**p-value**
Māori						
2003-2005	1.0		<0.001	1.0		0.004
2009-2011	0.7	(0.47-1.03)		0.68	(0.48-0.96)	
2015-2017	0.34	(0.22-0.53)				

Table 3.1-3. *Age-adjusted five- and 10-year CoxPH model of BCSS with HR (95% CI) for wāhine Māori by time cohort.*

The adjusted data shows Māori women diagnosed in 2015-17 were 66% less likely to have died of cancer five years after diagnosis than those diagnosed in 2003-2005. Ten-year age-adjusted risk of breast cancer mortality for Māori had decreased 32% by 2009-2011.

3.1.2 Detection and diagnosis

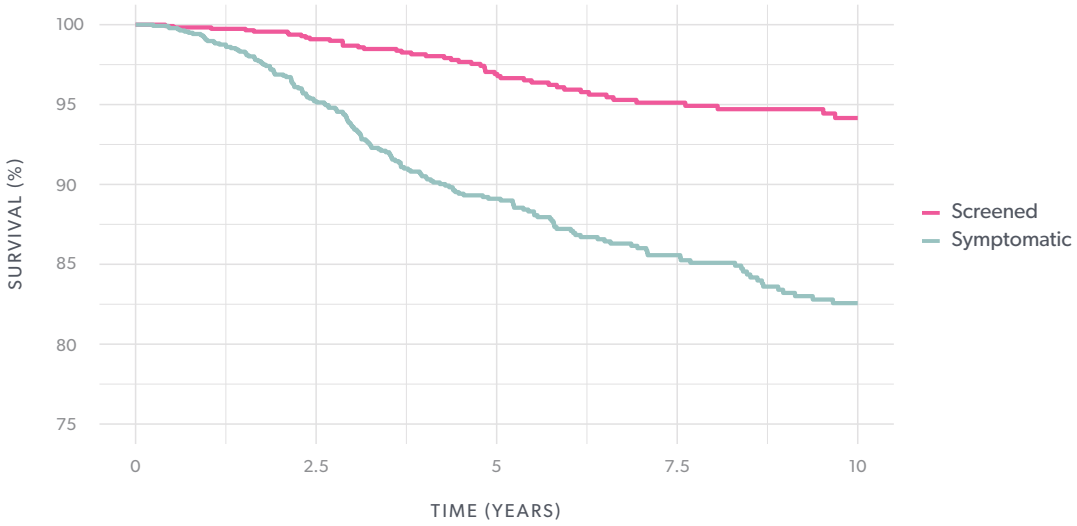
	Māori (N= 2,540)		
Method of Detection			
		%	Adjusted %
Screened	1,157	(45.6%)	42.1
Symptomatic	1,383	(54.4%)	57.9

Table 3.1-4. *Proportion of wāhine Māori with screen-detected vs symptomatic invasive breast cancer.*

Fewer than half of wāhine Māori had their breast cancer detected by screening mammogram (Table 3.1-4). Māori have lower participation in BreastScreen Aotearoa (BSA) than all ethnicities except Asian, with two-year participation to September 2019 (pre-Covid-19 pandemic) being 61.9% against the target of 70%. Over the Covid-19 pandemic period of 2020-21, Māori two-year screening participation declined to 57.3% [28]. Lack of participation can be related to non-engagement with the health system (for example, not being registered with a GP), or practicalities such as difficulty getting time off work for a mammogram, lack of transportation or childcare, or distance from a screening unit.

Survival by method of detection

Earlier studies have shown that Māori women with screen-detected cancer have substantially lower mortality from breast cancer than women whose breast cancers were not screen-detected. Wāhine Māori who participated in the BreastScreen Aotearoa programme experienced a significant survival benefit, with 56% (95% CI: 23-75) lower breast cancer mortality if their cancer was screen-detected [29]. A Waikato study suggested that differences in the pathway to diagnosis (screened or symptomatic) may account for approximately 15% of the survival disparity between Māori and European women [26].



DETECTION METHOD	5-YEAR SURVIVAL	10-YEAR SURVIVAL
Screened Māori	97% (96-98)	94% (92-96)
Symptomatic Māori	89% (87-91)	83% (80-85)

Fig. 3.1-3. *Five- and 10-year BCSS (95% CI) for wāhine Māori, by detection method.*

The Register data supports these earlier findings: wāhine whose cancers were screen detected had significantly better five- and 10-year survival than those diagnosed after experiencing a symptom (Figure 3.1-3).

Keitha (Ngāti Awa and Ngāti Korokī Kahukura), Bay of Plenty, diagnosed at 46:

"My story is one of early detection. Thanks to the free mammogram programme, I'm still here for my whānau today. I know wāhine can be staunch and stubborn, we think we don't need to go for screening. But if breast cancer can happen to me then it can happen to anyone. We all need to go and get checked."

3.1.3 Tumour pathology

Wāhine Māori were more likely to have higher risk tumour characteristics (for example, large size, high grade, high-risk subtype) than Asian or European women. A full comparison of the tumour pathology for women of different ethnicities is shown in Section 5.2.

Tumour size

Across the reporting period, nearly 60% of Māori women's tumours were ⩽20mm in size (Table 3.1-5).

	Māori (N = 2,561)		
Tumour size (mm)			
		%	Adjusted %
⩽ 20	1,469	(57.4%)	57.5
21 - 50	941	(37.7%)	37.1
⩾ 50	151	(5.9%)	5.4

Table 3.1-5. *Size of invasive breast tumours in wāhine Māori, crude and age-adjusted.*

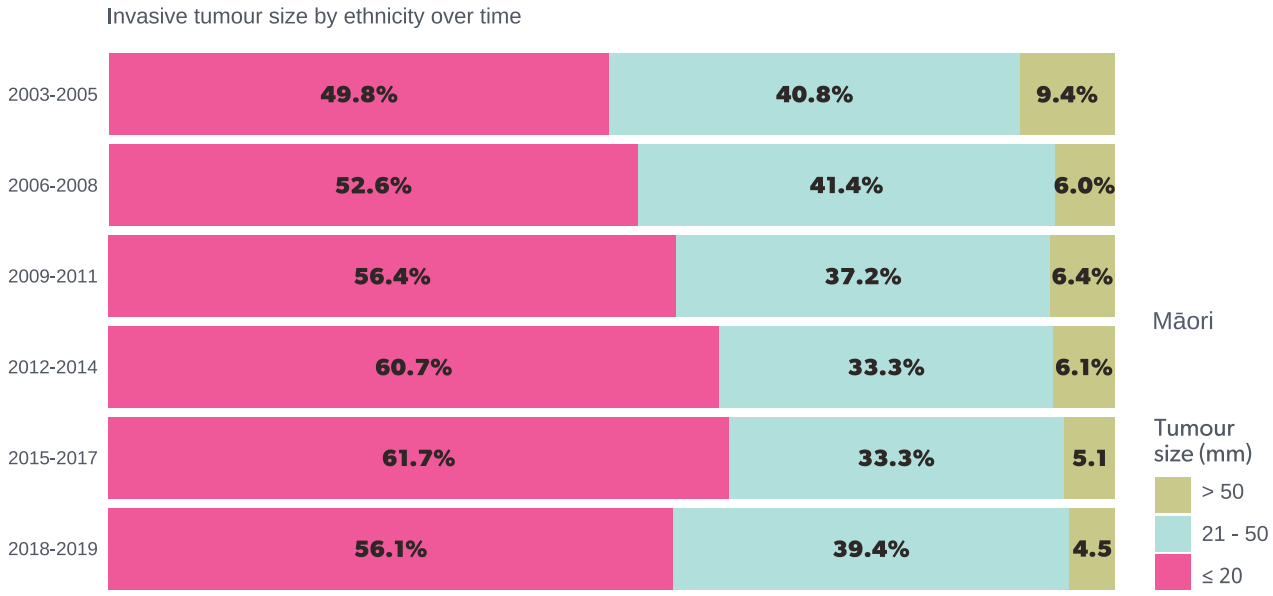


Fig. 3.1-4. *Size of invasive breast tumours in wāhine Māori in total, and changes over time.*

There has been a positive trend over time towards more tumours being found at this smaller size (Figure 3.1-4). However, disconcertingly, there was an increase in larger (21-50mm) tumours during 2018-19. Reasons for this are not clear. In considering how this pattern might develop in the future, the decline in screening participation through the Covid-19 pandemic, along with an acknowledged backlog in access to BreastScreen Aotearoa mammograms, give rise to a concern that the proportion of smaller tumours may be unlikely to return to 2015-2017 levels in the near future.

On a positive note, the percentage of very large (>50mm) tumours has continued to decline.

Tumour grade

	Māori (N = 2,418)		
Tumour Grade			
		%	Adjusted %
1	539	(22.3%)	22.1
2	1,223	(50.6%)	51.7
3	656	(27.1%)	26.2

Table 3.1-6. *Tumour grade for Māori women diagnosed with invasive breast cancer.*

Approximately 50% of wāhine Māori were diagnosed with grade 2 tumours, and just over one quarter with grade 3 tumours (Table 3.1-6) (see Figure 5.2-2).

Receptor status

	Māori (N = 2,409)		
		%	Adjusted %
ER+/HER2-	1,799	(74.7%)	75.5
ER+/HER2+	289	(12%)	11.5
ER-/HER2+	141	(5.9%)	5.5
Triple Negative	180	(7.5%)	7.5

Table 3.1-7. *Receptor status of invasive breast cancer in wāhine Māori.*

Three quarters of wāhine Māori had ER+/HER2- breast tumours (Table 3.1-7). Among the more aggressive breast cancer subtypes, wāhine Māori had more ER- and / or HER2+ cancers than European women, but fewer had triple negative breast cancer.

Lymph node status

	Māori (N = 2,429)		
		%	Adjusted %
N0	1,482	(61%)	61
N1	666	(27.4%)	27.2
N2	185	(7.6%)	7.9
N3	96	(4%)	3.8

Table 3.1-8. *Nodal status of wāhine Māori diagnosed with invasive breast cancer.*

Most wāhine Māori were diagnosed with node-negative (N0) breast cancer.

De novo status

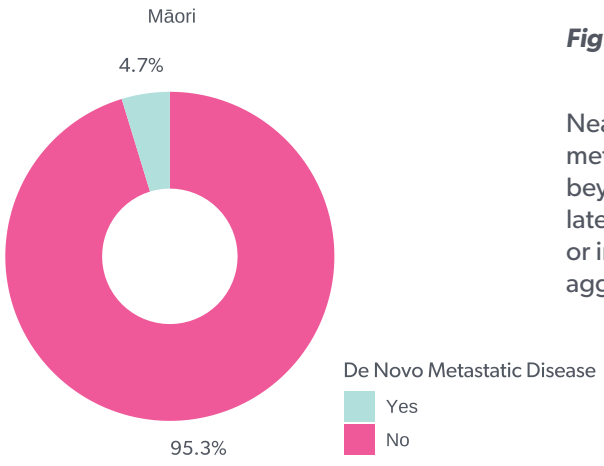


Fig. 3.1-5. De novo *metastatic disease in wāhine Māori.*

Nearly 5% of Māori were diagnosed with *de novo* metastatic breast cancer (cancer that had already spread beyond the breast) (Figure 3.1-5). This may be a factor of late diagnosis (either in women too young for screening or in unscreened eligible women) and / or of more aggressive tumour subtypes.

Tumour stage

Cancer stage at diagnosis is believed to be the dominant factor in the survival disparity between Māori and NZ European women, accounting for approximately 40% of the difference in survival [26].

	Māori (N = 2,541)		
Tumour Stage			
		%	Adjusted %
1	1,082	(42.6%)	41.8
2	953	(37.5%)	37.8
3	358	(14.1%)	14.1
4	148	(5.8%)	6.4

Table 3.1-9. *Overall stage of invasive breast tumours in wāhine Māori.*

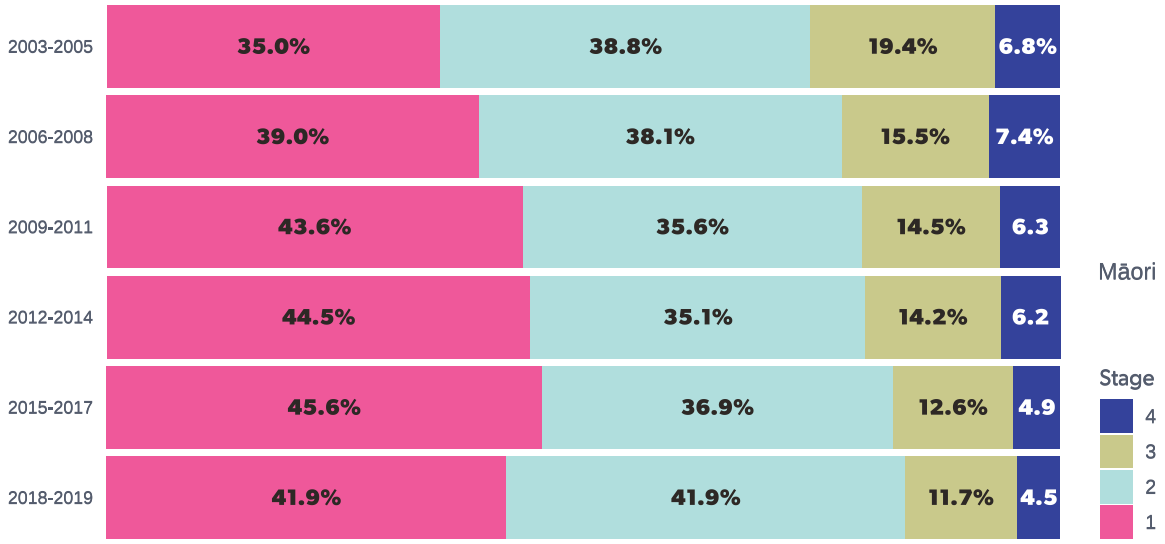


Fig. 3.1-6. *Overall stage of invasive breast tumours in wāhine Māori, and changes over time.*

During the study period, 20% of wāhine Māori presented with stage 3 (locally advanced) or stage 4 (metastatic) disease (Table 3.1-9). However, analysis by time cohorts shows that the percentage of larger tumours was declining steadily until 2018-2019 (Figure 3.1-6). The increase in stage 2 tumours diagnosed in 2018-2019 is likely linked to the decrease in the number of smaller-size cancers noted under Tumour size.

The proportion of stage 3 and 4 cancers has reduced over time from 25.2% of all Māori diagnoses in 2003-2005 to approximately 15% in 2018-2019 (Fig 3.1-6).

3.1.4 Treatment: surgery and radiotherapy

Type of surgery

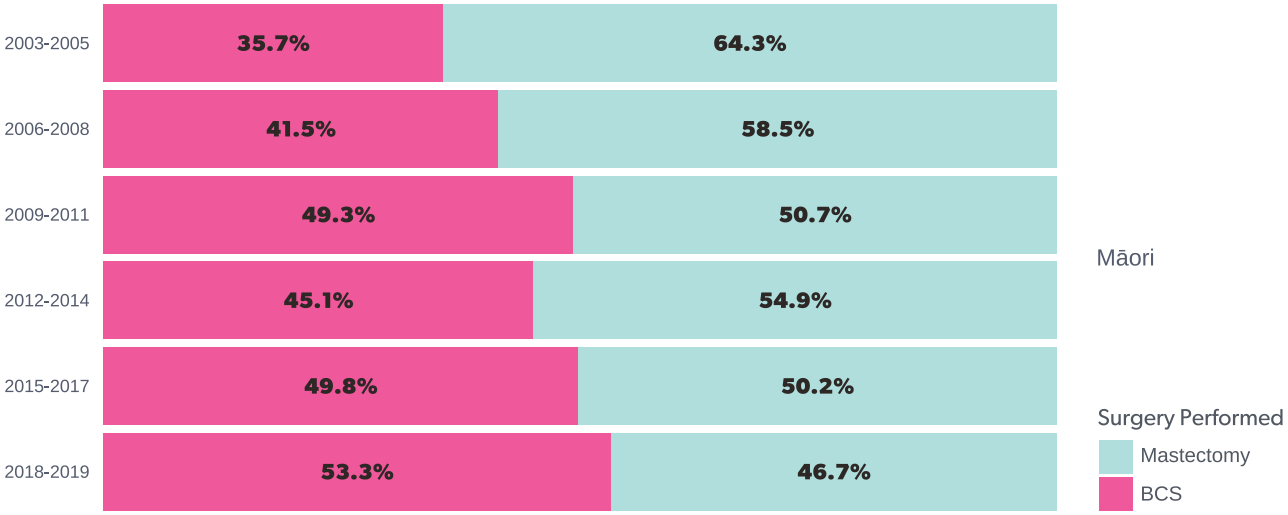


Fig. 3.1-7. *Surgery for invasive breast cancer over time, for wāhine Māori.*

Overall, wāhine Māori are trending towards a higher proportion of breast-conserving surgery (BCS), which is in line with best practice (Figure 3.1-7). However there is room for improvement in this area across all ethnicities (see Section 6.1.2).

Breast reconstruction

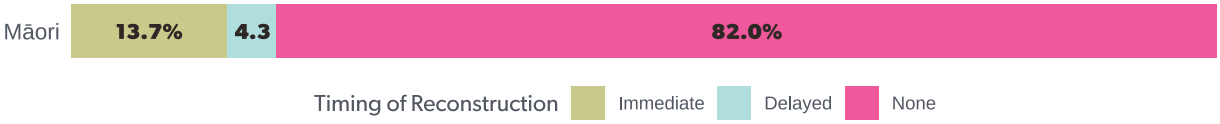


Fig. 3.1-8.*Wāhine Māori having breast reconstruction following mastectomy.*

While reconstruction numbers were small across all ethnicities, fewer Māori had breast reconstruction after mastectomy than Asian or European women, with only 18% having either immediate or delayed reconstruction (Figure 3.1-8). More details can be found in Section 6.1.6.

Radiation therapy

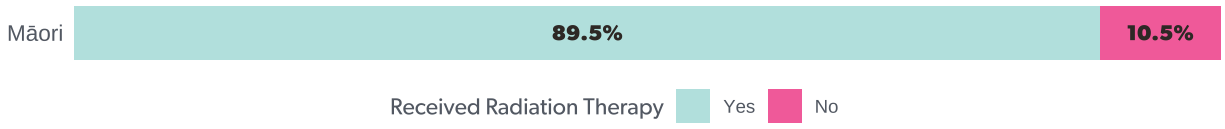


Fig. 3.1-9. *Wāhine Māori receiving radiation therapy following breast-conserving surgery.*

Wāhine Māori received radiation therapy following breast-conserving surgery at the same rate as European women (Figures 3.1-9, 6.2-2). A small percentage declined radiation (Figure 3.1-10).

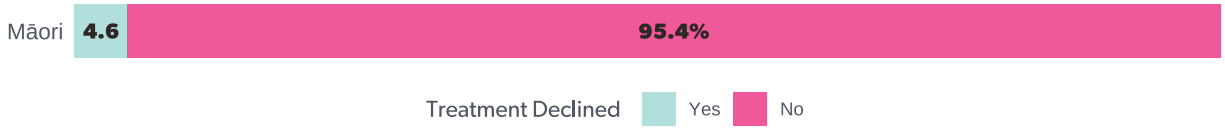


Fig. 3.1-10. *Rate of radiation therapy declined among wāhine Māori for whom treatment was recommended.*

3.1.6 Treatment: systemic therapies

Endocrine therapy

	Māori (N = 1,703)		
		%	Adjusted %
Received endocrine therapy	1,644	(96.5%)	96.8
Referred - deemed not necessary	4	(0.2%)	0.2
Referred - treatment declined	21	(1.2%)	1.1
Not Referred	34	(2%)	1.8

Table 3.1-10. *Wāhine Māori with HR+ tumours receiving endocrine therapy.*

Approximately 97% of wāhine Māori received endocrine therapy (Table 3.1-10), with referral and uptake rates for endocrine therapy in hormone receptor-positive breast cancer the same for Māori as for other ethnicities.

Chemotherapy

	Māori (N = 2,400)		
		%	Adjusted %
Received chemotherapy	965	(40.2%)	34.9
Referred - deemed not necessary	142	(5.9%)	6.3
Referred - treatment declined	156	(6.5%)	6.6
Not Referred	1,137	(47.4%)	52.3

Table 3.1-11. *Wāhine Māori being referred for and receiving adjuvant chemotherapy (from 2013) for invasive breast cancer.*

	Māori (N = 1,323)		
		%	Adjusted %
Received neoadjuvant chemotherapy	115	(8.7%)	7.6
Referred - deemed not necessary	1	(0.1%)	0.1
Referred - treatment declined	3	(0.2%)	0.26
Not Referred	1,204	(91%)	92.1

Table 3.1-12. *Wāhine Māori being referred for and receiving neoadjuvant chemotherapy (from 2013) for invasive breast cancer.*

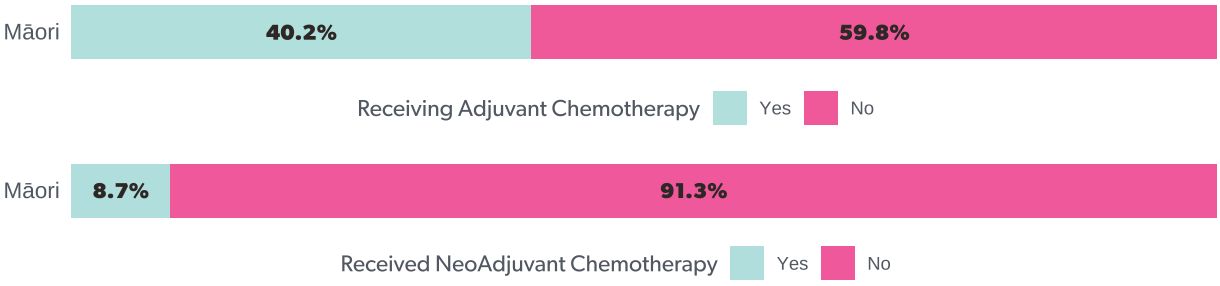


Fig. 3.1-11. *Wāhine Māori receiving a) adjuvant or b) neoadjuvant chemotherapy (from 2013) for invasive breast cancer.*

More wāhine Māori received either adjuvant or neoadjuvant chemotherapy than European women; this is likely to be because they had higher risk tumours. Māori and European women declined chemotherapy at the same rate (Figure 3.1-11, Section 7.2).

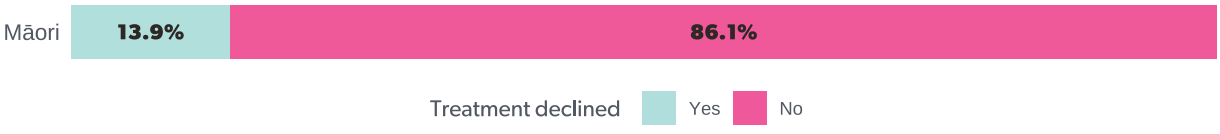


Fig. 3.1-12. *Rate of adjuvant chemotherapy declined among wāhine Māori for whom treatment was recommended.*

Anti-HER2 therapies

	Māori (N = 287)		
		%	Adjusted %
Received anti-HER2 therapy	229	(79.8%)	77.6
Referred - deemed not necessary	11	(3.8%)	4.5
Referred - treatment declined	18	(6.3%)	7
Not Referred	29	(10.1%)	10.9

Table 3.1-13. *Wāhine Māori with HER2+ breast tumours referred for and receiving anti-HER2 therapies, from 2009.*

Fig. 3.1-13. *Wāhine Māori with HER2+ breast tumours receiving anti-HER2 therapies, from 2009.*

Approximately 80% of wāhine Māori with HER2+ breast cancer received anti-HER2 therapy (Table 3.1-13). The proportion of wāhine Māori who received and declined anti-HER2 therapy was the same as for European women (Figs 3.1-14 and 7.3-2).

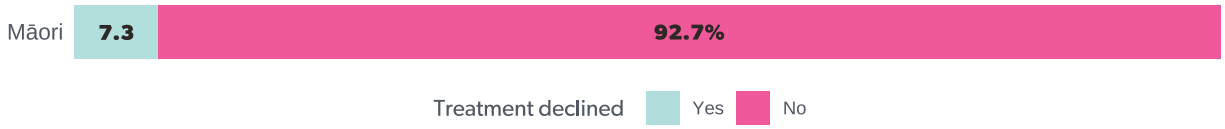


Fig. 3.1-14. *Rate of anti-HER2 therapy declined among wāhine Māori for whom treatment was recommended.*

3.2 Pacific Women and Breast Cancer

The incidence of breast cancer in Pacific women has historically been lower than that of European women [30]. However, in recent years, incidence has increased, with one study suggesting it is 21% higher than European / Other women [21].

3.2.1 Demographics

Nationally, approximately 170 Pacific women are diagnosed with invasive breast cancer each year [17, 19].

Region

Pacific women's breast cancers are well-represented in Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register, as more than 75% of New Zealand's Pacific people live in major urban areas [22].

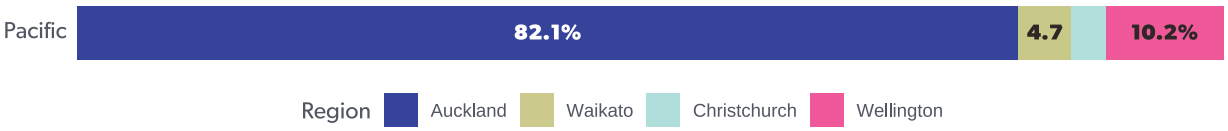


Fig. 3.2-1. *Region of diagnosis for Pacific women in te Rēhita.*

Over 80% of Pacific breast cancer diagnoses recorded in the Register were in the Auckland region, which is home to more than 60% of New Zealand's Pacific population, with a predominance in the Counties Manukau DHB catchment. Over the reporting period, 10.2% of Pacific diagnoses in the Register were in Wellington.

Age

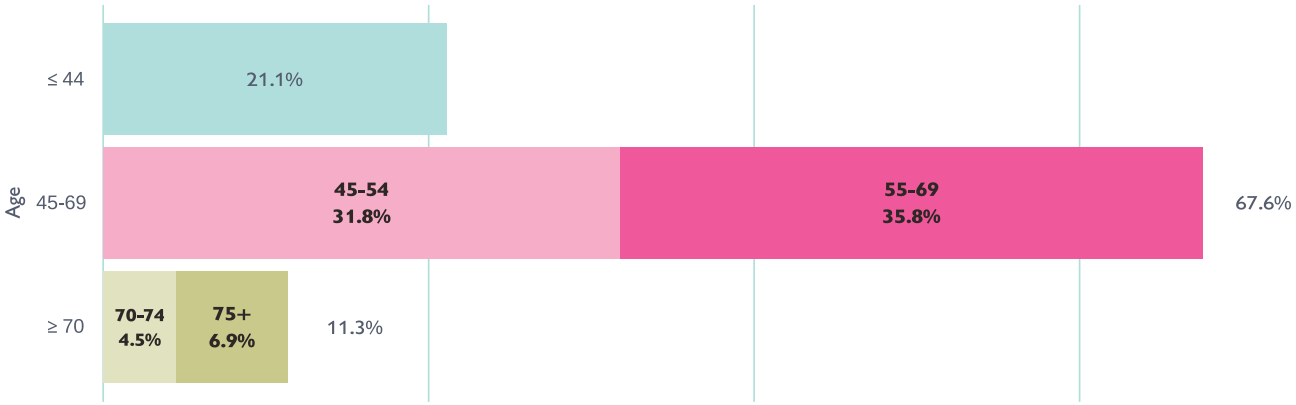


Fig. 3.2-2. *Proportion of Pacific women diagnosed with invasive breast cancer by age group.*

Pacific Peoples are the youngest population group in Aotearoa New Zealand, so it is not surprising they had a higher proportion of breast cancer diagnoses under age 45 (21%, Figure 3.2-2) than any other ethnicity (see Section 4.3). Two-thirds were diagnosed in the screening age group of 45-69. The small proportion of breast cancer diagnoses over age 70 reflects both the younger population and shorter life expectancy.

The median age of breast cancer diagnosis for Pacific women was 54, the same as for Māori, but younger than for European (median=60).

Ana, Auckland, diagnosed at 48:

"I was shocked when they said it was breast cancer because I have no family history of it. They told me I needed to have my breast removed. When I went home to discuss this with my family, we all agreed that I should have the surgery. For the sake of my children, my family and myself, we decided I had to go ahead with it."

ETHNICITY & AGE AT DIAGNOSIS		5-YEAR SURVIVAL	10-YEAR SURVIVAL
Pacific	⩽ 44	83% (79-87)	75% (70-81)
	45-69	89% (87-91)	84% (81-87)
	⩾ 70	85% (79-91)	79% (72-88)

Table 3.2-1. *Breast cancer-specific survival for Pacific women by age.*

Viewed over the entire study period, 10-year survival for young Pacific women was only 75%. See Figure 3.4-4 for a full comparison by ethnicity.

Breast cancer-specific survival over time

Previous studies have shown that Pacific women in Aotearoa New Zealand have a significantly higher risk of dying of their breast cancer. These showed that Pacific women diagnosed from 2006-2011 had a 53% higher mortality than European / Other women [21]; and those diagnosed between 2000-2014 had nearly twice the risk of dying compared with non-Māori non-Pacific women [31].

ETHNICITY	5-YEAR SURVIVAL	10-YEAR SURVIVAL
Pacific		
2003-2005	81% (75-87)	73% (66-80)
2009-2011	86% (82-90)	80% (75-85)
2015-2017	91% (89-94)	

Table 3.2-2. *Five- and 10-year BCSS (95% CI) for Pacific women by time cohort.*

Raw data in the Register suggests a trend of improving five- and 10-year survival for these women over time, with five-year survival becoming significant in later cohorts (Table 3.2-2). However, from this crude data analysis, 10-year survival does not differ between the cohorts (due to overlapping confidence intervals).

	5-year survival			10-year survival		
	HR	**95% CI**	**p-value**	**HR**	**95% CI**	**p-value**
Pacific			0.011			0.009
2003-2005	1.0					
2009-2011	0.71	(0.44-1.15)		0.72	(0.48-1.09)	
2015-2017	0.46	(0.28-0.74)				

Table 3.2-3. *Age-adjusted five- and 10-year BCSS (95% CI) for Pacific women by time* cohort.

When adjusted for age, Pacific women diagnosed in 2015-17 were 54% less likely to die of breast cancer within five years of diagnosis than those diagnosed at the start of the reporting period (Table 3.2-3). There was also significantly improved 10-year survival, with Pacific women diagnosed in 2009-2011 28% less likely to die than those diagnosed in 2003-2005. However, other ethnicities had a greater improvement (see Section 3.4.3).

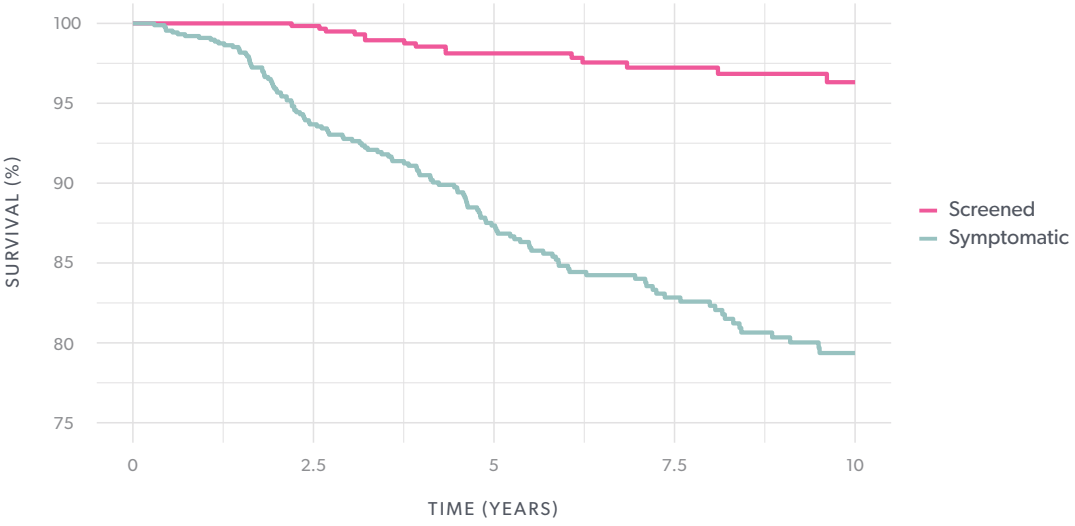
3.2.2 Detection and diagnosis

	Pacific (N = 1,555)		
Method of Detection			
		%	Adjusted %
Screened	667	(42.9%)	41.9
Symptomatic	888	(57.1%)	58.1

Table 3.2-4. *Proportion of Pacific women with screen-detected vs symptomatic invasive breast cancer.*

Pacific women had a slightly lower proportion of screened diagnosis than Māori and European women (Table 3.2-4, Figure 5.1-1). However, they have had the biggest improvement in the ratio of screened to symptomatic diagnoses over time (see Fig. 5.1-2), likely reflective of high levels of participation in BreastScreen Aotearoa, which from 2012-2019 was consistently above the 70% target [28].

Unfortunately, Pacific women have experienced the biggest decline in screening participation during the Covid-19 pandemic, perhaps due to the high population concentration in Auckland, where screening was severely impacted by lockdowns in 2020-2021. Participation declined to 59.4% in the two years to September 2021; this is likely to result in a higher percentage of symptomatic diagnoses in future.



DETECTION METHOD	5-YEAR SURVIVAL	10-YEAR SURVIVAL
Screened Pacific	98% (97-99)	96% (94-98)
Symptomatic Pacific	87% (85-90)	79% (76-83)

Fig. 3.2-3. *Five- and 10-year BCSS (95%) CI for Pacific women, by detection method.*

Regular screening is highly effective for Pacific women: in screened Pacific women; published data showed that regular screening mammography was associated with an 86% reduction in breast cancer mortality compared to women who screened less frequently [32]. The Register showed significantly better five- and 10-year survival for Pacific women with screened vs symptomatic diagnosis (Figure 3.2-3). In fact, Pacific women had by far the biggest difference in 10-year survival for screened vs symptomatic diagnosis; this highlights the importance for these women of addressing the Covid-related decline in screening participation.

3.2.3 Tumour pathology

Tumour size

	Pacific (N = 1,573)		
Tumour size (mm)			
		%	Adjusted %
⩽ 20	779	(49.5%)	49.8
21 - 50	626	(39.8%)	39.6
⩾ 50	168	(10.7%)	10.5

Table 3.2-5. *Size of invasive breast tumours in Pacific women in total.*

Fewer Pacific women had small tumours than other ethnicities; 50.5% were diagnosed with tumours ⩾21mm (whereas small tumours are generally classified as ⩽20mm). Twice as many Pacific women had large tumours, >50mm, as in other groups (Table 3.2-5, Figure 5.2-1).

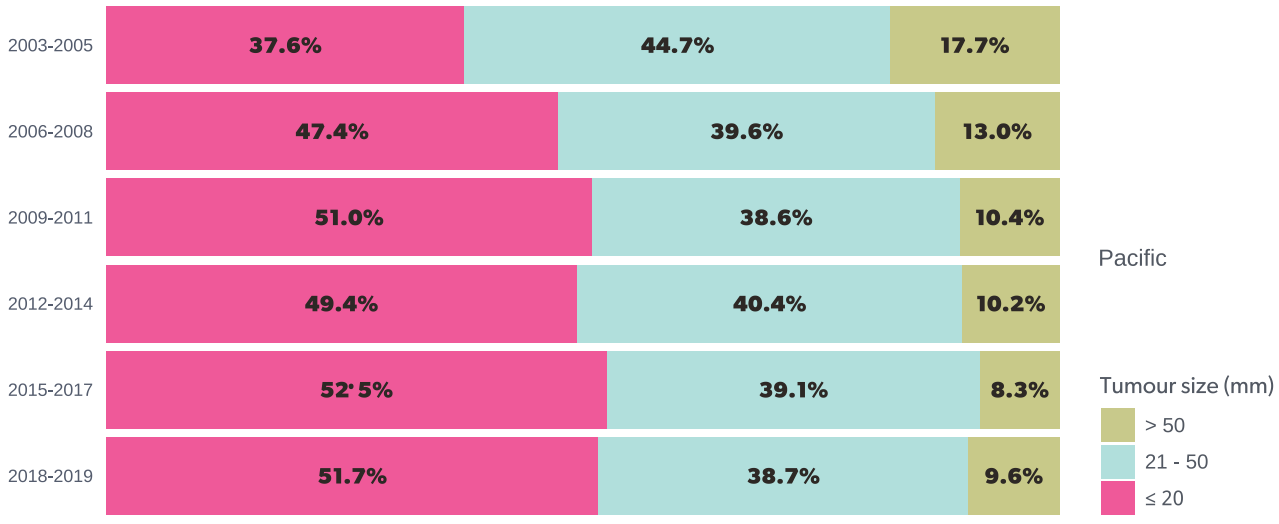


Fig. 3.2-4. *Size of invasive breast tumours in Pacific women in total, and changes over time.*

Since 2009, approximately 50% of Pacific women have been diagnosed with small tumours, but the proportion of Pacific women diagnosed with large tumours (>50mm) has slowly decreased (Figure 3.2-4).

Tumour grade

	Pacific (N = 1,444)		
Tumour Grade			
		%	Adjusted %
1	249	(17.2%)	18
2	658	(45.6%)	46.7
3	537	(37.2%)	35

Table 3.2-6. *Tumour grade for Pacific women diagnosed with invasive breast cancer.*

Pacific women were more likely than all other ethnicities to have more aggressive grade 3 tumours. Only 17% had low-risk grade 1 tumours (Table 3.2-6).

Receptor status

	Pacific (N = 1,438)		
		%	Adjusted %
ER+/HER2-	998	(69.4%)	71.9
ER+/HER2+	208	(14.5%)	12.3
ER-/HER2+	138	(9.6%)	8.8
Triple Negative	94	(6.5%)	6.9

Table 3.2-7. *Receptor status of invasive breast cancer in Pacific women.*

It has been previously reported that Pacific women have a much higher incidence of HER2+ breast cancer (a higher-risk subtype) than other ethnicities [31]. In our study, nearly a quarter of Pacific women had HER2+ tumours. Conversely, Pacific women have the lowest rate of triple negative tumours at 6.5%. See section 5.2.3 for a comparison across ethnicities.

Lymph node status

	Pacific (N = 1,450)		
		%	Adjusted %
N0	837	(57.7%)	59.1
N1	368	(25.4%)	24.4
N2	154	(10.6%)	10.3
N3	91	(6.3%)	6.1

Table 3.2-8. *Nodal status of Pacific women diagnosed with invasive breast cancer.*

Node negative disease was diagnosed in 58% of Pacific women, compared to between 61-67% of women of other ethnicities (Table 3.2-8). Pacific women were nearly twice as likely as European and Asian women to have high-risk N3 nodal status, meaning that cancer cells have spread to 10 or more lymph nodes in the armpit and / or nodes around the breastbone and collarbone.

De novo status

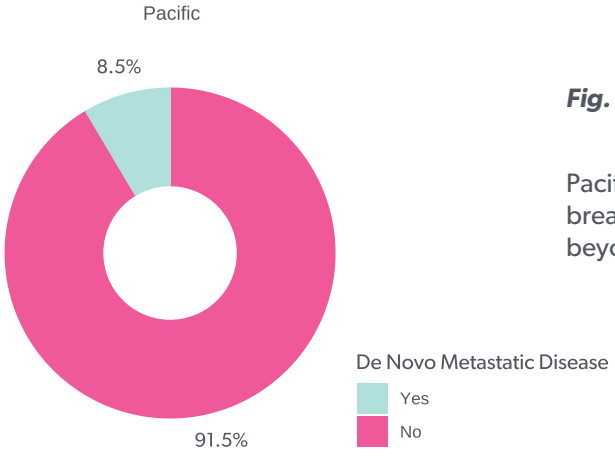


Fig. 3.2-5. De novo *metastatic disease in Pacific women.*

Pacific women had the highest rate of *de novo* metastatic breast cancer, meaning their cancer had already spread beyond the breast at diagnosis.

Tumour size

	Pacific (N = 1,595)		
Tumour Stage			
		%	Adjusted %
1	508	(31.8%)	31.8
2	609	(38.2%)	38.2
3	315	(19.7%)	18.6
4	163	(10.2%)	11.4

Table 3.2-9. *Overall stage of invasive breast tumours in Pacific women*

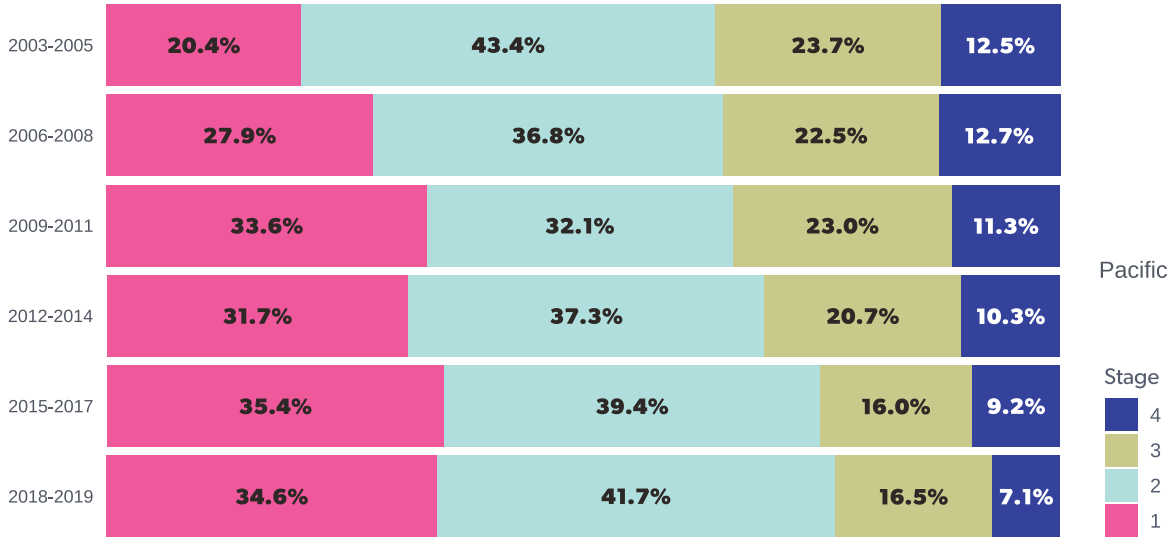


Fig. 3.2-6. *Overall stage of invasive breast tumours in Pacific women, and changes over time.*

Pacific women had the lowest proportion of stage 1 and highest proportion of stage 3 and 4 disease at breast cancer diagnosis, though the incidence of these later stage tumours has steadily decreased over time (Table 3.2-9 and Fig 3.2-6). The proportion of Pacific women with stage 1 disease slowly increased over time. (Figure 3.2-6).

3.2.4 Treatment: surgery and radiotherapy

Type of surgery

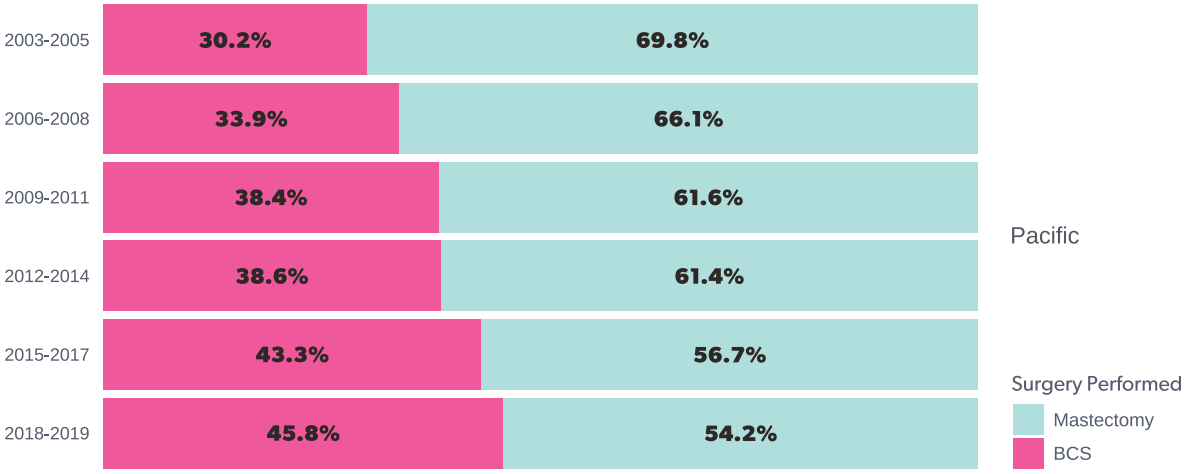


Fig. 3.2-7. *Surgery for invasive breast cancer over time, for Pacific women.*

The rate of breast-conserving surgery has steadily increased for Pacific women, from 30% in 2003-2005 to over 45% for Pacific women diagnosed in 2018-2019; this is an encouraging trend that is in line with best practice recommendations.

Reconstruction

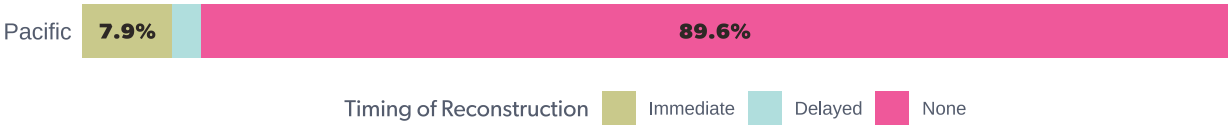


Fig. 3.2-8. *Pacific women having breast reconstruction following mastectomy.*

Pacific women had the lowest rate of reconstruction of all ethnicities, at nearly half the rate of Māori and less than half the rate of European women (see Figure 6.1-19).

Radiation therapy

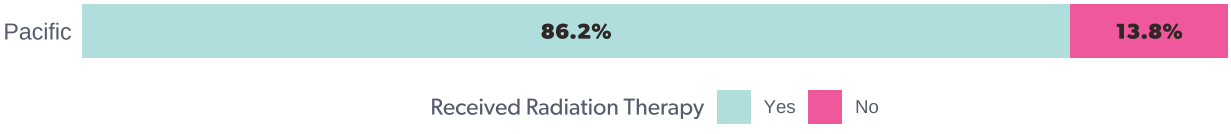


Fig. 3.2-9. *Rate of radiation therapy received by Pacific women.*

While 86.2% of Pacific women received radiation therapy (Figure 3.2-9), this was a lower proportion than other ethnicities, and more Pacific women declined this treatment (Figure 3.2-10); see Section 6.2 for comparison with other ethnicities. One reason for this may be the large proportion of Pacific women located in DHB areas without radiation therapy facilities, thus requiring daily travel to neighbouring DHBs to access treatment (e.g. from Counties Manukau DHB to Auckland DHB, or from Hutt Valley DHB to Capital and Coast DHB). While physical distances may not be large, access to transport, time off work for the patient and their support person, and parking costs can all have an impact.

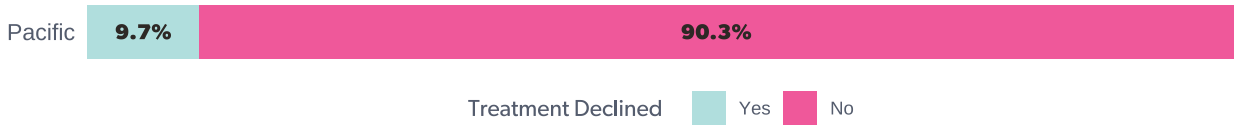


Fig. 3.2-10. Rate of radiation therapy declined among Pacific women for whom treatment was recommended.

3.2.5 Treatment: systemic therapies

Endocrine therapies

	Pacific (N = 973)		
		%	Adjusted %
Received endocrine therapy	932	(95.8%)	95.8
Referred - deemed not necessary	1	(0.1%)	0.1
Referred - treatment declined	6	(0.6%)	0.5
Not Referred	34	(3.5%)	3.5

Table 3.2-10. *Pacific women with HR+ tumours receiving endocrine therapy.*

Pacific women had a similar uptake of endocrine therapy to other ethnicities, with very few patients declining to start this treatment.

Chemotherapy

	Pacific (N = 1,432)		
		%	Adjusted %
Received chemotherapy	652	(45.5%)	37.9
Referred - deemed not necessary	71	(5%)	5.3
Referred - treatment declined	132	(9.2%)	9.3
Not Referred	577	(40.3%)	47.4

Table 3.2-11. *Pacific women having or being referred for adjuvant chemotherapy for invasive breast cancer.*

	Pacific (N = 837)		
		%	Adjusted %
Received neoadjuvant chemotherapy	78	(9.3%)	7.3
Referred - deemed not necessary	2	(0.2%)	0.3
Referred - treatment declined	0	(0%)	0
Not Referred	757	(90.4%)	92.2

Table 3.2-12. *Pacific women having or being referred for neoadjuvant chemotherapy (from 2013) for invasive breast cancer.*

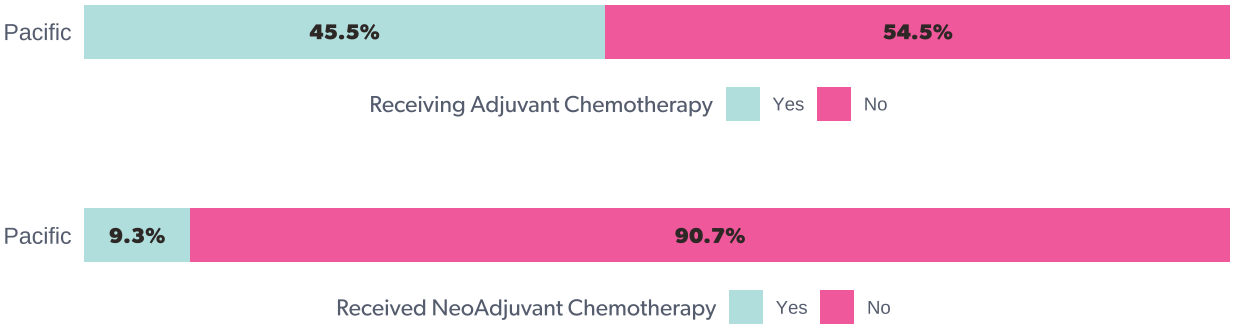


Fig. 3.2-11. *Pacific women having a) adjuvant or b) neoadjuvant (from 2013) chemotherapy for invasive breast cancer.*

Pacific women had the highest referral rate and uptake of adjuvant chemotherapy referral. This will be due to their later stage at diagnosis, larger tumours, and higher incidence of HER2+ cancers. The percentage of women declining chemotherapy (Figure 3.2-12) was slightly higher than, but similar to, European women.

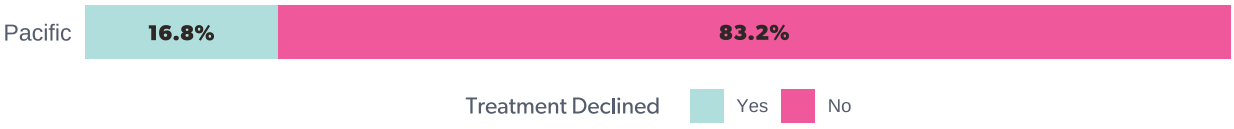


Fig. 3.2-12. *Rate of adjuvant chemotherapy declined among Pacific women for whom treatment was recommended.*

Anti-HER2 therapies

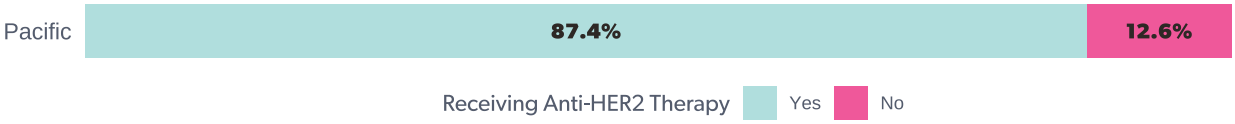


Fig. 3.2-13. *Pacific women with HER2+ breast tumours having anti-HER2 therapies, from 2009.*

	Pacific (N = 230)		
		%	Adjusted %
Received anti-HER2 therapy	201	(87.4%)	81
Referred - deemed not necessary	3	(1.3%)	2.5
Referred - treatment declined	11	(4.8%)	5
Not Referred	15	(6.5%)	9.1

Table 3.2-13. *Pacific women with HER2+ breast tumours having or being referred for anti-HER2 therapies, from 2009.*

Among women with HER2+ breast cancer, Pacific women had the highest uptake of anti-HER2 therapies (Figure 3.2-13, Table 3.2-13, Figure 7.3-1). These therapies are generally only omitted for women with very small tumours; Pacific women typically had larger tumours. There was a low rate of decline of anti-HER2+ treatment (Figure 3.2-14).

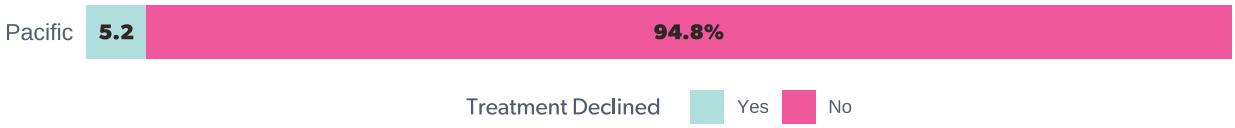


Fig. 3.2-14. *Rate of anti-HER2 therapy declined among Pacific women for whom treatment was recommended.*

3.3 Asian Women and Breast Cancer

3.3.1 Demographics

Asian women are the least reported-on ethnicity in New Zealand breast cancer studies. One study suggests a 25% lower incidence rate for Asian women than European women. However, while the rate may be low, it has increased over time and is higher than among women in Asian countries. This is believed to be attributable to increased exposure to lifestyle risk factors common in Western countries [30]. Nationally, 228 Asian women were diagnosed with breast cancer in 2017 [19].

Asian women had consistently better breast cancer survival than other ethnicities.

Region

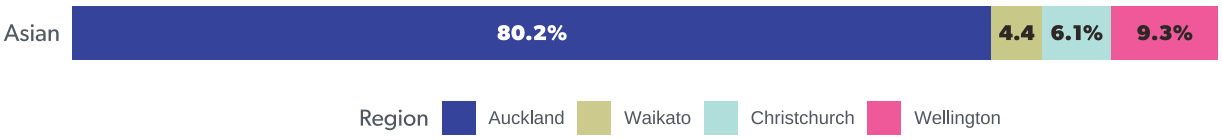


Fig. 3.3-1. *Region of diagnosis for Asian women in te Rēhita.*

Reflective of Aotearoa New Zealand's Asian population, most breast cancer diagnoses recorded in Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register were in the Auckland region, followed by Wellington (Figure 3.3-1).

Surbhi, Manawatū, diagnosed at 40:

"In my culture we don't like to speak out about our health problems, we're usually very shy. I hope that by sharing my story, it will help other Indian women have the confidence to check their breasts and to see a doctor if they notice any changes. If I didn't see my doctor when I did, then I don't know if my cancer could have been treated successfully."

Age

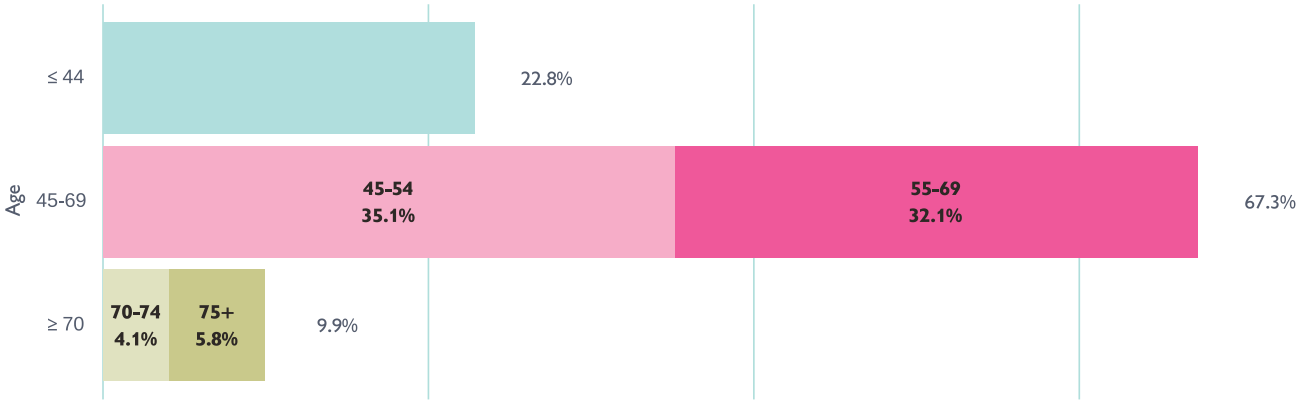


Fig. 3.3-2. *Proportion of Asian women diagnosed with invasive breast cancer by age group by ethnicity.*

The median age of diagnosis of invasive breast cancer was lowest for Asian women, at 52 years of age. Over one-fifth of Asian women were diagnosed before age 45 (22.8%), and they were the only group with the largest proportion of breast cancers being diagnosed between 45-54 years of age (35%), in the screening age subgroup considered premenopausal. Despite Asian women having New Zealand's longest life expectancy (87.9 years) [33], only 10% of Asian breast cancer diagnoses were in women age 70 and older (Figure 3.3-2).

ETHNICITY & AGE AT DIAGNOSIS		5-YEAR SURVIVAL	10-YEAR SURVIVAL
Asian	⩽ 44	94% (92-96)	90% (86-93)
	45-69	95% (94-96)	92% (90-94)
	⩾ 70	92% (88-96)	90% (85-95)

Table 3.3-1. *Breast cancer-specific survival for Asian women by age.*

Breast cancer-specific survival over time

ETHNICITY	5-YEAR SURVIVAL	10-YEAR SURVIVAL
Asian		
2003-2005	87% (82-92)	83% (78-89)
2009-2011	94% (91-97)	92% (89-95)
2015-2017	97% (95-98)	

Table 3.3-2. *Five- and 10-year BCSS (95% CI) for Asian women by time cohort.*

Raw data in the Register showed significantly higher five-year survival of Asian women diagnosed in 2015-2017 compared to those diagnosed in 2003-2005. Their 10-year survival also appears to be improving (Table 3.3-2).

	5-year survival			10-year survival		
	HR	95% CI	p-value	HR	95% CI	p-value
Asian			0.014			0.01
2003-2005	1.0					
2009-2011	0.46	(0.25-0.87)		0.46	(0.26-0.80)	
2015-2017	0.24	(0.13-0.46)				

Table 3.3-3. *Age-adjusted five- and 10-year BCSS (95% CI) for Asian women by time cohort.*

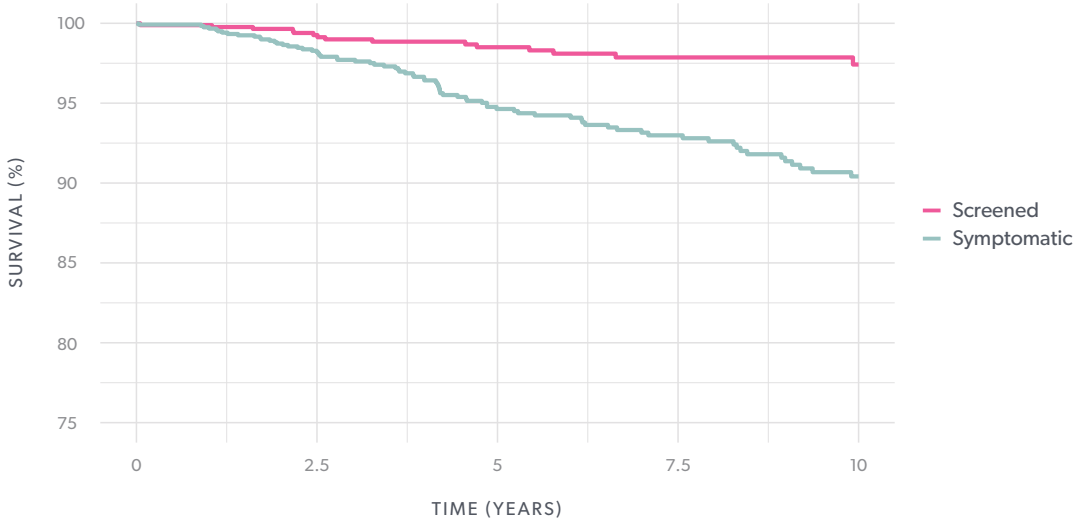
In the age-adjusted analysis, women diagnosed in 2015-2017 were 76% less likely to have died of their breast cancer within five years of diagnosis than the earliest cohort, and women diagnosed in 2009-2011 were less than half as likely to die before 10 years than those diagnosed in 2003-2005 (Table 3.3-3).

3.3.2 Detection and diagnosis

	Asian (N = 2,056)		
Method of Detection			
		%	Adjusted %
Screened	855	(41.6%)	42.1
Symptomatic	1,201	(58.4%)	57.9

Table 3.3-4. *Proportion of Asian women with screen-detected vs symptomatic invasive breast cancer.*

Well below half of Asian women had a screened diagnosis of breast cancer (Table 3.3-4). Asian women have consistently had the lowest participation in the BreastScreen Aotearoa screening programme with just over 60% of women participating pre-Covid-19 pandemic [34]. The reason for this is unclear; with the incidence rate among Asian women rising, it will be important to increase the level of screening participation.



DETECTION METHOD	5-YEAR SURVIVAL	10-YEAR SURVIVAL
Screened Asian	99% (98-99)	97% (96-99)
Symptomatic Asian	95% (93-96)	90% (88-93)

Fig. 3.3-3. *Five- and 10-year BCSS (95% CI) for Asian women, by detection method.*

Similar to other ethnicities, Asian women with screened diagnoses had significantly better survival than symptomatic diagnoses. However, Asian women with symptomatic diagnoses also had excellent five- and 10-year survival (Figure 3.3-3).

3.3.3 Tumour pathology

Tumour size

	Asian (N = 2,096)		
Tumour size (mm)			
		%	Adjusted %
⩽ 20	1,256	(59.9%)	60.8
21 - 50	728	(34.7%)	34.2
⩾ 50	112	(5.3%)	5

Table 3.3-5. *Size of invasive breast tumours in Asian women.*

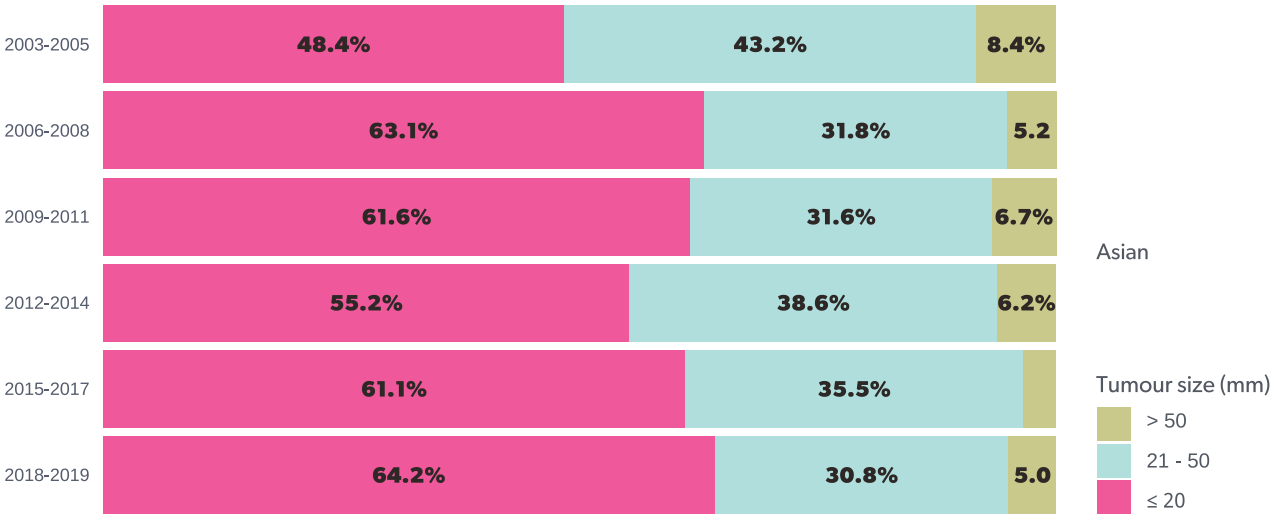


Fig. 3.3-4. *Size of invasive breast tumours in Asian women in total, and changes over time.*

A trend toward diagnosis of smaller-size tumours is less clear in the Asian population; however, the proportion of large tumours has decreased over time (Figure 3.3-4).

Tumour grade, receptor and lymph node status

Asian (N = 1,988)			
Tumour Grade			
		%	Adjusted %
1	458	(23%)	24.5
2	879	(44.2%)	44.6
3	651	(32.7%)	30.9

Table 3.3-6. *Tumour grade in Asian women diagnosed with invasive breast cancer.*

Asian (N = 1,952)			
Receptor Status			
		%	Adjusted %
ER+/HER2-	1,411	(72.3%)	74.1
ER+/HER2+	226	(11.6%)	10.1
ER-/HER2+	120	(6.1%)	5.8
Triple Negative	195	(10%)	10

Table 3.3-7. *Receptor status in Asian women diagnosed with invasive breast cancer.*

Asian (N = 2,010)			
Nodal Status			
		%	Adjusted %
N0	1,347	(67%)	67.8
N1	459	(22.8%)	22.6
N2	136	(6.8%)	6.5
N3	68	(3.4%)	3.2

Table 3.3-8. *Lymph node status of Asian women diagnosed with invasive breast cancer.*

Asian women have a higher rate of grade 3 tumours (Table 3.3-6) than Māori and European women. The incidence of the aggressive triple negative breast cancer subtype (10%) is higher than in Māori and Pacific women, but is similar to European women (Table 3.3-7). Asian women were diagnosed with N0 or N1 lymph node status in 89.8% of cases, the same as European women (Table 3.3-8; see Section 5.2 for comparisons with other ethnicities).

De novo status

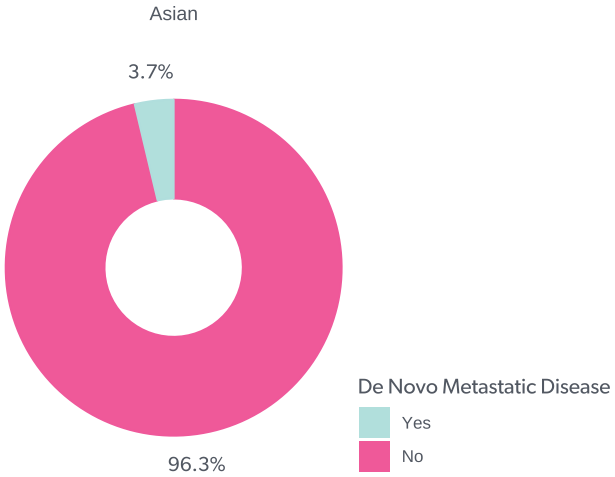


Fig. 3.3-5. De novo *metastatic disease in Asian women.*

Tumour stage

Tumour Stage	Asian (N = 2,047)		
		%	Adjusted %
1	940	(45.9%)	47
2	767	(37.5%)	36.7
3	261	(12.8%)	12.2
4	79	(3.9%)	4.1

Table 3.3-9. *Overall stage of invasive breast tumours in Asian women.*

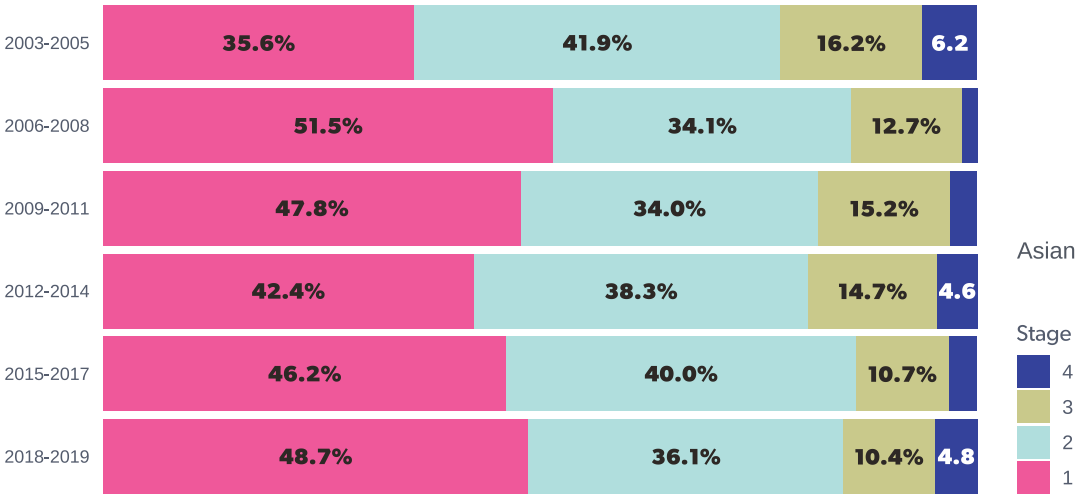


Fig. 3.3-6. *Overall stage of invasive breast tumours in Asian women, and changes over time.*

Asian women had a low rate of *de novo* metastatic disease (Figure 3.3-5).

Stage 1 or stage 2 disease was diagnosed in 83.4% of Asian cases (Table 3.3-9), very similar to European women.

The Asian tumour stage profile is very similar to European women. As with tumour size, the trend over time to smaller tumours is unclear (Figure 3.3-6).

3.3.4 Treatment: surgery and radiotherapy

Type of surgery

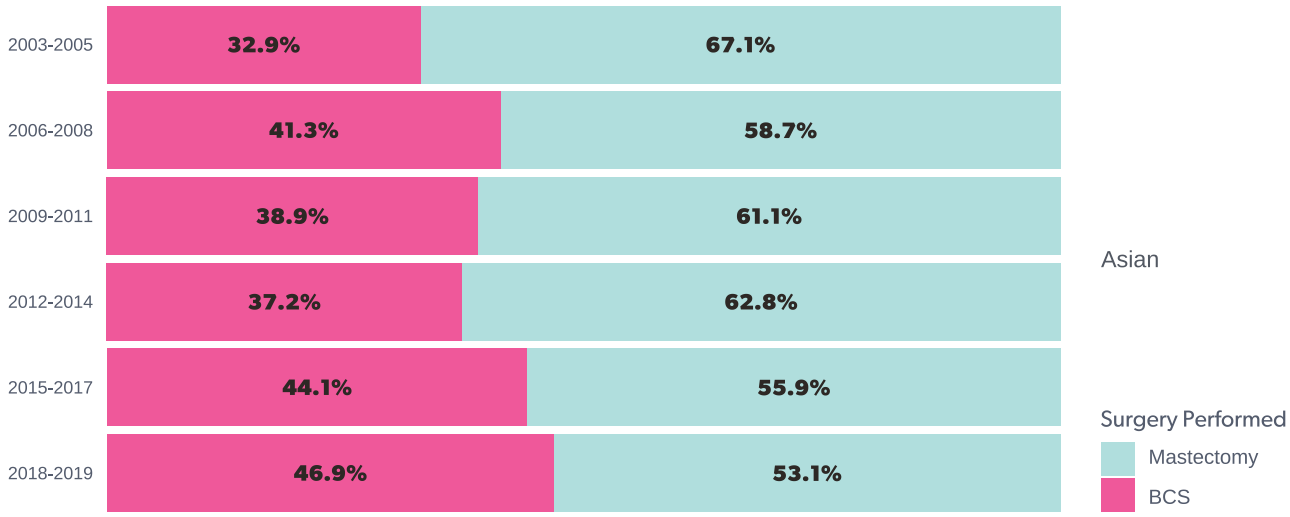


Fig. 3.3-7. *Surgery for invasive breast cancer over time, for Asian women.*

Over time, the proportion of Asian women receiving breast conserving surgery has increased, but this has been significantly lower than for European women (Fig 3.3-7). This may be due to Asian women having a smaller breast size, making it harder to achieve an acceptable cosmetic outcome with BCS, though new oncoplastic techniques can mitigate this.

Reconstruction

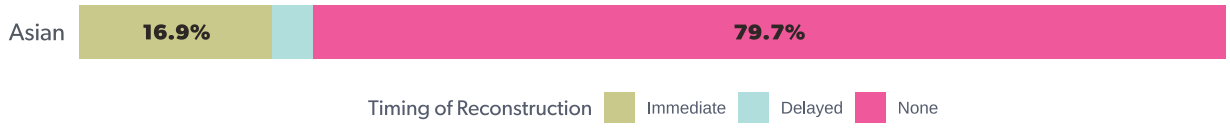


Fig. 3.3-8. *Asian women having breast reconstruction following mastectomy.*

Asian women had the second highest rate of breast reconstruction, after European women.

Radiation therapy

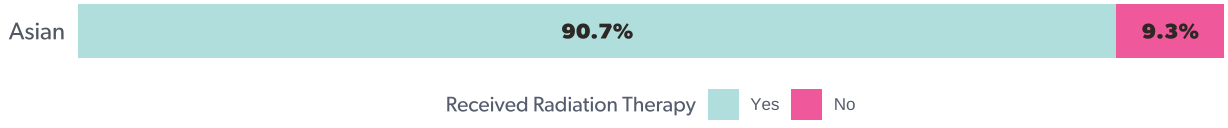


Fig. 3.3-9. *Rate of radiation therapy received by Asian women.*

Radiation therapy uptake is high (Figure 3.3-9) and consistent with other ethnicities. Only 3.5% of Asian women declined recommended therapy.

3.3.5 Treatment: systemic therapies

Endocrine therapy

	Asian (N = 1,291)		
		%	Adjusted %
Received endocrine therapy	1,255	(97.2%)	97.3
Referred - deemed not necessary	4	(0.3%)	0.3
Referred - treatment declined	11	(0.9%)	0.8
Not Referred	21	(1.6%)	1.7

Table 3.3-10. *Asian women with HR+ tumours receiving endocrine therapy.*

Nearly all Asian women with hormone receptor-positive breast cancer commenced endocrine therapy (Table 3.3-10).

Chemotherapy

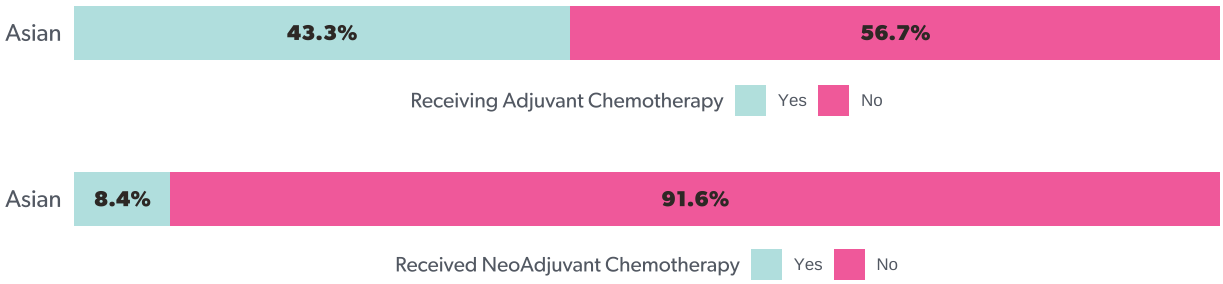


Fig. 3.3-10. *Asian women having a) adjuvant or b) neoadjuvant chemotherapy (from 2013) for invasive breast cancer.*

	Asian (N = 1,985)		
		%	Adjusted %
Received chemotherapy	860	(43.3%)	35.2
Referred - deemed not necessary	120	(6%)	6.7
Referred - treatment declined	103	(5.2%)	5.4
Not Referred	902	(45.4%)	52.7

Table 3.3-11. *Asian women having or being referred for adjuvant chemotherapy (from 2013) for invasive breast cancer.*

	Asian (N = 1,196)		
		%	Adjusted %
Received neoadjuvant chemotherapy	101	(8.4%)	6.1
Referred - deemed not necessary	2	(0.2%)	0.1
Referred - treatment declined	0	(0%)	0
Not Referred	1,093	(91.4%)	93.8

Table 3.3-12. *Asian women having or being referred for neoadjuvant chemotherapy (from 2013) for invasive breast cancer.*

Asian women had the second highest rate of adjuvant chemotherapy, after Pacific women (Table 3.3-12), and were least likely to decline treatment (Figure 3.3-11). See Section 7.2 for ethnicity comparisons.

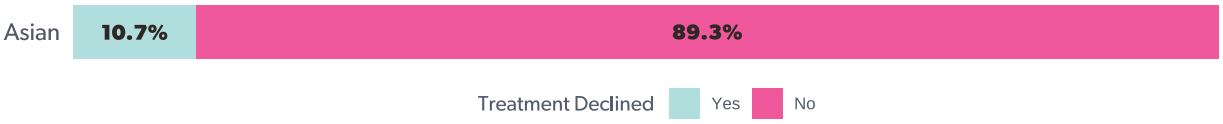


Fig. 3.3-11. *Rate of adjuvant chemotherapy declined among Asian women for whom treatment was recommended.*

Anti-HER2 therapies

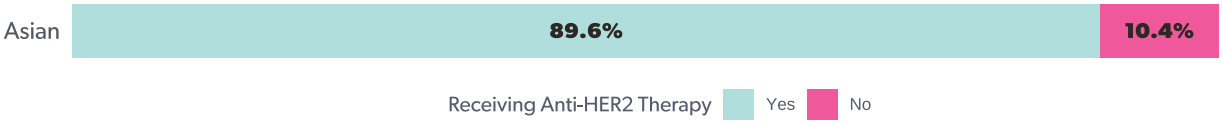


Fig. 3.3-12. *Asian women with HER2+ breast tumours having anti-HER2 therapies, from 2009.*

	Asian (N = 251)		
		%	Adjusted %
Received anti-HER2 therapy	225	(89.6%)	85.6
Referred - deemed not necessary	4	(1.6%)	1.5
Referred - treatment declined	7	(2.8%)	2.9
Not Referred	15	(6%)	7.6

Table 3.3-13. Asian women with HER2+ breast tumours having or being referred for anti-HER2 therapies, from 2009.

Asian women with HER2+ breast tumours had a very high uptake of anti-HER2 therapies (Table 3.3-13), with only 3% declining treatment.

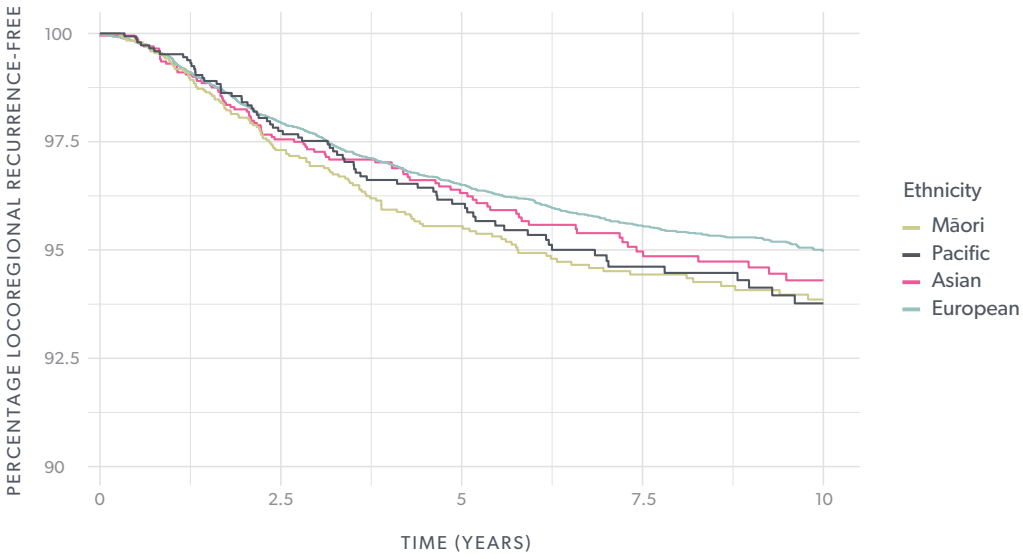
3.4. Breast Cancer Recurrence and Survival by Ethnicity

In this section, we report on breast cancer recurrence rates by ethnicity, as measured by locoregional recurrence, and disease-free survival.

3.4.1 Locoregional recurrence

Local or regional (locoregional) recurrence of breast cancer means a recurrence in or near the same place in the breast (local), or in nearby lymph nodes (regional). The rate of locoregional recurrence (LRR) is a measure of the effectiveness of surgery and radiation therapy.

Locoregional recurrences are usually treated with intent to cure; treatments for locoregional recurrence may include surgery, radiation and / or drug treatments.



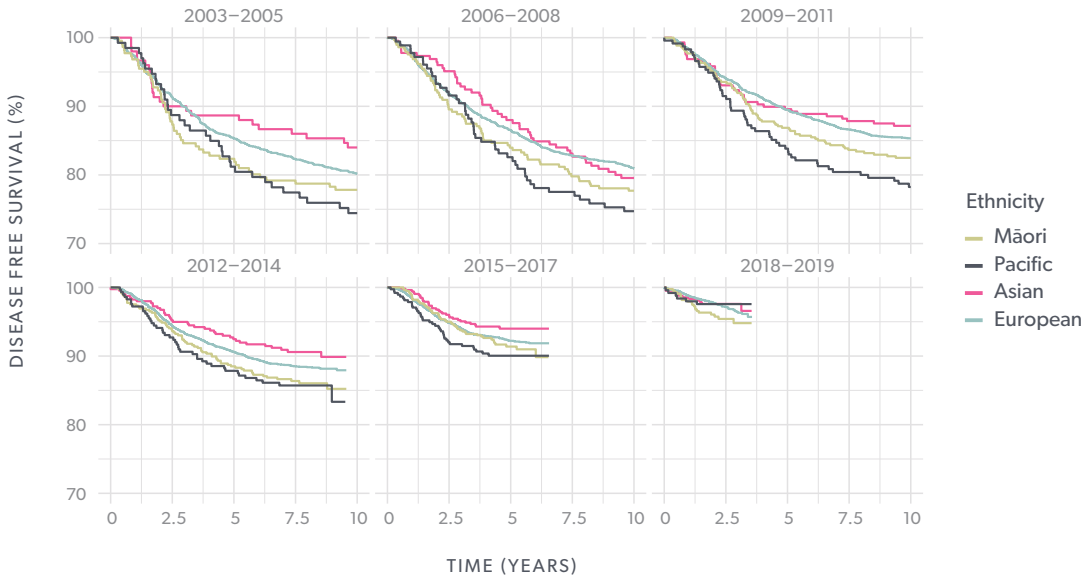
ETHNICITY	5-YEAR LRR-FREE	10-YEAR LRR-FREE
Māori	96% (95-96)	94% (93-95)
Pacific	96% (95-97)	94% (92-95)
Asian	96% 95-97)	94% (93-96)
European	97% (96-97)	95% (95-95)

Fig. 3.4-1. *Locoregional recurrence-free survival by ethnicity. Proportion of women LRR-free up to 10 years after being diagnosed with invasive breast cancer, shown by ethnicity.*

Rates of locoregional recurrence-free survival were almost identical across ethnicities at both five and 10 years (Figure 3.4-1).

3.4.2 Disease-free survival over time

Disease-free survival (DFS) measures the length of time after a breast cancer diagnosis without a cancer recurrence or death. This includes both locoregional recurrence and distant recurrence (when cancer spreads beyond the breast and lymph node area).



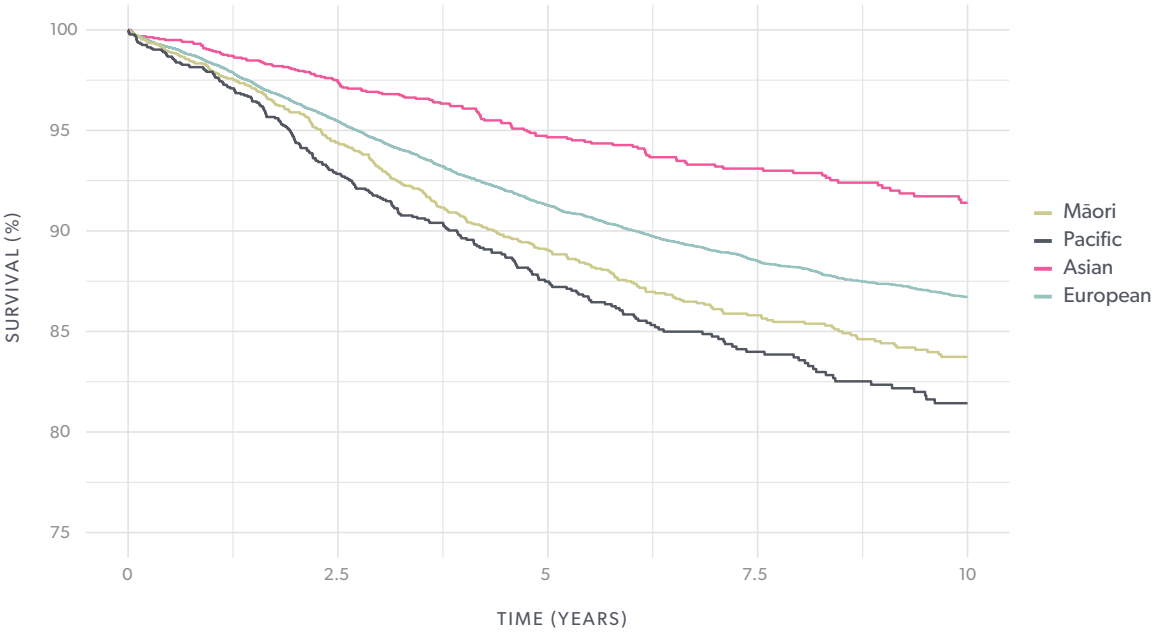
ETHNICITY	5-YEAR DFS	10-YEAR DFS
Māori		
2003-2005	82% (77-88)	78% (73-84)
2009-2011	87% (84-90)	82% (79-86)
2015-2017	91% (89-94)	
Pacific		
2003-2005	81% (75-88)	74% (67-82)
2009-2011	84% (79-89)	78% (73-84)
2015-2017	90% (87-93)	
Asian		
2003-2005	89% (84-94)	84% (78-90)
2009-2011	87% (83-91)	87% (83-91)
2015-2017	94% (92-96)	
European		
2003-2005	85% (84-87)	80% (78-82)
2009-2011	89% (88-91)	85% (84-87)
2015-2017	92% (91-93)	

Fig. 3.4-2. *Disease-free survival by ethnicity by year of diagnosis. Proportion of women disease-free by their year of diagnosis by ethnicity.*

In 2003-2005, five-year DFS differed by eight percentage points from those women that had the best outcomes (Asian women) to those that had the worst (Pacific women), but by 2015-2017 this difference was halved (Figure 3.4-2). The differences between ethnicities were greater at 10 years, with Pacific women having a 22% chance of recurrence or death, compared with Māori (18%) and European (15%) women. Asian women had a 13% chance of recurrence or death by 10 years.

3.4.3 Breast cancer-specific survival

Breast cancer-specific-survival excludes people who died of other causes, and only includes those who died of breast cancer.



ETHNICITY	5-YEAR SURVIVAL	10-YEAR SURVIVAL
Māori	89% (88-90)	84% (82-85)
Pacific	87% (86-89)	81% (79-84)
Asian	95% (94-96)	91% (90-93)
European	91% (91-92)	87% (86-87)

Fig. 3.4-3. *Breast cancer-specific survival by ethnicity. Proportion of women surviving out to 10 years after being diagnosed with invasive breast cancer, shown by ethnicity (unadjusted).*

The survival percentages in Figure 3.4-3 are higher than reported in some other New Zealand studies.

There are several possible reasons for this. First, we report outcomes for women diagnosed up to the end of 2017, making the dataset more recent than some others. Because data collection in Christchurch and Wellington began in 2009 and 2010 respectively, a larger proportion of all records in the Register date from a more modern era, when anti-HER2 therapies and taxane chemotherapy had begun to have a positive impact on survival. Second, as noted in the Introduction, the four original regions described in this report, while comprising 63% of national diagnoses, represent a predominantly urban population. While studies have shown that breast cancer outcomes in Aotearoa New Zealand are similar overall for rural and urban women, rural Māori women are a third more likely to die of breast cancer than urban Māori women. [35]

When data from other regions matures in the Register, there will be a higher percentage of rural women than currently.

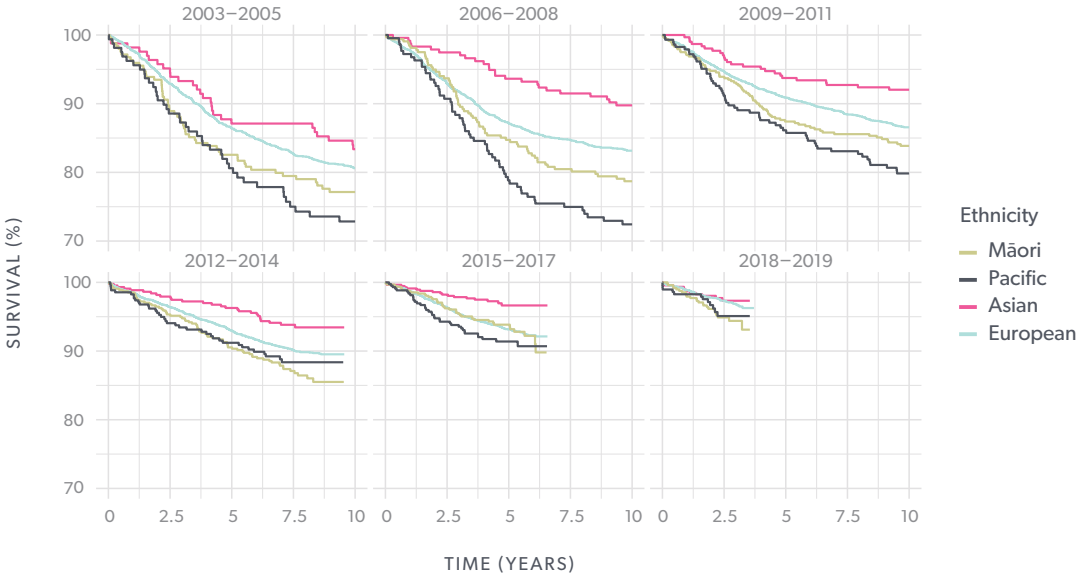
These factors notwithstanding, when analysed over the entire study period, the crude data shows that the proportion of women surviving with breast cancer to five- and 10-years after diagnosis was lower for Māori and Pacific women, and higher for Asian women, compared to women of European ethnicity (Figure 3.4-3). After adjusting for age (Table 3.4-1), wāhine Māori were 33%% more likely to die of breast cancer than European women, and Pacific women 52% more likely to die.

Characteristic	HR	95% CI	p-value
Ethnicity			
European	1.0		
Asian	0.62	0.51 (0.74)	<0.001
Māori	1.33	1.17 (1.50)	<0.001
Pacific	1.52	1.32 (1.75)	<0.001

Table 3.4-1 *Age-adjusted risk of mortality at 10 years after diagnosis by ethnicity.*

However, that gap has narrowed over time, with five- and 10-year survival improving for all ethnicities (Fig. 3.4-4). Observed five-year survival for Māori and European women in the 2015-2017 cohort was similar at 94% and 93%, closely followed by Pacific women at 91%, and overlapping confidence intervals suggest the difference is not statistically significant. Asian women had a clear 10-year survival advantage for the cohort diagnosed 2009-11. Although confidence intervals for the other ethnicities overlap, it appears there is a trend for Pacific women to fare worse at the 10-year mark.

3.4.4 Survival by ethnicity by year of diagnosis



ETHNICITY	5-YEAR SURVIVAL	10-YEAR SURVIVAL
Māori		
2003-2005	83% (78-88)	77% (72-83)
2009-2011	87% (84-90)	84% (81-87)
2015-2017	94% (92-96)	
Pacific		
2003-2005	81% (75-87)	73% (66-80)
2009-2011	86% (82-90)	80% (75-85)
2015-2017	91% (89-94)	
Asian		
2003-2005	87% (82-92)	83% (78-89)
2009-2011	94% (91-97)	92% (89-95)
2015-2017	97% (95-98)	
European		
2003-2005	86% (85-88)	81% (79-82)
2009-2011	91% (90-92)	87 (85-88)
2015-2017	93% (92-94)	

Fig. 3.4-4. *Breast cancer-specific survival by ethnicity by year of diagnosis. Proportion of women surviving invasive breast cancer to 10 years by year of diagnosis, shown by their ethnicity (unadjusted).*

Separate Cox Proportional Hazard survival models were generated using data for each ethnicity to examine time-cohort effects on both five-year and 10-year breast cancer-specific survival – to understand, for example, the difference in survival for a Māori woman diagnosed in 2015-17 compared to a Māori woman diagnosed in 2003-05. Hazard Ratios were generated relative to the earliest time cohort (2003-2005). After adjusting for age, women of all ethnicities diagnosed in the later time cohorts had significantly decreased risk of breast cancer mortality compared to those women diagnosed in 2003-2005 (Table 3.4-2). This table does not compare survival between ethnicities.

	5-year survival			10-year survival		
	HR	95% CI	p-value	HR	95% CI	p-value
Māori			<0.001			0.004
2003-2005	1.0			1.0		
2009-2011	0.7	(0.47-1.03)		0.68	(0.48-0.96)	
2015-2017	0.34	(0.22-0.53)				
Pacific						
2003-2005	1.0			1.0		
2009-2011	0.71	(0.44-1.15)		0.72	(0.48-1.09)	
2015-2017	0.46	(0.28-0.74)				
Asian						
2003-2005	1.00			1.0		
2009-2011	0.46	(0.25-0.87)		0.46	(0.26-0.80)	
2015-2017	0.24	(0.13-0.46)				
European						
2003-2005	1.0			1.0		
2009-2011	0.66	(0.56-0.78)		0.67	(0.58-0.78)	
2015-2017	0.48	(0.40-0.57)				

Table 3.4-2. *Age-adjusted risk of breast cancer mortality over time, within each ethnicity, at five and 10 years after diagnosis, with 95% confidence intervals. This table does not compare survival between ethnicities.*

The data in Table 3.4-2 was also discussed / described in the individual ethnicity sections. The biggest improvements in outcomes were in five-year survival; 10-year survival also showed improvements within each ethnicity, though in smaller increments. Compared to Māori women diagnosed in 2003-05, Māori women diagnosed in 2009-11 were 32% less likely to die of breast cancer within ten years. Pacific women had by far the smallest improvement: those diagnosed in 2009-11 were 28% less likely to die than Pacific women diagnosed in 2003-05 (note that the confidence interval overlaps with 1.00). Asian women were 54% less likely to die than their 2003-05 counterparts, and European women 33% less likely.

4. Invasive Breast Cancer Overview and Demographics

In brief

- Younger women (<45 years) represent 13.3% of invasive diagnoses and have much lower 10-year survival: 82% compared to 89% in the 45-69 year age group.
- Māori, Pacific and Asian women were more likely to be diagnosed before age 45 than European women. This may reflect the age distribution of these populations and / or higher incidence rate <45.
- Older women (aged 70+) accounted for 20% of all invasive tumour diagnoses and had 80% 10-year survival.
- Breast cancer survival across the study population was significantly higher in the 45-69 age group. Māori and European women had the greatest survival advantage in the 45-69 age group compared with other ages within each ethnicity.
- The 45-69 age group has experienced the biggest gain in survival. This may relate in part to increased participation in breast screening over time.
- Auckland reported significantly higher five-year breast cancer-specific survival (unadjusted) than other regions. However, differences in 10-year survival were not meaningful, due to overlapping confidence intervals.

This section reports on diagnoses of invasive breast cancer for all patients, providing breakdowns by ethnicity, region and age for data in Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register.

4.1 Breast Cancer Diagnoses

In recent years, approximately 3,500 women a year have been diagnosed with breast cancer in Aotearoa New Zealand; this number has steadily increased over time in line with our growing and aging population. The actual rate of diagnoses (per 100,000 women) has increased slightly over the past 20 years for both wāhine Māori and non-Māori women [36]. In 2018, the incidence of breast cancer per 100,000 women was 124.9 for Māori and 97.4 for non-Māori [20].

The Register has 30,367 cases of breast cancer recorded in 29,580 unique patients, with 85.4% (N=25,921) cases being invasive breast cancer and 14.6% (N=4,446) DCIS (Figure 4.1-1a). See Section 9 for a discussion of DCIS.

Over 99% of those diagnosed with invasive breast cancer are women (Figure 4.1-1b), with the median age of diagnosis being 58 years. See Section 10 for a discussion of male breast cancer.

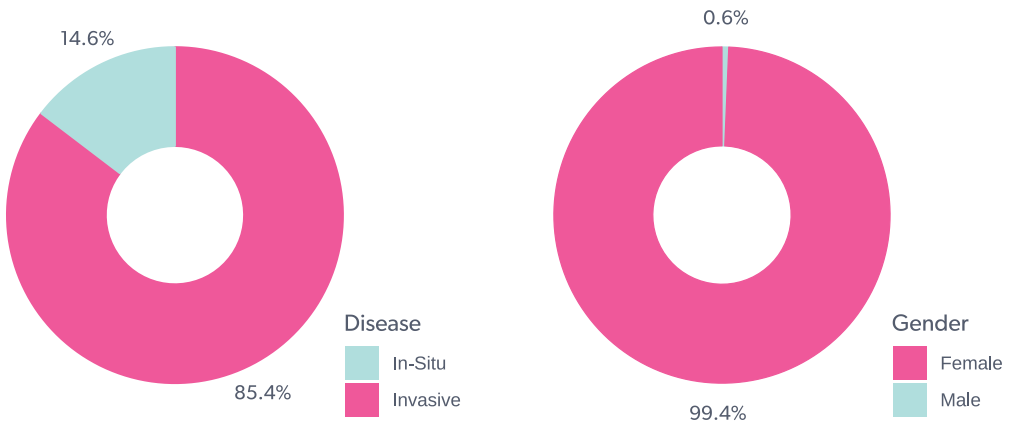
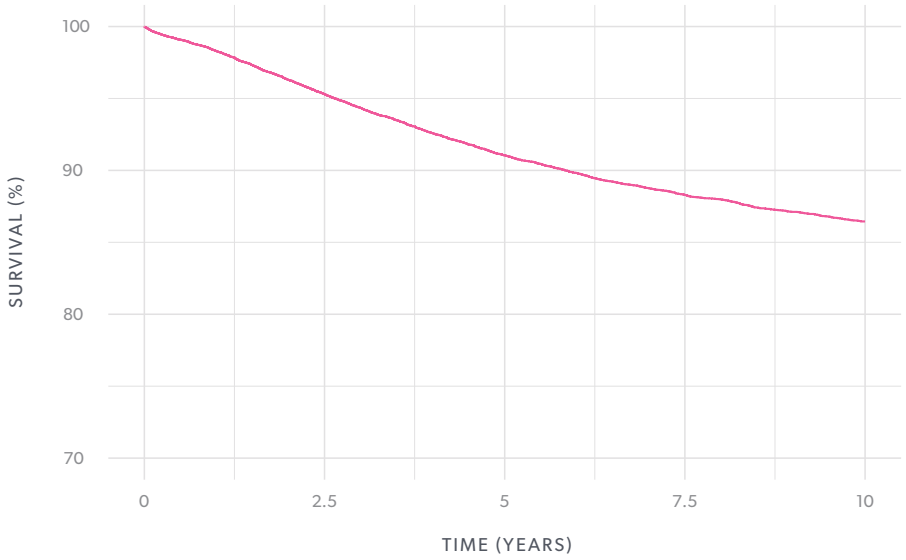


Fig. 4.1-1. *Overall breakdown of people diagnosed with breast cancer in the Register by disease type and gender. Proportion a) with DCIS or invasive disease, or b) by gender.*

4.2 Breast Cancer-Specific Survival

Breast cancer-specific survival (BCSS) is a measure that includes only deaths from breast cancer. Patients who die from other causes are not included in BCSS statistics.

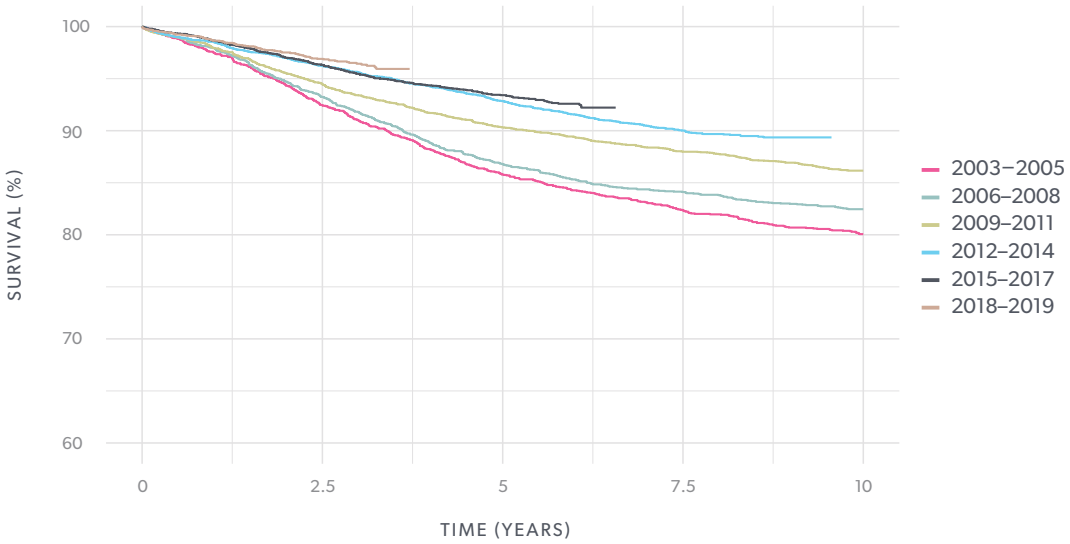
Breast cancer-specific survival



5-YEAR SURVIVAL	10-YEAR SURVIVAL
91% (91-91)	86% (86-87)

Fig. 4.2-1. *Breast cancer-specific survival to 10 years after diagnosis. Table: Proportion of women surviving to five and 10 years after diagnosis (95% CI).*

The Register shows that 91% of all women diagnosed with invasive breast cancer survived to five years and 86% to 10 years (Figure 4.2-1).



YEAR OF DIAGNOSIS	5-YEAR SURVIVAL	10-YEAR SURVIVAL
2003-2005	86% (84-87)	80% (78-82)
2006-2008	87% (86-88)	82% (81-84)
2009-2011	90% (89-91)	86% (85-87)
2012-2014	93% (92-94)	
2015-2017	93% (93-94)	

Fig. 4.2-2. *Breast cancer-specific survival by year of diagnosis. Proportion of women surviving invasive breast cancer to 10 years by year of diagnosis. Table: Proportion of women surviving to five and 10 years after diagnosis (95% CI).*

Survival curves for successive 3-year patient cohorts showed steady improvement over time (Figure 4.2-2). For those women diagnosed with invasive breast cancer in 2003-2005, 86% survived to five years. Since then, breast cancer survival rates have improved steadily so that for women diagnosed in 2015-2017, 93% survived to five years. Similarly, 10-year survival rates have improved over time, from 80% for women diagnosed with invasive breast cancer in 2003-2005, to 86% for women diagnosed in 2009-2011.

Indeed, it appears that five-year breast cancer survival was better in Aotearoa New Zealand than in Australia [38] (contrary to findings of other studies) and markedly better than in England [37] (Table 4.2-1).

Country	**Period**	**5 year**	**10-year**	**Survival**	**Notes**
NZ	2009-2011	90.0%	86.0%	BCSS	Crude data
	2012-2014	93.0%		BCSS	Crude data
	2015-2017	93.0%		BCSS	Crude data
England	2010-2011	86.6%			Age-standardised
	2013-2017	85.0%	75.0%	Net survival	Age-standardised
Australia	2013-2017	91.5%		Relative	Crude data
Australia	2011-2015		85%	Relative	Crude data

Table 4.2-1. *Five and 10-year survival for New Zealand, England and Australia.*

While the measures reported in the different countries vary, BCSS and relative survival are both calculations of net survival that exclude death from other causes, and tend to produce very similar results, as can be seen in the full Australian report cited.

A plausible explanation for superior five-year survival in Aotearoa New Zealand (or at least in this report), could be our excellent screening rate, which is higher than both Australia and England (see Section 5.1.1). Treatment for early breast cancer is very similar across all three countries (the issues of fewer approvals of and slower access to new drugs in New Zealand relate mostly to metastatic breast cancer and have less impact on five-year survival). As noted earlier, this report does not present national data, but rather represents a predominantly urban population. While studies have shown that breast cancer outcomes in Aotearoa New Zealand are similar overall for rural and urban women, the population bias in the Register may affect the comparison with Australian and English data.

Survival was similar across the regions, though Auckland showed significantly better five-year survival in the latest cohort (see Figure 13.2-2). For most regions, there was no significant difference in 10-year survival.

4.3 Ethnicity

Characteristics of breast cancer in individual ethnicities are described separately in Section 3. This section reports on the overall ethnic composition of register data and regional ethnicity profiles.

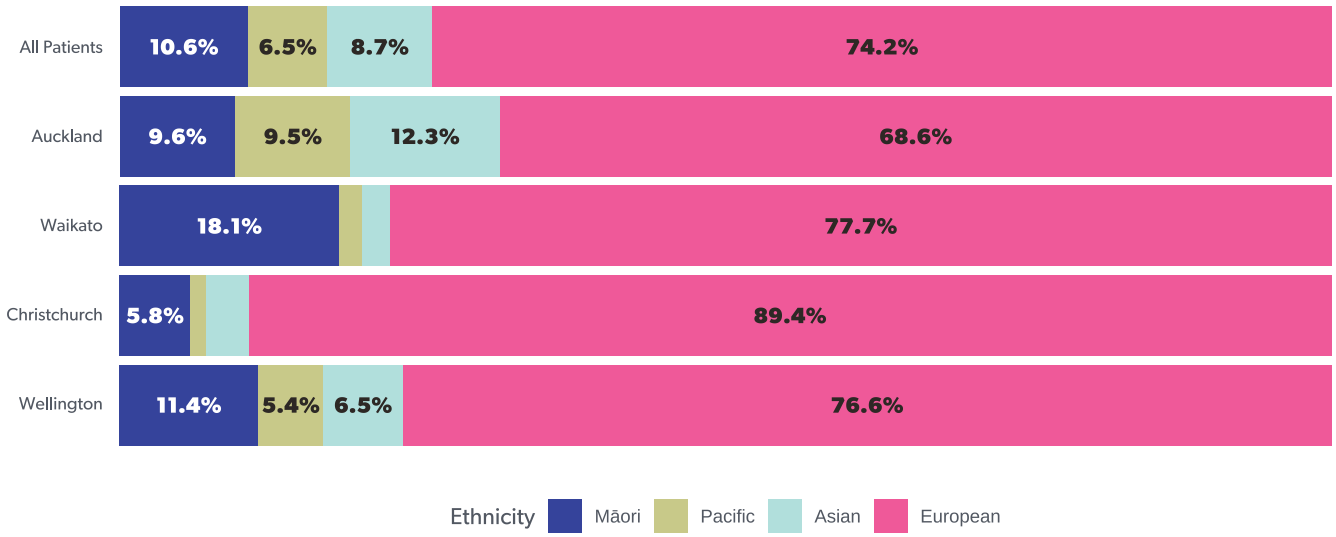


Fig. 4.3-1. *Overall breakdown ethnicity in the Register. a) Overall invasive breast cancer diagnoses by ethnicity. b) Diagnoses by ethnicity for each of the four regions.*

Women diagnosed with invasive breast cancer were predominantly European (74.2%) with 10.6%, 6.5% and 8.7% Māori, Asian and Pacific respectively (Figure 4.3-1). However, these figures vary by region, with wāhine Māori making up 18.1% of Waikato diagnoses and 11.4% in Wellington. Asian and Pacific women comprise a larger proportion of diagnoses in Auckland than elsewhere. In Christchurch, European women were by far the dominant ethnicity (89.4% of diagnoses).

4.4 Age at Diagnosis

In the Register, the median age of diagnosis of invasive breast cancer in Aotearoa New Zealand was 58. This varied by ethnicity, being 52 years for Asian women, 54 for wāhine Māori and Pacific women, and 60 for European women.

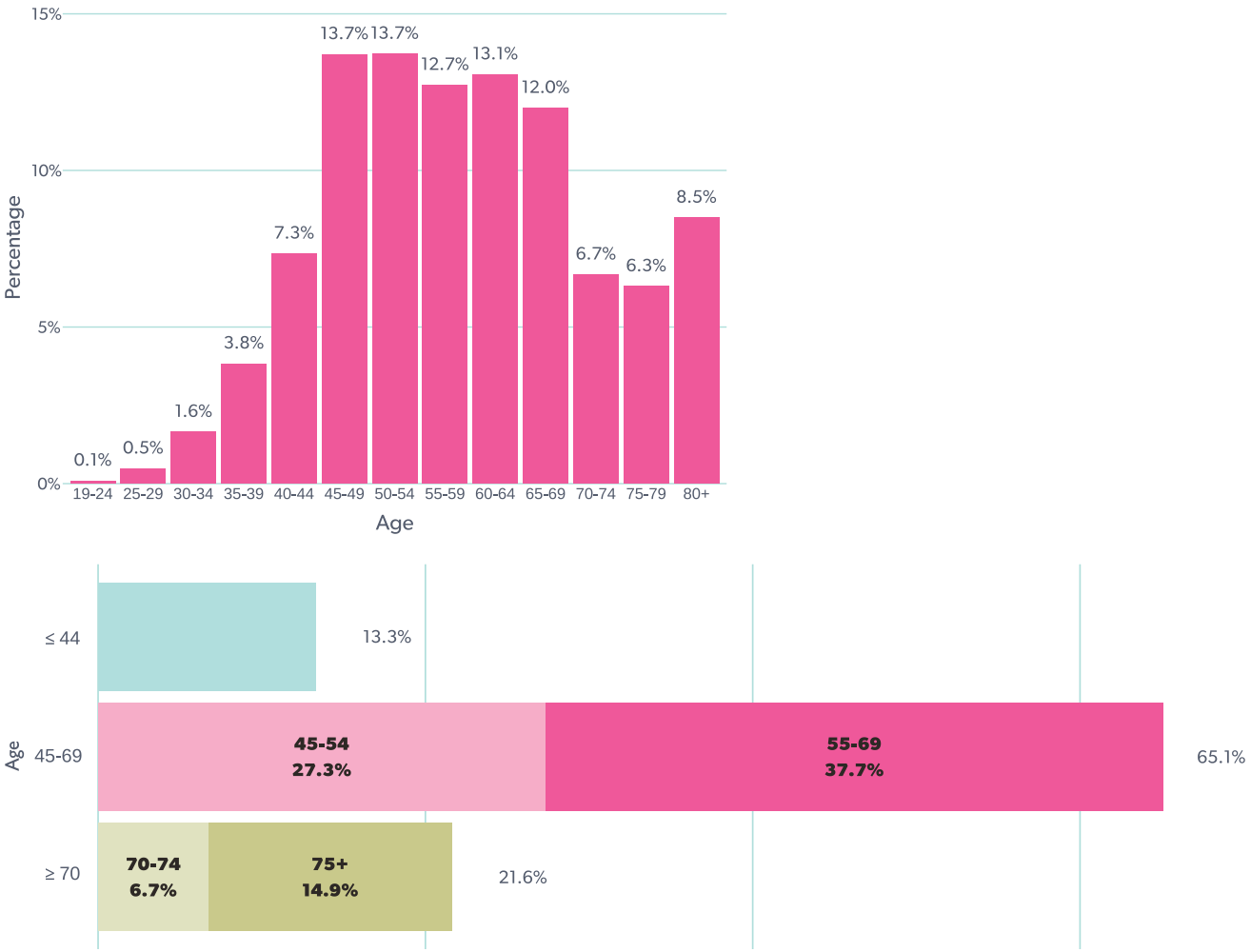


Fig. 4.4-1. *Age of diagnosis of women with invasive breast cancer. a) Percentage of women diagnosed with breast cancer by five-year age bands. b) Percentage of women diagnosed with breast cancer by age categories 18-44 years, 45-69 years, 70 years and over, with women over 44 years of age further subdivided into smaller categories.*

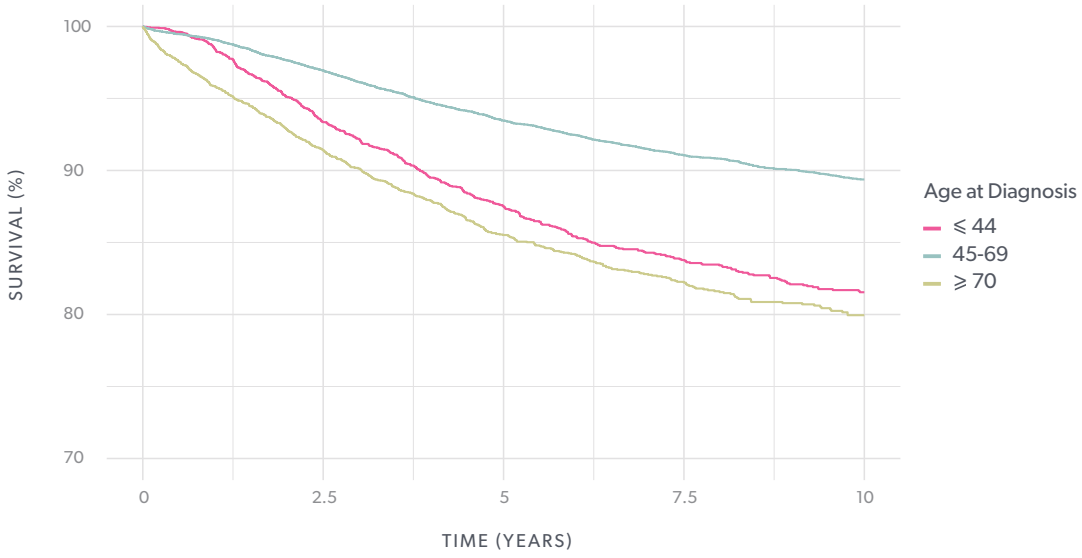
While older age is the highest contributing factor to breast cancer risk for women [39, 40], 13.3% of diagnoses of invasive breast cancer were in women under 45 years (Figure 4.4-1b).

The surge in diagnoses recorded in the 45-49 age group in part reflects prevalent (existing) cancers diagnosed when women commence free mammogram screening with BreastScreen Aotearoa from age 45 (Figure 4.4-1a). Nearly two thirds (65.1%) of women were diagnosed with their invasive breast cancer between the ages of 45-69 (Figure 4.4-1b). This group has been separated into two sub-groups: 45-54 years old (27.3% of all diagnoses), considered mostly premenopausal; and 55-69 years old (37.7% of all diagnoses), deemed postmenopausal. Studies have shown that breast cancers in premenopausal and postmenopausal women have significant differences in tumour size and grade, lymph node metastases, and hormone receptor status and HER2 expression. As a consequence, they are subject to different treatment modalities.

Women aged 70 and over at diagnosis comprised 21.6% of invasive breast cancers (the rate of cancers remains high, but the population is smaller), with 6.7% being between 70 and 74 years, and 14.9% being women 75-plus. Diagnoses decrease suddenly at age 70-74 (Figure 4.4-1a), when free screening is no longer available.

The age profile of diagnoses may change in future if the proposed extension of the current national breast screening programme to include women age 70-74 years is implemented [41]. Screening for women aged 40-44 is not currently a subject of active debate in Aotearoa New Zealand. However, updated results of the UK Age study published in 2020 showed a reduction in breast cancer mortality in the order of 25% for women having yearly mammography between age 40 and 49 years, without increasing over-diagnosis [42]; it seems inevitable that this will become a topic of discussion in Aotearoa New Zealand in the next few years.

4.4.1 Survival by age



AGE AT DIAGNOSIS	5-YEAR SURVIVAL	10-YEAR SURVIVAL
⩽ 44	88% (86-89)	82% (80-83)
45-69	93% (93-94)	89% (89-90)
⩾ 70	86% (84-87)	80% (79-81)

Fig. 4.4-2. *Breast cancer-specific survival by woman's age. The proportion of women surviving invasive breast cancer to 10 years after diagnosis, by age at diagnosis. Table: Proportion of women surviving to five and 10 years after diagnosis (95% CI).*

Women diagnosed between 45-69 years of age had the best prognosis, with a five-year breast cancer survival of 93% (Figure 4.4-2), and 10-year survival of 89%.

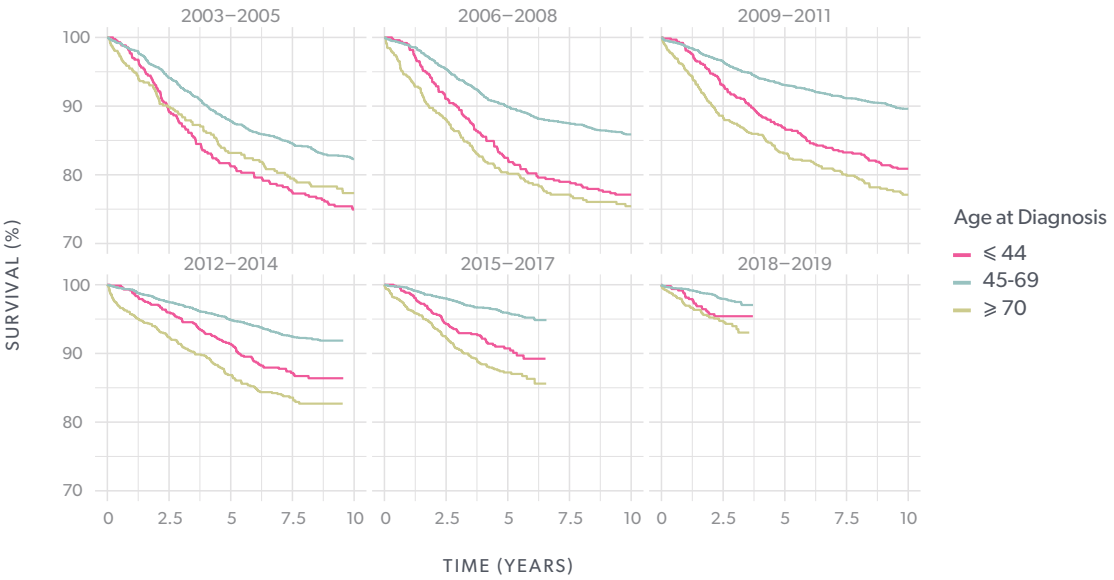
Women under 45 were less likely to have screen-detected cancers, and more likely to have larger tumours (a consequence of symptomatic diagnosis) and more aggressive breast cancer subtypes, such as HER2+ or triple negative (see Section 5).

Similarly, women aged 70 or over were less likely to have screen-detected cancers. A 2015 study of Auckland data in the Register found that women over 70 diagnosed after experiencing a symptom were more than twice as likely to die as those with a screened diagnosis [43].

An analysis of survival by age for each ethnicity can be viewed in Section 3, with all ethnicities compared in Appendix B, Figure 13.2-3.

Lindsey, Auckland, diagnosed at 71:

"I had an aggressive grade 3 tumour, and leakage into lymph nodes came to light during my lumpectomy, so my oncologist recommended chemotherapy. There was a lot of information to take in but I had great trust in the medical professionals. You can't mess about with cancer, if you're offered a treatment that's proven to be efficacious then why wouldn't you take it? More than five years on, I've had no sign of recurrence and I know I've given myself the best chance of fending it off."



AGE AT DIAGNOSIS	5-YEAR SURVIVAL	10-YEAR SURVIVAL
⩽ 44		
2003-2005	81% (78-85)	75% (71-79)
2009-2011	87% (84-89)	81% (78-84)
2015-2017	91% (88- 93)	
45-69		
2003-2005	88% (86-89)	82% (80-84)
2009-2011	93% (92-94)	90% (89-91)
2015-2017	96% (95-97)	
⩾ 70		
2003-2005	83% (80-87)	77% (73-81)
2009-2011	83% (81-86)	77% (74-80)
2015-2017	87% (85-89)	

Fig. 4.4-3. *Proportion of women surviving invasive breast cancer to 10 years by year of diagnosis, by age at diagnosis. Table: Proportion of women surviving to five and 10 years, with 95% confidence intervals shown in brackets.*

Survival in all age groups improved over the period 2003-2017. Five-year survival of women aged ⩽44 rose steadily from 81 to 91%. For women aged 45-69, five-year survival rose from 88 to 96%, and for older women (⩾70) from 83 to 87%. Similarly, 10-year survival improved from 2003 to 2011 in young women (though confidence intervals overlapped) and the 45-69 group, but remained the same in older women.

The lack of improvement in older women's survival might be explained by a recent study suggesting that decisions on treatment of New Zealand women with invasive breast cancer have been influenced by age, with women over 70 tending to have lower rates of chemotherapy [40]. International evidence that chemotherapy is less effective in very elderly women [44] may also have a bearing on New Zealand women's survival in this age group.

4.5 Familial Breast Cancer and Genetic Testing

While only about 2% of all breast cancers are attributable to a BRCA1 or BRCA2 gene mutation, the proportion is much higher in some patient groups. For example, studies show that about 10% of women diagnosed with breast cancer under age 40, and 7% of women diagnosed with triple negative breast cancer aged ⩽60, have a BRCA mutation [45, 46].

Testing for BRCA mutations has historically been used to guide decisions on breast cancer surgery (helping to understand consequent risk of recurrence or contralateral breast cancer), and to counsel family members about their risk of future cancers. More recently, drugs have been approved for treatment of advanced breast cancer specifically in people with BRCA mutations; it is reasonable to assume that such targeted treatments will in future be available in early breast cancer.

Only 1,131 (3.2%) of patients in the Register are recorded as having genetic testing for BRCA1/2 gene mutations (this data was not collected in the early years of the Register's existence). From 2013 (when the widely-publicised prophylactic mastectomy of movie star Angelina Jolie raised awareness of the BRCA gene around the world) the percentage was 5%. A BRCA1 gene mutation was identified in 156 of the patients tested (14%), while 117 (10%) had a BRCA2 gene mutation (Table 4.5-1). No one had both BRCA1 and BRCA2 gene mutations.

	Patients tested (N= 1131)
BRCA1 variant detected	156 (13.8%)
BRCA2 variant detected	117 (10.3%)
No BRCA1/2 variant detected	858 (75.9%)

Table 4.5-1. *Women with invasive breast cancer or DCIS tested for BRCA1 and BRCA2 gene mutations.*

Guidelines for testing have evolved over time, and these changes are likely to result in more patients being tested. In recent years, New Zealand Genetic Health Service lowered the eligibility threshold for testing from a 20% likelihood of having a mutation to 10%. The eviQ guidelines published by NSW Cancer Institute, widely used in Aotearoa New Zealand, currently recommend women aged ⩽40 diagnosed with breast cancer, or ⩽60 with triple negative breast cancer, should be referred for genetic testing, as should any male diagnosed with breast cancer. Further eviQ guidelines relate to family history [47]. Researchers are continuing to study other hereditary mutations known to affect breast cancer risk (for example, PALB2).

The completeness of data held in the Register for genetic testing needs further investigation in order to understand whether the referral rate for testing is appropriate.

5. Detection and Diagnosis of Invasive Breast Cancer

Invasive breast cancer is defined as cancer cells that have spread from their place of origin, in the milk ducts, into the surrounding breast tissue. From 2003-2019, Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register recorded 25,921 cases of invasive breast cancer, accounting for 85% of all female breast cancers in the Register (the remaining 15% being DCIS). There are a number of invasive subtypes; these are all included in the Register.

5.1 Screened vs Symptomatic Detection

In brief

- Survival was much better for women with screened diagnosis, and this applies across ethnicities, regions and time cohorts. Ninety-five percent of women diagnosed through screening survived to 10 years, vs 85% of women diagnosed with symptoms.
- The proportion of screen-detected cancers increased over time, with the biggest increase in non-European ethnicities. This probably reflects increased Māori and Pacific participation in BreastScreen Aotearoa, and also the introduction of new detection technologies such as digital mammography.
- Pacific women experienced the biggest survival benefit for screened vs symptomatic diagnosis, followed by Māori and European women.
- In 2020, the proportion of diagnoses that were screen-detected decreased 12%, and screening participation has declined sharply during the Covid-19 pandemic, particularly for Māori and Pacific women. This may put screening-associated survival gains at risk.

5.1.1 The context of breast screening in Aotearoa New Zealand

Breast cancer can be detected after a woman develops a symptom, such as a lump or a change in the nipple, and seeks medical advice, or it may be found in an asymptomatic woman by mammogram screening, either in the BreastScreen Aotearoa programme or at a private clinic. The BreastScreen Aotearoa programme commenced in 1999, offering free breast screening for women aged 50 to 64 years. In July 2004, the age range was extended to include women aged 45 to 69.

Before the Covid-19 pandemic, BreastScreen Aotearoa had achieved very high participation, with the 70% target exceeded every year from 2012-2019. This compared favourably with 55% screening participation in Australia [48]. England had a participation rate of 71.6% for 2018-19 [49], but screening there is only offered every three years, to women aged 50-70. It seems fair to say, therefore, that Aotearoa New Zealand has had exemplary screening practice in recent years.

However, participation in BSA screening has decreased considerably since the Covid-19 pandemic, with screening paused in Level 4 lockdowns and running at reduced capacity in Level 3. As a result, two-year participation is now lower than it was in 2011. Pacific and Māori women have been worst impacted [28]. In 2020, the proportion of diagnoses that were screen-detected decreased 12% [50]. This may put screening-associated survival gains at risk.

5.1.2 Screened vs symptomatic detection

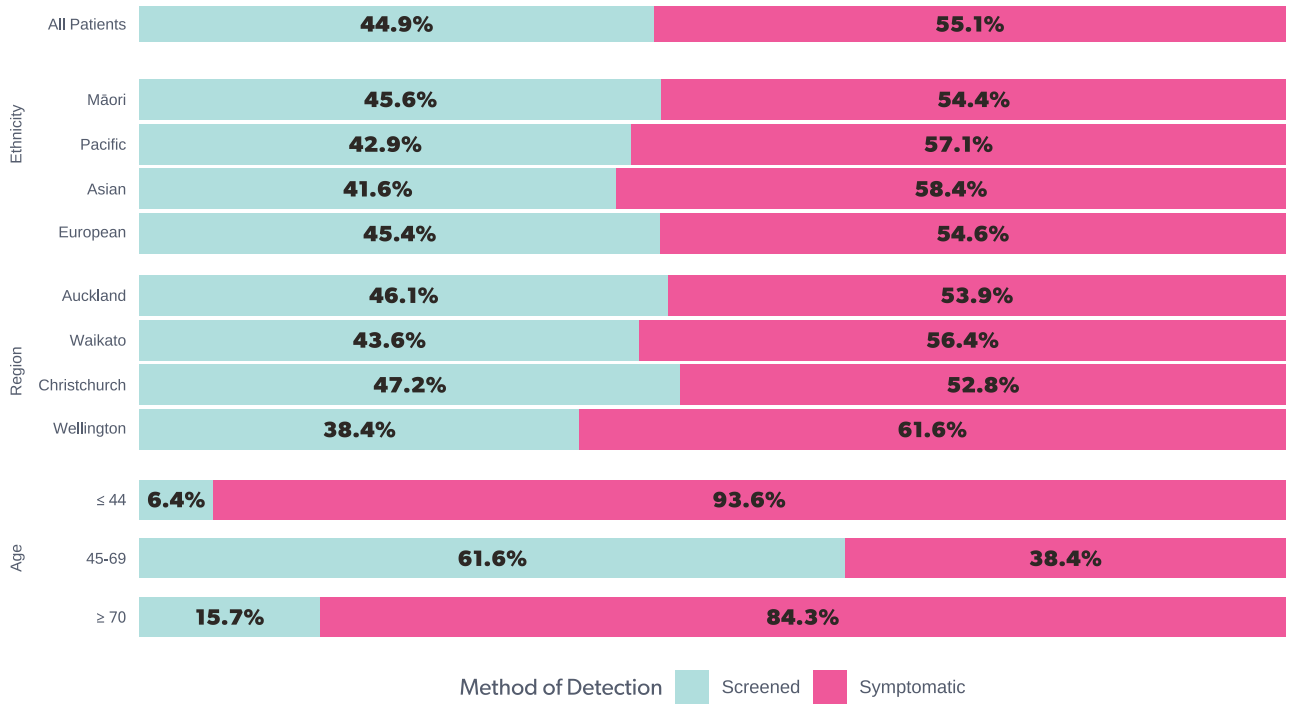


Fig. 5.1-1. *Method of detection of invasive breast cancer. a) Overall proportion of invasive breast cancers detected by/during mammographic screening or by women presenting with symptoms, b) Proportion of women diagnosed by each detection method by their ethnicity, c) proportion of women within the four regions diagnosed by each detection method by their ethnicity, d) proportion of women diagnosed by each detection method by age.*

Slightly more Pacific women (57.1%) and Asian women (58.4%) were diagnosed after experiencing symptoms than European and Māori women (Figure 5.1-1). This likely reflects historically low screening participation by Pacific women. Asian women have low participation in BreastScreen Aotearoa; just 61.5% of the eligible Asian population were screened in the two years to 2018, much lower than Māori (65.3%), Pacific (72.7%) and European (73.9%) participation [34].

The BreastScreen Aotearoa programme is currently opt-in, which means that people who are not actively engaged in the health system, or those in high deprivation groups, may be less likely to participate. There is a plan to make the service opt-out in future.

By region, Wellington had the highest proportion of women diagnosed with symptoms (61.6%) and Christchurch the lowest (52.8%). Nearly all women diagnosed with breast cancer under the age of 45, and 84.3% of women aged over 70 years, were diagnosed with symptoms. Only 38.4% of women of screening age (45-69 years) presented with symptoms.

Lisa, Waikato, diagnosed at 54:

"I had skipped my mammogram appointment because of work. Seven months later, I was in the shower when I felt a lump. I was subsequently diagnosed with HER2-positive breast cancer and now I beat myself up that I didn't reschedule that mammogram. A few minutes of discomfort to not have to go through what I went through is priceless; I can't stress enough that if you catch it earlier you might not have to go through what I did."

Year of diagnosis	2003-2005	2006-2008	2009-2011	2012-2014	2015-2017	2018-2019
Proportion of breast cancers screen detected	875 (8.2%)	1,112 (10.4%)	1,944 (18.2%)	2,326 (21.8%)	2,585 (24.2%)	1,847 (17.3%)

Table 5.1-1. *Proportion of invasive breast cancer cases detected by screening, over time.*

The proportion of breast cancers detected by screening rose from 8.2% to 24.2% from 2003 to 2017. The was a drop in 2018-2019; the reason for this is unknown (Table 5.1-1).

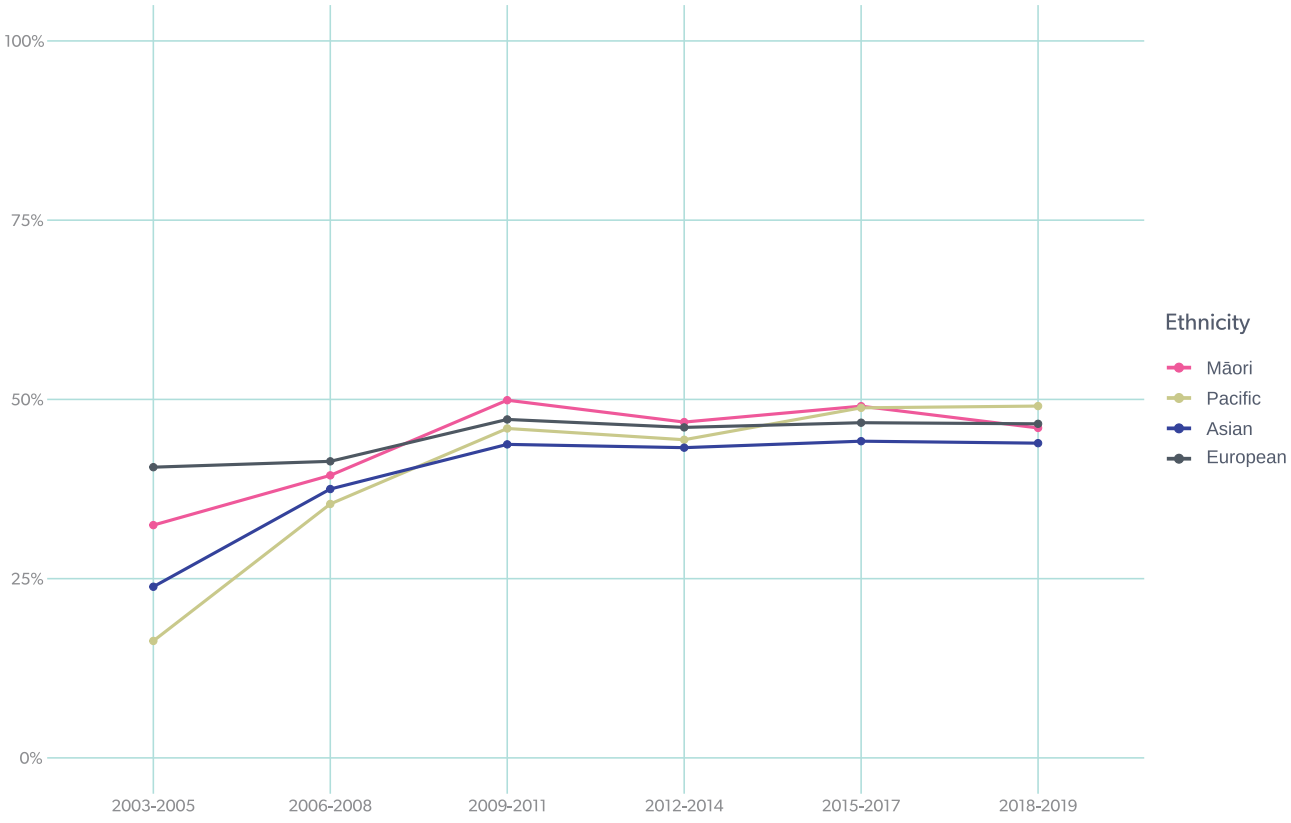
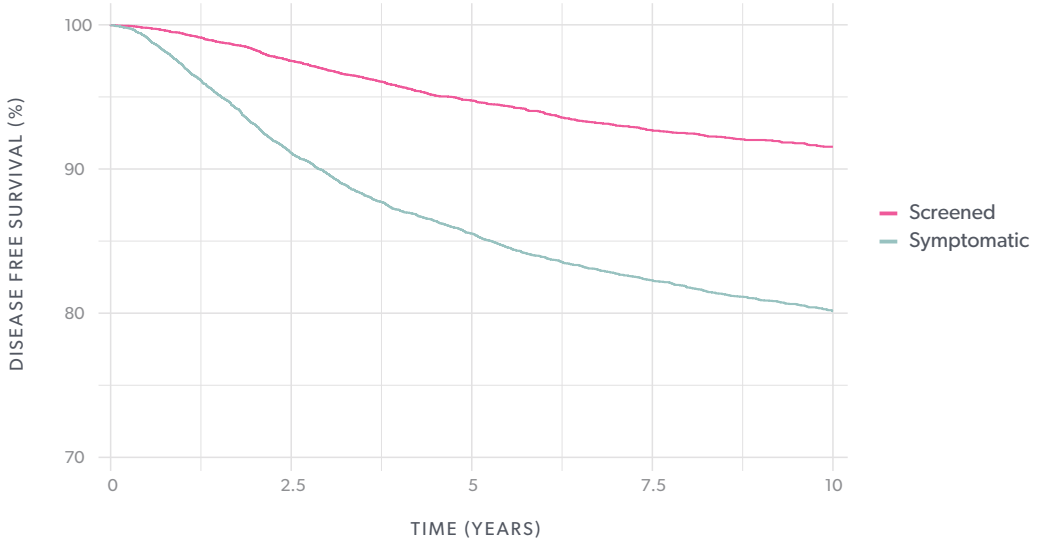


Fig. 5.1-2. *The proportion of invasive breast cancers that were screen-detected, by ethnicity over time.*

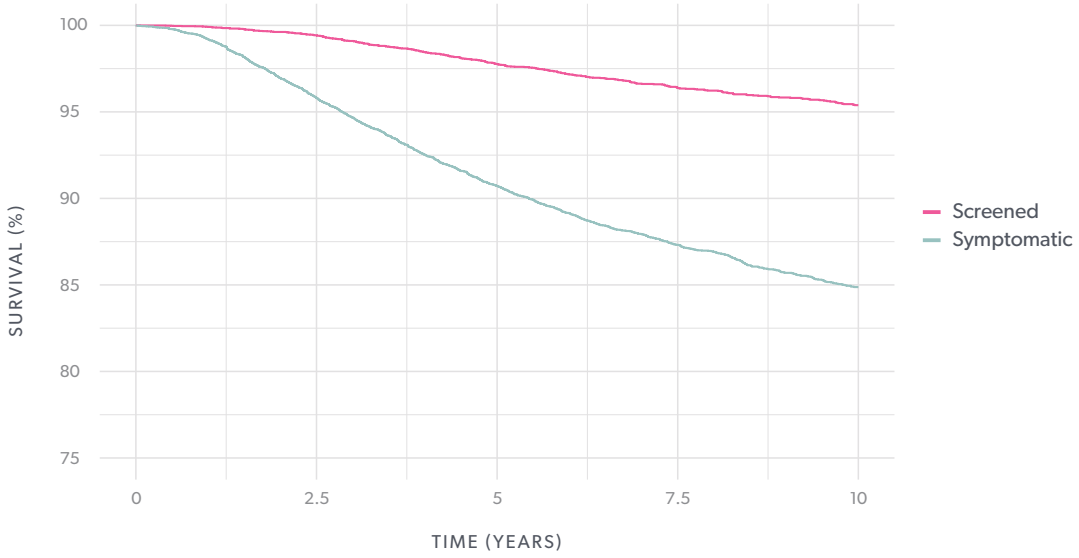
The screening participation of Pacific women had increased to over 70% in the years prior to the Covid-19 pandemic; this is likely to be the reason for the increase in Pacific screened diagnoses in recent years (Figure 5.1-2).

Survival by detection method

When comparing the outcomes of women with breast cancer by detection method, both disease-free survival (women who have not had a recurrence of their breast cancer) and breast cancer-specific survival were analysed.



DETECTION METHOD	5-YEAR DFS	10-YEAR DFS
Screened	95% (94-95)	92% (91-92)
Symptomatic	86% (85%-86)	80% (79-81)



DETECTION METHOD	5-YEAR SURVIVAL	10-YEAR SURVIVAL
Screened	98% (97-98)	95% (95-96)
Symptomatic	91% (90-91)	85% (84-86)

Fig. 5.1-3. *Survival by detection method. Prognosis out to 10 years for women with invasive breast cancer detected either by mammographic screening or after presenting with symptoms. a) the proportion of women disease-free, b) the proportion of women surviving invasive breast cancer.*

Women with screen-detected tumours had better outcomes than those who were diagnosed with symptoms: 95% of women who had invasive breast cancer detected by screening were disease-free five years after diagnosis, and at 10 years this was still 92% of women (Figure 5.1-3a).

In comparison, for those diagnosed after presenting with symptoms, 86% of women were disease-free at 5 years, and 80% at 10 years.

The breast cancer-specific survival rate of women with tumours detected by screening was 98% at five years and 95% at 10 years, superior to women presenting with symptoms (91% and 85%) (Figure 5.1-3b). Thus the absolute breast cancer survival benefit for women whose cancer was diagnosed by mammography before symptoms developed was 10% at 10 years. While this data includes patients outside the screening age, including younger women at higher risk of death and older women who may benefit less from chemotherapy, much of the difference may be attributed to the survival benefits for New Zealand women participating in the BreastScreen Aotearoa programme, which have been previously reported [32, 40].

5.2 Tumour Pathology

In brief

- Tumour pathology has a major impact on survival. While women with grade 1 tumours had a 99% five-year and 98% 10-year survival, women with grade 3 tumours fared much worse (91% five-year and 81% 10-year survival), though the gap has narrowed over time.
- Women with ER+ subtypes had superior five-year breast cancer-specific survival to those with ER- cancers. The biggest improvement over time was in five-year survival for women with ER-/HER2+ tumours, with their 10-year survival also improving over time. These improvements are most likely due to the funding of 12 months of Herceptin since December 2008.
- Women with triple negative breast cancer had improved five-year survival, and there was a trend towards improvement in 10-year survival.
- Women with stage 1 cancers had a 99% five-year and 97% 10-year survival, compared with 81% and 71% for those with stage 3. However, stage 3 survival has greatly improved since 2003-2005, and the proportion of cancers diagnosed at stage 3 decreased.
- Nearly one in every 11 Pacific women (8.5%) diagnosed with invasive breast cancer had *de novo* metastatic disease.

5.2.1 Tumour size

Tumour size is an independent prognostic factor and it is well established that the smaller the tumour is at the time of detection, the better the outcomes. Tumour size is used in the calculation of disease stage [4].

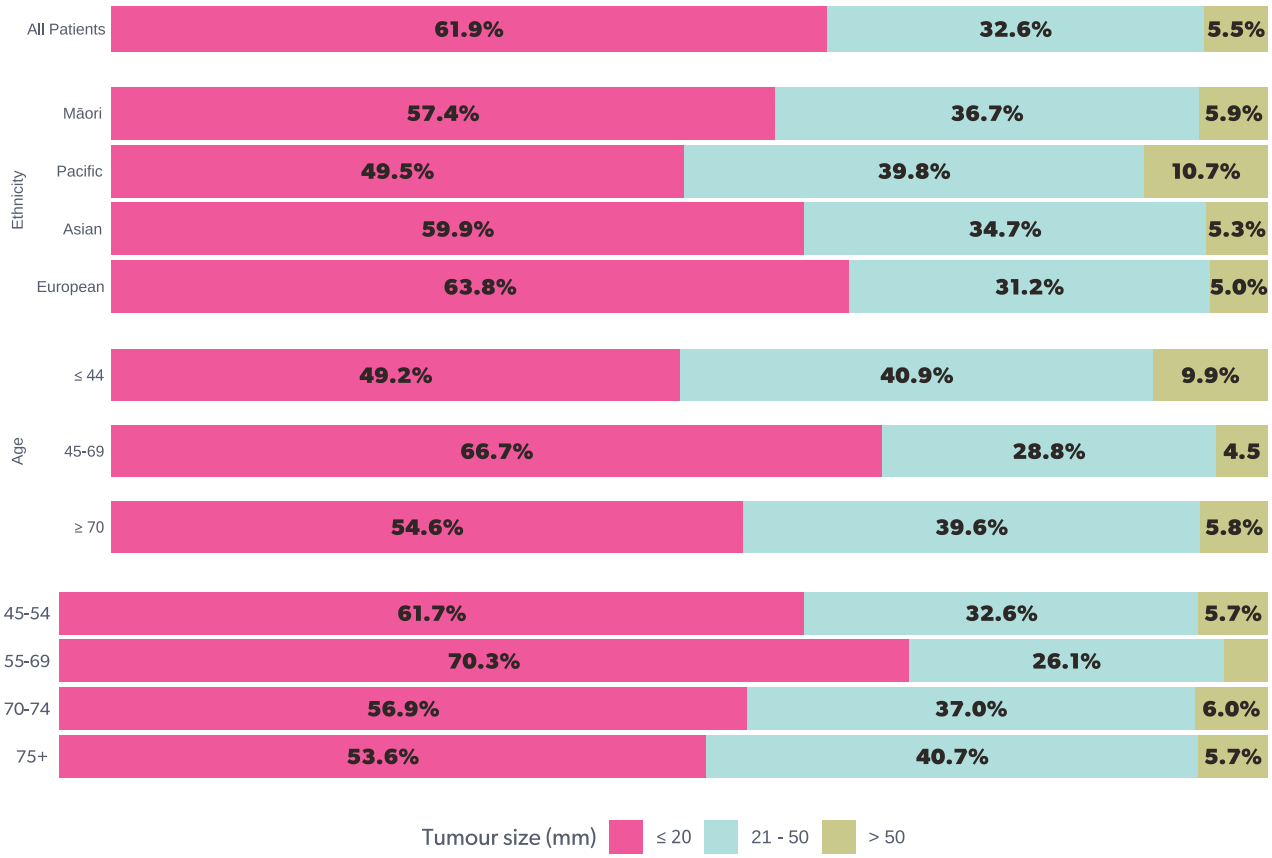


Fig. 5.2-1. *Analysis of tumour size of women with invasive breast cancer. a) Overall proportion of tumours by size categories, b) Invasive tumour sizes by woman's ethnicity, c) Invasive tumour sizes by woman's age at diagnosis.*

Tumour size of all invasive breast cancers is shown in Figure 5.2-1a, with over 60% of women having tumours 20mm or smaller (also staged as T1 tumours), a third with tumours 21-50mm, and 5% having tumours >50mm. Māori and Asian women had slightly fewer small tumours (57.4% and 59.9%) and slightly more tumours between 21-50mm (Figure 5.2-1b). Pacific women had fewer small tumours and more than half were >20mm. Pacific had twice as many large tumours as other groups.

Smaller tumours are less likely to be detectable by feel, and more likely to have been found on a screening mammogram. Among women of screening age, two-thirds (66.7%) were 20mm or smaller. There was a marked difference in the proportion of smaller tumours between the premenopausal (70.3%) and postmenopausal (61.7%) subgroups, but a much smaller difference between the two 70+ subgroups.

Half of all women under age 45 had tumours >20mm, and 9.9% had tumours >50mm (Figure 5.2-1c). For women diagnosed with breast cancer over 70 years old, 54.6% and 39.6% were diagnosed with breast tumours of ⩽20mm or between 21-50mm respectively.

5.2.2 Tumour grade

Tumour grade is a measure of the aggressiveness of the tumour and is well established as an independent prognostic factor [7, 8]. Grade is calculated by pathologists using a standard set of criteria based on the Nottingham grading system. Grade of a tumour can be assessed on a biopsy or excision sample of tumour with a three-tier system, from grade 1 well differentiated (least abnormal, most closely resembling normal cells), to grade 3 poorly differentiated (most abnormal cells). [51, 52].

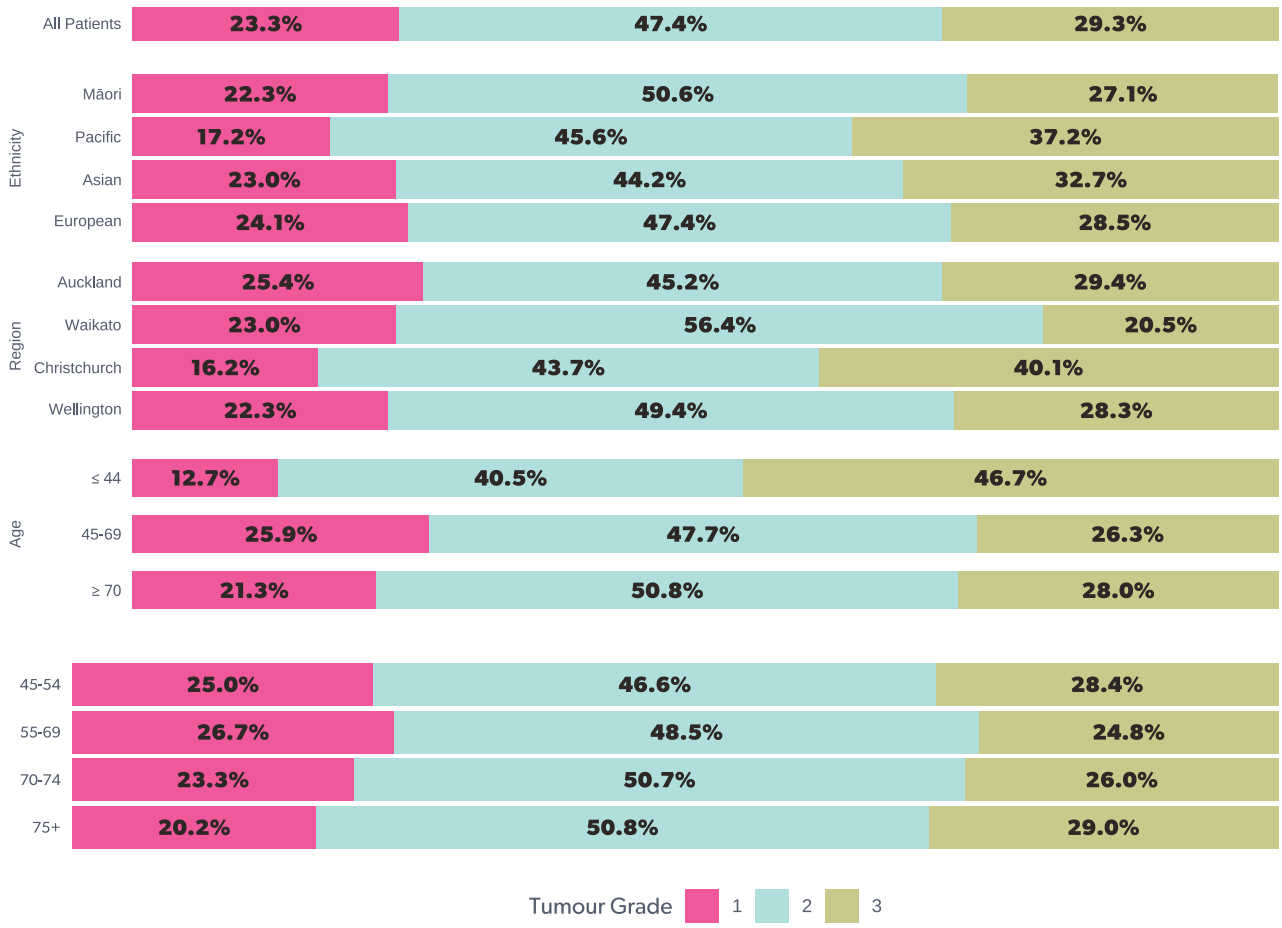
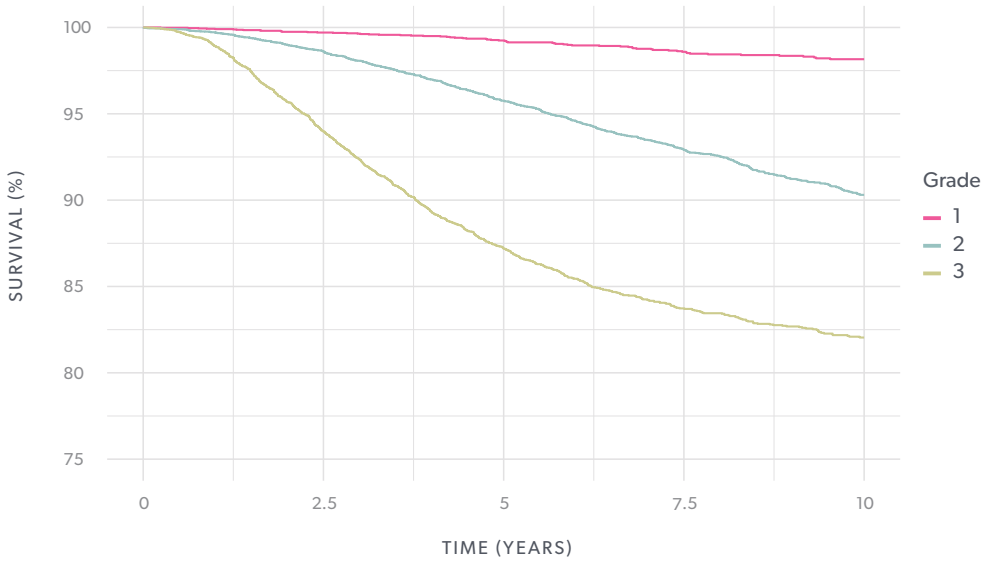


Fig. 5.2-2. *Analysis of invasive tumour grade. Proportion of women with each breast cancer grade, a) overall and by woman's ethnicity, and b) by woman's age at diagnosis.*

The data highlights a higher proportion of grade 3 tumours in Pacific (37.2%) and Asian (32.7%) women. Only 17.2% of Pacific women had low-risk grade 1 tumours. There are regional differences, with more grade 3 tumours reported in Christchurch and fewest in Waikato. Nearly half (46.7%) of all women under 45 years of age had grade 3 breast tumours, with only 12.7% having grade 1 tumours (Figure 5.2-2).

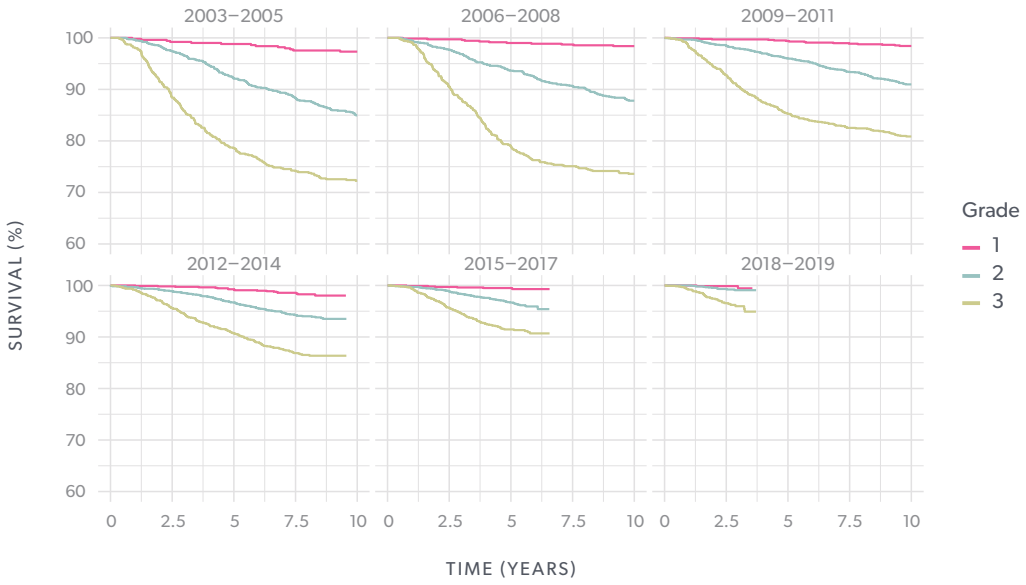
Survival by tumour grade



GRADE	5-YEAR SURVIVAL	10-YEAR SURVIVAL
1	99% (99-99)	98% (98-99)
2	96% (95-96)	90% (90-91)
3	87% (86-88)	82% (81-83)

Fig. 5.2-3. *Breast cancer-specific survival by tumour grade. The proportion of women surviving invasive breast cancer to 10 years by their tumour grade. Table: Proportion of women surviving to five and 10 years (95% CI).*

Women with grade 1 breast tumours had an excellent prognosis, with five- and 10-year survival rates of 99% and 98% (Figure 5.2-3). Women with grade 2 tumours had slightly poorer outcomes, but for women with grade 3 tumours, their five- and 10-year survival fell to 87% and 82% respectively.



GRADE	5-YEAR SURVIVAL	10-YEAR SURVIVAL
1		
2003-2005	99% (98-100)	97% (96-99)
2009-2011	99% (99-100)	98% (98-99)
2015-2017	99% (99-100)	
2		
2003-2005	92% (91--94)	85% (8387)
2009-2011	96% (95-97)	91% (90-92)
2015-2017	97% (96-97)	
3		
2003-2005	79% (76-82)	72% (69-76)
2009-2011	85% (83-87)	81% (79-83)
2015-2017	91% (90-93)	

Fig. 5.2-4. *Breast cancer-specific survival by tumour grade by year of diagnosis. Proportion of women surviving invasive breast cancer to 10 years by year of diagnosis, shown by their tumour grade. Table: Proportion of women surviving to five and 10 years (95% CI).*

Over time, as seen above, breast cancer-specific survival has improved for women diagnosed with all cancer grades (Figure 5.2-4). Reasons for improvement are likely to be multifactorial, including smaller lesions and improved treatment options, including funding for 12 months' Herceptin from December 2008, wider access to taxane chemotherapy and, to a lesser extent, the funding of newer chemotherapy drugs such as vinorelbine and capecitabine to extend survival once breast cancer has metastasised.

Women with grade 1 tumours had excellent survival in all time cohorts, with five- and 10-year survival of 99% and 98%. Five-year survival for women with grade 2 tumours also improved, from 92% (2003-2005) to 97% (2015-2017).

The most noticeable five-year survival improvement was for women with grade 3 breast tumours, rising to 91% for those diagnosed in 2015-2017. This may be because, anecdotally, it has become common practice to offer chemotherapy to most women with grade 3 breast cancer (exceptions may include postmenopausal women with small tumours with good margins of excision). However, although 10-year survival rates for these women also increased, to 81%, they were poor compared to 10-year survival for women with lower-grade tumours.

5.2.3 Receptor status

Invasive breast tumours, like normal cells, need surface growth factors. Examples include the circulating hormones oestrogen and progesterone, which control the growth of breast tissue: the majority of breast cancers retain these oestrogen (ER) and progesterone (PR) receptors and are called hormone receptor-positive (HR+, ER+, PR+). These and other growth factors can be targeted and inactivated by drugs, thereby retarding the tumour growth and spread. Women with ER+/PR+ tumours tend to have better outcomes than those with hormone negative (ER-, PR-) tumours. Even more importantly, oestrogen-sensitive cancer can be controlled and in many cases cured by use of drugs such as tamoxifen or aromatase inhibitors to prevent the natural circulating oestrogen/progesterone from stimulating cancer growth. Tumours that do not have oestrogen or progesterone receptors (ER-/PR-) cannot benefit from hormone blocking drugs and are more commonly treated with chemotherapy.

In addition to hormonal control of breast cancer, the HER2 gene is recognised as being increased in 15-25% of breast cancers and in these cases is associated with a poorer outcome for patients. Measurement of HER2 receptors is routinely performed to screen women to determine those that would benefit from treatment with Herceptin and possibly other anti-HER2 medications.

A pathologist determines the biological profile of the tumour using well-established guidelines; only tumours that express these receptors are suitable for targeted treatments. There is interaction between hormone and HER2 receptors and more recently, as mentioned earlier, the biological profile together with grade has been included in the staging system to finesse treatment options.

The receptor and HER2 status also form surrogate markers for molecular classification, which divides tumours into luminal types (ER+), HER2-enriched (mostly ER- / HER2+) and triple negative (these tumours can be hard to treat, having no targetable receptors). These molecular subtypes are a factor in treatment decisions.

Receptor status in the Register

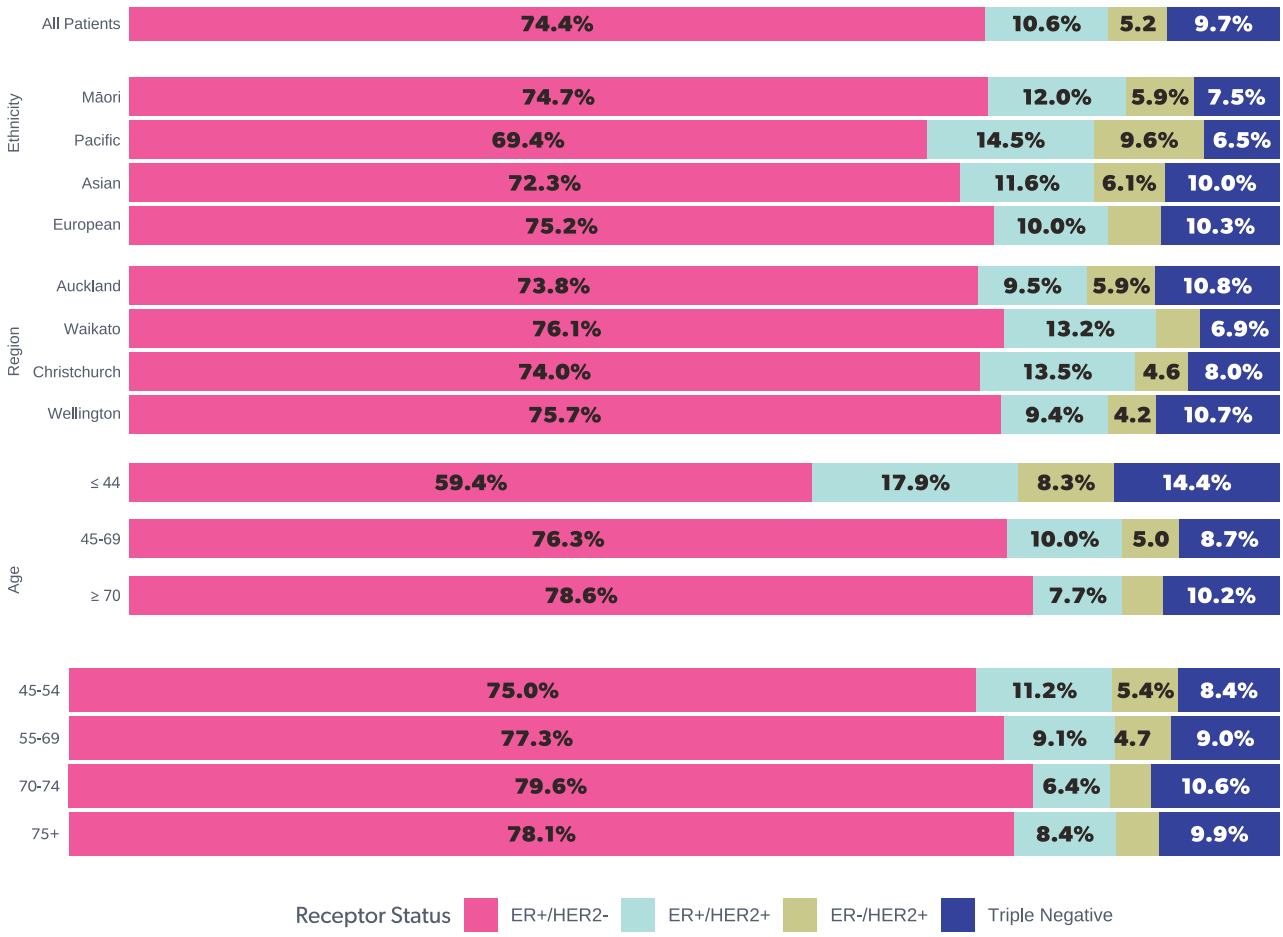


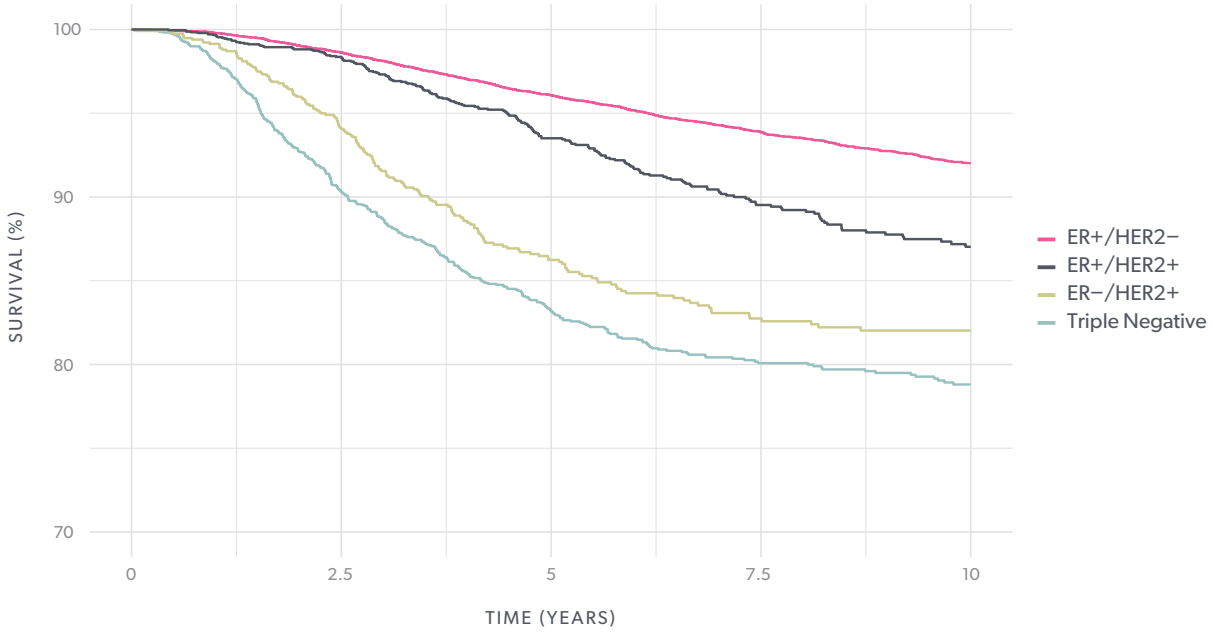
Fig. 5.2-5. *Analysis of receptor status of invasive tumours. Receptor status of tumours is shown by woman's ethnicity, region and age at diagnosis. ER+ means >1% of tumour cells stained for the ER.*

The total proportion of women with ER+ tumours was similar across all ethnicities. Approximately 75% of Māori, European, and Asian women had ER+/HER2- breast cancer, and an additional 10-12% were ER+/HER2+, sometimes called triple positive (Figure 5.2-5).

HER2+ and triple negative breast cancers are often more aggressive and, in the case of triple negative, can be difficult to treat. Māori, European, and Asian populations had similar total HER2+ tumours (14.5-18%), but Pacific women had more HER2+ tumours at 24% (shown in Figure 5.2-5). European and Asian women had the highest rate of triple negative breast cancer at 10%.

Regionally, the proportion of women with ER+/HER2- tumours was similar, ranging from 73.8–76.1%. This suggests the existence of good testing criteria and quality controls. There was a slightly higher incidence of HER2+ tumours in Waikato and Christchurch (17% and 18.1%); this could be a factor of testing regimes. Auckland and Wellington had the highest proportion of women with triple negative tumours, with just over 10% of women diagnosed with these cancers (Figure 5.2-5).

By age, nearly 80% of women diagnosed aged ⩾45 had ER+/HER2- tumours, but this dropped to 59.4% of women diagnosed under 45 years. Young women had a higher rate of both HER2+ and triple negative breast cancer (Figure 5.2-5).

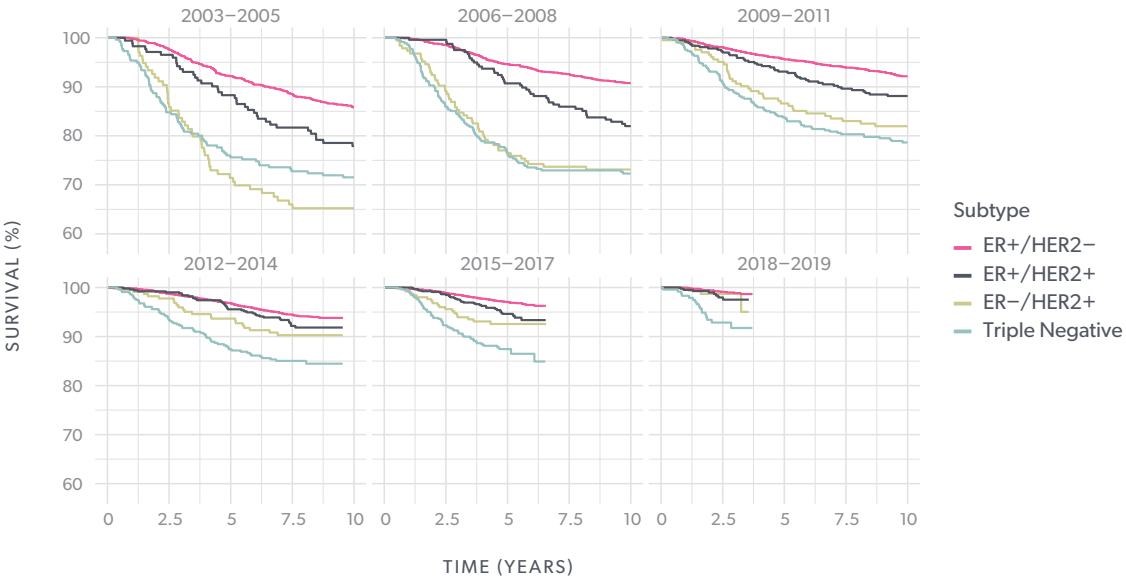


SUBTYPE	5-YEAR SURVIVAL	10-YEAR SURVIVAL
ER+/HER2−	96% (96-96)	92% (91-93)
ER+/HER2+	94% (92-95)	87% (85-89)
ER−/HER2+	86% (84-88)	82% (80-85)
Triple Negative	83% (82-85)	79% (77-81)

Fig. 5.2-6. *Breast cancer-specific survival by receptor status of invasive tumours. Proportion of women surviving invasive breast cancer to 10 years by their tumour receptor status. Table: Proportion of women surviving to five and 10 years, (95% CI).*

Overall, ER+ subtypes had superior five-year breast cancer-specific survival to ER- cancers, with ER+/HER2- doing slightly better than ER+/HER2+ (Figure 5.2-6). But by 10 years after diagnosis ER+/HER2+ survival had fallen behind ER+/HER2-.

However, when looking at the data by three-year cohort, the mortality burden of ER+/HER2- breast cancer lay mostly in the earlier cohorts; for women diagnosed with these cancers in 2009-2011, the survival difference between ER+/HER2- and ER+/HER2+ was not meaningful, with, confidence intervals overlapping (Figure 5.2-7). This is mostly likely due to funding of 12 months' Herceptin for early breast cancer from December 2008.



SUBTYPE	5-YEAR SURVIVAL	10-YEAR SURVIVAL
ER+/HER2−		
2003-2005	92% (91-94)	86% (84-88)
2009-2011	96% (95-96)	92% (91-93)
2015-2017	97% (96-98)	
ER+/HER2+		
2003-2005	88% (84-93)	78% (72-84)
2009-2011	93% (91-96)	88% (85-92)
2015-2017	95% (93-97)	
ER−/HER2+		
2003-2005	71% (64-80)	65% (58-74)
2009-2011	87% (82-91)	82% (77-87)
2015-2017	93% (89-96)	
Triple Negative		
2003-2005	76% (71-81)	72% (66-77)
2009-2011	84% (80-87)	79% (75-83)
2015-2017	87% (84-91)	

Fig. 5.2-7. *Breast cancer-specific survival by receptor status of invasive tumours by year of diagnosis. Proportion of women surviving invasive breast cancer to 10 years by their date of diagnosis and their tumour receptor status. Table: Proportion of women surviving to five and 10 years, with 95% confidence intervals (95% CI).*

Breast cancer survival rates have improved over time, with progressively better outcomes for women with tumours of all receptor types have (Figure 5.2-7).

Among women with ER+/HER2- tumours – the majority of patients – 92% of those diagnosed in 2003-2005 survived for five years. This rose to 97% for those diagnosed in 2015-2017.

The biggest improvement over time was in five-year survival for women with ER-/HER2+ tumours, with their 10-year survival also experiencing a significant improvement. As with women with ER+/HER2+ tumours, these improvements are most likely due to the funding of 12 months of Herceptin for HER2+ breast cancer.

Women with triple negative breast cancer had greatly improved five-year survival, most likely reflecting earlier detection, as treatments have not changed markedly. There was a trend towards improvement in their 10-year survival. Most triple negative metastatic recurrences occur within three years of initial diagnosis, making 10-year survival a very positive indicator of long-term survival for these patients.

5.2.4 Lymph node status

Lymph node status, or lymph node involvement, refers to spread of the cancer to lymph nodes, usually under the arm (axillary nodes). N0 means no cancer cells were detected in the woman's lymph nodes (called node-negative disease), with N1-N3 referring to increasing numbers of lymph nodes with cancer cells detected (called node-positive disease). This information is used to determine breast cancer stage, and those women with higher numbers of cancerous nodes have poorer prognosis [53].

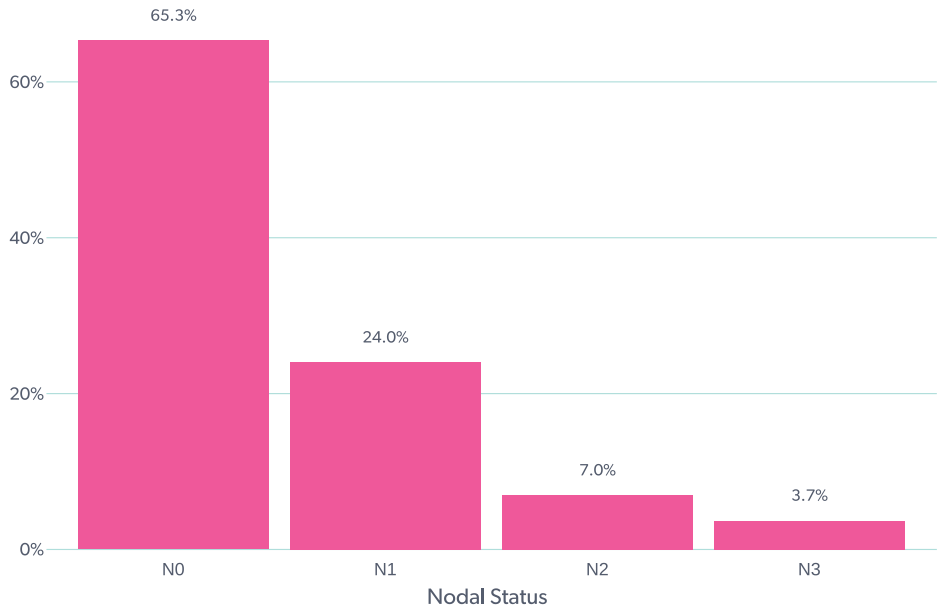


Fig. 5.2-8 *Proportion of women with each nodal status.*

Two thirds (65.3%) of women were diagnosed as having node-negative disease (Figure 5.2-8). One quarter (24%) had a lymph node status of N1 (1-3 lymph nodes with cancer cells), and 10.7% had a lymph node status of N2 or N3 (4 or more lymph nodes with cancer cells).

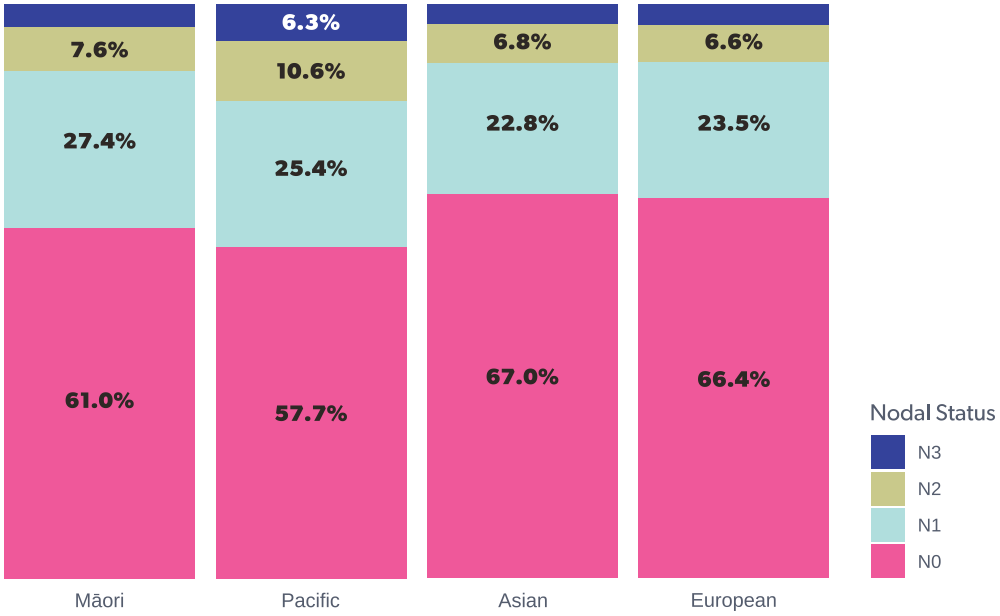
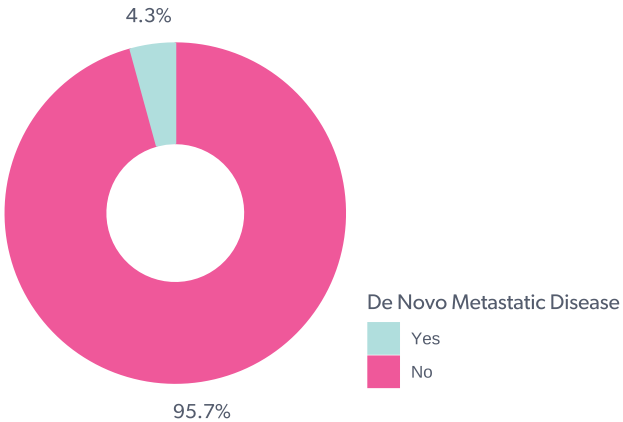


Fig. 5.2-9. *Nodal status by ethnicity. Proportion of women with each lymph node status by ethnicity.*

Wāhine Māori and Pacific women had slightly lower rates of N0 (Figure 5.2-9) and slightly higher rate of N1 lymph node status. Pacific women had the highest proportions of N2 and N3 lymph node nodal status at 16.9% altogether – approximately twice the rate of other groups.

5.2.5 *De novo* metastatic breast cancer

Women diagnosed initially with metastatic breast cancer, or who had metastases detected within three months of surgery for breast cancer, were classified as having *de novo* metastatic breast cancer. In total, 1,095 women (4.3%) with invasive breast cancer had *de novo* metastatic disease.



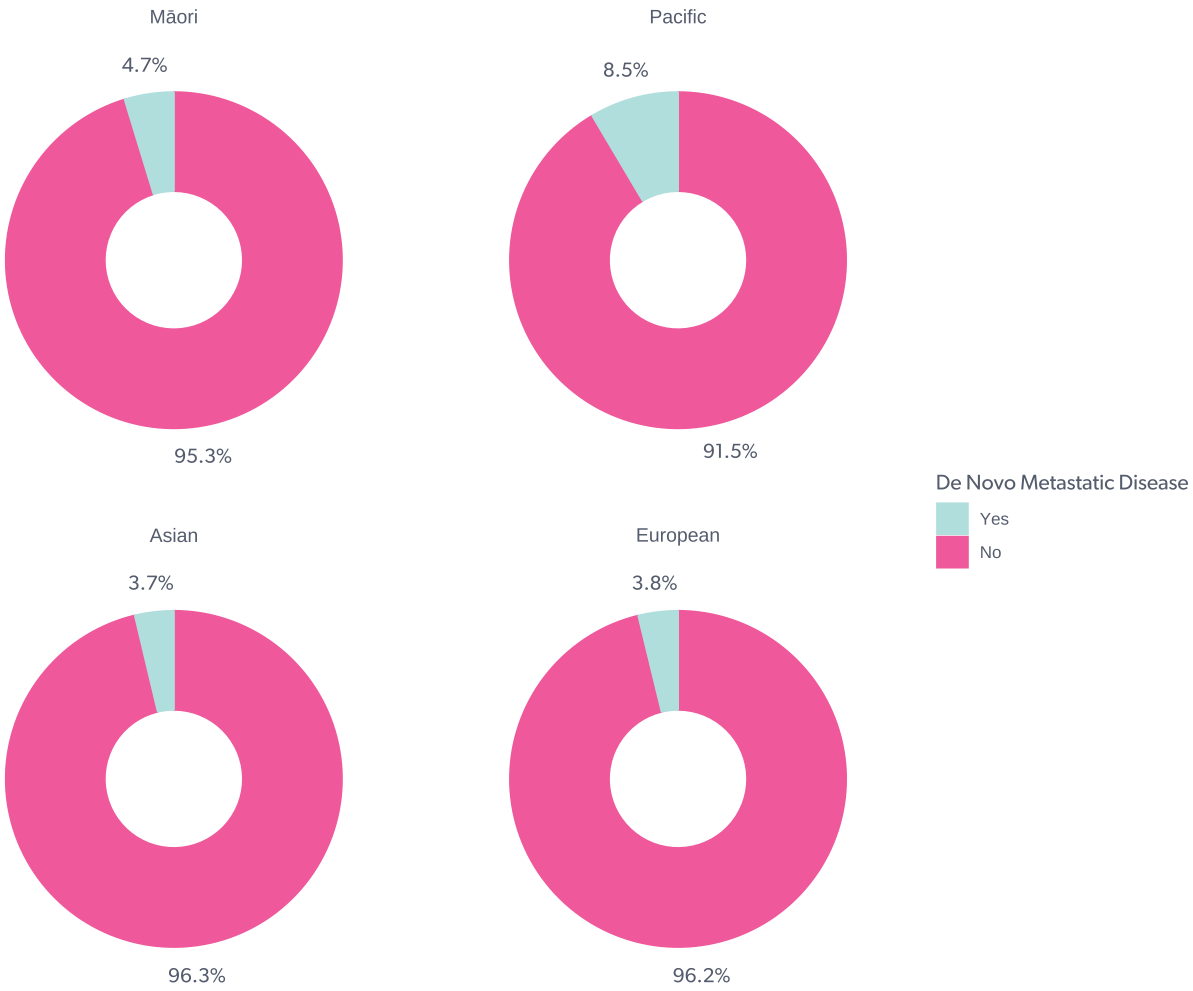


Fig. 5.2-10. De novo *metastatic disease by ethnicity. Proportion of women with invasive breast cancer diagnosed with* de novo *metastatic disease, by ethnicity.*

Pacific women had the highest proportion of *de novo* metastatic breast cancer (8.5% of all Pacific women with invasive breast cancer; Figure 5.2-10). Compared to European (3.7%) and Asian (3.8%) women, a slightly higher proportion of wāhine Māori (4.7%) were diagnosed with *de novo* metastatic breast cancer.

De novo diagnoses by age

	⩽44 (N = 3,441)	45-69 (N = 16,782)	⩾70 (N = 5,521)	Total (N = 25,744)
***De Novo* Metastatic Disease**				
Yes	184 (5.3%)	507 (3%)	404 (7.3%)	1,095 (4.3%)
No	3,257 (94.7%)	16,275 (97%)	5,117 (92.7%)	24,649 (95.7%)

Table 5.2-1. De novo *metastatic disease by age.*

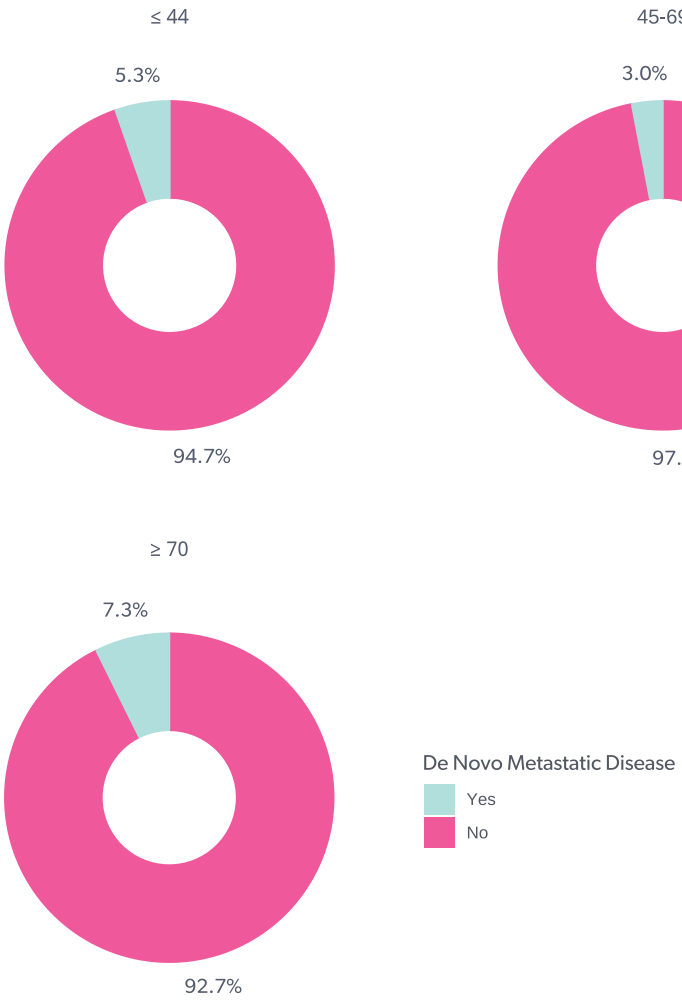


Fig. 5.2-11. De novo *metastatic disease by age. Proportion of women diagnosed with invasive breast cancer who had* de novo *metastatic disease, by age at diagnosis.*

Only 3% of women between 45-69 years at diagnosis had *de novo* metastatic disease. The proportions were higher for women younger than 45 or over 69 years, being 5.3% and 7.3% respectively (Figure 5.2-11).

5.2.6 Breast cancer stage

The stage of breast cancer denotes the extent of disease, with stages 1-3 regarded as early breast cancer and stage 4 as advanced or metastatic breast cancer.

Until recently, stage was reported as anatomic (TNM) stage, determined from the size of the tumour (T), the number of lymph nodes (N) to which the cancer has spread and whether cancer has metastasised (M), or spread, to a second site in the body. In 2018, tumour grade and receptor status were added to breast cancer stage definitions, forming pathological prognostic stages. However, this report uses anatomic stage, in order that the maximum number of cases could be analysed [3].

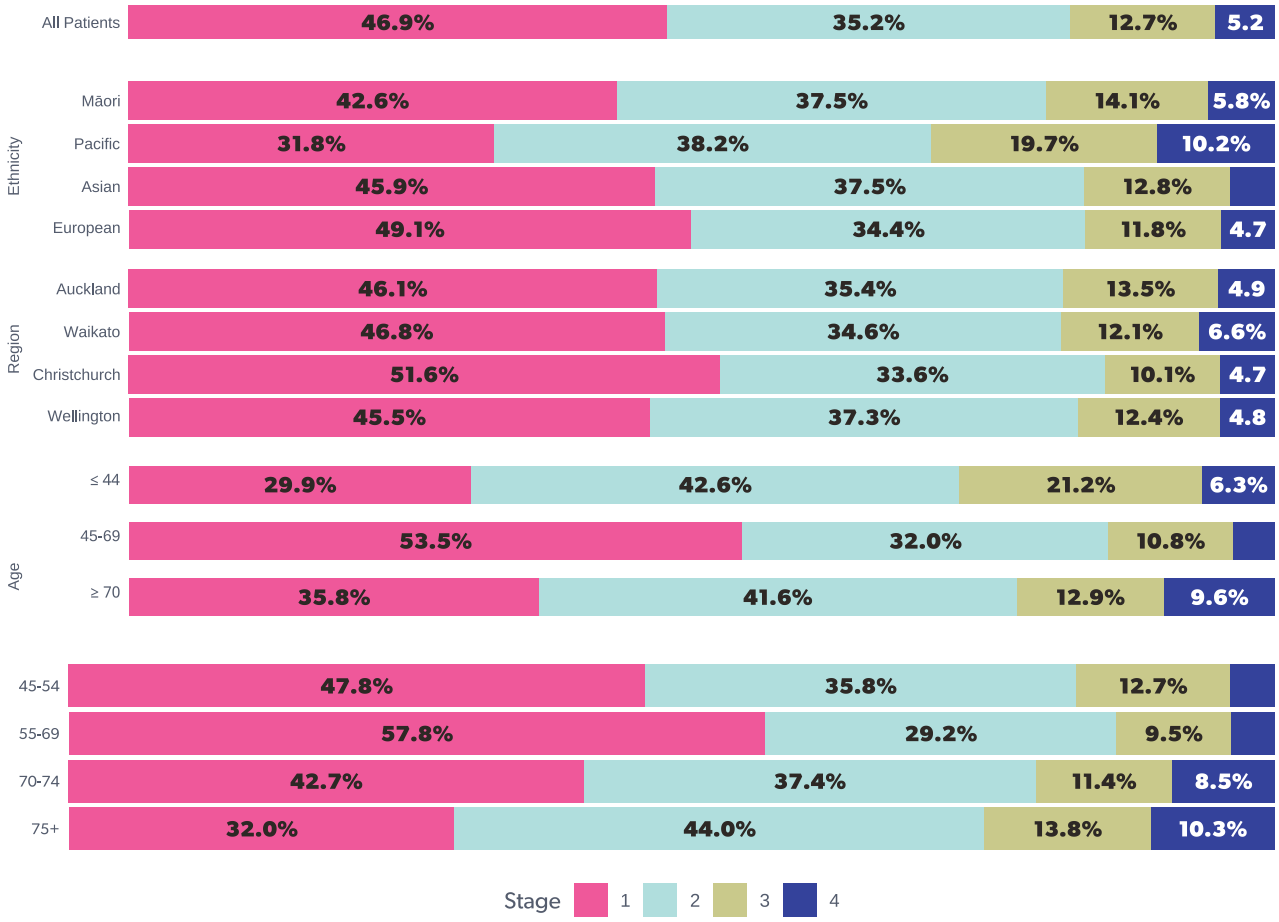


Fig. 5.2-12. *Analysis of invasive tumour stage. Overall proportion of women diagnosed with breast cancer stages 1-4, by woman's ethnicity, by region and by age.*

Stage at diagnosis is shown for all women and by ethnicity, region and age. Overall, just under half (46.9%) of all women diagnosed with invasive breast cancer had stage 1 disease, 35.2% had stage 2 disease, 12.7% had stage 3 disease and 5.2% had stage 4 disease (Figure 5.2-12)

European, Māori, and Asian women had similar stage distribution, but Pacific women had fewer stage 1 cases (31.8%), a similar proportion of stage 2 cases, but more stage 3 (19.7%) and stage 4 (10.2%) cases. Over the study period, 14.1% of wāhine Māori were diagnosed with stage 3 disease, compared with 11.8% of European women.

In Auckland, Waikato and Wellington, similar proportions of women with invasive breast cancer were diagnosed with stages 1-3 disease (45.5% to 46.8% for stage 1, 33.6% to 37.3% for stage 2, and 12.1% to 13.5% for stages 3), but in Christchurch, 51.6% had stage 1 disease, with a corresponding lower proportion having stage 2 and stage 3 disease (33.6% and 10.1% respectively; Figure 5.2-12)). Waikato had the highest proportion of women diagnosed with stage 4 disease (6.5% compared to 4.7% to 4.9% in the other regions).

Analysis of stage by women's age at diagnosis shows stage 1 disease in over half (53,5%) of all women of screening age (45-69), with the premenopausal subgroup having higher stage disease. Outside the screening age group, stage 1 disease occurred in only 29.9% of young women (< 45 years), and 35.8% of older women (> 69). Additionally, younger woman had increased proportion of stage 3 (21.2%) and stage 4 (6.3%) disease.

Older women also had an increased proportion of stage 3 disease (12.9%) and 9.6% were diagnosed with *de novo* metastatic cancer. Women in the 70-74 subgroup were more likely to have stage 1 disease than those aged 75+; this may be related to more screen-detected cancers.

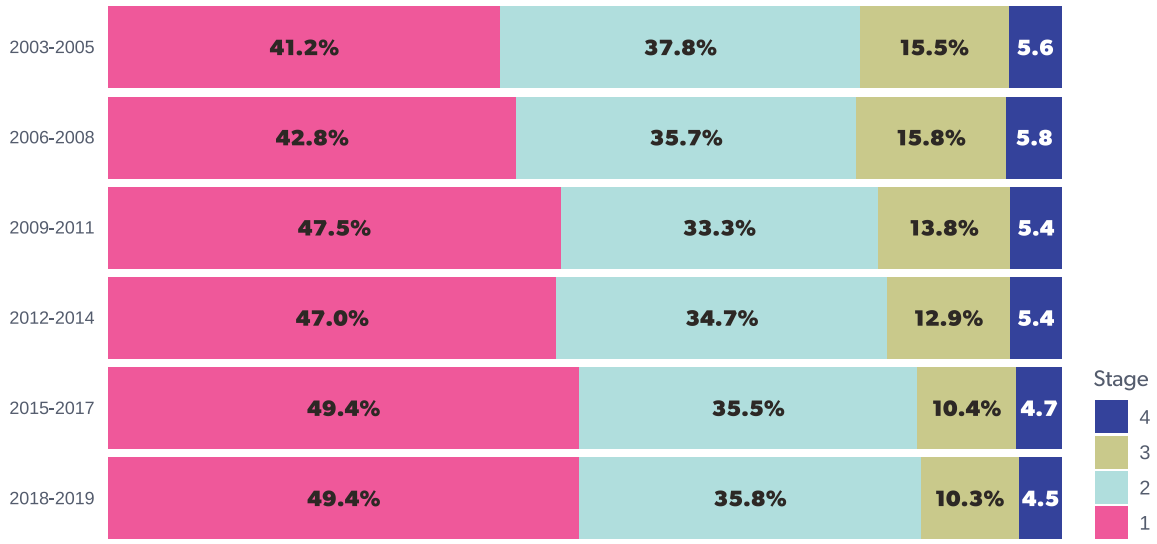
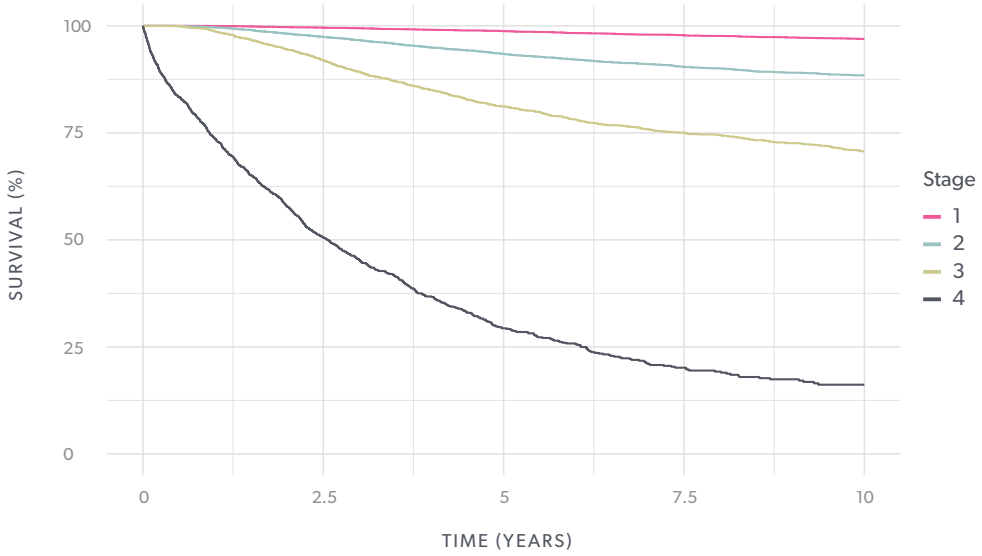


Fig. 5.2-13. *Changes in invasive tumour stage over time.*

The proportion of women diagnosed with stage 1 disease increased to nearly 50% by 2015-2017, whilst those diagnosed with stage 3 disease decreased over time (Figure 5.2-13). This data is also shown by ethnicity in Section 3.

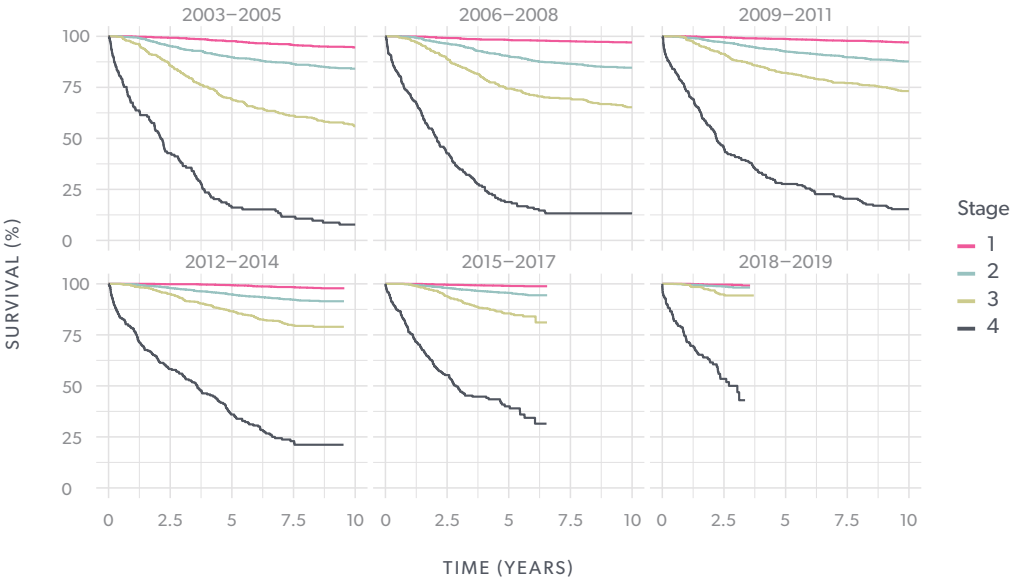
Survival by stage



STAGE	5-YEAR SURVIVAL	10-YEAR SURVIVAL
1	99% (99-99)	97% (97-97)
2	93% (93-94)	88% (88-89)
3	81% (80-83)	71% (69-73)
4	29% (27-32)	16% (13-19)

Fig. 5.2-14. *Breast cancer-specific survival by stage. Proportion of women surviving invasive breast cancer to 10 years by disease stage at diagnosis. Table: Proportion of women surviving to five and 10 years after a diagnosis (95% CI).*

The data shows that early stage tumours had good survival rates. Those with stage 1 disease showed 99% five-year and 97% 10-year survival (Figure 5.2-14). Of women diagnosed with stage 3 disease, 81% survived for 5 years, with 71% surviving to 10 years. New Zealand women with stage 4 tumours had 29% five-year and 16% 10-year survival rates; these numbers bear further investigation as they differ from other Register-based studies[6, 100].



STAGE	5-YEAR SURVIVAL	10-YEAR SURVIVAL
1		
2003-2005	98% (97-99)	95% (93-96)
2009-2011	99% (98-99)	97% (96-98)
2015-2017	99% (99-99)	
2		
2003-2005	90% (88-92)	84% (82-87)
2009-2011	93% (91-94)	88% (86-89)
2015-2017	96% (95-97)	
3		
2003-2005	69% (65%-74)	56% (51-61)
2009-2011	82% (79-85)	73% (70-77)
2015-2017	86% (82-89)	
4		
2003-2005	16% (11-24)	7.7% (4.1-15)
2009-2011	28% (22-34)	15% (11-21)
2015-2017	40% (34-47)	

Fig. 5.2-15. *Breast cancer-specific survival by stage by year of diagnosis. The proportion of women surviving invasive breast cancer to 10 years by year of diagnosis, shown by disease stage at diagnosis. Table: Proportion of women surviving to five and 10 years (95% CI).*

Over time, five-year survival improved for women with stage 2 and 3 diagnoses (Figure 5.2-15), but there is wide variation between stage 1 and higher stages. Women with stage 1 cancers had 99% five-year and 97% 10-year survival, compared with 86% and 73% for women with stage 3 cancers (Figure 5.2-15). Five-year survival greatly improved since 2003-2005 for women with stage 3 cancer.

Ten-year survival has not changed for women with stage 1 and 2 cancers (confidence intervals overlap). However, 10-year survival rates for women with stage 3 disease have increased from 56% for those diagnosed in 2003-2005 to 73% for those diagnosed in 2009-2011. For women with stage 4 disease, their five-year survival rate appeared to increase from 16% (2003-2005 diagnosis) to 40% (2015-2017 diagnosis). However, this increase differs from that reported in other recent studies of the Register [6, 100] and confidence intervals between cohorts overlap. There is no difference in 10-year survival over time for women with stage 4 diagnosis (confidence intervals overlap) (Figure 5.2-15).

6. Treatment: Surgery and Radiation Therapy

6.1 Surgery

In brief

- The median time to surgery increased over time, with the percentage of surgeries performed within 31 days substantially decreasing (from 55.7% to 36.8%). Local reports and international studies suggest that the Covid-19 pandemic will exacerbate this situation. Studies show that delays to surgery have an impact on survival for some patients.
- The rate of axillary node dissection decreased substantially over time (<20% of women by 2019), in line with best practice.
- Breast-conserving surgery (BCS) increased in proportion to mastectomy, but at a lower rate than might be expected. The overall proportion of breast-conserving surgerywas lower than it should be, given that many of the traditional contraindications can be mitigated by oncoplastic BCS techniques.
- 20% of patients who had breast-conserving surgery required a re-excision or completion mastectomy. This is comparable with other countries (and better than some), but still represents an opportunity for improvement, given the distress this causes patients and the additional health system resources required.
- Radiation therapy after breast-conserving surgery was delivered as expected, with only a small number of patients declining this treatment.

Surgery – either breast-conserving surgery (BCS) or mastectomy – is the first cancer treatment for most people with breast cancer in Aotearoa New Zealand.

Of the invasive breast cancer cases in Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register, 8.8% did not have surgery. These are likely to be predominantly women with *de novo* metastatic breast cancer, for whom surgery does not typically offer a survival advantage, or patients with inoperable stage 3 cancers (the increase in neoadjuvant therapy will likely have reduced the number of inoperable cancers in recent years). Surgery is occasionally omitted in elderly women whose comorbidities mean the risks of surgery may outweigh the benefit, and there is a small number of people who decline all treatment.

6.1.1 Time to surgery

Time to surgery is an important measure of cancer service quality:

- It can potentially identify ethnic inequalities in timely access to treatment.
- The time between a cancer diagnosis and treatment is stressful, even traumatic, for patients and whānau. Patients view their condition as urgent; timely treatment can reduce uncertainty and anxiety.
- Delays to surgery can increase risk of cancer progression, and ultimately can affect survival.

Current use of time to surgery measures in New Zealand

"Time from diagnosis to surgery" and "time from diagnosis to decision-to-treat to surgery" are New Zealand Quality Performance Indicators (QPIs) for bowel and prostate cancer respectively. While QPIs for breast cancer had not been published at the time of writing, time to surgery can be regarded as an important measure, given that surgery is currently the primary cancer treatment for most breast cancer patients.

The Ministry of Health's Faster Cancer Treatment (FCT) indicators, introduced in 2012 with the expectation that DHBs should meet these targets for 90% of patients by June 2017 [54], include two indicators for time to first treatment.

31-day indicator – patients with a confirmed cancer diagnosis receive their first cancer treatment (or other management) within 31 days of a decision to treat.

DHBs report to the Ministry on this indicator; however their performance is not routinely published. Decision to treat data has been collected in the Register since 2018. Although it is an optional field, it is 90% complete.

62-day indicator – patients referred urgently with a high suspicion of cancer receive their first treatment (or other management) within 62 days of the referral being received by the hospital.

While DHB performance against this indicator is published, it has limitations as a source of accessible data for breast cancer, as performance is not routinely published by tumour stream. Across all cancers, 10 DHBs met this target for at least 90% of patients in the first quarter of 2020-21. Twelve DHBs met it in the second quarter and three in the third quarter.

A major limitation of this measure is that it only measures patients referred on high suspicion of cancer. A large minority (one DHB anecdotally reported 30%) of patients diagnosed with breast cancer after symptomatic referral are referred with less than a high suspicion; timeliness of treatment for these patients is not captured by the FCT indicator. This indicator also does not capture time to treatment for people diagnosed via breast screening. It is estimated that only about 20% of breast cancer patients are captured by the 62-day indicator, meaning it gives little insight into the experience of most patients.

Time to surgery analysis in this report

This report investigates trends in time from date of diagnosis to date of surgery. While this has some limitations (for example, delays due to requirement for additional imaging or availability of reconstruction are not recorded), almost all patients in the Register have this date recorded, giving a clear picture of how time to surgery has changed over time. It also allows comparison with international data.

The report also presents the available data on time from decision to treat to surgery from 2018-2020.

Note that women receiving any neoadjuvant treatment (radiation, hormone therapy, chemotherapy or targeted therapy prior to surgery) have been omitted from this analysis.

Time to surgery in the public hospital system

Delays in cancer treatment are an issue in public health systems worldwide, and Aotearoa New Zealand is no exception to this. Data in the Register showed that time to surgery from diagnosis steadily increased over time.

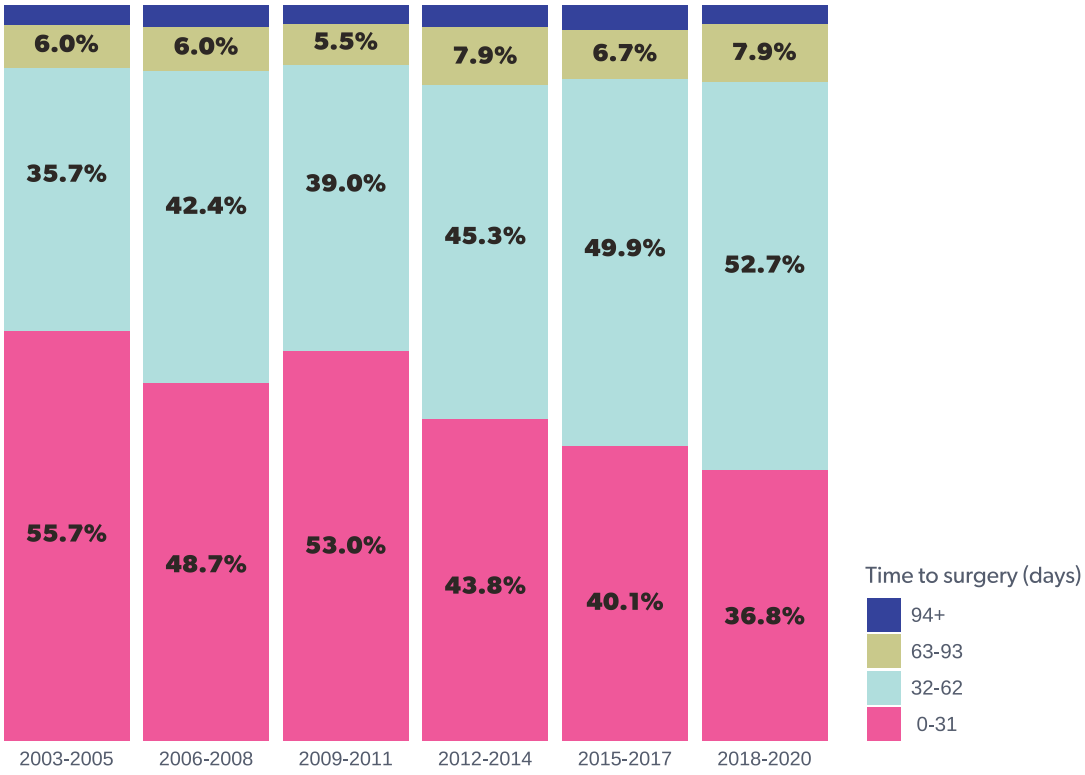


Fig. 6.1-1. *Time to public hospital surgery for invasive breast cancer, by year of diagnosis.*

Of women who received their treatment in a public hospital, the proportion having surgery within 31 days of their date of diagnosis decreased over time. In 2003-2005, just over half of patients (55.7%) had surgery within 31 days of diagnosis. By 2018-2020, that had dropped to only one third (36.8%) (Figure 6.1-1).

In 2018-19, 88% of New Zealand women in the Register had their surgery with 62 days of diagnosis. In comparison, in Australia in 2019-2020, 90% of patients with a principal diagnosis of breast cancer were admitted for surgery within 29 days of diagnosis (and 50% were admitted within 14 days) [55].

Tarirai, Northland, diagnosed at 40:

"I was diagnosed with DCIS in the first week of February after finding a lump, and given a surgery date of 19 March. I was counting down every single day for my mastectomy, desperate to get this thing out of me. Then Covid happened and five days before my surgery, I was told all operations were cancelled. I didn't cry when I found out I had breast cancer, but I broke down when they told me this. It ended up being delayed by a month and it was an agonising wait. Afterwards, I learnt they'd found invasive cancer. If I'd been delayed any longer, who knows what the outcome would have been?"

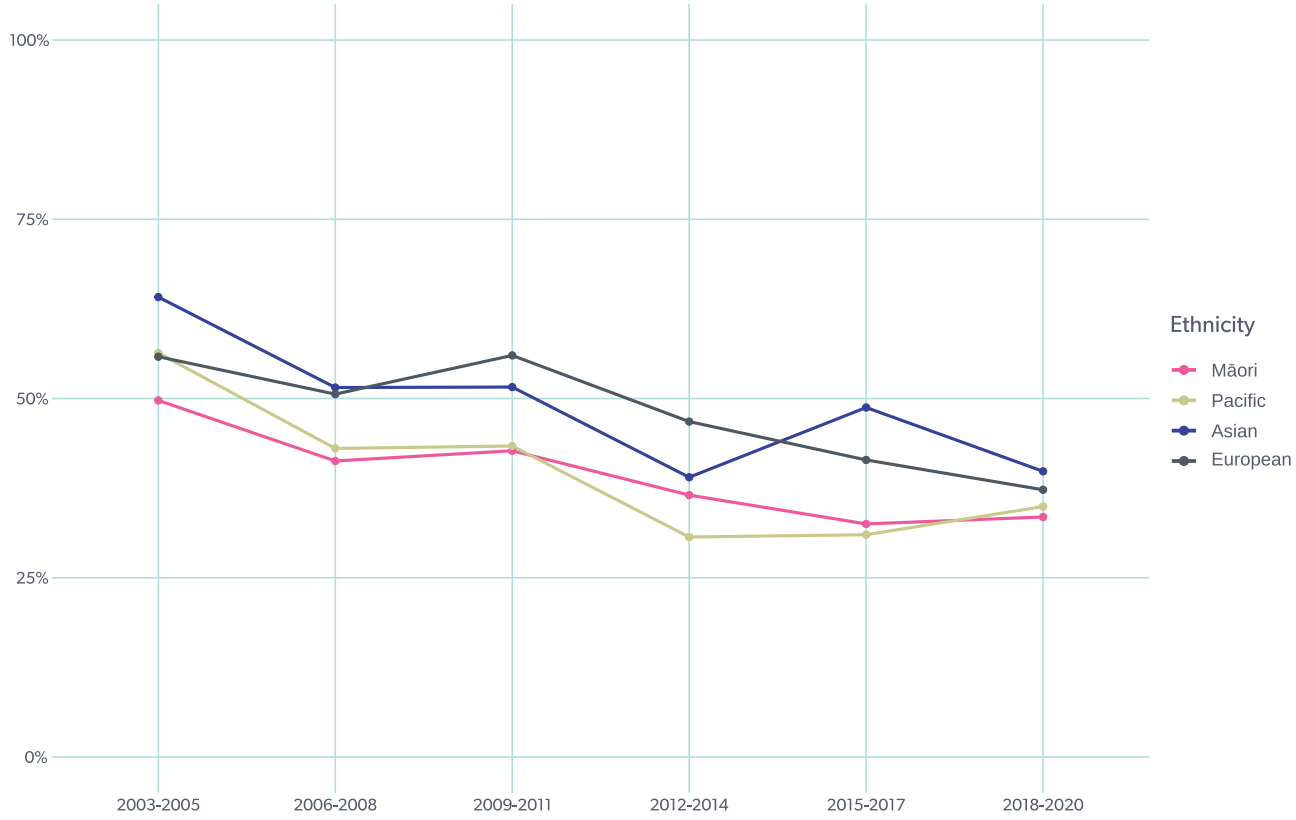


Fig. 6.1-2. *Public hospital surgery for invasive breast cancer within 31 days of diagnosis by ethnicity, by year of diagnosis.*

Time to surgery has increased for all ethnicities, with Pacific and Māori patients least likely to have surgery with 31 days (Figure 6.1-2).

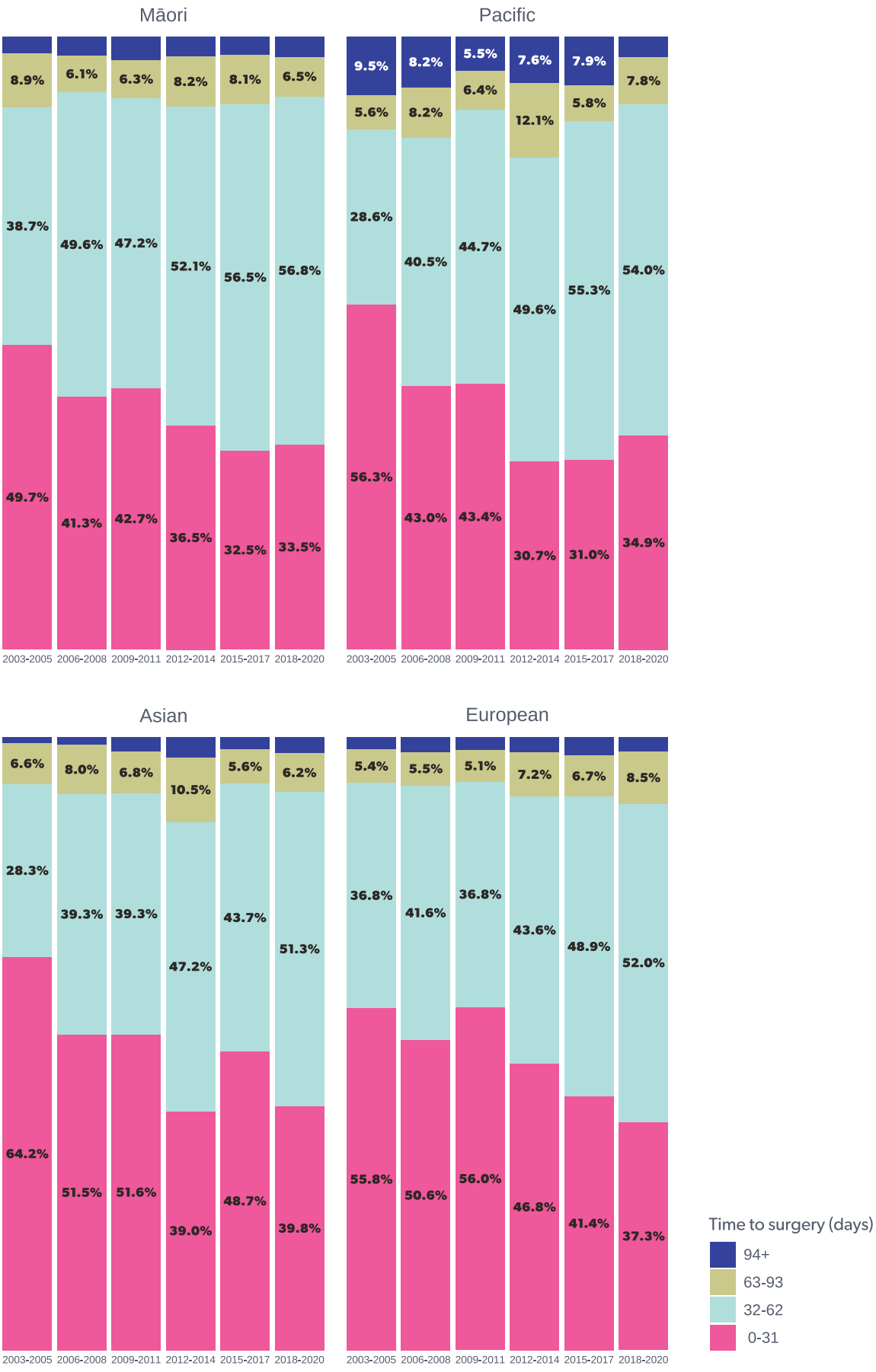


Fig. 6.1-3. *Time to surgery for invasive breast cancer in the public hospital system over time by ethnicity.*

In 2003-2005, 49.7% of wāhine Māori had surgery within 31 days; this had dropped to 33.5% in 2018-2020 (Figure 6.1-3). For Pacific women, surgery within 31 days decreased from 56.3% for those diagnosed in 2003-2005 to 34.9% for those diagnosed in 2018-2020.

In 2018-20, 39.8% of Asian women had surgery within 31 days, as did 37.3% of European women (Figure 6.1-3)

In 2018-2020, the median time to surgery from date of diagnosis was 35 days for Asian women, and 36 days for wāhine Māori, Pacific and European women.

Surgery within 31 days by region

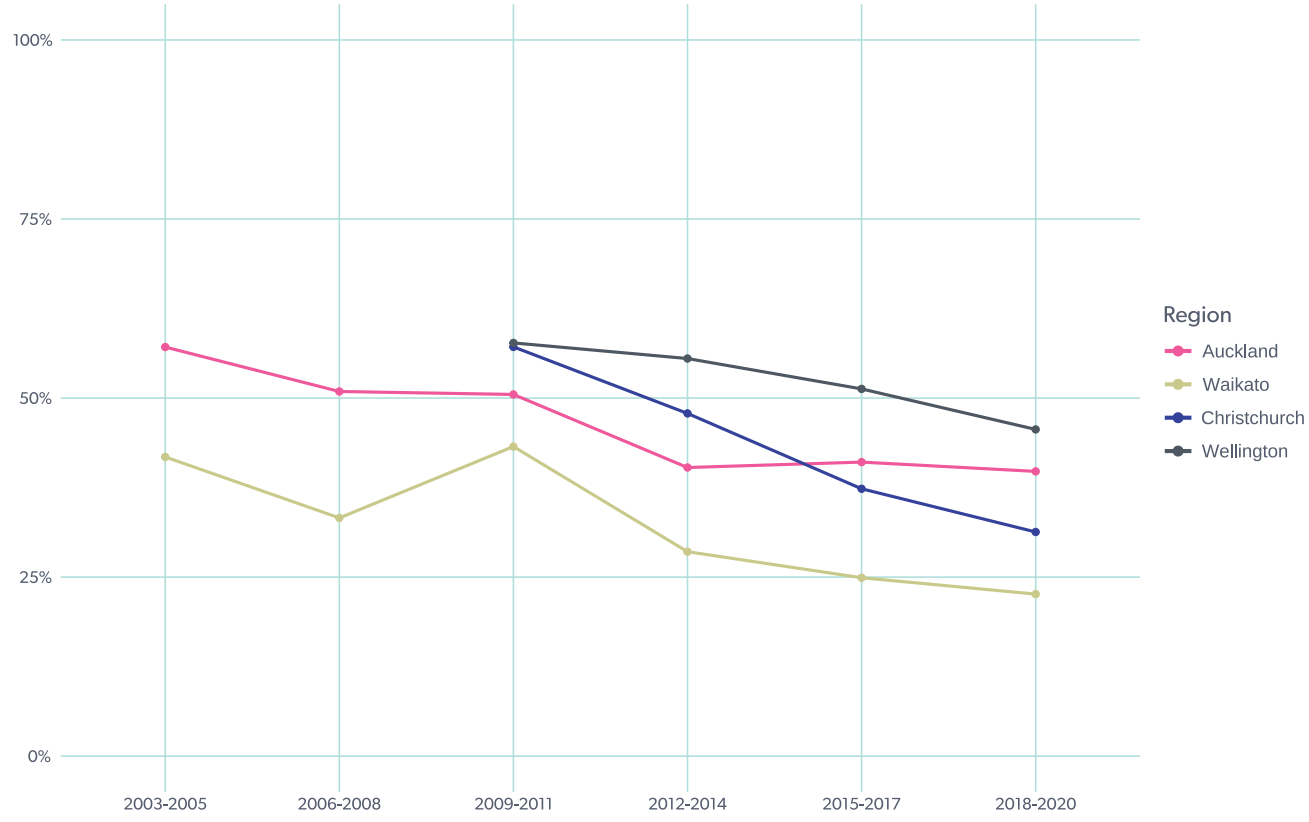


Fig. 6.1-4. *Percentage of patients having surgery for invasive breast cancer within 31 days of diagnosis, by region, by year of diagnosis.*

Analysis of the proportion of women with breast cancer having surgery within 31 days of diagnosis by region showed that the increasing time to surgery has been consistent across all regions, although this may have levelled off in Auckland (Fig 6.1-4).

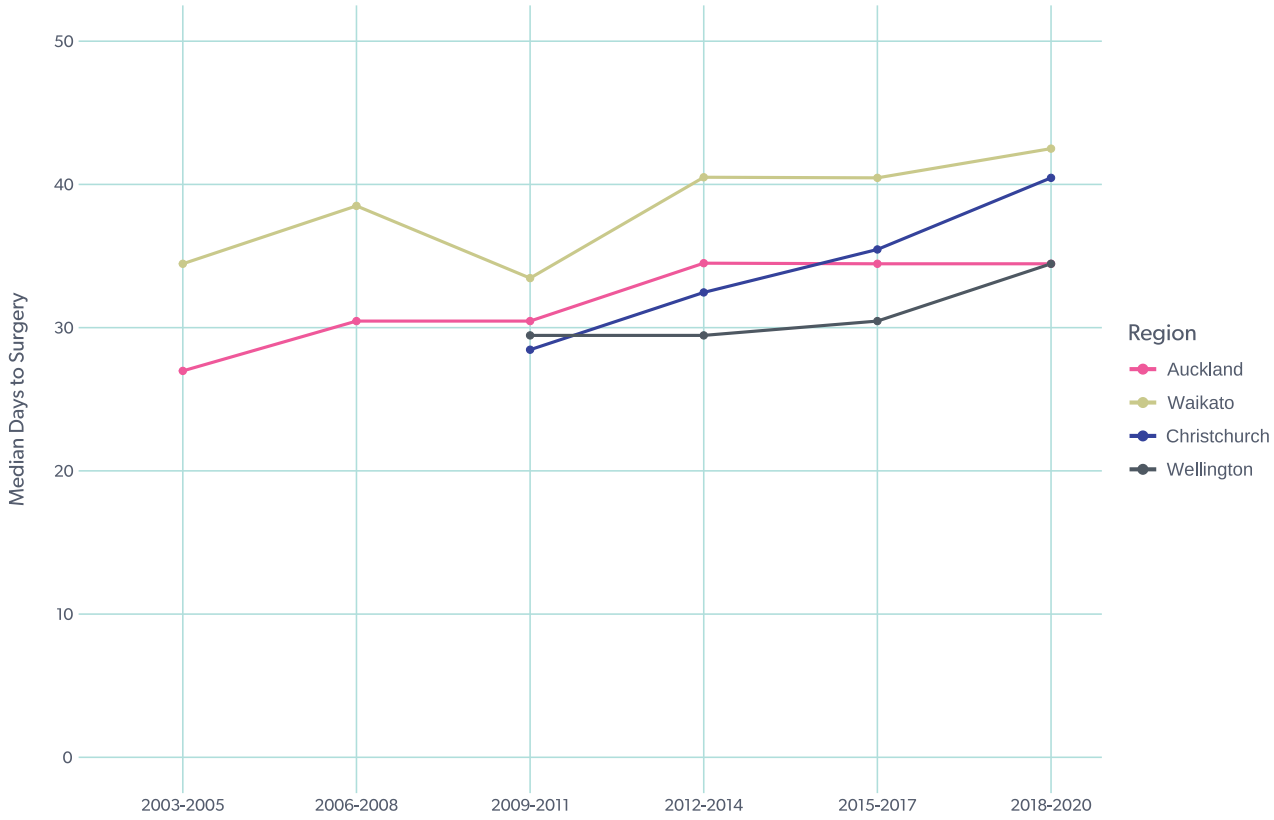


Fig. 6.1-5. *Median time to public hospital surgery for invasive breast cancer by region, by year of diagnosis.*

For women diagnosed in Auckland and Waikato in 2003-2005, the median time to surgery from date of diagnosis was 26.5 and 34.5 days respectively (Figure 6.1-5). By 2018-2020, this was 33.5 and 42.5 days. In Christchurch and Wellington, women diagnosed in 2009-2011 (the earliest data recorded for those regions), waited a median of 27.5 and 28.5 days respectively for surgery after their date of diagnosis, but by 2018-2020, this was 40.5 and 33.5 days respectively.

Time to surgery by date of decision to treat

Date of decision to treat has been recorded in the Register since 2018, and data is 90% complete for 2018-2020. Achievement of the 31-day indicator target of 90% of patients receiving their surgery with 31 days of decision to treat varied by region from 43% to 86% (not shown). However, the definition of decision to treat also varied widely by region, and can be set at a point long after diagnosis yet within a couple of weeks of planned surgery. Due to the short data collection period and wide variation in definition, we do not believe this data provides useful insights for this report.

Nonetheless, as a possible point of comparison, in England in 2019-20, 97.3% of breast cancers were treated within the targeted One Month Wait from a Decision to Treat to a First Treatment for Cancer [56], down from 98.9% in 2009-10 (the first year of national data collection) [57].

Reasons for increasing time to surgery

We suggest that reasons for increasing time to surgery could be clinical, demographic or resource-related.

Likely reasons for increasing delay to surgery include: increasing use of breast MRI scans and other specialist imaging as part of workup; increasing use of breast reconstruction with the need for additional

specialist consultations and operating theatre time; waits for genetic testing in some women; and a shortage of surgeons, anaesthetists and operating theatre resource.

Regarding preoperative imaging, national tracking is not currently performed for the timeliness of radiology procedures for cancer, but Te Aho o Te Kahu has acknowledged that access to imaging is a key issue in cancer treatment [36]. However, any trend of increased use of imaging might also be expected to be occurring in Australia, yet Australia has not experienced a large decline in time to surgery.

The number of women who had immediate reconstruction was small (see Figure 6.1-19) and barely changed from 2003-05 (15.5%) to 2018-19 (17%) (see Table 11.2-2); it is hard to quantify the extent to which waiting for immediate reconstruction is a major factor in the increasing time to surgery. Anecdotally, there is increased use of free-flap type reconstructions, which require specialist microvascular surgeons and extensive theatre time.

Demographic and resource factors may be closely intertwined as factors in increased time to surgery. The aging population not only means more breast cancer diagnoses, but also greater incidence of other cancers and other age-related conditions requiring imaging and surgery and therefore requiring access to radiology teams and equipment, operating theatres, anaesthetist and nursing resources.

Anecdotally, surgeons report insufficient access to operating rooms (ORs), often at short notice, leading to cancellation or postponement of operating lists. Issues of OR availability are compounded by documented shortages of anaesthetists and OR nurses, and other efficiency issues [58].

It is not only the patients who are aging: New Zealand's aging cancer workforce is an issue, with nearly 30% of general surgeons aged 60 and over in 2019-20 [36]. Fewer than 15% are aged under 40; this may imply a declining number of breast and general surgeons available to perform the increasing number of breast cancer surgeries required.

It seems likely that constrained resources and increasing demand are the main cause of delays to surgery.

Impact of delayed time to surgery

In a resource-constrained environment, breast clinics are likely to need to triage patients for surgery based on prognostic factors such as tumour size, grade and receptor status, and patient factors such as age. A question of deep importance to patients is, what is the impact of increased time to surgery on breast cancer survival? Despite a general sense that short delays are unlikely to affect outcomes for most patients, there has not been a great deal of evidence around the impact of treatment delays.

A recent meta-analysis casts some light on this question. Hanna et al concluded that each four-week delay in breast cancer surgery carried a mortality risk of 1.08, and that an eight-week delay in breast cancer surgery would increase the relative risk of death by 17%, and a 12-week delay by 26% [59]. To put that in terms of absolute risk, if a woman's risk of death without surgical delay was 10%, her risk would increase to 11.7% with an eight-week delay, and 12.6% with a 12-week delay. The authors suggest these findings are more applicable to policy-setting and planning, rather than to predict risk for individual patients, and that minimising system-level delays and improving time to treatment could translate to gains in survival.

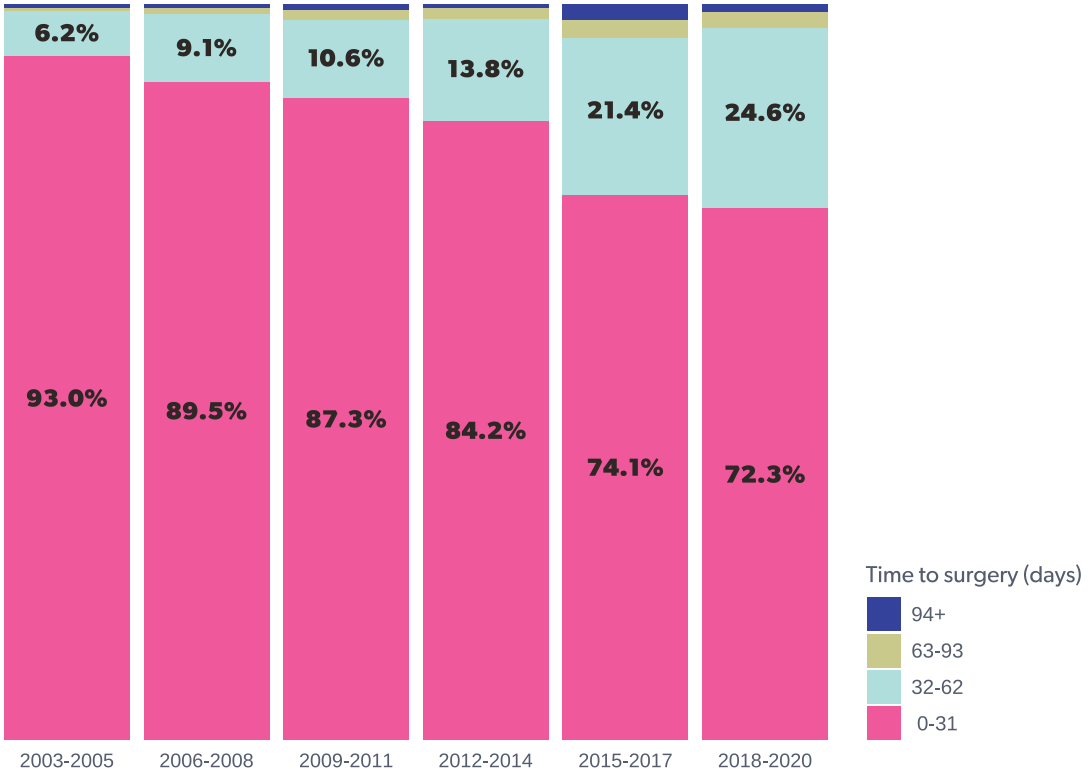
Private hospital surgery

Private hospital surgery is overwhelmingly the domain of European patients: 32% of them opted for private breast cancer surgery, and they represent 85% of all private breast cancer surgeries in the Register not shown.

Until 2016, fewer than 20 Māori patients a year had private breast cancer surgery, and numbers are still below 30 per year. Pacific patients having private surgery are in single digits most years. Among Asian patients, uptake of private surgery was 27%.

Christchurch has the highest ratio of private to public surgeries: 32% of breast cancer surgeries in Christchurch are private, compared with 29% in Auckland and 26% in Waikato. Less data is available for Wellington, but from 2015-2020, 16% of surgeries in the region were private.

Time to surgery for private patients



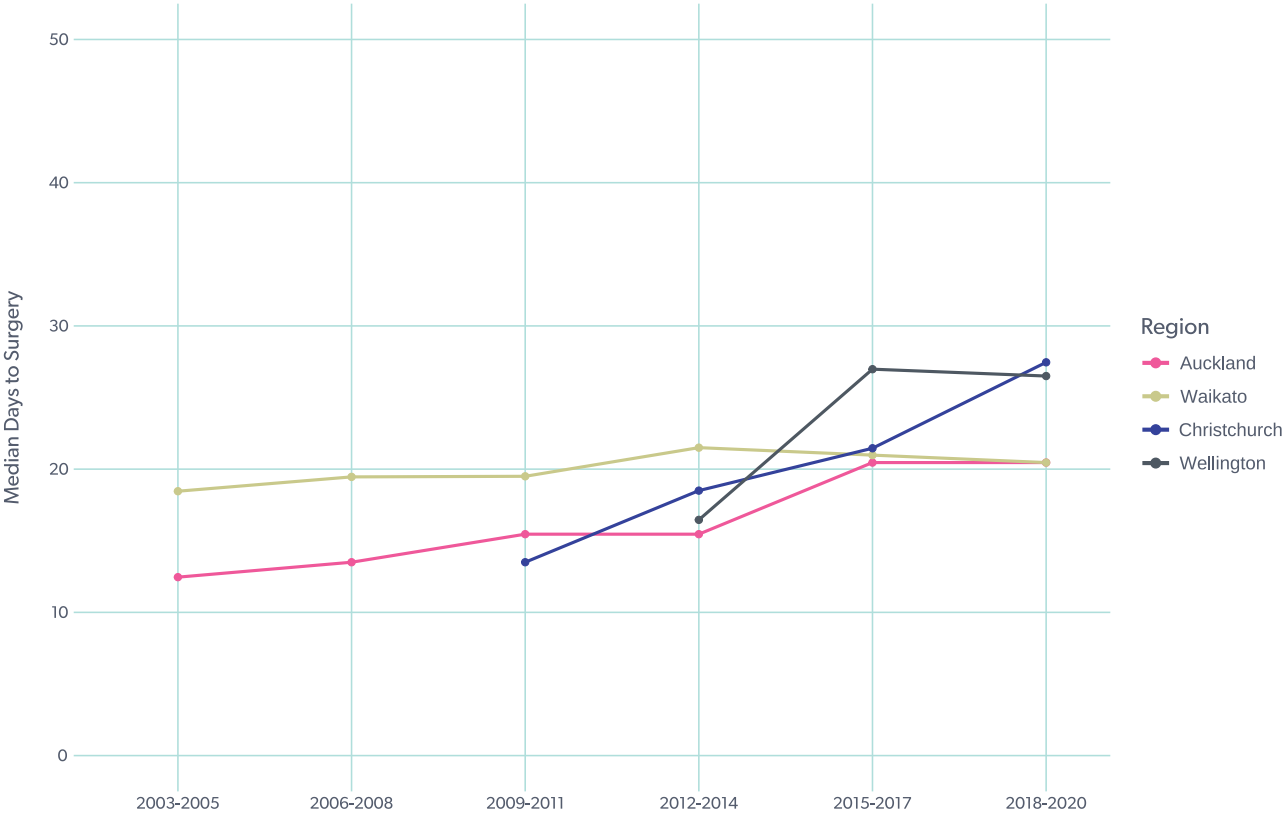


Fig. 6.1-6. *Time to surgery for invasive breast cancer from date of diagnosis, for women treated in the private health system. a) time to surgery over time, by year of diagnosis, and b) median time to surgery by region, by year of diagnosis.*

Although the median times to surgery from date of diagnosis are shorter for women treated in private hospitals than in the public health system, the private sector has not been immune to growing surgical lead-times. The proportion of women obtaining private surgical treatment within 31 days of their date of diagnosis has decreased from 93% in 2003-2005, to 72.3% in 2018-2020 (Figure 6.1-6). Consistent with this, the median time from diagnosis to surgery increased for all regions. In Auckland and Waikato for women diagnosed in 2003-2005, the median time from date of diagnosis to private surgery was 13 and 18.5 days respectively (Figure 6.1-6). By 2018-2020, it was 21 and 22 days respectively. For women diagnosed in Christchurch, in 2009-2011 the median time from date of diagnosis to surgery was 15 days, increasing to 28 days by 2018-2020. Wellington private surgery numbers are incomplete.

6.1.2 Type of surgery for women with invasive breast cancer

Surgery type over time

A number of factors influence the type of surgery a patient has for breast cancer. These include tumour size compared to breast volume, multi-focality, patient willingness or suitability for post-operative radiotherapy (which follows breast-conserving surgery), tumour features such as locally advanced tumours with skin or chest wall involvement, any genetic predispositions, and patient preference. The literature indicates that the most significant influence on type of surgery is the patient's surgeon. With modern oncoplastic techniques, many cases that were previously considered only appropriate for mastectomy, may now be offered breast conservation.

The combination of earlier detection (hence smaller tumours), better oncoplastic surgical techniques, and better and more accessible radiotherapy treatments have led to more women being suitable for breast-conserving surgery (BCS). Women who are suitable for breast-conserving surgery are usually offered the choice of breast-conserving surgery together with radiation therapy, or mastectomy. In the original randomised trials, there was no difference in survival whether women underwent breast-conserving surgery or mastectomy, although locoregional recurrence rates were higher with BCS. Over time, locoregional recurrence following breast-conserving surgery and RT have markedly decreased, and in many more recent observational studies, women undergoing breast-conserving surgery and RT appear to possibly do better than women having mastectomy (see below). Despite this, there are some women who prefer to have a mastectomy. Often this is based on fear of local recurrence (although local recurrence rates are very low with modern breast-conserving surgery and radiotherapy), or because of advice from a friend or relative.

Some international studies suggest the number of women having "unnecessary" mastectomy is increasing. One study of 1.2 million women treated for breast cancer found that, among women eligible for BCS, the odds of mastectomy increased 34% from 2003 to 2011. Rates of increase were greatest in women with low-risk breast cancers (clinically node-negative disease and *in situ* disease). Rates of bilateral mastectomy for unilateral disease increased from 1.9% in 1998 to 11.2% in 2011 [60].

However, the overall trend observed in Aotearoa New Zealand (Figure 6.1-7) and elsewhere is a decline in mastectomy rates.

Lynette, Waikato, diagnosed at 51:

"I had my breast removed instead of just the lump because travelling to Auckland for radiation five days a week for five weeks made me feel uneasy, and mentally, I felt I couldn't do this. I asked if I was being dramatic by choosing a mastectomy and my doctors were very kind – they reassured me there was no right or wrong option. I'm happy with my choice but that doesn't mean it's the right decision for everyone – understand your options, the side effects and recovery time for both."

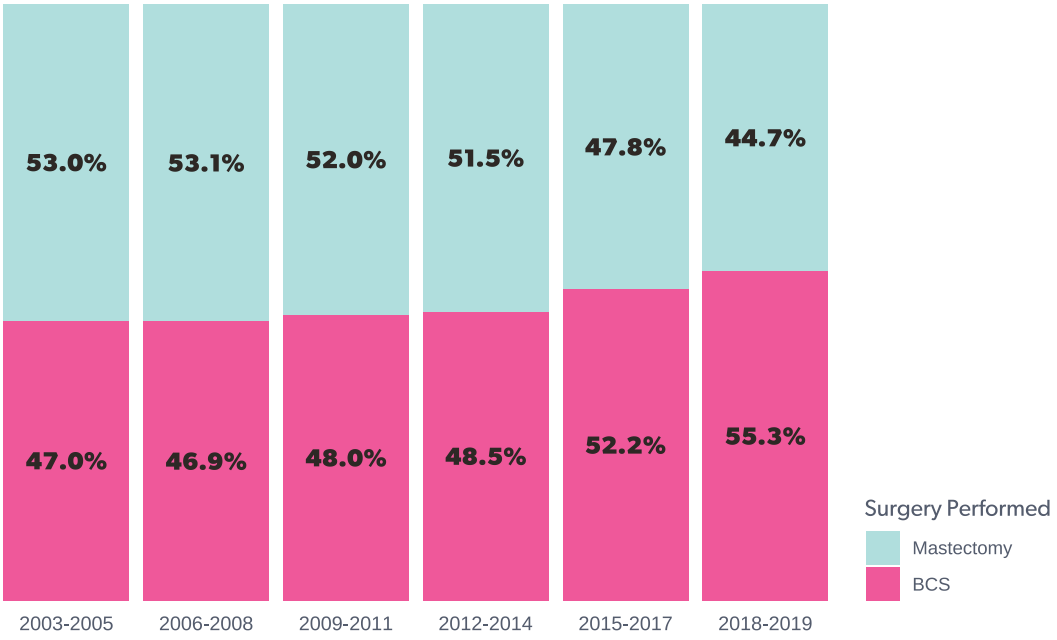


Fig. 6.1-7. *Surgery type over time. Proportion of women having breast-conserving surgery (BCS) or mastectomy for invasive disease over time.*

In the Register, the overall proportion of women who had a mastectomy for invasive breast cancer decreased each year from 2008 (Figure 6.1-7). From 2003-2008, just over half (53%) of all surgeries for invasive breast cancer were mastectomies, but by 2018-2019 this had dropped to 44.7%.

This decrease in mastectomy rates has arguably been slower than it should be. An attempt to set an "ideal breast conservation rate" suggested a target of 70%, noting that many of the traditional contraindications for breast-conserving surgery can be mitigated, for example by neoadjuvant chemotherapy or oncoplastic techniques [61]. That overall recommendation aligns with the ESMO clinical guidelines for early (stage 1-3 operable) breast cancer, which suggest 60-80% of newly diagnosed breast cancers are amenable to breast-conserving surgery, and that breast-conserving surgery should be the preferred treatment option for most patients [62].

Examples of high rates of breast conservation (and low rates of mastectomy) include a European study that analysed patterns of surgery in patients with stage 1 or 2 breast cancer. From 2005 to 2010, adjusted mastectomy rates experienced a progressive reduction of 4.24% per year down to a rate of 13.1% in 2010 [63].

In the US, a study of more than 1.2 million patients diagnosed from 1998 to 2011 with stage 1-3a breast cancer showed that 35.5% underwent mastectomy [60]. However, another large study, of 200,000 women diagnosed with invasive breast cancer or DCIS from 2005-2016, found that while mastectomy rates had decreased, they were still too high at 49% [64].

In 2018, the overall proportion of breast-conserving surgery reported by BreastSurgANZ members was 63.9% for Australian surgeons, and 56.7% for New Zealand surgeons [80].

The Register data suggests the rate of breast-conserving surgery in Aotearoa New Zealand has been lower than ideal. With growing expertise in oncoplastic techniques, and increasing use of neoadjuvant chemotherapy, we expect breast-conserving surgery rates will increase in the future. In the Register, the rate of breast conserving surgery varied by ethnicity, region and age. The analysis by ethnicity is shown in Section 3 and in Table 6.1-1 on the following page. The proportion of women having breast conserving surgery by region and age of diagnosis is shown on the following page.

	Māori (N= 2476)	Pacific (N= 1484)	Asian (N= 2053)	European (N= 17279)
Surgery Performed				
BCS	1,166 (47.1%)	588 (39.6%)	850 (41.4%)	9,055 (52.4%)
Mastectomy	1,310 (53.9%)	896 (60.4%)	1,203 (58.6%)	8,224 (47.6%)

Table 6.1-1. *Type for surgery for invasive breast cancer by ethnicity, 2003-2019*

Fig. 6.1-8. *Surgery type over time by region. Proportion of women having breast-conserving surgery (BCS) or mastectomy for invasive disease over time, by each region.*

The proportion of women having mastectomies decreased over time for all regions. The decrease was minimal in Auckland (3.6%) and Christchurch (2.9%), but marked in Waikato and Wellington, where mastectomies decreased by almost 20%; in both regions, around one-third of patients had mastectomies in 2018-19, compared to around half of patients in Auckland and Christchurch.

Surgery type by age

Fig. 6.1-9. *Surgery type over time by age. Proportion of women having breast-conserving surgery (BCS) or mastectomy for invasive disease over time, by age at diagnosis.*

Barbara, Northland, diagnosed at 49 and faced recurrence at 60:

"I chose to have a partial mastectomy the first time round, as I had been assured breast conserving surgery plus radiation would give the same outcome as a mastectomy. For me, that meant a smaller surgery to recover from, and I felt the radiation would get rid of anything that remained. With the recurrence, my medical team were divided in their opinion because of where the tumour was located. It was harder to make this decision without clearer direction from them, but I was 11 years older and living away from my usual home. So again, I opted for less invasive surgery as that was the right decision for me and my circumstances at the time."

The type of surgery for invasive breast cancer for women of different age groups changed over time and varied by age group. For women aged 45-69 years at diagnosis, the proportion having a mastectomy decreased from 46.1% to 39.1% between 2010-2019. For women diagnosed age 70 or upwards, the proportion of women having a mastectomy decreased from nearly two thirds (63.9%) to just over half (52.5%) over the same time. However, for women aged under 45 years at diagnosis, two thirds or more had a mastectomy for all years (Figure 6.1-9).

The lack of change in breast-conserving surgery rates for younger women likely reflects the average later stage at diagnosis in this group, the higher risk of local recurrence after BCS, and greater risk of genetic predisposition in younger women. Consensus guidelines for surgery for women <40 with early breast cancer recommend that while the surgical recommendation should be tailored to the individual patient, they should in general not differ from that of older patients, and that breast-conserving surgery should be performed as the first option whenever suitable [65].

Surgery type by tumour size

Breast tumour size relative to the size of the breast, is important, as this may influence the ability to obtain an acceptable cosmetic result with breast-conserving surgery. If this cannot be achieved due to the tumour being too large relative to the size of the breast, or multifocal, or in a difficult location, then a mastectomy will be recommended [66]. Decisions on surgery approach are made on clinical-radiological tumour size preoperatively; however, not uncommonly, imaging does not accurately reflect postoperative histopathological tumour size.

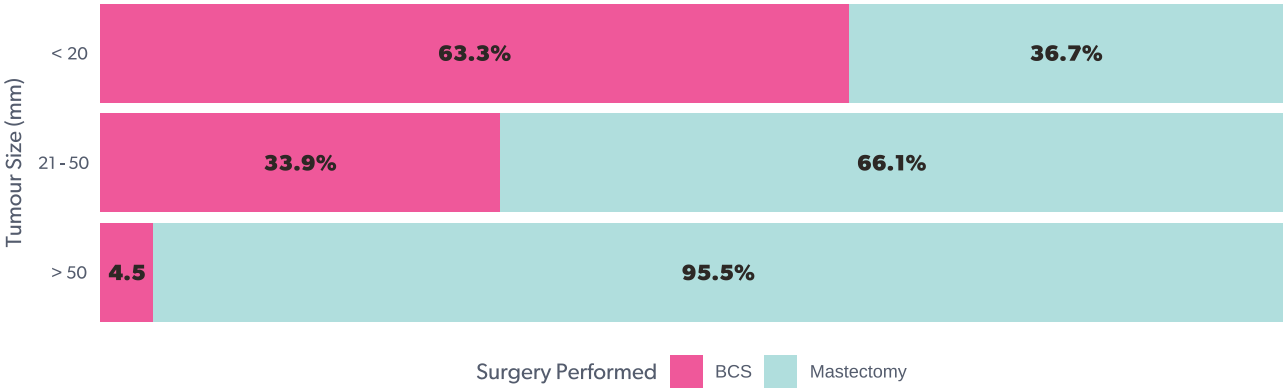


Fig. 6.1-10. *Surgery type by tumour size. Proportion of each type of breast surgery performed (breast-conserving surgery or mastectomy) by tumour size.*

Of women with breast tumours under 20mm, 63.3% had breast-conserving surgery. For women with breast tumours between 21-50mm, 66.1% had a mastectomy, with nearly all women with tumours larger than 50mm having a mastectomy (Figure 6.1-10).

Vivienne, Wellington, diagnosed at 68:

"Initially we talked about a lumpectomy but an MRI showed up two more lumps, so it was decided a mastectomy was the only real option. During my surgery some additional tumours were found so I had radiation afterwards as a safeguard. We discussed reconstruction but after looking into the options I decided to remain flat. I'm small-breasted anyway, so it wasn't a major issue to me. I've been really lucky in that with all of the treatment, I have come through really well."

6.1.3 Surgery for lymph node analysis

Sentinel lymph node biopsy

Regional lymph nodes are one of the first sites that a breast cancer may spread to, and knowledge of involvement is important as it helps to allocate the correct staging, determine the prognosis, and importantly, the need for additional treatment. Sentinel lymph node biopsy is a procedure that removes the first lymph nodes that the breast (and breast cancer) drain to, to determine if any cancer cells have spread beyond the tumour. This sentinel node status is largely accurate at predicting node status, and results in less morbidity, especially risk of lymphoedema or arm swelling compared with axillary node dissection (the operation recommended for many women who have proven nodal involvement). Sentinel node biopsy (SNB) is used for patients who are clinically and radiologically node-negative, that is, patients who have no palpable lymph node involvement and none seen on imaging.

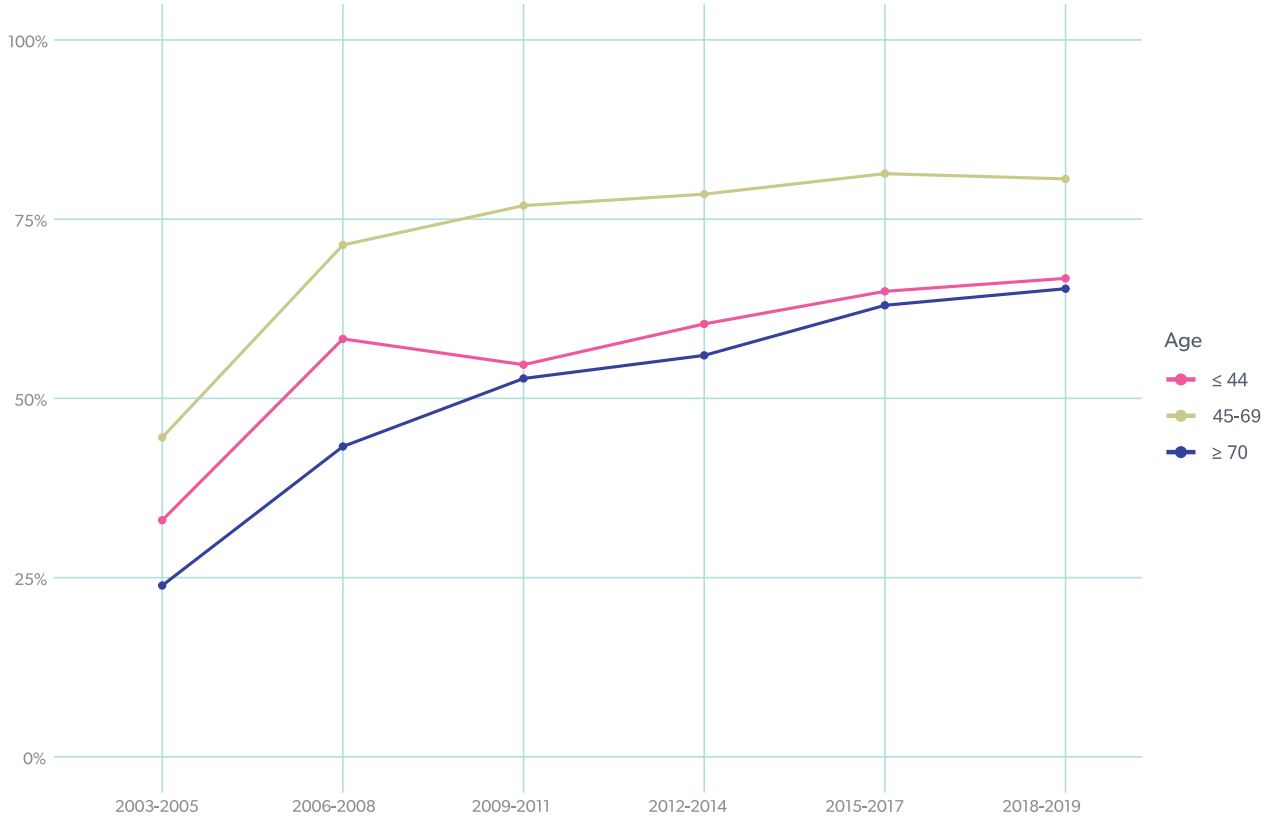


Fig. 6.1-11. *Sentinel node biopsy by age of diagnosis over time. Proportion of women who had surgery for invasive disease having a sentinel lymph node biopsy, analysed over time.*

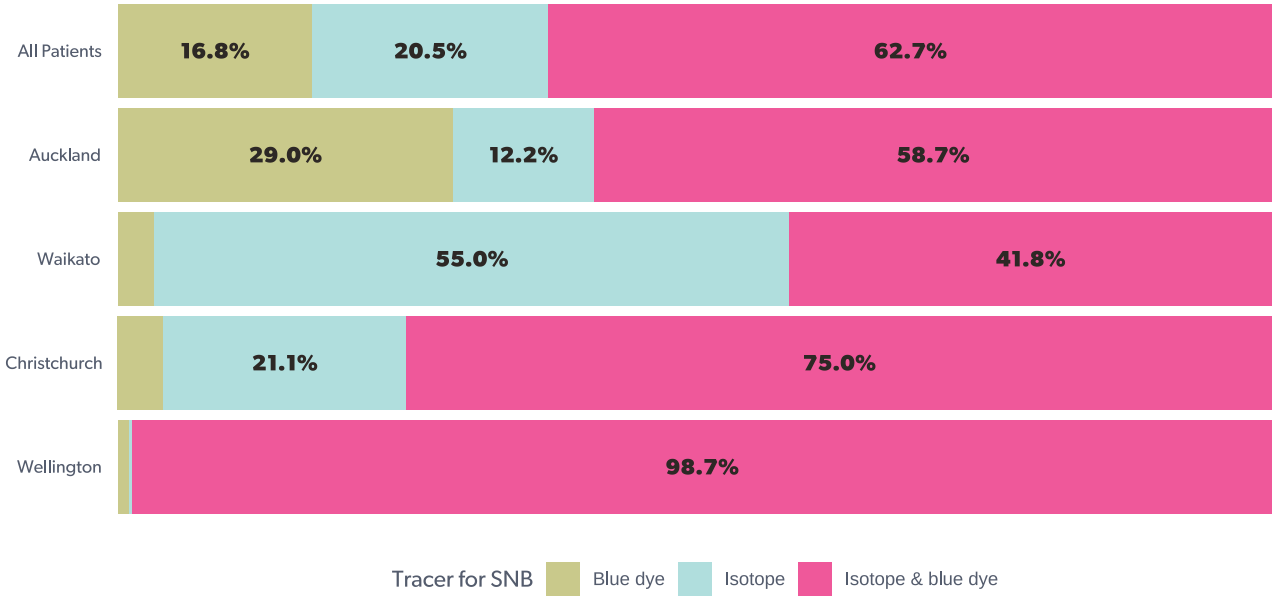
The proportion of women receiving sentinel lymph node biopsy has increased over time for women of all ages. The high rate of SNB in the screening age group (45-69) is likely to be because these women have a higher proportion of early stage, screen-detected cancer, with no clinically detectable lymph node involvement. Conversely, younger women (<45) are more likely to have node-positive disease detected on imaging or palpation, and there is cohort of older (70+) women that presents with later-stage disease as they are no longer participating in screening.

This analysis by age indicates that the most likely reason for not having SNB was because it was not necessary, as the patient had clinically or radiologically node-positive disease. SNB may also be omitted if there is a view that the risk of the procedure outweighs the benefit, for example, in some elderly or very frail patients, or occasionally because patients decline any nodal surgery.

Method of detection of sentinel nodes

Surgeons need to identify or locate the sentinel lymph node/s in order to excise them. This requires use of at least one tracer; the most common tracer technologies are radioactive isotope and blue dye. Each has its disadvantages: radio-isotope can only be used in centres with radiation storage facilities; blue dye can cause adverse reactions including anaphylaxis in up to 1% of patients.

The gold standard for sentinel node biopsy is in fact to use both of these technologies, a combination known as "dual tracer", to maximise the accuracy of sentinel node detection [67]. However, actual practice in Aotearoa New Zealand can vary by institutional or surgeon preference. The Register offers potential insight into the impact of this variation on the number of sentinel nodes detected and on survival.



Tracer for Sentinel Node Detection	Blue dye (N = 493)	Isotope (N = 503)	Isotope & blue dye (N = 1,735)
Number of Positive Sentinel Nodes			
1 node	360 (73%)	368 (73.2%)	1,242 (71.6%)
2 nodes	99 (20.1%)	92 (18.3%)	343 (19.8%)
3 nodes	22 (4.5%)	28 (5.6%)	88 (5.1%)
>3 nodes	12 (2.4%)	15 (3%)	62 (3.6%)

Fig. 6.1-12. *Tracer used for sentinel node biopsy. Analysis of method used to detect positive sentinel lymph nodes. a) methods used by region, and b) method used by the number of positive sentinel lymph nodes detected.*

Tracer use varied significantly by region, with blue dye alone being used in 29% of women in Auckland, isotope alone for 55% of women in Waikato, and Wellington predominantly using dual tracer (98.7%). (Figure 6.1-12). This is an area for further investigation.

Sentinel lymph node biopsy by ethnicity

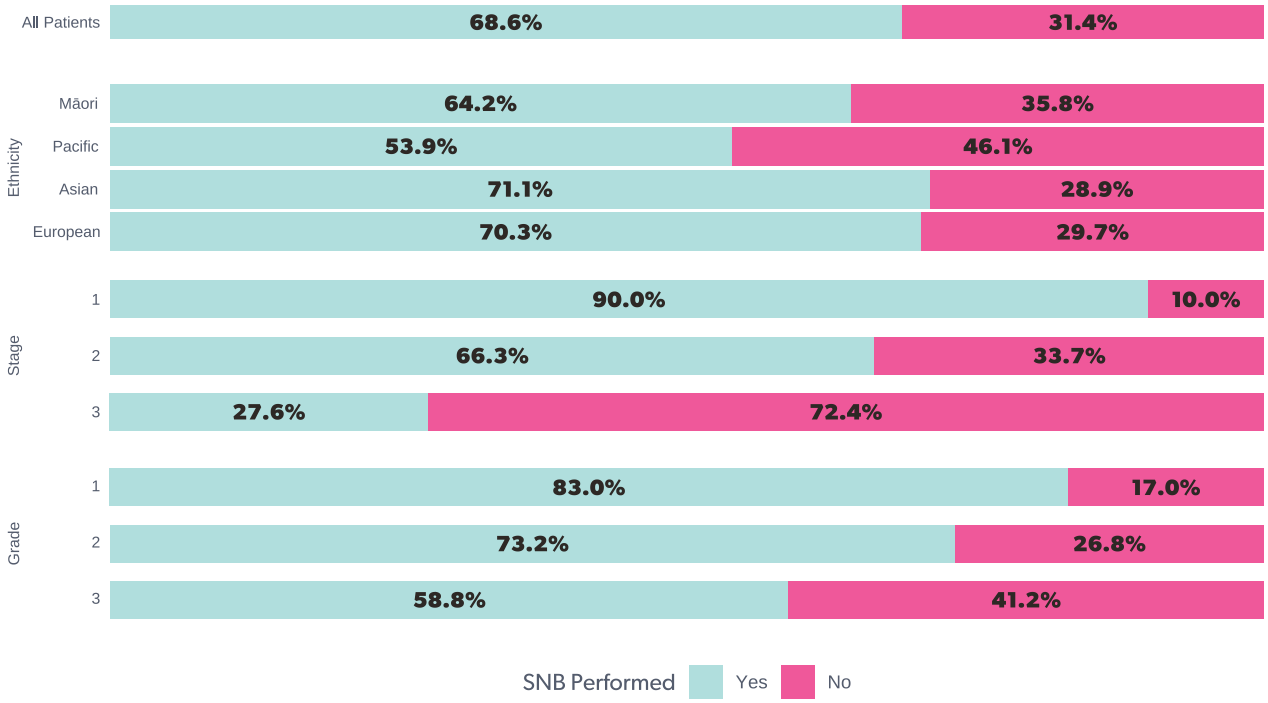


Fig. 6.1-13. *Sentinel lymph node biopsy by stage and grade. Proportion of women having sentinel lymph node biopsy by a) their ethnicity, b) their breast cancer stage of diagnosis, and c) their tumour grade.*

Māori had slightly fewer SNBs (64.2%) than Asian and European women (c. 70%), but only 53.9% of Pacific women had SNB. Most women with stage 1 disease (90%) had a sentinel lymph node biopsy (Figure 6.1-13), which is indicative of the fact that these women were less likely to have clinically or radiologically detectable lymph node disease. The rate of SNB decreased for women with stage 2 and 3 cancers, where lymph node metastases are more likely to be detected in clinic. Despite this, the distribution of positive nodes was very similar across all ethnicities, with 80% of women in each ethnicity having one or two positive nodes (Figure 6.1-14). Pacific women had the highest percentage of 3+ nodes, though numbers in all groups are similar.

	Māori (N = 1,569)	Pacific (N = 815)	Asian (N = 1,441)	European (N = 11,938)
Number of Positive Sentinel Nodes				
0 nodes	1,186 (75.6%)	618 (75.8%)	1,144 (79.4%)	9,456 (79.2%)
1 node	278 (17.7%)	135 (16.6%)	215 (14.9%)	1,798 (15.1%)
2 nodes	80 (5.1%)	43 (5.3%)	61 (4.2%)	475 (4%)
3 nodes	19 (1.2%)	8 (1%)	15 (1%)	121 (1%)
>3 nodes	6 (0.4%)	11 (1.3%)	6 (0.4%)	88 (0.7%)

Table 6.1-2. *Sentinel lymph node biopsy by ethnicity. Analysis of sentinel lymph node biopsy information by ethnicity the number of positive sentinel lymph nodes detected.*

Catherine, Waikato, diagnosed at 55:

"Cancer was found in nine out of the 18 lymph nodes I had removed. A few months after the axillary clearance, I had a lot of swelling around my left breast and I learnt I had lymphoedema. For the rest of my life, I'll need to wear compression garments and try to keep lymphoedema under control. It takes a lot of effort to stop it from getting out of hand. If I had unlimited funds, I would see my lymphoedema therapist every week."

Sentinel node biopsy after neoadjuvant chemotherapy

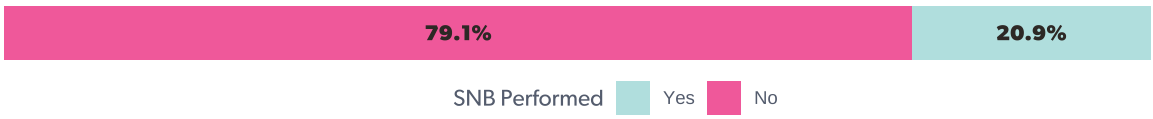


Fig. 6.1-14. *Sentinel lymph node biopsy after neoadjuvant chemotherapy. Proportion of women having sentinel lymph node biopsy after neoadjuvant chemotherapy.*

Approximately one fifth (20.9%) of women had a sentinel lymph node biopsy after their neoadjuvant chemotherapy treatment (Figure 6.1-14).

Axillary lymph node dissection

Axillary lymph node dissection (ALND) was the standard examination/treatment of the axilla for many years but has been increasingly replaced by sentinel node biopsy, which has a lower risk of side effects, including lymphoedema.

Axillary lymph node dissection is surgery to remove and examine lymph nodes in the armpit, with the goals of detecting, and removing any lymph nodes that cancer cells may have spread to. It is usually still recommended if there is known cancer spread to the lymph nodes at the time of the breast cancer surgery. Some patients will need ALND if the sentinel node biopsy shows cancer has spread to the lymph nodes, and this may occur either at the time of surgery or in a subsequent operation.

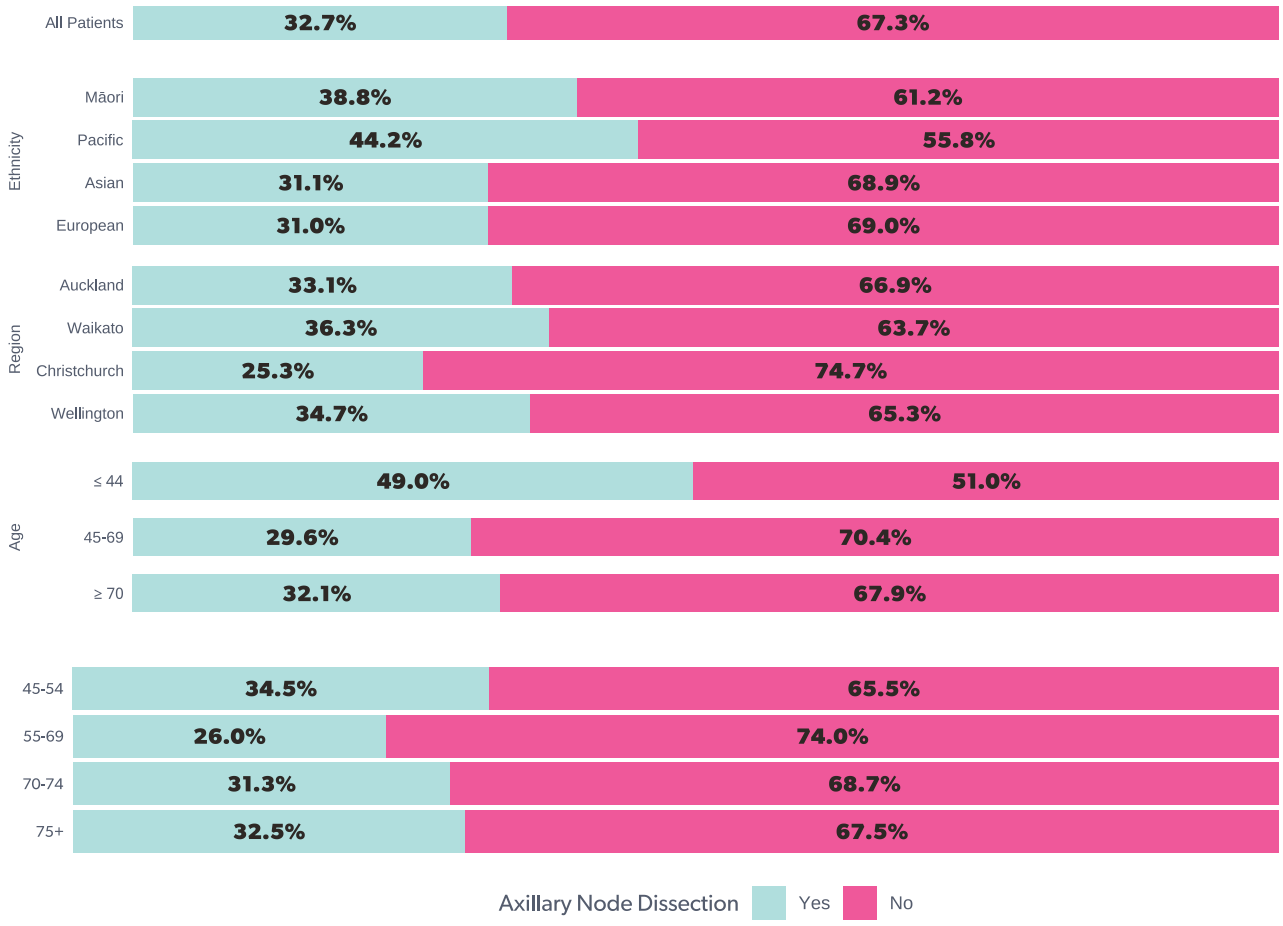


Fig. 6.1-15. *Use of axillary node dissection by ethnicity, region and age. Proportion of women have axillary lymph node dissection by ethnicity, region and age at diagnosis.*

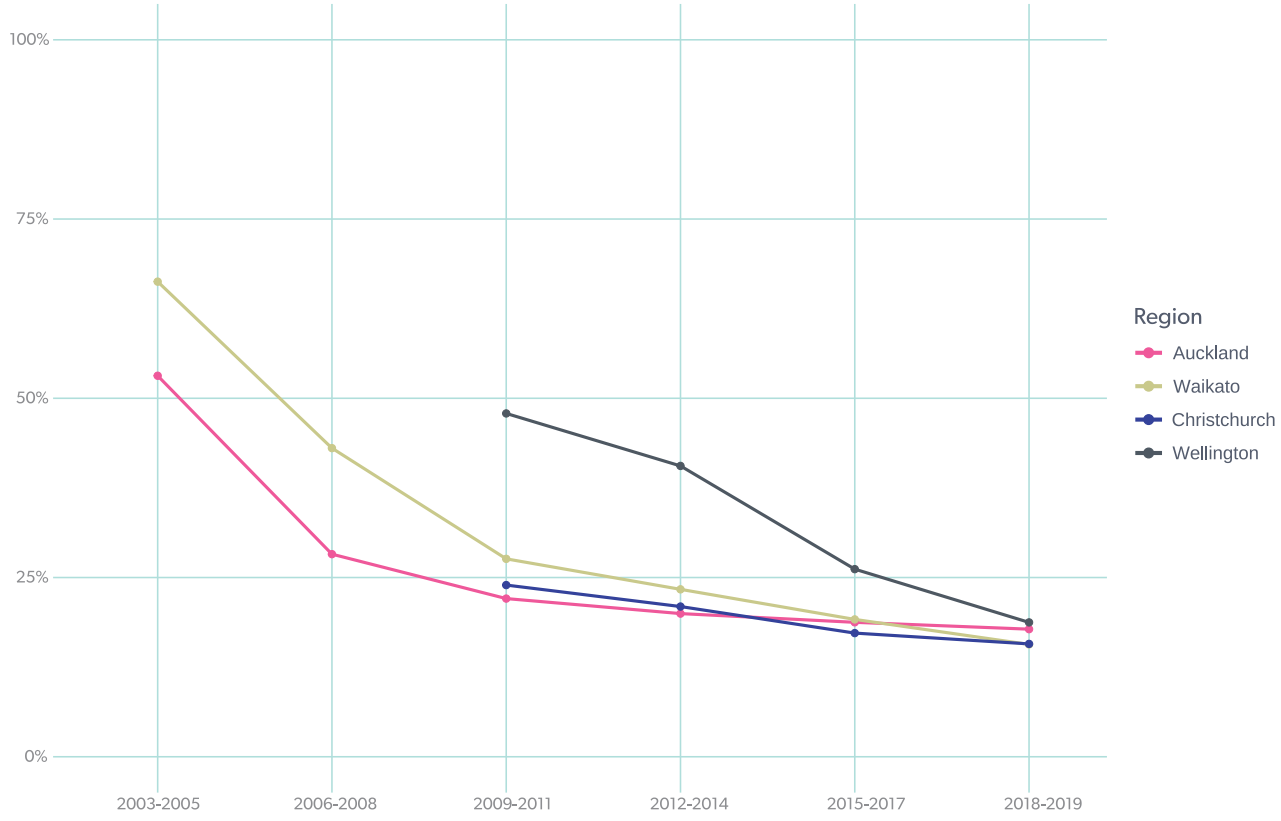


Fig. 6.1-16. *Use of axillary node dissection over time. Proportion of women have axillary lymph node dissection by region over time.*

The proportion of women who had axillary lymph node dissection (ALND) decreased continuously from 2003 to 2018-2019 across all regions, reflecting increased early stage detection and the increase in SNB use (Figure 6.1-16). The other reasons for less ALND are the AMAROS Trial showing that radiation therapy to the lymph nodes after a positive SNB gives just as good cancer control in appropriate cases, but with about half the risk of lymphoedema. Also, other studies have demonstrated that it may be safe to omit ALND in women with micrometastases (deposits of cancer cells greater than 0.2mm but not greater than 2mm in size) only in their sentinel nodes. Whether ALND may be omitted after the finding of macrometastases in 1 or 2 sentinel nodes remains controversial, with some groups accepting the American Z0011 Trial, which concluded no further surgery was necessary, and others having major concerns with the trial's methodology and conclusions, so awaiting the results of the recently closed POSNOC trial to help answer this question.

One third (32.7%) of women in the Register had axillary node dissection. Higher proportions of Pacific women and wāhine Māori had axillary node dissection (44.2% and 38.8% respectively) compared to 31% of European or Asian women. Nearly half (49%) of all women diagnosed under 45 years of age had ALND, but for women diagnosed between 45-69 years and over 69 years, this proportion was 29.6% and 32.1% (Figure 6.1-15).

6.1.4 Surgical margins

Surgical margin assessment (distance of tumour from edge of excision) is a measure of the adequacy of surgery, although some controversy exists internationally as to the optimal distance.

Recent American guidelines have recommended as little as "no tumour on ink". More recent British Guidelines recommend a 1mm margin for invasive cancer (BASO), and 2 mm (ASCO [68]) for DCIS. Previous New Zealand guidelines have recommended a postoperative pathological margin of ⩾2mm. The International Collaboration on Cancer Reporting (ICCR) agreed in 2021 to adopt the ASCO / CAP guidelines: for invasive cancer, a positive margin is defined as tumour on ink. A minimum 2mm margin is required for DCIS with or without invasive breast cancer.

	Auckland (N = 5,120)	Waikato (N = 2,231)	Christchurch (N = 1,585)	Wellington (N = 1,015)	Total (N = 9,951)
Closest Radial Margin (mm)					
0	68 (1.3%)	30 (1.3%)	9 (0.6%)	12 (1.2%)	119 (1.2%)
(0,1)	393 (7.7%)	66 (3%)	57 (3.6%)	47 (4.6%)	563 (5.7%)
(1,2)	447 (8.7%)	104 (4.7%)	94 (5.9%)	40 (3.9%)	685 (6.9%)
> 2	4,212 (82.3%)	2,031 (91%)	1,425 (89.9%)	916 (90.2%)	8,584 (86.3%)

Table 6.1-3. *Margin sizes following breast-conserving surgery.*

Register data is incomplete for this field, with high proportions missing in Auckland (27%) and Wellington (43%). The rate of missing data is lower in Waikato (10%) and Christchurch (13%).

For women for whom measurements were recorded, the radial resection margins following breast-conserving surgery were greater than 2mm for over 80%. For Waikato and Christchurch, close to or over 90% of resected samples had margins greater than 2mm (Table 6.1-3). Of resected samples in Auckland, Waikato and Wellington, 1.2-1.3% had no measurable clearance (tumour on ink). Auckland had the largest proportion of samples with resection margins between 0 and 2mm (16.4%), with this being 7.7-9.5% for the other regions.

Nina, Canterbury, diagnosed at 53:

"It was a shock to find out I needed another operation after my wide local excision. A mastectomy seemed extreme so I opted for another wide excision, but the DCIS ended up being more widespread than originally thought, so I needed the mastectomy after all. Having three surgeries in seven weeks was physically challenging and there were definitely emotional highs and lows."

6.1.5 Subsequent surgery after breast-conserving surgery

A subsequent surgery following initial breast-conserving surgery is sometimes required when pathological analysis shows that invasive cancer or DCIS extends up to, or close to, the margins of excision, raising the risk that a significant burden of disease has been left in the breast. A subsequent surgery may re-open the existing site to remove an additional margin of breast tissue (re-excision) if this is considered practical, or a mastectomy may be required, which at this point is called a completion mastectomy.

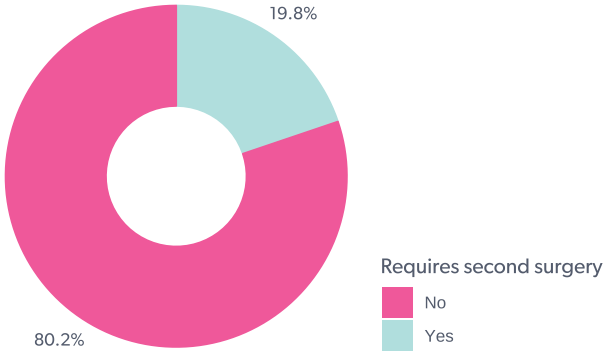


Fig. 6.1-17. *Percentage of women requiring a second surgery.*

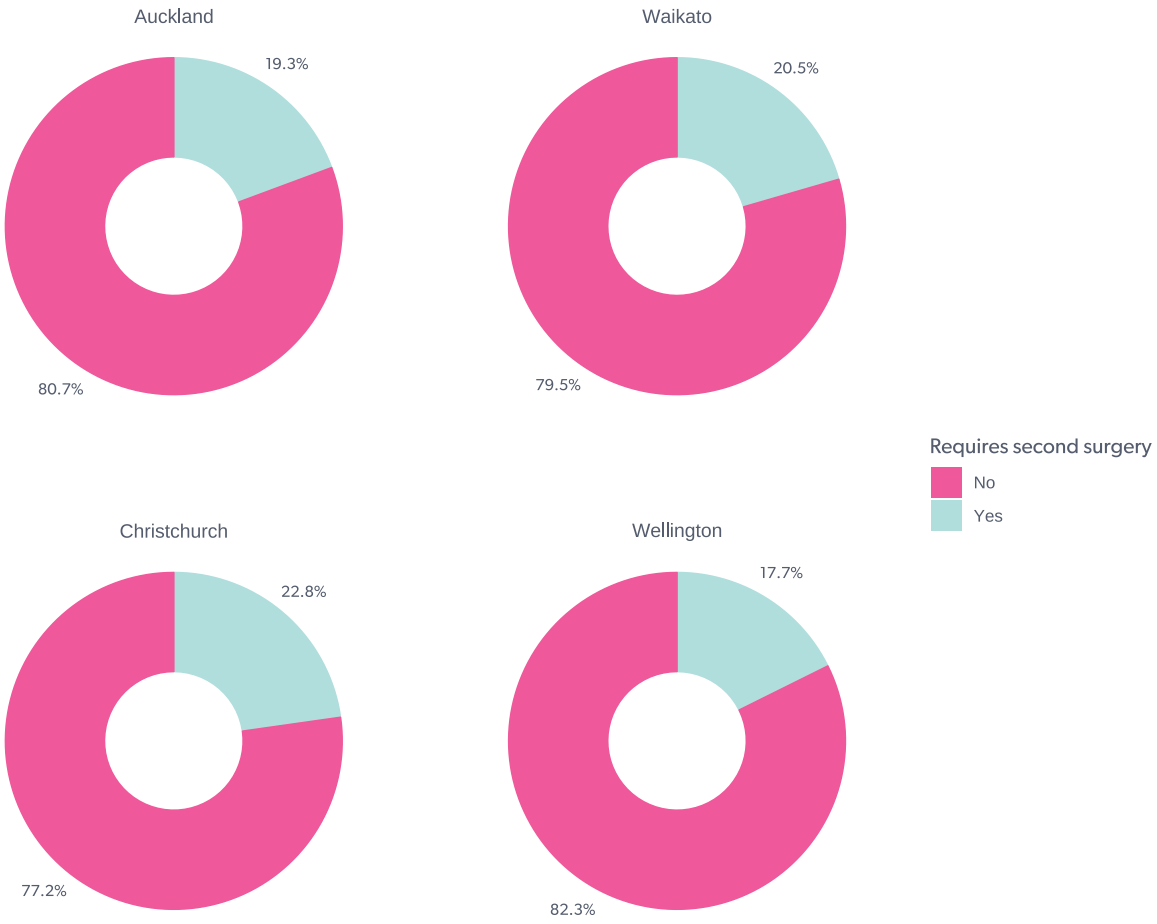


Fig. 6.1-18. *Second surgeries by region. Proportion of women having a subsequent surgery after breast-conserving surgery, overall and within each of the four regions.*

Overall, 20% of women in the Register had a subsequent surgery (Figure 6.1-17) following breast-conserving surgery, with only minor differences between regions (Figure 6.1-18). Wellington had the lowest rate of second surgeries.

New Zealand rates of second surgeries are similar to those reported in international studies. A combined New Zealand and Australian audit found that 22% of invasive cancers and 32% of DCIS treated with breast-conserving surgery required further surgery [69]. An English 2012 study found that 18% of invasive breast cancer patients had a reoperation, as did 29.5% of DCIS patients [70], though re-excision rates varied widely by centre.

Type of second surgery

	Auckland (N = 7,026)	Waikato (N = 2,482)	Christchurch (N = 1,819)	Wellington (N = 1,778)	Total (N = 13,105)
Re-excision	579 (8.2%)	310 (12.5%)	260 (14.3%)	148 (8.3%)	1,297 (9.9%)
Re-excision & mastectomy	112 (1.6%)	46 (1.9%)	49 (2.7%)	28 (1.6%)	235 (1.8%)
Completion mastectomy	668 (9.5%)	153 (6.2%)	105 (5.8%)	138 (7.8%)	1,064 (8.1%)
None	5,667 (80.7%)	1,973 (79.5%)	1,405 (77.2%)	1,464 (82.3%)	10,509 (80.2%)

Table 6.1-4. *Type of re-excision or completion mastectomy following breast-conserving surgery, by region.*

Although a wider local excision (re-excision), is a relatively minor surgical procedure, it has a number of significant impacts for women having to go through this. Firstly, it involves further time and recovery, utilisation of resource and cost (either to the public health service or to the individual, or both). Secondly, a wider excision raises the risk of an unsatisfactory aesthetic outcome from breast-conserving surgery and of a complication such as infection which may also result in worse aesthetic outcomes in addition to the morbidity of the complication. The alternative is mastectomy – the operation which breast-conserving surgery was initially aimed at avoiding. Generally, women find the necessity for further surgery a distressing event.

The alternative of not doing further surgery with close or involved margins raises the risk of local recurrence, and high rates of recurrence may have a detrimental effect on survival.

6.1.6 Breast reconstruction after mastectomy

For women requiring or choosing mastectomy, breast reconstruction may be offered. For women who wish to undergo this surgery, and who do so, studies show significant psychosocial benefits including, lower rates of depression, greater self-confidence, self-esteem and body image, and improved sexuality.

For other women, reconstruction is not an important consideration, and the most important factor here is the opportunity to choose either option.

Breast reconstruction does not recreate a functional breast, but rather a breast shape, that in clothing disguises the fact that one or both breasts have been removed. Breast reconstruction requires more major surgery and recovery than mastectomy alone, and raises the risk of a surgical complication.

The simplest form of reconstruction is an implant-based technique. While implant reconstructions are quicker to perform and to recover from, this is also the technique that is most likely to result in a complication, or to require future revisional surgery, or yield a less than satisfactory outcome.

Reconstruction with autologous tissue yields better results on average, but necessitates major surgery, with more prolonged time in the operating theatre, and in hospital, and for subsequent recovery. Reconstruction can be immediate (at the time of surgery to remove the tumour), or delayed for months or years after surgery.

Reasons for delayed reconstruction may include a clinical recommendation to delay reconstruction until after radiation therapy (though practice is changing in this area), the patient needing time to reduce BMI to lower the risk of surgery, or the patient deferring the decision or changing her mind after an earlier decision not to have reconstruction.

Juliet, diagnosed at 59:

"My expectations going into surgery were many. I expected to feel some grief and also the thought of having a three to four-hour surgery was a little frightening. I worried about how I would feel seeing my new breasts and how long it would take to recover. When I saw them for the first time in the hospital bathroom mirror I thought to myself, 'whose are those?' It looked like a 20-year-old's perky breasts on a 59-year-old body. Very bizarre! My breasts looked symmetrical and I was really happy with the results."

Christine, Canterbury, diagnosed at 45:

"My surgeon persuaded me away from immediate reconstruction. She told me it would be a long, hard recovery and that I could change my mind and have reconstruction later. I didn't know anything and I didn't have any support, so I said 'just chop it off, I'll be fine'. After my mastectomy I had a prosthesis and I had a lot of trouble with it, so I tried to get reconstruction. I had initially been told I could get it done whenever I wanted, but in the end had to fight the system for it. I'm very strong-minded, but it's been a hard journey."

Tracy, Hawke's Bay, diagnosed at 54:

"I was so used to seeing my breast so it was a complete shock not having it, but I'm happy with the decision to not get a reconstruction. I'm quite a confident person in myself anyway and I don't really want another operation. I thought I'd feel imbalanced but actually, I feel fine. If I was younger I might be more bothered. If anyone looks at me strangely or feels uncomfortable, that's their problem, not mine."

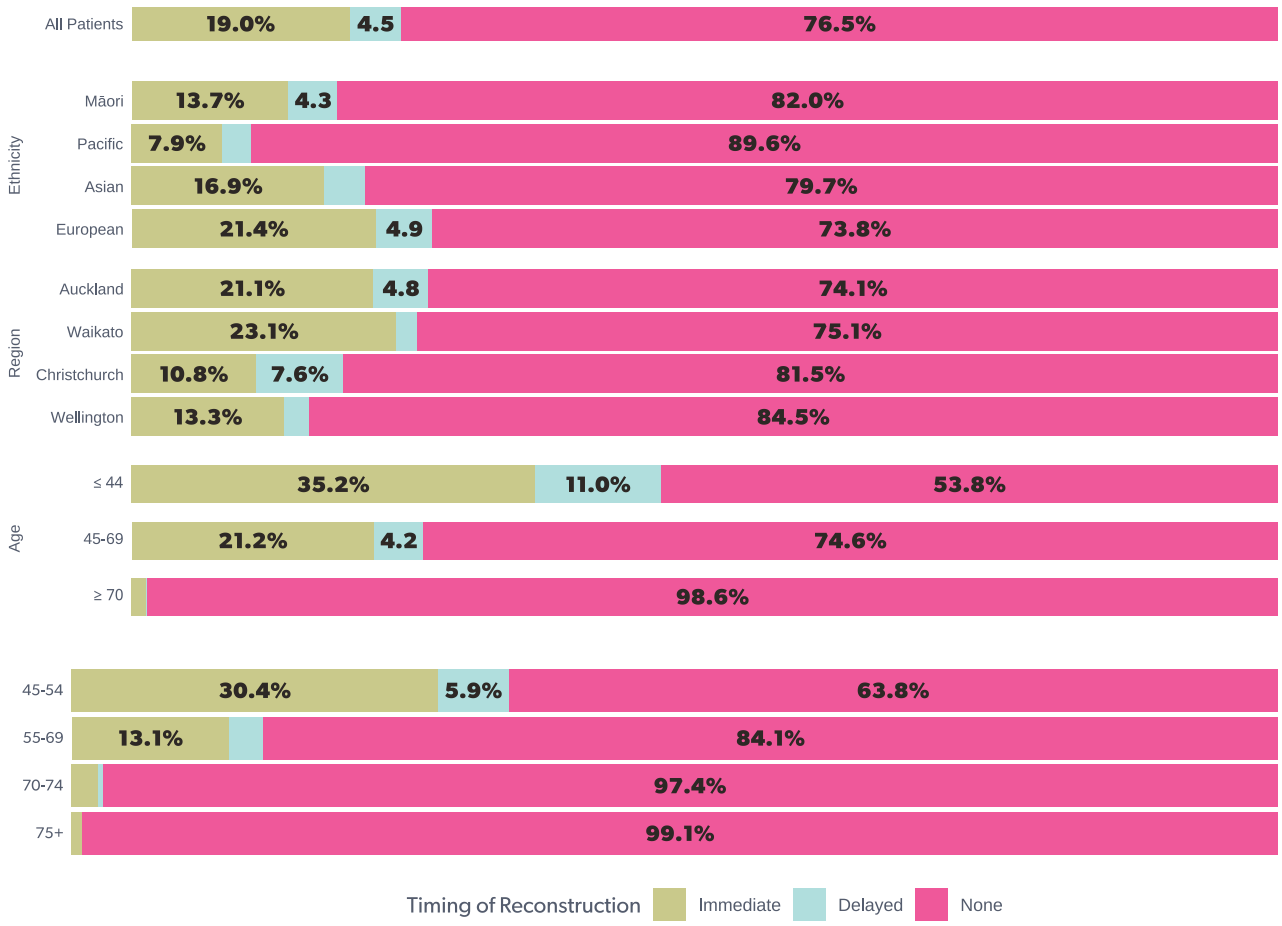


Fig. 6.1-19. *Breast reconstruction and its timing. Proportion of women having breast reconstruction after mastectomy by ethnicity, region and age at diagnosis.*

Overall, three-quarters of women did not have breast reconstruction following a mastectomy (Figure 6.1-19). The immediate breast reconstruction rate of 19% was similar to Australia (17-18%) [71].

Wāhine Māori and Pacific women were less likely to have reconstruction than other women. (Figure 6.1-19). The largest proportion of women having reconstruction were European, who also had the highest delayed reconstruction rate. Reconstruction was less common in Christchurch and Wellington; this may be related to access to oncoplastic trained breast surgeons or plastic surgery services.

Reconstruction was most common in younger women, with nearly half (46.2%) of those diagnosed under 45 years of age having either immediate or delayed breast reconstruction. Reconstruction was rare in women aged 70+ (Fig 6.1-19).

Immediate reconstruction was far more common than delayed reconstruction. This may be because availability of delayed reconstruction varies by region, and it is also possible that the Register is missing data on delayed reconstruction, as plastic surgeons do not report all their procedures to the Register.

6.2 Radiation Therapy

In brief

- 95% of women who had breast-conserving surgery were referred for radiation treatment, and 90% received it.
- Christchurch had the highest rate of radiation therapy and the lowest rate of non-referrals.
- Older women were less likely to have radiation therapy, in line with guidelines.
- High-risk Pacific women were least likely to receive radiation therapy after mastectomy, with 11.6% of women not referred and 12.6% reported as declining radiation therapy.

Radiation therapy uses high-energy beams to kill cancer cells and is an important part in many women's breast cancer treatment. The primary aim of radiation therapy is to prevent local recurrence of breast cancer. It is usually given after surgery and is considered standard therapy for women after breast-conserving surgery. Radiation therapy can also be given after a mastectomy to women whose cancer has spread to the lymph nodes or those with other high-risk features such as large tumours or tumour growth to the chest wall. Radiation may also be given to nodal regions after a positive sentinel node biopsy, as an alternative to further nodal dissection; however, nodal radiation is not included in this report.

Radiation therapy is delivered in short daily doses called fractions. Following the results of clinical trials, the typical length of radiation treatment has decreased over time from five weeks to three weeks (hypofractionation). In 2020, a one-week regimen has been introduced for patients at low risk of recurrence.

Referral for radiation therapy after breast-conserving surgery

In this report, "Referred" includes patients who were referred for and received radiation treatment, and also those who were referred but did not ultimately receive treatment, either because the clinician deemed it unnecessary, or because the patient declined. "Not referred" encompasses patients whose clinician deemed radiation treatment unnecessary or unsuitable.

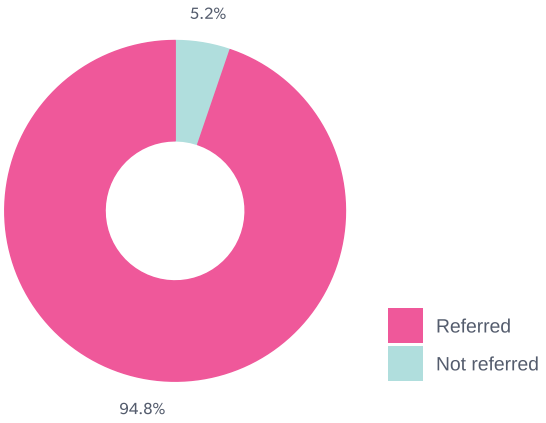


Fig. 6.2-1. *Referral for radiation therapy. Proportion of women with invasive breast cancer referred for radiation therapy follow breast-conserving surgery.*

Overall, 94.8% of women were referred for radiotherapy after breast-conserving surgery for invasive breast cancer (Figure 6.2-1).

	Māori (N=1,153)	Pacific (N= 581)	Asian (N= 845)	European (N=8,984)
Ethnicity	58 (5.0%)	20 (3.4%)	46 (5.4%)	479 (5.3%)
	Auckland (N=6,196)	**Waikato (N=2,268)**	**Christchurch (N=1,662)**	**Wellington (N=1,610)**
Region	409 (6.6%)	71 (3.1%)	24 (1.4%)	111 (6.9%)
	⩽ 44 (N=1,005)	**45-69 (N=8,928)**	**⩾ 70 (N=1,803)**	
Age	28 (2.8%)	328 (3.7%)	259 (14.4%)	

Table 6.2-1. *Women not referred for radiation therapy after breast-conserving surgery, by demographic factors.*

In the Register, fewer older women were referred for radiation therapy than other age groups (Table 6.2-1). Clinical trials have shown the treatment does not improve overall survival for older patients, and that hormone therapy alone after surgery gives similar outcomes. Guidelines say radiation therapy is not recommended after age 80, but women in their 70s who are in good health and have a long life expectancy may benefit from a lower risk of recurrence in the breast [72].

Women receiving radiation therapy after breast-conserving surgery

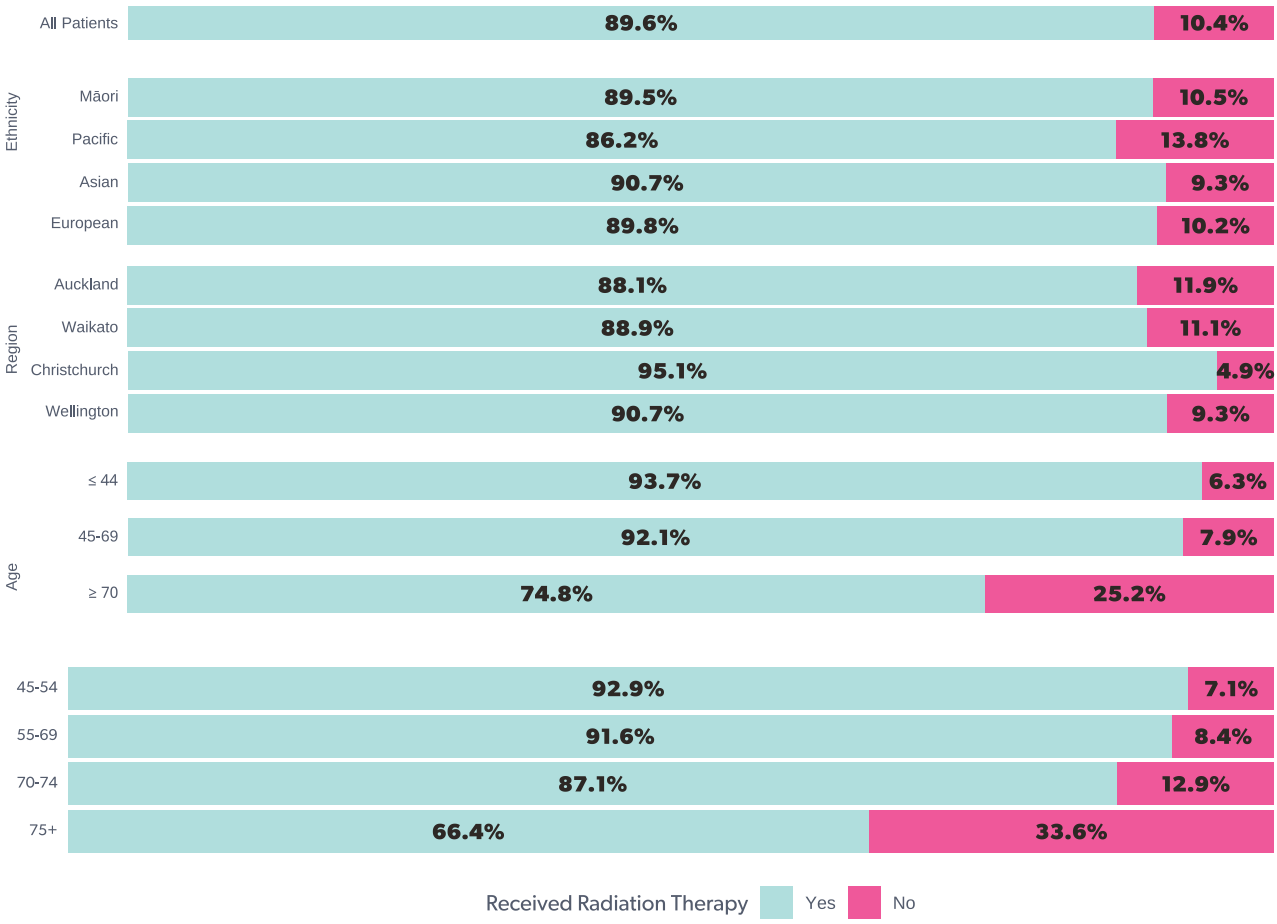


Fig. 6.2-2. *Use of radiation therapy. Proportion of women receiving radiation therapy after breast-conserving surgery for invasive breast cancer, by ethnicity, region and age. Not receiving were those who were not referred for treatment or who declined.*

For wāhine Māori, European and Asian women, nearly 90% received radiation therapy after breast-conserving surgery. Pacific women were least likely to receive radiation (86.2%).

Christchurch had the highest proportion of patient receiving radiation therapy after breast-conserving surgery. Anecdotally, Christchurch clinicians report a robust multidisciplinary meeting (MDM) and breast nurse follow-up process to ensure participation in treatment.

Among older patients, the 70-74 subgroup was far more likely to have radiation than those aged 75+.

Radiation therapy declined

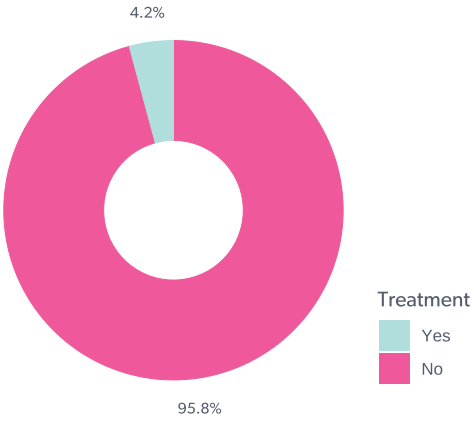


Fig. 6.2-3. *Proportion of referred women declining radiation therapy after BCS, overall and by ethnicity.*

For those women who were recommended to have radiation therapy, 4.2% were recorded as declining treatment (Figure 6.2-3). There are a number of reasons why a woman might decline treatment, including not being available for treatment at the current time (due to work or family commitments, for example), distance from the radiation centre, leaving the country, or concluding from conversation with the radiation oncologist that the benefits did not justify the risk or inconvenience.

By region, the rate of decline of radiation ranged from 2% (Wellington) to 5.8% (Christchurch) of all patients having breast-conserving surgery (not shown).

6.2.1 Radiation after mastectomy

Women defined as at higher risk may be referred for radiation therapy after mastectomy. High risk can be defined in several ways, but in this section, these higher-risk women are defined in accordance with the BreastSurgANZ KPIs: they have at least four positive lymph nodes and / or their breast tumours are at least 50mm in size.

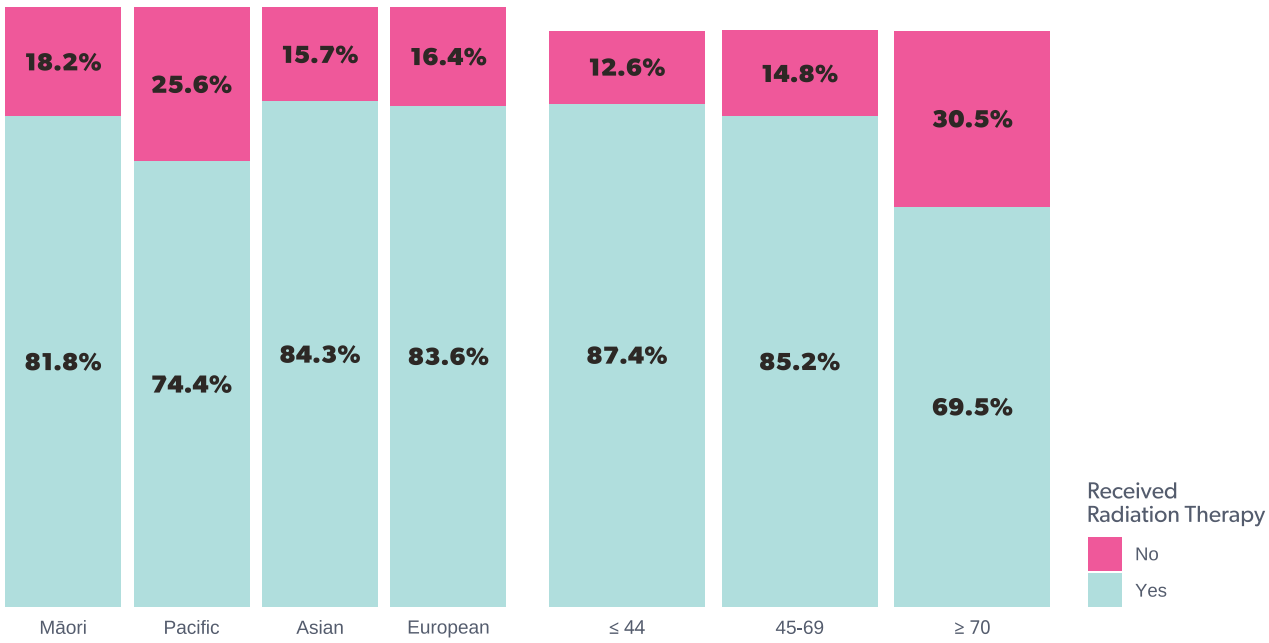


Fig. 6.2-4. *Use of radiation therapy for high-risk women by ethnicity and by age. Proportion of high-risk women receiving radiation therapy after mastectomy, by woman's ethnicity and by age.*

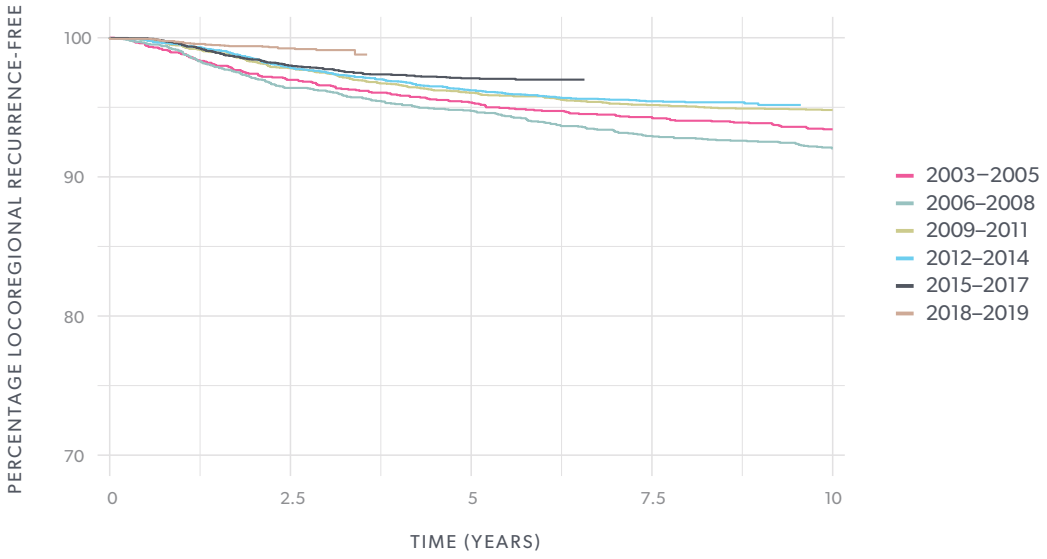
High-risk Pacific women were least likely to receive radiation therapy after mastectomy, with 11.6% of women not referred and 12.6% reported as declining radiation therapy (Table 13.2-19). Of high-risk wāhine Māori, 81.8% received radiation therapy after masectomy (Figure 6.2-4), with 9.2% of wāhine not referred for radiation therapy and 7% reported as declining treatment (Figure 6.2-4). Of high-risk Asian and European women, 84.3% and 83.6% respectively received radiation therapy after mastectomy (Table 13.2-19). Of high-risk European women, 9.9% were not referred and 4.2% were recorded as declining radiation therapy. For high-risk Asian women, 8.7% were not referred for radiation therapy after mastectomy and 4.8% reported as declining treatment.

High-risk women diagnosed at 70 years or older were less likely to receive radiation therapy after mastectomy (Figure 6.2-4). This is to be expected, as older patients are more likely to have comorbidities, leading to clinical unsuitability, and a different view of benefits and risks than younger women, leading to declining treatment (Table 13.2-19).

6.3 Locoregional Recurrence; and Survival by type of surgery

6.3.1 Locoregional recurrence

Local or regional (locoregional) recurrence of breast cancer means a recurrence in or near the same place in the breast (local), or in nearby lymph nodes (regional). Rate of locoregional recurrence (LRR) can be used to measure the impact of surgery and radiation therapy.



YEAR OF DIAGNOSIS	5-YEAR LRR-FREE	10-YEAR LRR-FREE
2003-2005	95% (94-96)	93% (92-94)
2006-2008	95% (94-96)	92% (91-93)
2009-2011	96% (95-97)	95% (94-95)
2012-2014	96% (96-97)	
2015-2017	97% (97-98)	

Fig. 6.3-1. *Locoregional recurrence by year of diagnosis. Proportion of women having a local or regional disease recurrence, by year of diagnosis with invasive breast cancer.*

The proportion of women who had a locoregional recurrence decreased over time. For women diagnosed between 2003-2008, 5% had a locoregional recurrence by 5 years, but for those women diagnosed in 2015-2017, this had improved to 3% (Fig 6.3-1). Similar improvements over time were seen in the proportion of women who did not have a locoregional recurrence by 10 years.

6.3.2 Impact of Type of Surgery on Survival

In the 1980s and 1990s, studies suggested that breast-conserving surgery was non-inferior or equal to mastectomy in terms of survival outcomes. However, there is a growing body of evidence that breast-conserving surgery offers higher survival rates and, more controversially, improved local control compared with mastectomy [61]. The original studies were randomised trials, however, which are the scientifically most rigorous way to avoid any bias in outcomes. The subsequent studies have all been observational studies with statistical methods used to try and account for possible known biases (confounders), for example, the fact that women undergoing mastectomy have on average, larger, worse-outlook breast cancers.

An updated study from the Netherlands Cancer Registry of women diagnosed from 1999-2012 concluded that breast-conserving surgery "showed roughly 25% better" breast cancer-specific survival and overall survival than mastectomy, after correction for confounders [73]. Survival was better for breast-conserving surgery than mastectomy in most subgroups, and similar for breast-conserving surgery and mastectomy in women aged under 50, patients without comorbidity, and patients having chemotherapy.

A 2021 Swedish study of nearly 50,000 women with Stage 1 or 2 breast cancer (patients most likely to have had the choice of breast-conserving surgery or mastectomy) reported an overall and breast cancer–specific relative survival gain for BCCS of 56% to70% in node-negative patients [74], with the same association in lower-burden node-positive disease. The results held true when adjusted for socioeconomic factors (breast-conserving surgery is less common in women with a lower socioeconomic status, who also tend to have later diagnosis and worse survival) and comorbidity (which can reduce options for systemic therapy or locoregional treatments, as well as survival). The researchers conclude, "this report gives no support to advocate mastectomy in women without specific risk factors, such as a strong family history or gene mutations."

This summary of data in the Register did not include survival analysis by surgery type. However, another study of the Register published in 2021 found that patients receiving breast-conserving surgery plus radiation therapy had the lowest risk of breast cancer-specific mortality; in comparison, patients treated with mastectomy had a 38% (95% CI: 5–82%) increased risk of mortality [75]. The confidence intervals are very wide, but the results are in keeping with international studies.

Additional data from the authors showed that adjusted overall survival was better for women having breast-conserving surgery. Crude data is shown in Figure 6.3-2, with adjusted data in Table 6.3-1.

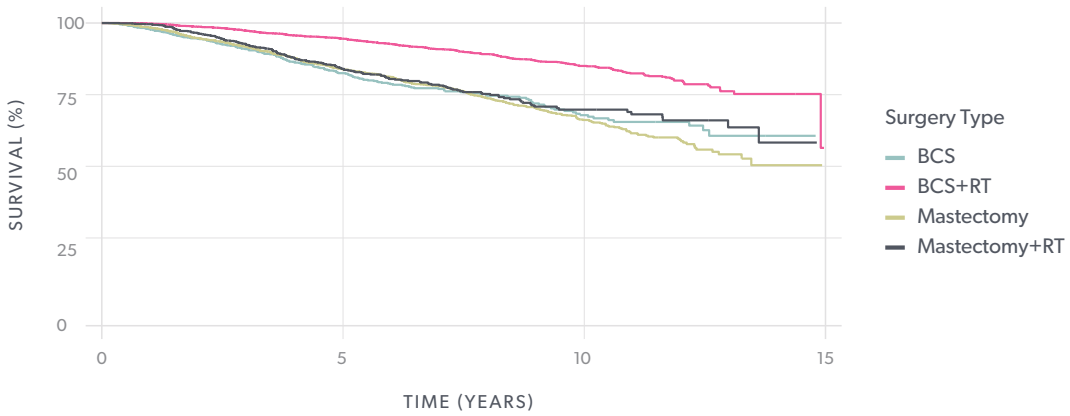


Fig. 6.3-2. *Overall survival after surgery for invasive breast cancer, by type of surgery.*

Type of surgery	Crude HR (95% CI)	Adjusted HR (95% CI) *	Adjusted HR (95% CI) **	Adjusted HR (95% CI) ***
BCS+RT	1.00	1.00	1.00	1.00
BCS	2.58 (2.17-3.08)	2.04 (1.71-2.44)	1.72 (1.43-2.08)	1.72 (1.42-2.07)
MTX	2.66 (2.34-3.02)	1.87 (1.65-2.16)	1.53 (1.34-1.77)	1.52 (1.32-1.75)
MTX+RT	2.35 (1.96-2.81)	2.41 (2.01-2.90)	1.38 (1.14-1.68)	1.42 (1.17-1.73)

*adjusted for demographic factors: age, ethnicity, NZ dep, urban status, register, private/public

**adjusted for demographic and clinic-pathological factors: age, ethnicity, NZ dep, urban status, register, public/private, screen detected/symptomatic, grade, HER2, hormone receptor status, histology, tumour size, lymph node status, lympho-vascular invasion (LVI), C3 index

***adjusted for demographic, clinic-pathological and systemic treatment factors: age, ethnicity, NZ dep, urban status, register, public/private, screen detected/symptomatic, grade, HER2, hormone receptor status, histology, tumour size, lymph node status, lympho-vascular invasion (LVI), C3 index, systemic treatment (hormonal and chemo- therapies)

Table 6.3-1. *Cox Proportional Hazards Hazard Ratios for Overall Survival by type of surgery. Additional data, Abrahimi et al, 2021.*

7. Treatment: Systemic Therapy

In brief

- Nearly all women (97.3%) with hormone receptor-positive breast cancers commenced endocrine therapy, in line with international guidelines.
- Just over one third (36.3%) of women with invasive breast cancer received adjuvant chemotherapy (Figure 7.2-1). The proportion receiving chemotherapy varied depending on risk factors for relapse.
- Nearly three quarters (74%) of women aged <45 received adjuvant chemotherapy, compared with 35.9% of women diagnosed between age 45-69 and 8.6% of women aged 70+.
- Regional differences in chemotherapy use are of interest and need further investigation.
- The proportion of women who declined chemotherapy rose between 2006 and 2017, but dropped back in 2018-19, when 14.2% of women declined.
- Since 2013, 23% of younger women (<45) have received neoadjuvant chemotherapy.
- Anti-HER2 therapies were used by less than half (46.9%) of women aged over 70 with HER2+ breast cancer.

7.1 Endocrine Therapy

Women with the oestrogen receptor on their tumour cells (ER+ breast cancer) are usually offered treatment with drugs that specifically target the dependency of these on oestrogen in order to grow. Tumours that have another receptor called the progesterone receptor (PR positive) are also dependent on oestrogen, therefore women with either ER+ and/or PR positive breast cancers (called hormone receptor-positive) are treated with the same drugs. This treatment is called endocrine therapy and uses drugs such as tamoxifen or aromatase inhibitors.

Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register shows that nearly all women (97.3%, not shown) with hormone receptor-positive breast cancers commenced endocrine therapy. This is in line with international guidelines [62]. Only 0.8% of patients declined endocrine therapy, and 1.9% were not referred (see Table 13.2-20 for a breakdown by ethnicity). The most common reason for non-referral or decline is likely to be lower risk disease.

It is important to note that up to half of patients have suboptimal (<80%) adherence to endocrine therapy, or discontinue treatment within the first five years. In New Zealand, optimal adherence at the end of the first year ranged from 77% to 90%, declining year-on-year to a low of 50-59% after five years [101]. This is an area which, if addressed, may enable future improvements in survival.

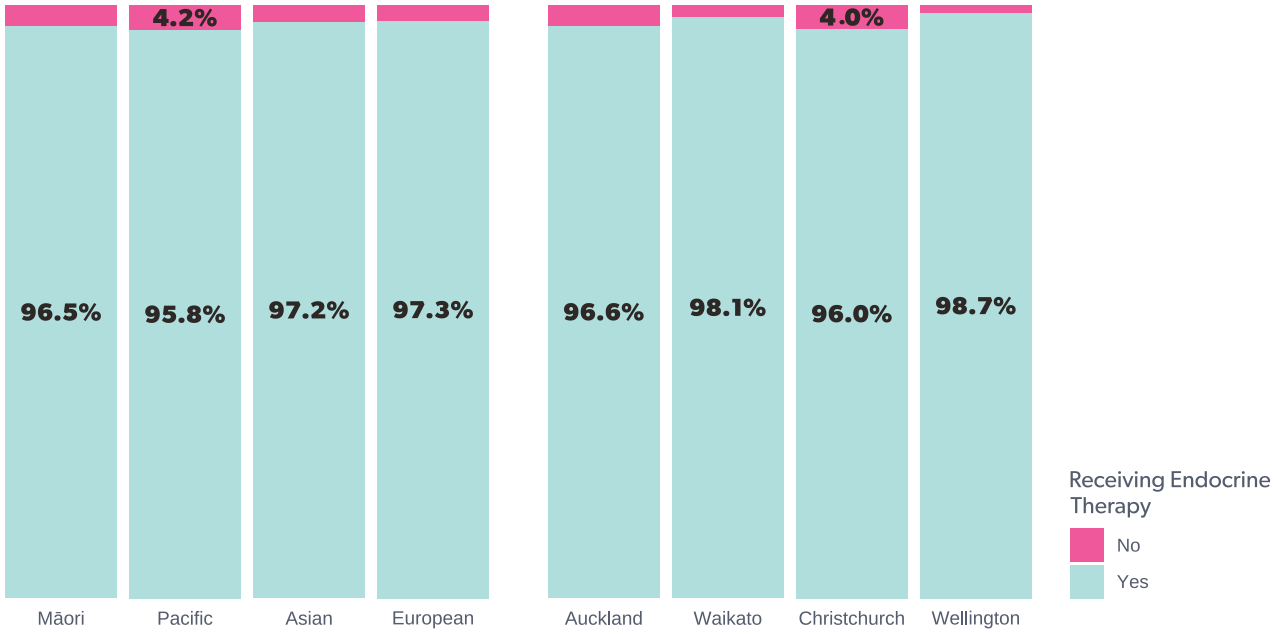


Fig. 7.1-1. *Use of endocrine therapy for hormone receptor-positive tumours. Proportion of women with hormone receptor-positive breast cancers receiving endocrine therapy by woman's ethnicity and by region. Proportions smaller than 4% are not labelled.*

Uptake of endocrine therapy was consistently high across women of all ethnicities and their region of diagnosis (Fig 7.1-1).

7.2 Chemotherapy

Chemotherapy is a systemic treatment where the drugs are usually given intravenously over several months. Sometimes this treatment is given before surgery, called neoadjuvant chemotherapy, and sometimes after, which is called adjuvant chemotherapy. Chemotherapy can be offered to women who are at higher risk of relapse because of involved lymph nodes or higher grade, HER2+ or hormone insensitive (triple negative) tumours. For women with HER2+ breast tumours, chemotherapy is usually given together with a HER2-targeted therapy such as Herceptin (see Section 7.3).

In this report, chemotherapy tables labelled "adjuvant" do include women who had neoadjuvant chemotherapy (approximately 10% of women over the reporting period), and therefore give a good idea of the total use of chemotherapy in breast cancer. But in order to see how many women have been referred for neoadjuvant chemotherapy in recent years, when it has become a standard of care, separate tables and charts have also been compiled for neoadjuvant chemotherapy delivered since 2013.

Adjuvant chemotherapy

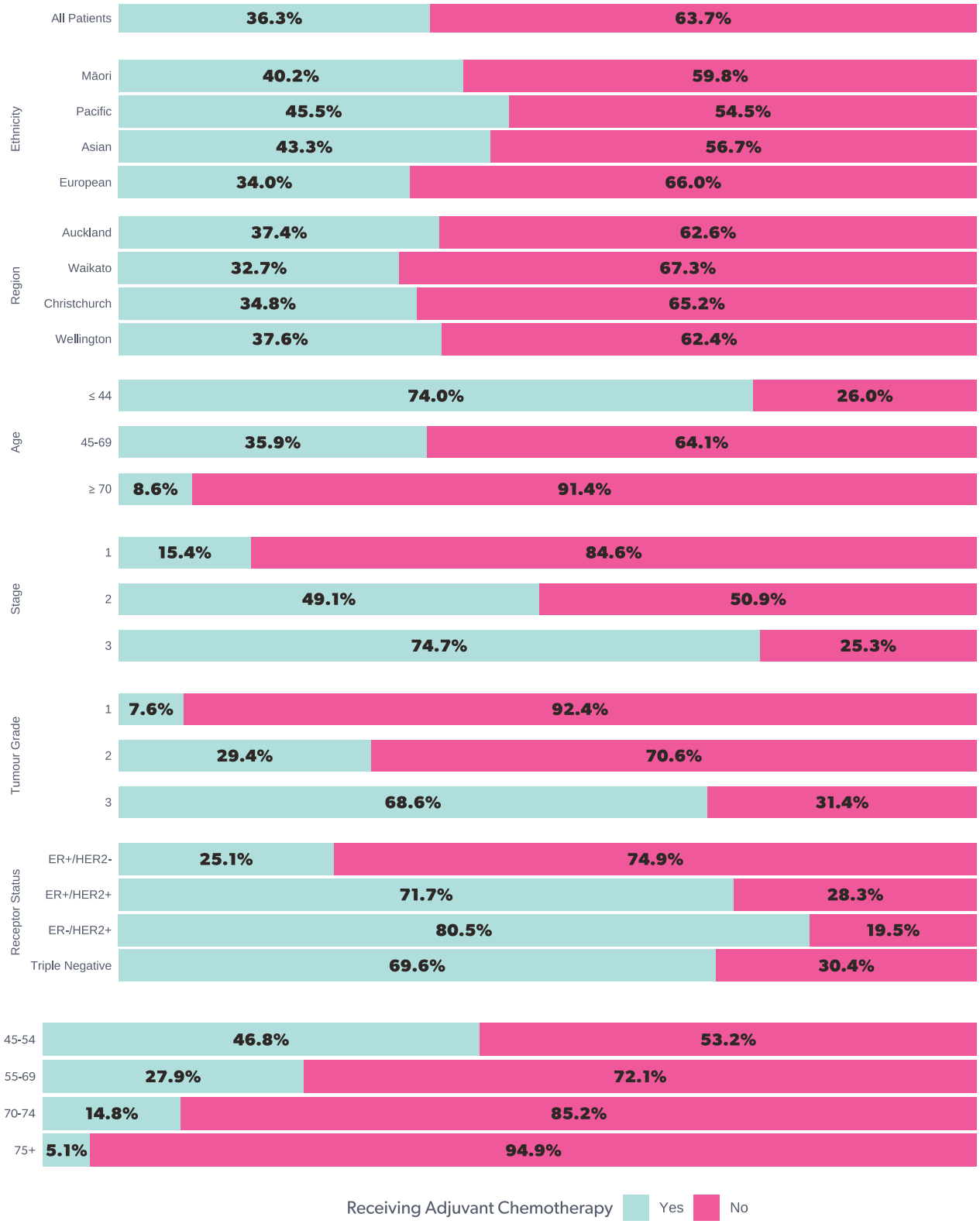


Fig. 7.2-1. *Adjuvant chemotherapy use. Proportion of women with invasive breast cancer receiving adjuvant chemotherapy.*

Just over one third (36.3%) of women with invasive breast cancer in Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register received adjuvant chemotherapy (Figure 7.2-1). The proportion of women who received chemotherapy varied depending on risk factors for relapse, such as pathology, age and receptor status.

For example, nearly three quarters (74%) women diagnosed with invasive breast cancer before 45 years, a higher risk group, received adjuvant chemotherapy, compared with 35.9% of women diagnosed between age 45-69 and 8.6% of women 70+. The same guidelines for chemotherapy apply to young women as older: treatment decisions should be based on the extent of disease and the biological characteristics of the tumour. Age should not be the sole reason to prescribe adjuvant chemotherapy in women aged <40 [65].

There was a marked difference in uptake of chemotherapy within the pre- and postmenopausal subgroups, and in the 70-74 and 75+ subgroups.

Section 3 discussed chemotherapy for individual ethnic groups. European women were least likely (34%) to receive chemotherapy, probably due to a lower incidence of high-risk tumours.

Changes in adjuvant chemotherapy over time

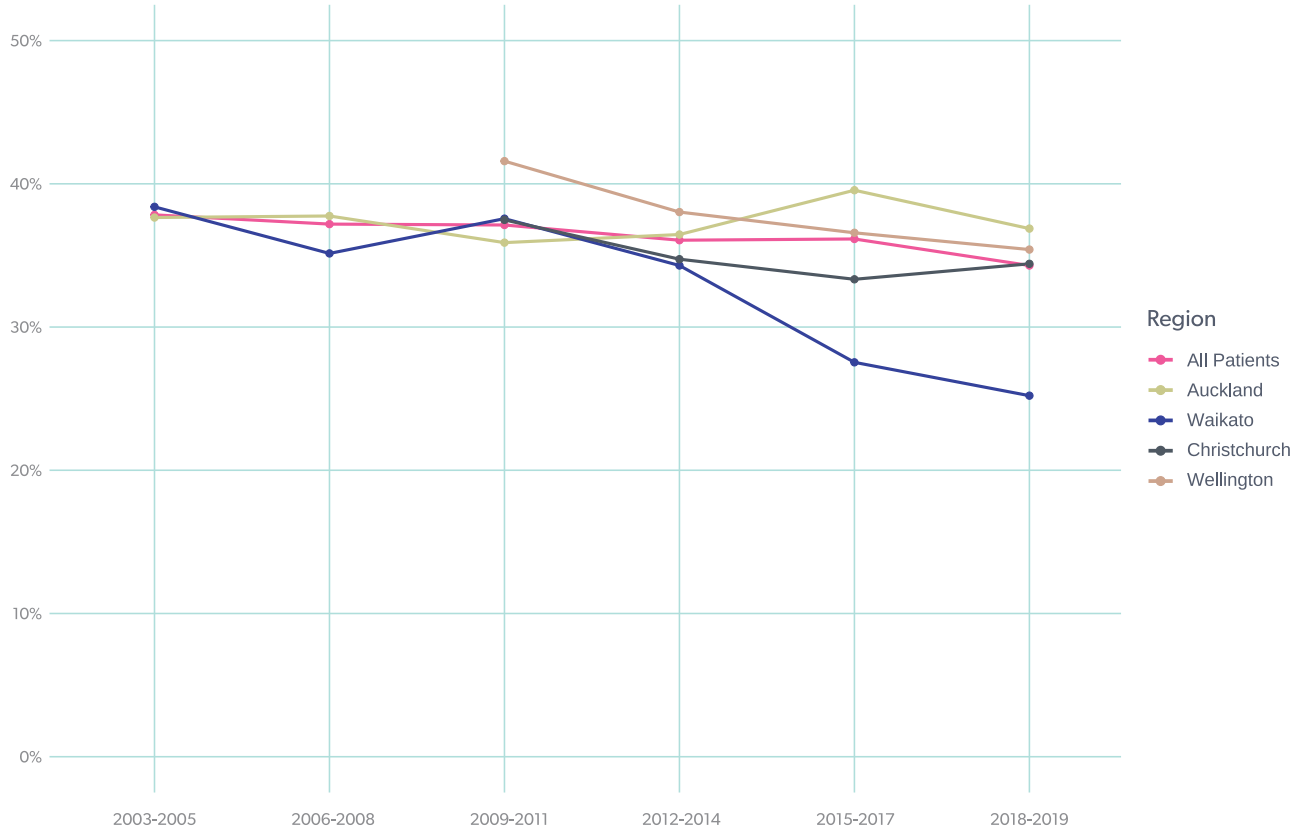


Fig. 7.2-2. *Analysis of adjuvant chemotherapy use by region over time. Proportion of women with invasive breast cancer receiving adjuvant chemotherapy by region over time.*

The overall proportion of women receiving adjuvant chemotherapy over time has been relatively steady (37.0%-38.4%; Figure 7.2-2), but there were some regional differences. The reason for the increased use over time of chemotherapy in Auckland (from 36.5% to 46.2%) compared to the decreasing use in Waikato (from 39.3% to 27.1%) and the more stable but differing level of use in Christchurch (from 37.5% to 34.7%) and Wellington (from 41.6% to 35.4%) is of interest and needs further investigation.

Adjuvant chemotherapy declined

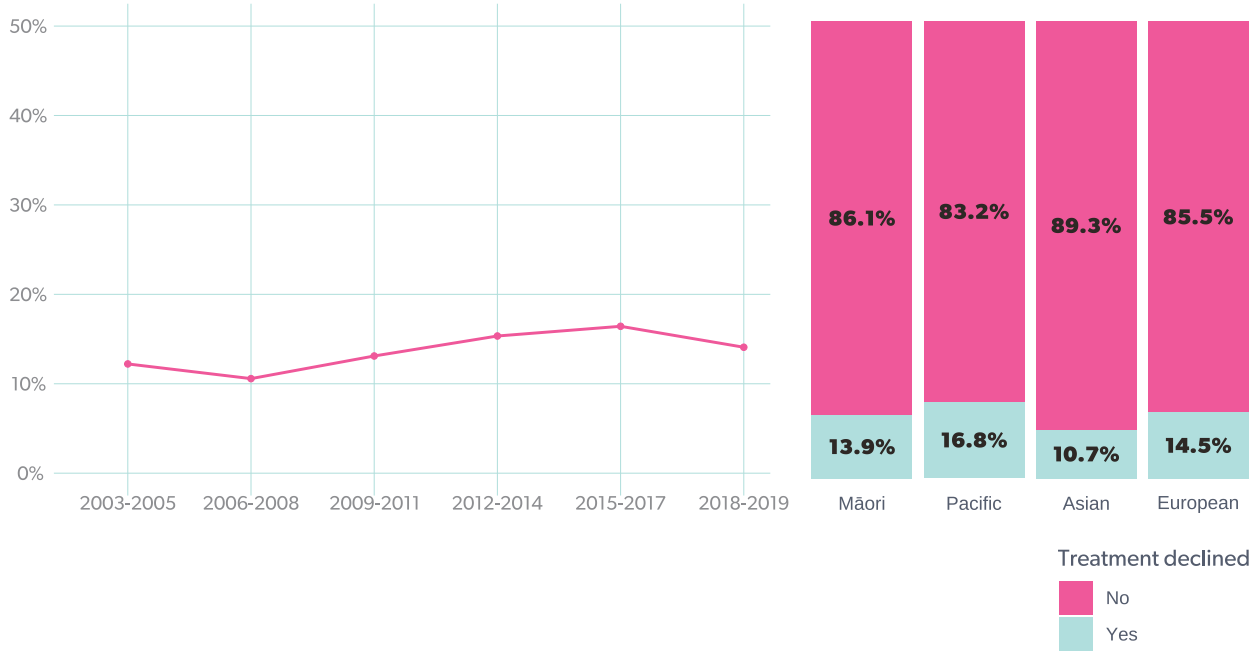


Fig. 7.2-3. *Analysis of women reported as declining adjuvant chemotherapy. Proportion of women reported as declining adjuvant chemotherapy out of all women having adjuvant chemotherapy a) over time, and b) by ethnicity.*

The proportion of women who were referred for adjuvant chemotherapy but declined treatment rose 55% between 2006-2008 (10.6%) and 2015-2017 (16.4%, Figure 7.2-3). This dropped back to 14.1% for 2018-19; it will be interesting to see if this is the start of a downward trend in declines.

Overall, Pacific women had the highest proportion of women reported as declining treatment (16.8%), with this figure being 14.5% and 13.9% of European women and wāhine Māori respectively (Figure 7.2-3). Only 10.7% of Asian women were reported as declining adjuvant chemotherapy.

Reasons for declining treatment are complex. Studies have shown that distrust of the health system can lead to patients declining therapy [76]. Other reasons may be a perception of insufficient benefit from the proposed treatment [77], or purely practical considerations such as employment, lack of transportation or childcare; or distance from the treatment centre.

Neoadjuvant chemotherapy

Neoadjuvant therapy (chemotherapy before surgery) has been used for many years in women with large tumours not technically suitable for radiotherapy, but in recent years has increasingly been used to treat HER2+ tumours and triple negative disease, as a result of evidence of effectiveness of neoadjuvant anti-HER2 therapy reported in the literature.

This is an area of changing practice internationally. While survival and rate of distant recurrence are statistically the same for neoadjuvant and adjuvant treatment, guidelines state that neoadjuvant therapy is now the preferred initial approach in women with stage 2 or 3 HER2+ or triple negative breast cancer [72].

Neoadjuvant therapy enables clinicians to assess the chemo-sensitivity of a tumour, enabling tailored approaches to therapy (these may involve drug regimens not currently funded in Aotearoa New Zealand).

Using chemotherapy to shrink a large tumour before surgery can enable downstaging from mastectomy to breast-conserving surgery, or can render an inoperable tumour operable. It may also avoid axillary node dissection surgery, helping to prevent lymphoedema.

In Aotearoa New Zealand, neoadjuvant chemotherapy was approved for use in women with HER2+ or triple negative tumours from 2016, and prior to that for women with large tumours in 2000.

Sarah, Auckland, diagnosed at 36:

"Having chemotherapy as my initial treatment (before surgery and radiation) was an incredibly reassuring experience. Being able to feel the tumour shrinking with each round of chemo was really encouraging. Even though the chemo side effects worsened with each round, knowing it was definitely working was the fuel I needed to keep going. Chemo was also the treatment I was most nervous about, so getting that done first helped me feel like I could tackle anything else that came my way."

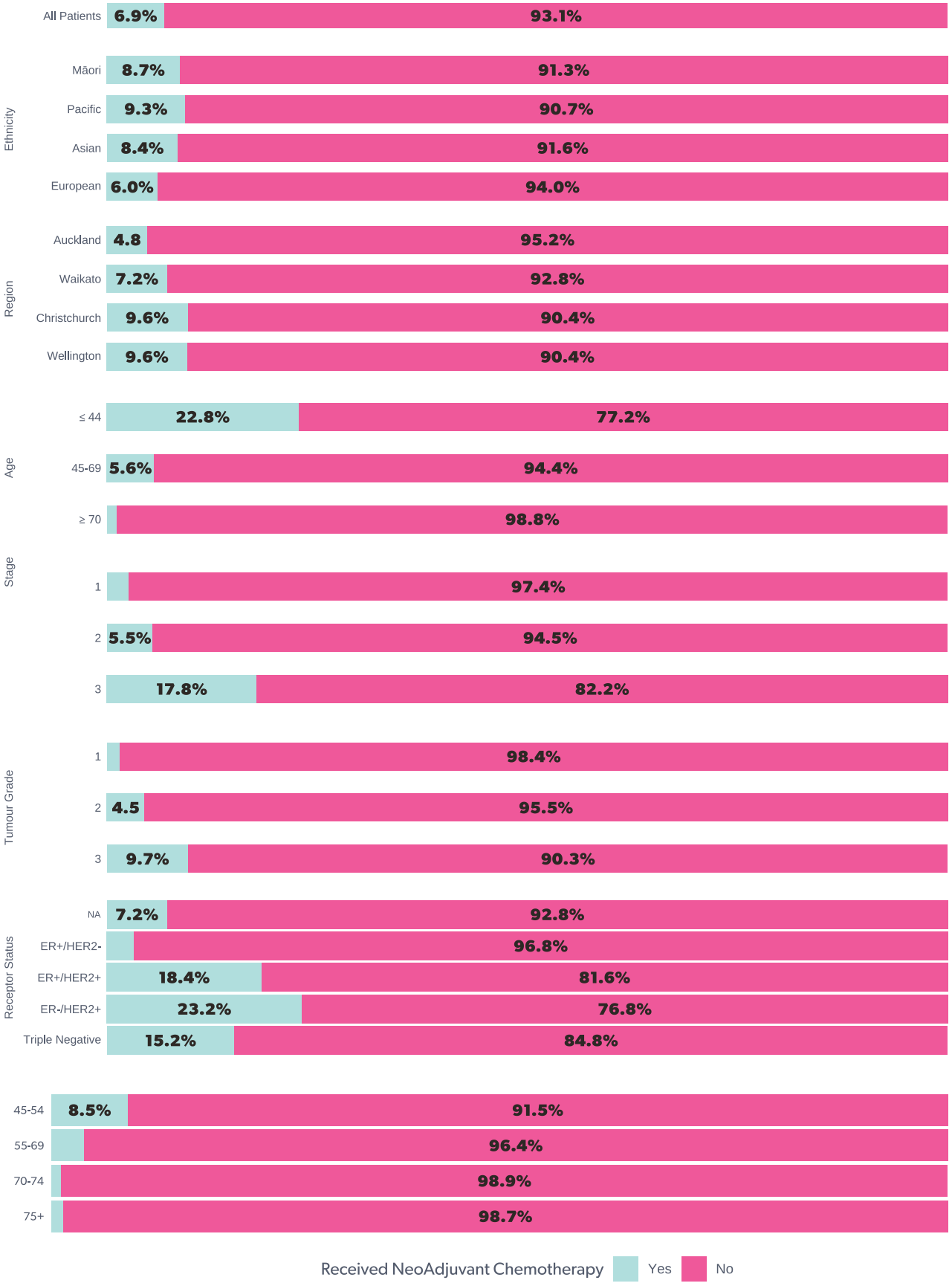


Fig. 7.2-4. *Neoadjuvant chemotherapy use. Proportion of women with invasive breast cancer receiving neoadjuvant chemotherapy from 2013 onwards.*

6.9% of women with invasive breast cancer received neoadjuvant chemotherapy (Figure 7.2-4). As expected, use is more common in higher risk groups: younger women, Pacific women, and women with grade 3 tumours.

The change in use of neoadjuvant therapy for younger women over time is shown in Table 11.2-4.

7.3 Anti-HER2 Therapies

Women with the HER2 receptor on their tumour cells (HER2+ breast cancer) may be treated with drugs that specifically target the dependency of these cells on the HER2 receptor in order to grow. These are drugs such as Herceptin, which was initially funded for early breast cancer in Aotearoa New Zealand from 2007 as a nine-week course. This was extended to a 12-month course from December 2008, initially directly funded by the Government, then PHARMAC-funded after 2009.

In Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register, most women with HER2+ breast cancer received Herceptin, but some received other drugs that target the HER2 receptor (for example, lapatinib). In this report, all of these treatments are referred to as anti-HER2 therapies.

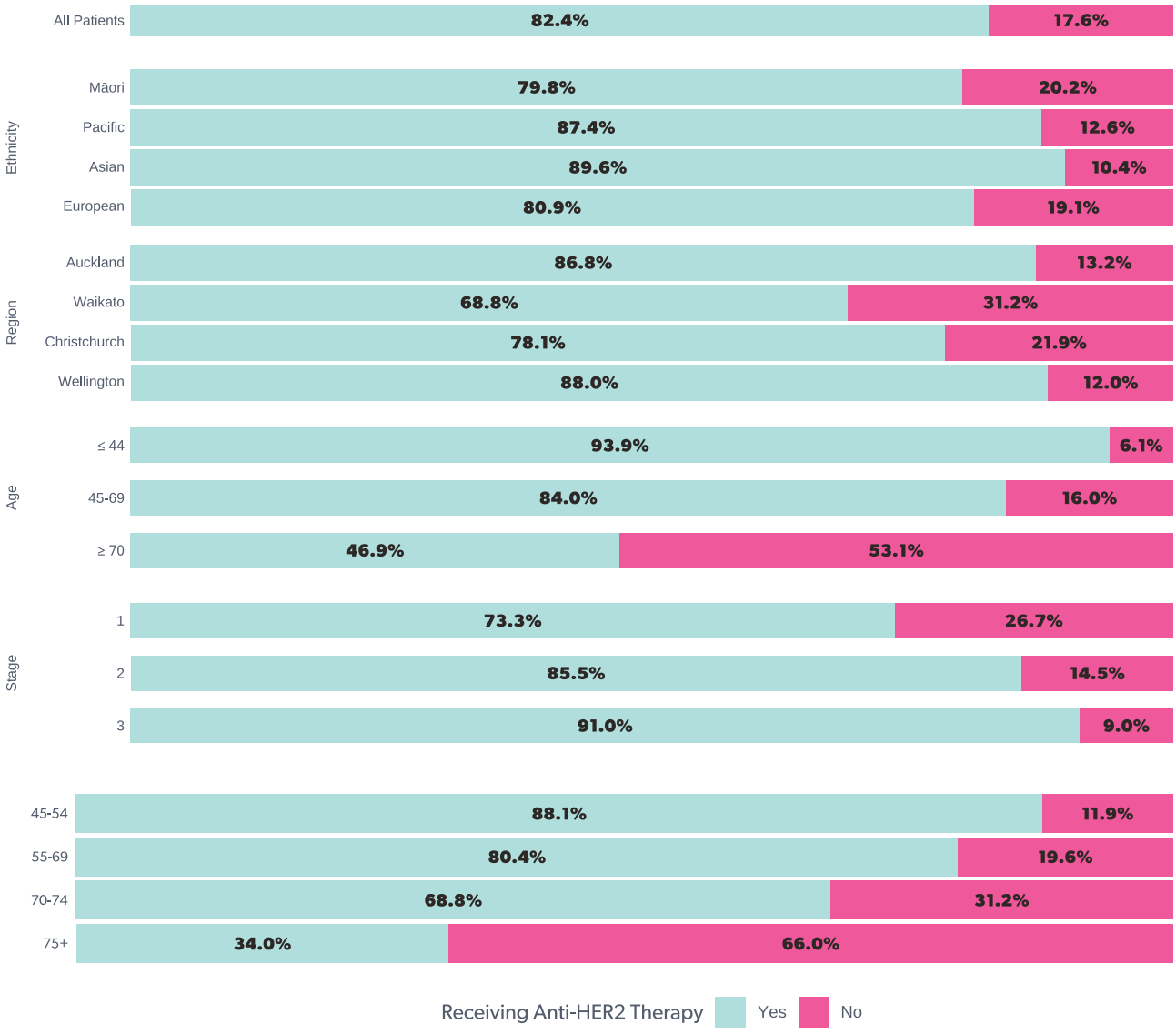


Fig. 7.3-1. *Analysis of use of HER2-targeted therapies. Proportion of women with HER2+ breast tumours, diagnosed in 2009 or later, receiving neoadjuvant or adjuvant HER2-targeted therapies. Data shown in Appendix B, Table 13.2-24.*

Among women with HER2+ breast tumours, 82.4% received Herceptin or other drugs that target HER2 (Figure 7.3-1). Waikato and Christchurch had the lowest use of anti-HER2 therapies; this may be related to tumour stage, as some stage 1 node-negative tumours may not need anti-HER2 treatment with chemotherapy. Additionally, some patients may not be suitable for chemotherapy.

Women aged over 70 were less likely to have these therapies, perhaps because of the requirement for concomitant chemotherapy. This may also be the main reason for a small percentage of patients across all ethnicities declining anti-HER2 therapy (Figure 7.3-2).

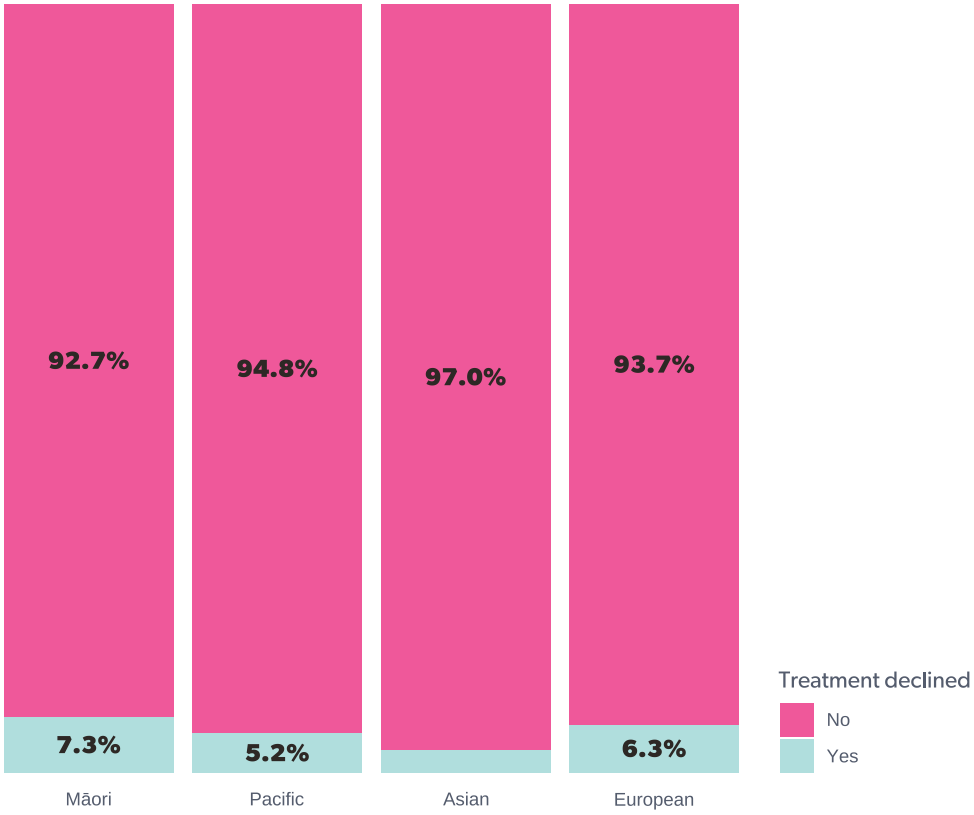


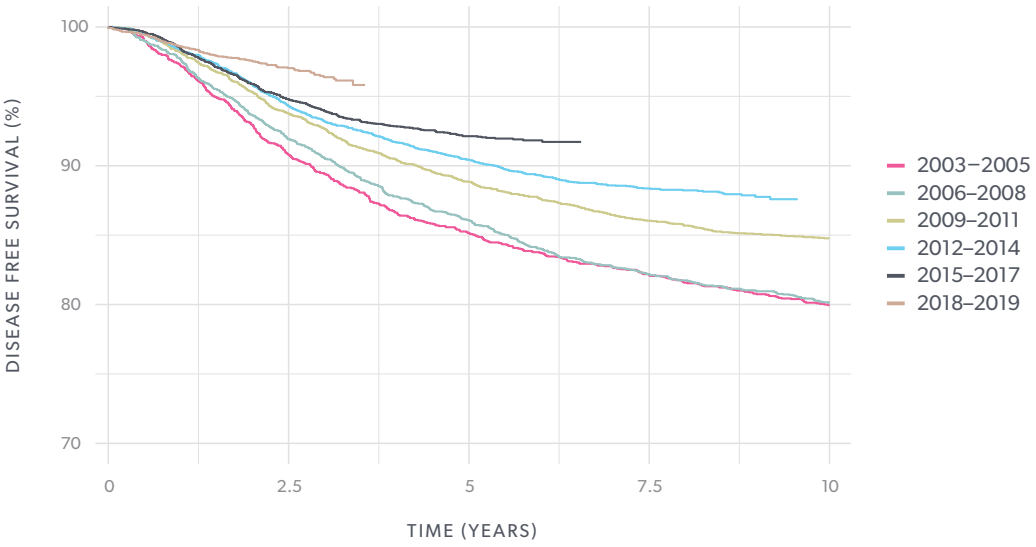
Fig. 7.3-2. *Anti-HER2 therapy declined by ethnicity.*

7.4 Disease-Free Survival

Disease free survival (DFS) of breast cancer measures how many people have not had either a locoregional recurrence or distant / metastatic (spread to another site in the body) recurrence of their cancer.

Analysis of DFS using data in Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register shows this has improved in Aotearoa New Zealand since 2003-2005.

Disease-free survival by year of diagnosis

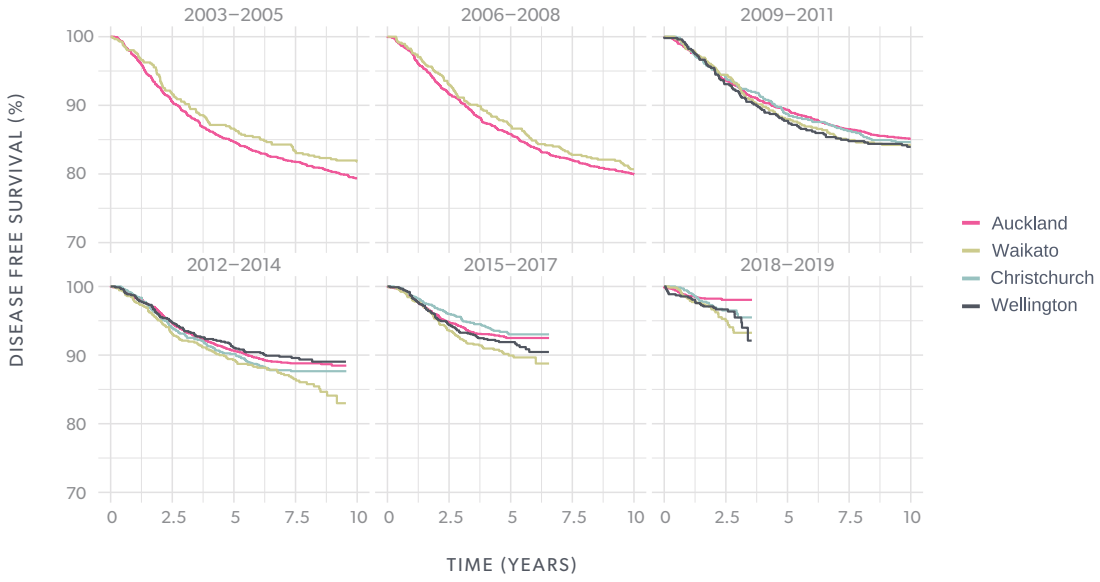


YEAR OF DIAGNOSIS	5-YEAR DFS	10-YEAR DFS
2003-2005	85% (84-87)	80% (78-82)
2006-2008	86% (85-87)	80% (79-82)
2009-2011	89% (88-90)	85% (84-86)
2012-2014	90% (90-91)	
2015-2017	92% (91-93)	

Fig. 7.4-1. *Disease-free survival by year of diagnosis. Proportion of women being disease-free out to 10 years, by the year they were diagnosed with invasive breast cancer.*

Disease-free survival improved (and rates of recurrence decreased) over time. For women diagnosed in 2003-2005, 15% had a recurrence within five years of diagnosis, but this decreased to 8% for women diagnosed in 2015-2017 (Figure 7.4-1). For those diagnosed in 2003-2005, 10-year DFS was 80%; those diagnosed in 2009-2011 had improved 10-year DFS of 85%.

Disease-free Survival by region over time



REGION	5-YEAR DFS	10-YEAR DFS
Auckland		
2003-2005	85% (83-86)	79% (77-81)
2009-2011	89% (88-91)	85% (84-87)
2015-2017	92% (91-94)	
Waikato		
2003-2005	87% (84-89)	82% (79-85)
2009-2011	88% (85-91)	84% (81-87)
2015-2017	90% (88-92)	
Christchurch		
2009-2011	89% (86-91)	85% (82-87)
2015-2017	93% (91-95)	
Wellington		
2009-2011	88% (85-91)	84% (81-87)
2015-2017	92% (90-94)	

Fig. 7.4-2. *Disease-free survival by region. Proportion of women disease-free in each region, by the year they were diagnosed with invasive breast cancer.*

In Auckland, 15% of women diagnosed in 2003-2005 had a recurrence by five years, but this dropped to 8% by 2015-2017. Auckland also had a decrease in 10-year recurrence, from 21% down to 15% for women diagnosed in 2009-2011.

In Waikato, 13% of women diagnosed in 2003-2005 had a recurrence (or 87% were disease-free) by five years, dropping to 10% for those diagnosed in 2015-2017. Changes in 10-year DFS are not meaningful, as confidence intervals overlap.

In Christchurch, 11% of women diagnosed in 2009-2011 had a recurrence within five years, dropping to 7% in 2015-2017. By 10 years, 15% had a recurrence. For Wellington, 12% of women diagnosed in 2009-2011 had a recurrence by five years,dropping to 8% in 2015-2017. By 10 years, 16% had a recurrence.

This analysis of DFS does not distinguish between locoregional recurrence, which is curable, and distant recurrence, which is treatable but not considered curable.

8. Invasive Breast Cancer in Young Women

In brief

- The rate of diagnoses of invasive breast cancer in women aged <45 in Aotearoa New Zealand does not appear to have increased over time.
- Young women had larger and higher grade tumours than older women, and a higher proportion of HER2+ and triple negative breast cancers.
- Younger women have more invasive or toxic treatments than older women: two-thirds had a mastectomy, rather than breast-conserving surgery, and 75% had chemotherapy.
- Survival is worse for young women: 24% had a recurrence within 10 years of diagnosis, and 10-year survival was 82%.

Analysis of national data from the Ministry of Health shows that neither the number nor age-standardised rate of diagnoses of invasive breast cancer in women aged under 45 in Aotearoa New Zealand has increased over time. Approximately 360 women have been diagnosed each year since 2008 [19, 20, 78-81].

8.1 Overview/Demographics

Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register recorded 3,453 women diagnosed with invasive breast cancer from age 19-44 during the reporting period, representing 13.4% of female invasive breast cancer diagnoses. Approximately half of these women (7.3%) were diagnosed between the ages of 40-44 years. More than 20% of Asian and Pacific women diagnosed with breast cancer were under 45 years old. Of wāhine Māori diagnosed with breast cancer, 17% were aged under 45 when diagnosed, compared with only 11% of European women (Figure 13.2-1).

8.2 Detection and Diagnosis

Nearly all women (93.6%) with breast cancer before free screening starts at age 45 were diagnosed after presenting with symptoms (Figure 5.1-1).

Young women also presented with large tumours, with 49.2% having invasive tumours larger than 20mm, and nearly 9.9% larger than 50mm (Figure 5.2-1c). Nearly half (46.7%) of young women had grade 3 breast tumours (Figure 5.2-2). Young women had the highest proportions of stage 2 and stage 3 disease (Figure 5.2-12); only 30% had stage 1 disease.

Analysis of the receptor status of breast cancers from young women show that they had a higher proportion of HER2+ (26.2%) and triple negative (14.4%) breast cancers than women diagnosed over the age of 44 years (Figure 5.2-5).

8.3 Treatment and Outcomes

The type of surgery for young women with invasive breast cancer changed very little over time, with approximately two thirds of young women having a mastectomy and one third having breast-conserving surgery (Figure 6.1-9). The proportion of young women having a sentinel lymph node biopsy increased over time, from 33% in 2003-2005 to 66.7% in 2018-2019 (Figure 6.1-11). Nearly half (49%) of young women had axillary node dissection, in contrast to around 30% of women diagnosed over the age of 45 years (Figure 6.1-15).

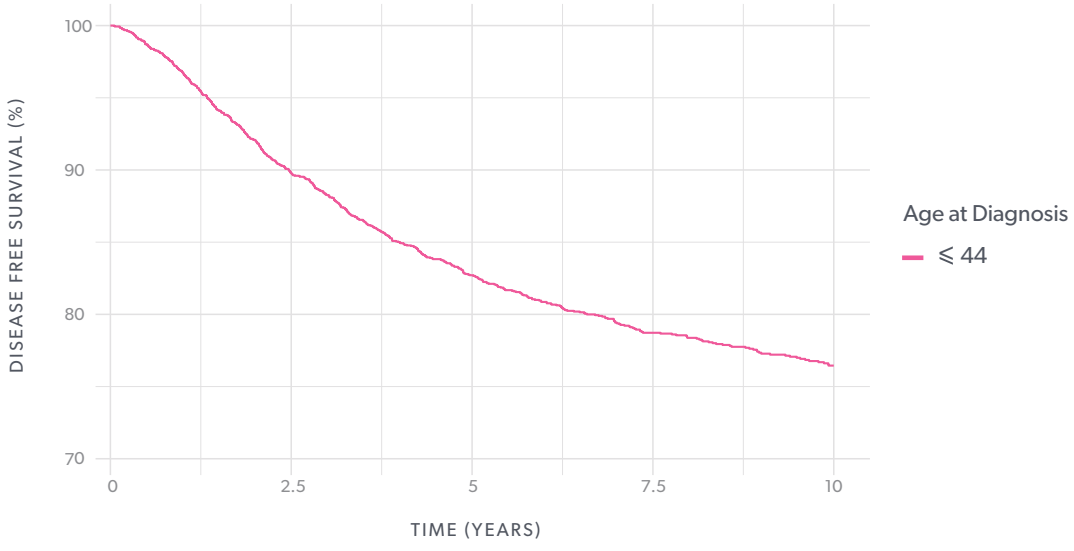
Young women were the most likely to have breast reconstruction: nearly half of all young women had a reconstruction, 11% immediate and 35.2% delayed (Figure 6.1-19).

As with other age groups, almost all young women were referred for radiation therapy after breast-conserving surgery (Figure 6.2-2). For young women with high-risk breast cancers, 87.4% received radiation therapy after having a mastectomy (Figure 6.2-4).

Young women with invasive breast cancer were the largest group to receive adjuvant and neoadjuvant chemotherapies. Three quarters (74%) of young women received adjuvant chemotherapy for invasive breast cancer, compared to 35.9% of women aged 45-69 years (Figure 7.2-1). Since 2013, 23% received neoadjuvant chemotherapy, usually given for more aggressive tumours, compared to 5.6% of women aged 45-69 years (Figure 7.2-4).

Nearly all young women (97.4%, table not shown) with HER2+ breast tumours were referred for treatment with HER2-targeted therapies.

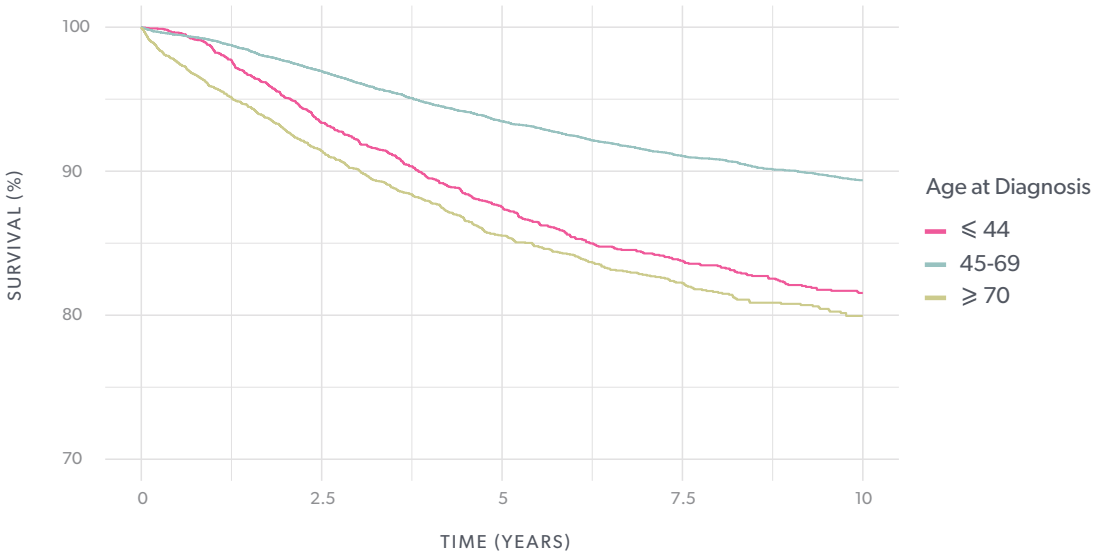
Outcomes for Younger Women



5-YEAR DFS	10-YEAR DFS
83% (81-84)	76% (75-78)

Fig. 8.3-1. *Disease-free survival for women ⩽ 44. Proportion of women who have not had a recurrence of their cancer, by their age of diagnosis.*

Young women were the most likely to have a recurrence of their breast cancer. 17% had a recurrence by five years and 24% by 10 years after diagnosis (Figure 8.3-1). In contrast, for women diagnosed between 45-69 years, 8% had a recurrence before five years and 12% had a recurrence before 10 years (not shown).



AGE AT DIAGNOSIS	5-YEAR SURVIVAL	10-YEAR SURVIVAL
⩽ 44	88% (86-89)	82% (80-83)
45-69	93% (93-94)	89% (89-90)
⩾ 70	86% (84-87)	80% (79-81)

Fig. 8.3-2. *Breast cancer-specific survival for women ⩽ 44 compared with other age groups.*

Breast cancer-specific survival (BCSS) was similarly worse for young women than for those aged 45-69 (Fig. 8.3-2). The 10-year survival rate for women <45 is 82%, compared to 89% for women diagnosed aged 45-69. This means that for every 100 women diagnosed with breast cancer, seven more women died from breast cancer if they were aged under 45. Factors in poorer survival will include later (unscreened) diagnosis, the greater incidence of higher-risk disease in young women, and greater likelihood of genetic mutations.

In summary, women diagnosed with breast cancer before the age of 45 years presented symptomatically with larger, higher grade tumours and more advanced disease stage than women of other age groups. Two thirds of young women had a mastectomy, and a half had breast reconstruction. More young women received chemotherapy than women of other age groups.

Younger women's breast cancer must be a priority area for research and improvement. Breast Cancer Foundation NZ is funding the Helena McAlpine Young Women's Breast Cancer Study, an in-depth analysis of breast cancer in young New Zealand women that aims to improve treatment and increase survival.

Sara, Auckland, diagnosed at 31:

"I wasn't given a choice in what type of surgery to have because I had more than one tumour and because of the size of them, there was little breast tissue to salvage. So a mastectomy was my only option really. And while I was given different options for reconstruction, it didn't feel like I had many real alternatives to under-the-muscle implants, because I felt that was the prevalent approach to reconstruction in NZ."

9. DCIS in New Zealand Women

In brief

- 47.6% of DCIS recorded in the Register was high grade and 36.5% was intermediate grade.
- 61.3% of women had breast-conserving surgery for DCIS, with women aged over 70 having the greatest increase.
- Three quarters of women had radiation therapy after breast-conserving surgery for DCIS.
- Only 5% of women had a recurrence within 10 years of a DCIS diagnosis.

9.1 Overview/Demographics

Breast cancers arise from the cells that line the glands and ducts that produce milk and deliver it to the nipple. Cancers that are confined to these glands and ducts are classified as *in situ* cancers. Two subtypes are recognised – ductal carcinoma *in situ* (DCIS) and lobular carcinoma *in situ* (LCIS). Both have differing pathology and prognostic implications. DCIS has established guidelines for diagnosis, treatment and follow-up and therefore is represented in this report. LCIS has undergone multiple changes in classification over the last 50 years and is now excluded from the Cancer Staging Manual (AJCC eighth edition).

There are 4,498 women with DCIS breast cancers in Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register diagnosed from 2003-2019, accounting for 14.8% of women diagnosed with breast cancer. This figure includes 4,426 women diagnosed with ductal carcinoma *in situ* (DCIS), 15 with Paget's disease of the breast, and 57 with lobular carcinoma *in situ*. Due to the small number of non-DCIS *in situ* cases, this report focuses on women with DCIS only.

The median age of diagnosis of all women with DCIS was 56 years. This was similar across all ethnicities because DCIS is mainly diagnosed during screening. Wāhine Māori comprised 8.5% of women diagnosed with DCIS, 5% were Pacific women, 14.7% were Asian and 71.9% were European. Comparing these to the proportions of each ethnicity diagnosed with invasive breast cancer, a higher proportion of those women diagnosed with DCIS were Asian (14.7% of all DCIS cases, compared to 8.5% of invasive breast cancer cases).

9.2 Detection and Diagnosis of DCIS

International studies have shown that the incidence of women diagnosed with DCIS has increased over time, coinciding with the introduction of screening mammograms [82, 83].

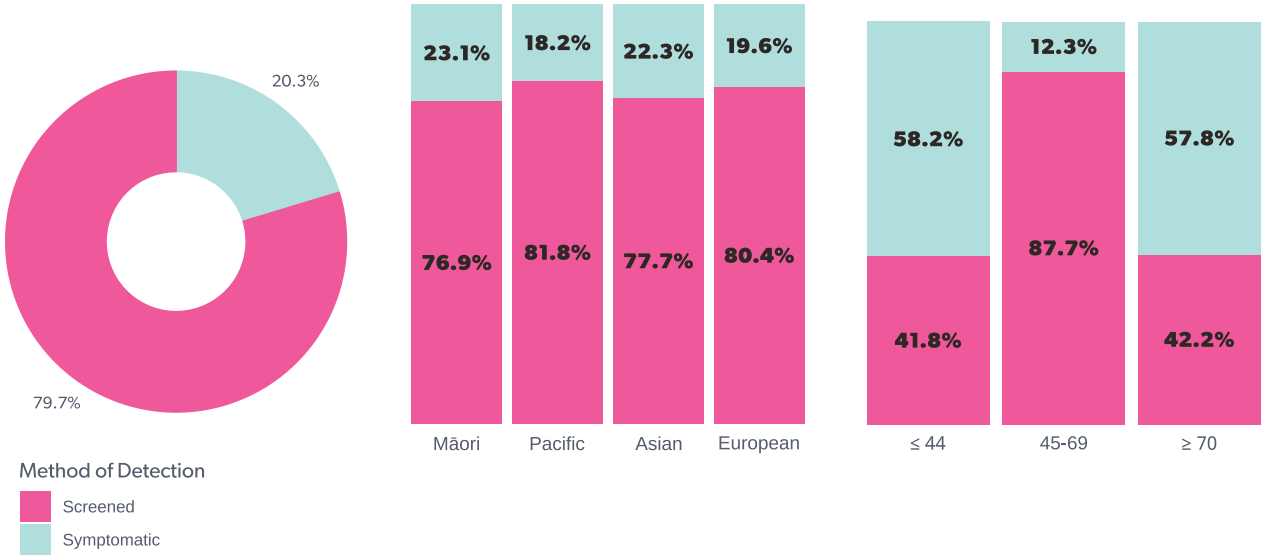


Fig. 9.2-1. *Overview of DCIS detection. a) Overall proportion of DCIS cases detected by mammographic screening or by women presenting with symptoms. b) Proportion of women diagnosed with DCIS by each detection method by ethnicity. c) Proportion of women diagnosed with DCIS by each detection method by age.*

DCIS is only occasionally detected as a lump, nipple change or other symptom. In the Register, nearly 80% of all DCIS was detected during breast screening (Figure 9.2-1a). For wāhine Māori and Asian women, similar proportions of DCIS were found after presenting with symptoms (23.1% and 22.3% respectively; Figure 9.2-1b), whereas these figures were lower for European and Pacific women (19.6% and 18.2%).

For nearly 90% of women between the ages of 45-69 years, DCIS was detected by screening mammography (Figure 9.2-1c). However, for women aged under 45 or over 69 years, who are not eligible for free screening, nearly 60% presented with symptoms.

9.3 Pathology of DCIS

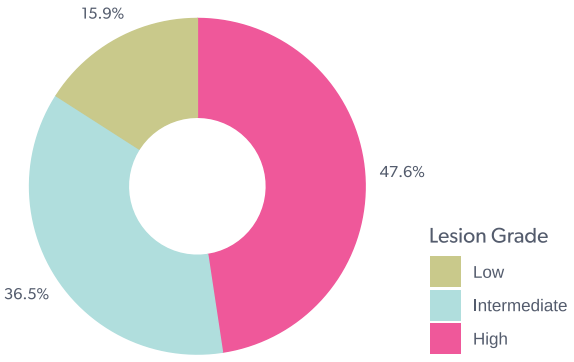


Fig. 9.3-1. *Analysis of DCIS grade. Proportion of women with each DCIS grade in the Register.*

DCIS is pathologically classified into low, intermediate and high grade. Women with low-grade DCIS are less likely to progress to an invasive cancer than those with high-grade DCIS.

Nearly half (47.6%) of DCIS recorded in the Register was high grade and 36.5% was intermediate grade (Figure 9.3-1). All DCIS is amenable to treatment to achieve a cure.

Pathology analysis is performed to determine the grade of the DCIS, as this is one factor that determines the type of treatment a woman with DCIS will receive [84].

9.4 Treatment of Women with Ductal Carcinoma *In Situ*

In a proportion of cases, DCIS can precede invasive breast cancer but it is not known which will progress to invasive breast cancer [85]. Internationally, several clinical trials are underway to investigate active surveillance as an alternative to surgery, but currently nearly all women diagnosed with DCIS in Aotearoa New Zealand undergo surgery.

9.4.1 Time to surgery after DCIS diagnosis

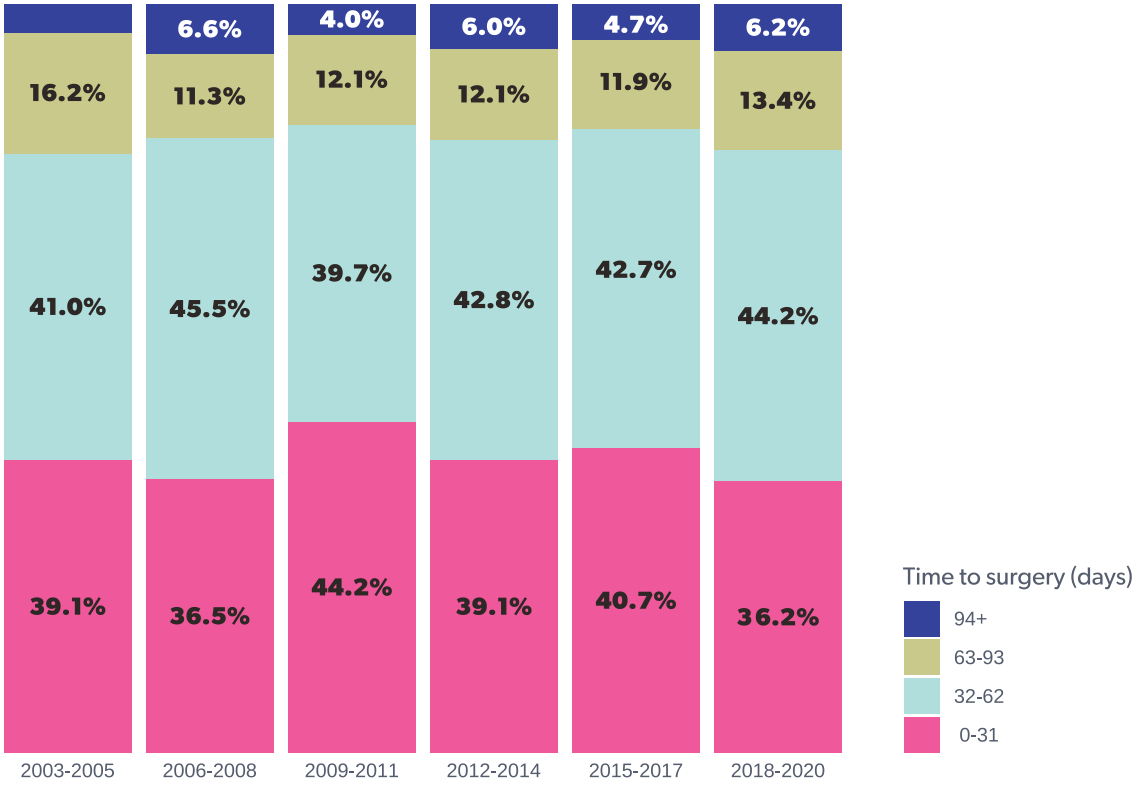


Fig. 9.4-1. *DCIS time to surgery from date of diagnosis by year group from 2003 to 2019.*

The time to surgery from the date of DCIS diagnosis in the public health system remained fairly consistent over time (Figure 9.4-1). Approximately 40% of women had surgery within 31 days after their diagnosis of DCIS.

Surgical treatment of women with DCIS can be breast-conserving surgery, with or without radiation therapy, or mastectomy [84].

9.4.2 Type of DCIS surgery by ethnicity

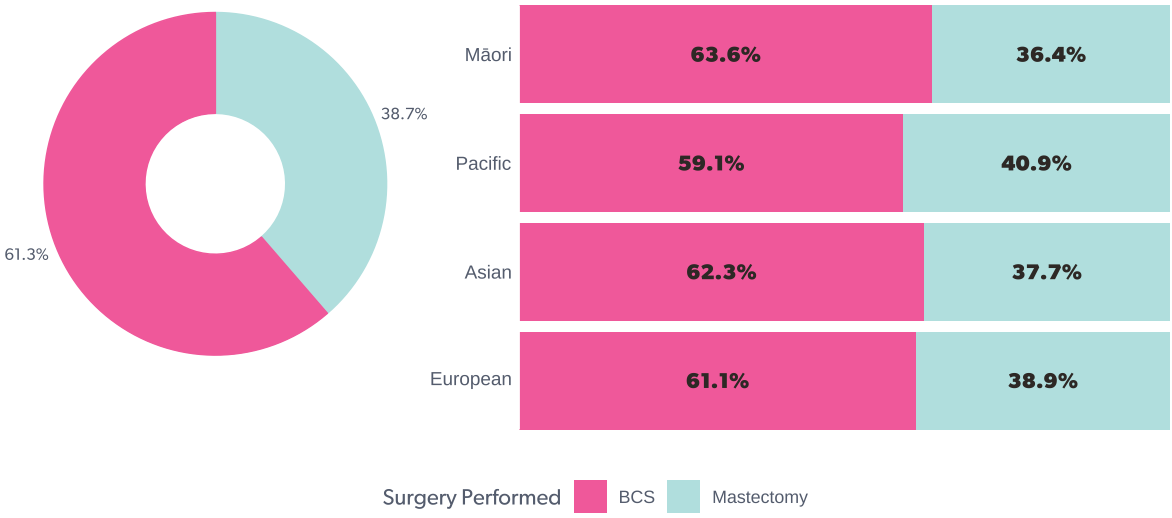


Fig. 9.4-2. *DCIS surgery type by ethnicity. a) Overall proportion of women having either breast-conserving surgery (BCS) or mastectomy for DCIS. b) type of surgical treatment performed on women with DCIS, by ethnicity.*

Overall, 61.3% of women had breast-conserving surgery for DCIS, with the remaining women having a mastectomy (Figure 9.4-2a). Wāhine Māori had the highest rates of breast-conserving surgery (63.6%), with Pacific women having the lowest rates (59.1%) (Figure 9.4-2b).

9.4.3 DCIS surgery type by year of diagnosis

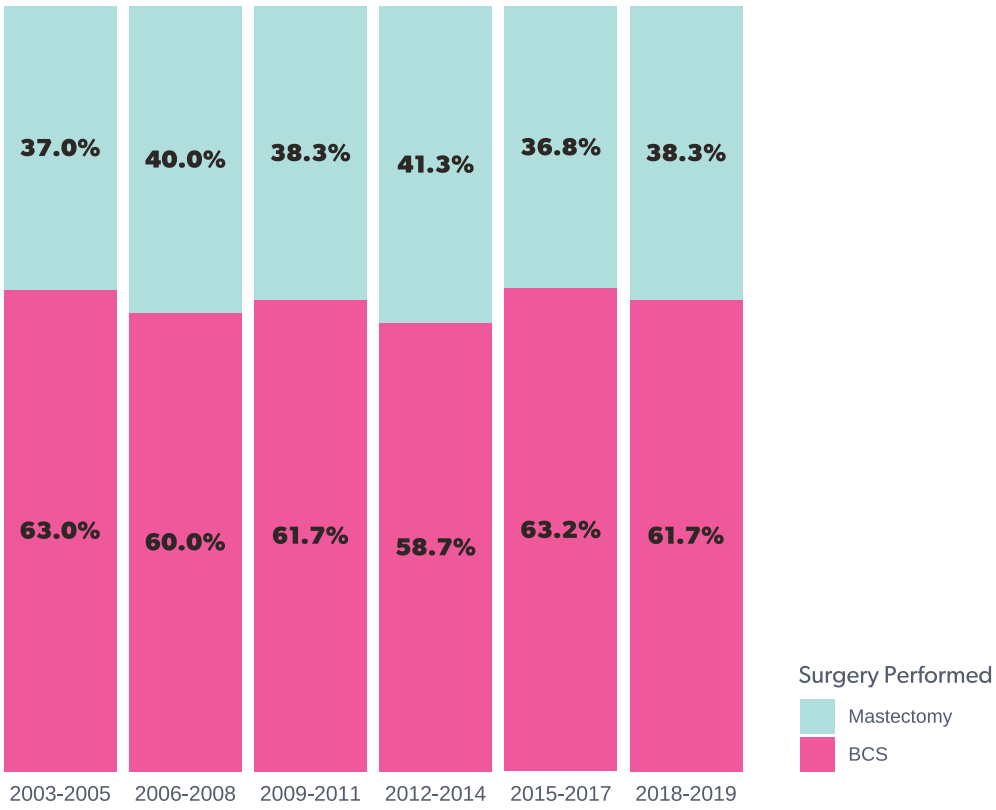


Fig. 9.4-3. *DCIS surgery type by year of diagnosis. Proportion of women receiving either breast-conserving surgery (BCS) or mastectomy for the treatment of DCIS over time from 2003 to 2019.*

The proportion of women receiving either breast-conserving surgery or mastectomy remained fairly constant from 2003 to 2019 (Figure 9.4-3).

Rose, Auckland, diagnosed at 43:

"I was told I had DCIS and there was a 50% chance of the cancer recurring in my other breast, so I opted to have a bilateral mastectomy and reconstructive surgery. I didn't want to have to go through this again. Six years on, I know I was spared further treatment by my choice to have a screening mammogram privately, and subsequent surgery."

9.4.4 DCIS surgery type by age

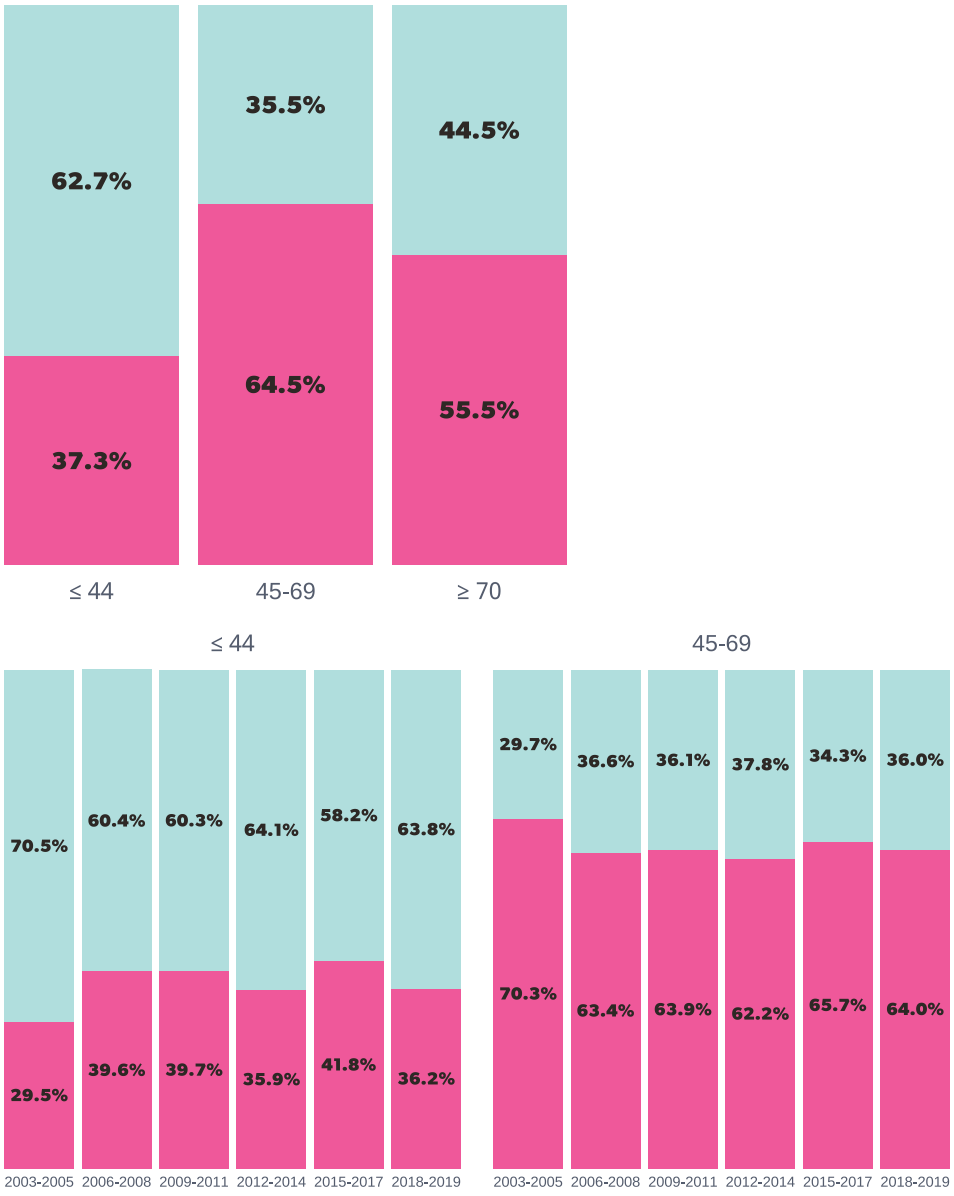


Fig. 9.4-4. *DCIS surgery type by age. Proportion of women receiving either breast-conserving surgery (BCS) or mastectomy for the treatment of DCIS by a) age at diagnosis, and b) age at diagnosis over time.*

The type of surgery recorded in the Register for DCIS varied by a woman's age at diagnosis. Just over one third (35.5%) of women aged 45-69 were treated with mastectomy. In contrast, nearly two thirds (62.7%) of women under 45 had a mastectomy (Figure 9.4-4a).

In addition to frequently presenting with larger and higher grade lesions, diagnosis of DCIS in younger women is a risk factor for subsequent development of invasive breast cancer [86, 87]. For women in the Register diagnosed aged 70+ with DCIS, 44.5% were treated with mastectomy.

Analysis of whether surgical treatment for DCIS has changed in the Register since 2009 shows that for women under 70, the proportion receiving breast-conserving surgery or mastectomy was relatively consistent (Figure 9.4-4b). However, for older women diagnosed with DCIS from 2012 onwards, the proportion having breast-conserving surgery to treat DCIS increased from 51.2% to 60.6%.

9.4.5 DCIS radiation referrals

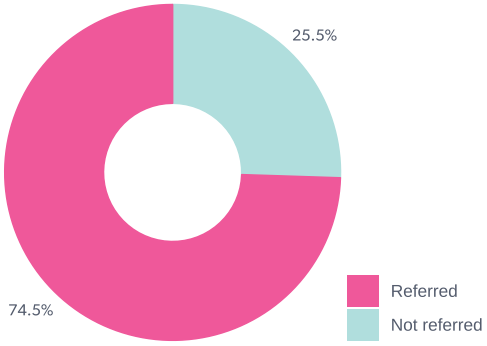


Fig. 9.4-5. *Women with DCIS referred for radiation therapy. Overall proportion of women with DCIS referred for radiation therapy following breast-conserving surgery.*

Three quarters (74.5%) of women were referred for radiation therapy following breast-conserving surgery for DCIS (Figure 9.4-5). Note that some women are not referred if they have low grade DCIS with clear margins after surgery. Surgeons aim for a wider clear margin with DCIS surgery than they do for invasive breast cancer. Consensus guidelines state that for patients having breast-conserving surgery followed by radiation therapy, the margin should be 2mm. For patients omitting radiation, the margin should be at least 2 mm. [88]

9.4.6 DCIS treatment declined

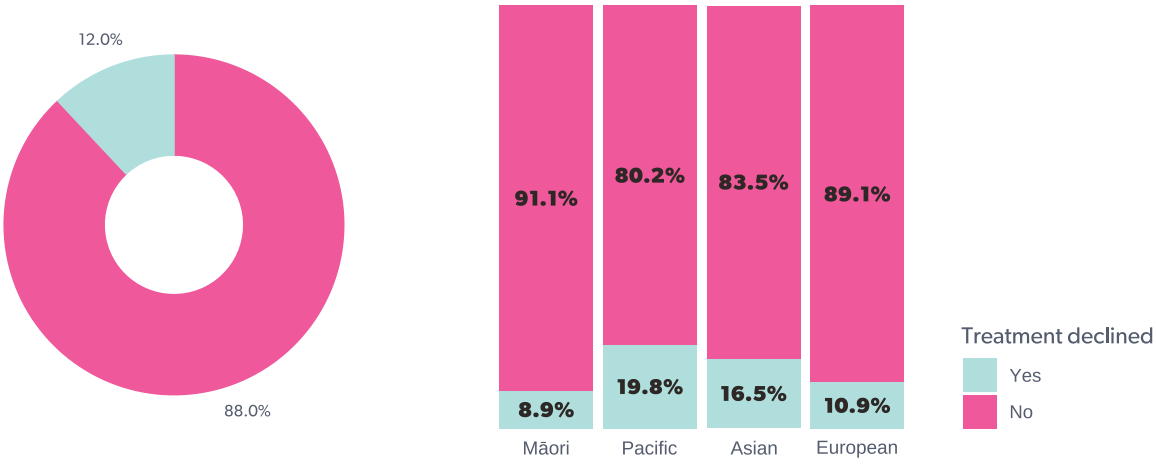
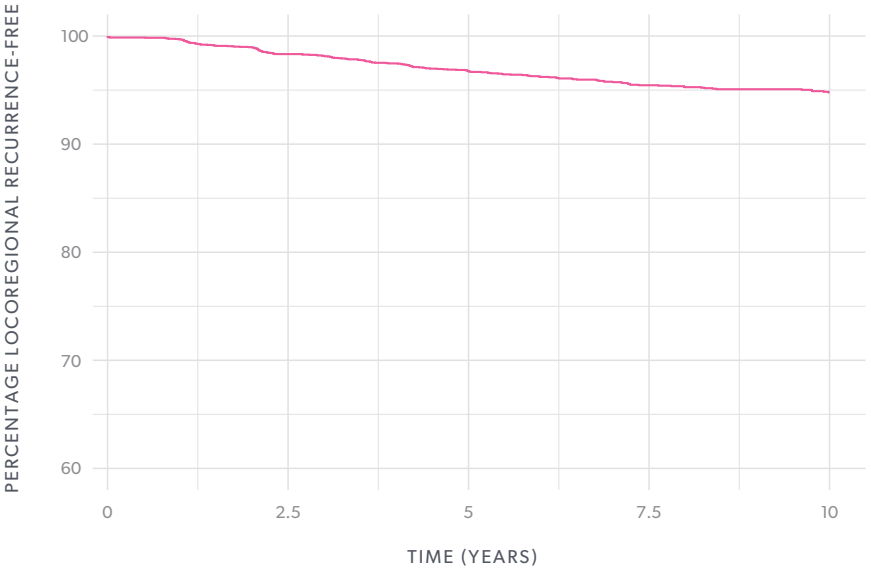


Fig. 9.4-6. *Women with DCIS reported as "declining" treatment. a) Overall proportion of women declining radiation therapy, b) Proportion of women declining by ethnicity*

A small proportion (12%) of women referred by their surgeon declined radiation therapy following breast-conserving surgery (Figure 9.4-6a). The lowest proportion of women reported as declining radiation therapy following breast-conserving surgery were wāhine Māori (8.9%), followed by European, Asian and then Pacific women (Figure 9.4-6b). Evidence suggests that radiation does not improve overall survival in DCIS but only improves local control. An informed decision may result in the patient opting for continued screening rather than radiation treatment.

9.4.7 DCIS recurrence

Women diagnosed with DCIS can experience a recurrence either as DCIS or as an invasive breast cancer; the literature suggests approximately half of DCIS recurrences are invasive.



	5-YEAR LRR-FREE	10-YEAR LRR-FREE
Overall	97% (96-97)	95% (94-96)

Fig. 9.4-7. *Locoregional recurrence for women with DCIS. The proportion of women not having either a locoregional recurrence of DCIS or invasive breast cancer up to 10 years after diagnosis of DCIS.*

Analysis of locoregional recurrence rates for women in the Register diagnosed with DCIS shows that by 10 years, 95% of women did not have a recurrence of DCIS or develop invasive breast cancer (Figure 9.4-7).

Although the recurrence rates are very low, there are a number of large international trials underway to determine whether surgery could be avoided for women with low-grade DCIS, with these women undergoing regular surveillance for a minimum of five to 10 years [89-91]. The results from these trials may either reinforce current clinical practice or may change the clinical management of New Zealand women with low-grade DCIS in the future.

10. Breast Cancer in New Zealand Men

In brief

- Around 25 New Zealand men are diagnosed with breast cancer each year. In the Register, the median age was 68.
- Nearly all male breast cancers were ER+.
- Mastectomy and endocrine therapy were the most common treatments.

10.1 Overview/Demographics

Around 25 New Zealand men are diagnosed with breast cancer each year [11-20]. Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register has recorded 197 cases of breast cancer in New Zealand men, 20 cases with DCIS and 177 with invasive breast cancer. This figure represents 0.6% of breast cancer cases in the Register, consistent with Ministry of Health records from 2016-2018 and international figures for men being up to 1% of all breast cancer registrations [18-20, 92]. The median age of diagnosis of breast cancer in men in the Register was 68 years. Although the numbers are small, 80% of men diagnosed with breast cancer were European, with 5.5%, 6.2% and 6.8% being Māori, Pacific and Asian respectively. Fifteen men died from breast cancer; this number is too small to allow breakdown by ethnicity, as there is a risk of individuals becoming identifiable.

10.2 Detection and Diagnosis of Breast Cancer in Men

As breast cancer in men is rare, they are not offered screening mammograms. Diagnosis of breast cancer in men is therefore usually symptomatic, a common symptom being a painless lump situated close to or behind the nipple [93, 94]. As with breast cancer in women, other symptoms can include nipple changes or discharge, skin changes, or a lump or thickening in or near the armpit or the breast [93, 94]. Strong risk factors for breast cancer in men include a family history of breast and ovarian cancer, and/or a BRCA2 gene mutation (present in about 10% of men diagnosed with breast cancer) [95, 96]. Other risk factors are older age, hormonal imbalance or previous exposure to radiation [94].

In the Register, pathology analysis of the tumour receptor status showed that 96.4% of men had breast tumours with the oestrogen receptor (ER+), 11.4% of male breast cancers had the HER2 protein and 2.9% were triple negative. These values are similar to international reports, where over 90% of male breast cancers are ER+ [93, 97].

10.3 Treatment of Breast Cancer in Men

Mastectomy is the most common surgical procedure for men with breast cancer, and guidelines recommend that those with hormone receptor-positive breast cancer receive the endocrine therapy tamoxifen for at least five years after surgery [98]. Indications for chemotherapy and anti-HER2 therapy are generally the same as for women with breast cancer.

Leigh, Taranaki, diagnosed at 58:

"It was very isolating going through a diagnosis that primarily affects women. I remember getting handed a bag full of pamphlets that contained no information that was particular to male breast cancer. I understood why, but it was disconcerting. I didn't get much consultation on what my treatment would be. I was told a mastectomy, chemotherapy and tamoxifen are how women are treated, and that it works for them so there was no reason why it wouldn't work for me."

11. Key and High Quality Performance Indicators (KPIs and HQPIs)

In brief

- The Royal Australasian College of Surgeons (RACS) Key Performance Indicators (KPIs) and High Quality Performance Indicators (HQPIs) are used to audit the treatment of women with breast cancer.
- New Zealand surgeons met most KPIs across all years. The exceptions were endocrine therapy referrals (met since 2015) and high-risk chemotherapy referrals, which fell slightly short in some years.
- The HQPIs do not have specific targets attached; however New Zealand practice fell short of suggested best practice for rates of breast-conserving surgery and reconstruction, as noted elsewhere in this report.
- In future, Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register will provide analysis of these measures by ethnicity, for use by local clinicians.

Many New Zealand surgeons are members of the Royal Australasian College of Surgeons (RACS), and audit their practice according to the six RACS breast cancer surgery Key Performance Indicators (KPIs) and six High Quality Performance Indicators (HQPIs). These evidence-based measures are used to audit the treatment of women with breast cancer over time. KPIs were introduced in 2004, and HQPIs were introduced in 2017. The definitions below (and the definitions of specific high-risk groups) are from https://www.surgeons.org/en/research-audit/morbidity-audits/morbidity-audits-managed-by-racs/breastsurganz-quality-audit/benefits-of-participating-performance-indicators.

11.1 Key Performance Indicators

KPI1 - Percentage of invasive cases undergoing breast-conserving surgery referred for radiotherapy

Year of Diagnosis	2003-2005 (N = 1,257)	2006-2008 (N = 1,468)	2009-2011 (N = 2,205)	2012-2014 (N = 2,725)	2015-2017 (N = 3,075)	2018-2019 (N = 2,307)
Referral for Radiation Therapy						
Yes	1,122 (89.3%)	1,293 (88.1%)	1,976 (89.6%)	2,422 (88.9%)	2,739 (89.1%)	2,106 (91.3%)
No	135 (10.7%)	175 (11.9%)	229 (10.4%)	303 (11.1%)	336 (10.9%)	201 (8.7%)

Table 11.1-1 *Percentage of women with invasive breast cancer undergoing breast-conserving surgery referred for radiotherapy.*

Target: at least 85%. This has been achieved for all years.

Year of Diagnosis	2003-2005 (N = 1,835)	2006-2008 (N = 2,153)	2009-2011 (N = 3,401)	2012-2014 (N = 4,318)	2015-2017 (N = 4,622)	2018-2019 (N = 3,421)
Referral for Endocrine Therapy						
Yes	1,532 (83.5%)	1,679 (78%)	2,751 (80.9%)	3,644 (84.4%)	4,012 (86.8%)	2,964 (86.6%)
No	303 (16.5%)	474 (22%)	650 (19.1%)	674 (15.6%)	610 (13.2%)	457 (13.4%)

Table 11.1-2. *Percentage of women with oestrogen receptor-positive invasive breast cancer referred for hormone therapy.*

Target: at least 85%. This has been achieved since 2015.

Year of Diagnosis	2003-2005 (N = 2,386)	2006-2008 (N = 2,752)	2009-2011 (N = 4,083)	2012-2014 (N = 5,056)	2015-2017 (N = 5,477)	2018-2019 (N = 3,931)
Axillary Surgery (including SNB)	2,261 (94.8%)	2,648 (96.2%)	3,971 (97.3%)	4,925 (97.4%)	5,351 (97.7%)	3,832 (97.5%)
No Axillary Surgery	125 (5.2%)	104 (3.8%)	112 (2.7%)	131 (2.6%)	126 (2.3%)	99 (2.5%)

Table 11.1-3. *Percentage of women with invasive breast cancer undergoing axillary surgery.*

Target: at least 90%. This has been achieved for all years. Note that according to BreastSurgANZ Quality Audit 2018 [69], this includes women receiving sentinel node biopsies.

KPI4 - Percentage of in situ *cases undergoing breast surgery without axillary clearance*

Year of Diagnosis	2003-2005 (N = 461)	2006-2008 (N = 502)	2009-2011 (N = 809)	2012-2014 (N = 965)	2015-2017 (N = 1,036)	2018-2019 (N = 661)
Axillary Clearance						
Yes	18 (3.9%)	27 (5.4%)	29 (3.6%)	33 (3.4%)	46 (4.4%)	40 (6.1%)
No	443 (96.1%)	475 (94.6%)	780 (96.4%)	932 (96.6%)	990 (95.6%)	621 (93.9%)

Table 11.1-4. *Percentage of* in situ cases *undergoing breast surgery without axillary clearance.*

Target: at least 90%. This has been achieved for all years.

KPI5 - Percentage of high-risk invasive cases undergoing mastectomy who are referred for radiotherapy

Women are defined as having high-risk invasive breast cancer if they have at least four positive lymph nodes or their tumours are at least 50mm in size.

Year of Diagnosis	2003-2005 (N = 330)	2006-2008 (N = 379)	2009-2011 (N = 502)	2012-2014 (N = 563)	2015-2017 (N = 514)	2018-2019 (N = 374)
Referral for Radiation Therapy						
Yes	291 (88.2%)	337 (88.9%)	456 (90.8%)	514 (91.3%)	472 (91.8%)	333 (89%)
No	39 (11.8%)	42 (11.1%)	46 (9.2%)	49 (8.7%)	42 (8.2%)	41 (11%)

Table 11.1-5. *Percentage of women with high-risk invasive breast cancer undergoing mastectomy who are referred for radiotherapy.*

Target: at least 85%. This has been achieved for all years.

KPI6 - Percentage of high-risk cases referred for chemotherapy

Women are defined as having high-risk invasive breast cancer if they fit any of the following:

1. Age < 55 years at diagnosis, have tumour grade > 1 and tumour size > 20mm,
2. Age < 55 years at diagnosis, have tumour grade > 1 and tumour size ⩽20mm and node involvement,
3. Age ⩽70 years at diagnosis, have a HER2+ tumour and tumour size > 5mm,
4. Age ⩽70 years at diagnosis, have a triple negative tumour and tumour size > 5mm.

Year of Diagnosis	2003-2005 (N = 735)	2006-2008 (N = 974)	2009-2011 (N = 1,342)	2012-2014 (N = 1,595)	2015-2017 (N = 1,683)	2018-2019 (N = 1,078)
Referral for Chemotherapy						
Yes	650 (88.4%)	854 (87.7%)	1,225 (91.3%)	1,419 (89%)	1,545 (91.8%)	961 (89.1%)
No	85 (11.6%)	120 (12.3%)	117 (8.7%)	176 (11%)	138 (8.2%)	117 (10.9%)

Table 11.1-6. *Percentage of women with high-risk invasive breast cancer referred for chemotherapy.*

Target: at least 90%. Performance has fallen slightly short in some years.

11.2 High Quality Performance Indicators

HQPIs were developed to be a metric of improved patient care. For this report, Breast Surgeons of Australia and New Zealand (BreastSurgANZ) provided HQPI data for cases with a diagnosis date between 30 November 2017 and 4 August 2021; we compare New Zealand data as reported in the Register with mean data reported to BreastSurgANZ. However, the definition and benchmark thresholds of HQPIs are still a subject for ongoing discussion within the Breast Quality Audit Committee. As the HQPIs are still a work in progress, BreastSurgANZ cautions that they may not be an informative or relevant measure of high quality care at this stage. We note also that recommendations for target achievement of HQPIs were made by Salindera in 2020 [99]. Note that the Register data does not enable evaluation of HQPIs 4 and 5.

HQPI1 - Rate of immediate breast reconstruction for in situ breast cancer patients requiring mastectomy

Year of Diagnosis	2003-2005 (N = 171)	2006-2008 (N = 202)	2009-2011 (N = 310)	2012-2014 (N = 400)	2015-2017 (N = 380)	2018-2019 (N = 256)
Reconstruction						
Immediate	29.2%	27.2%	29.4%	28%	32.6%	30.5%
Delayed	22.2%	18.3%	16.5%	16%	15%	13.7%
None	48.5%	54.5%	54.2%	56%	52.4%	55.9%

Table 11.2-1. *Rate of immediate breast reconstruction for* in situ *breast cancer patients requiring mastectomy.*

Mean surgeon achievement reported to the BreatSurgANZ Quality Audit from November 2017 was 31.6%; data reported in the Register in 2018-2019 was slightly lower (30.5%). The target recommended by Salindera is 40% or more [99].

HQPI2 - Rate of immediate breast reconstruction for invasive breast cancer patients requiring mastectomy

Year of Diagnosis	2003-2005 (N=1,265)	2006-2008 (N=1,461)	2009-2011 (N=2,124)	2012-2014 (N=2,603)	2015-2017 (N=2,608)	2018-2019 (N=1,751)
Timing of Reconstruction						
Immediate	15.5%	18.2%	16.5%	17.4%	17.9%	16.9%
Delayed	8.2%	8.6%	10%	9.8%	6.9%	5.7%
None	76.3%	73.2%	73.5%	72.8%	75.2%	77.4%

Table 11.2-2. *Rate of immediate breast reconstruction for women with invasive breast cancer requiring mastectomy.*

Mean surgeon achievement reported to the BreatSurgANZ Quality Audit from November 2017 was 18.5%; data reported in the Register in 2018-2019 was slightly lower (16.9%). The target recommended by Salindera is 20% or more [99].

HQPI3 – Rate of breast conservation for tumour < 2cm

Invasive and *in situ* breast cancer patients

Year of Diagnosis	2003-2005 (N=1,500)	2006-2008 (N=1,747)	2009-2011 (N=2,765)	2012-2014 (N=3,263)	2015-2017 (N=3,727)	2018-2019 (N=2,607)
Surgery Performed						
BCS	65.3 %	65.5 %	66.3 %	65.8 %	66.9 %	70.2 %
Mastectomy	34.7 %	34.5 %	33.7 %	34.2 %	33.1 %	29.8 %

Table 11.2-3. *Rate of breast conservation for patients with tumours < 2cm.*

Mean surgeon achievement reported to the BreatSurgANZ Quality Audit from November 2017 was 75.7%; data reported in the Register in 2018-2019 was slightly lower (70.2%) but just exceeded the target recommended by Salindera (70% or more) [99].

HQPI6 – Rate of use of neoadjuvant chemotherapy in women less than 50 years old

Year of Diagnosis	2012-2014 (N=3,263)	2015-2017 (N=3,727)	2018-2019 (N=2,607)
Use of Neoadjuvant Chemotherapy			
Yes	9.1 %	18.5 %	18.8 %
No	90.9 %	81.5 %	81.2 %

Table 11.2-4. *Rate of use of neoadjuvant chemotherapy in women less than 50 years old.*

Mean surgeon achievement reported to the BreatSurgANZ Quality Audit from November 2017 was 20.3%; data reported in the Register in 2018-2019 was slightly lower at 18.8%, but exceeded the target recommended by Salindera (15% or more) [99].

12. References

1. Elwood, J.M., et al., *Bias in survival estimates created by a requirement for consent to enter a clinical breast cancer registry.* Cancer Epidemiology, 2019. **58**: p. 178-183.
2. *Pedersen, R.N., et al., The Incidence of Breast Cancer Recurrence 10-32 Years After Primary Diagnosis*. JNCI: Journal of the National Cancer Institute, 2021.
3. Edge, S.B. and C.C. Compton, *The American Joint Committee on Cancer: the 7th edition of the AJCC cancer staging manual and the future of TNM*. Ann Surg Oncol, 2010. **17**(6): p. 1471-4.
4. Edge, S.B., et al., *AJCC cancer staging manual, 7th edition*. 2010, France: Springer.
5. Seneviratne, S., et al., *Breast Cancer Biology and Ethnic Disparities in Breast Cancer Mortality in New Zealand: A Cohort Study*. PLOS ONE, 2015. **10**(4): p. e0123523.
6. Breast Cancer Foundation NZ, *"I'm still here" Insights into living – and dying – with Advanced Breast Cancer in New Zealand*. 2018, Breast Cancer Foundation NZ.
7. Bouvier, A.M., et al., *Incidence and patterns of late recurrences in colon cancer patients*. Int J Cancer, 2015. **137**(9): p. 2133-8.
8. Pan, H., et al., *20-Year Risks of Breast-Cancer Recurrence after Stopping Endocrine Therapy at 5 Years*. New England Journal of Medicine, 2017. **377**(19): p. 1836-1846.
9. Rahal, R., *Improving outcomes through evidence based policy and performance measurement - the Canadian experience*. 2019: The University of Otago.
10. Lawrenson, R., et al., *Breast cancer inequities between Māori and non Māori women in Aotearoa/New Zealand*. European journal of cancer care, 2016. **25**(2): p. 225-230.
11. Ministry of Health NZ, *Cancer: New registrations and Deaths 2009*. 2012, Ministry of Health NZ: Wellington, NZ.
12. Ministry of Health NZ, *Cancer: New registrations and Deaths 2010*. 2013, Ministry of Health NZ: Wellington, NZ.
13. Ministry of Health NZ, *Cancer: New Registrations and Deaths 2011*. 2014, Ministry of Health NZ: Wellington, NZ.
14. Ministry of Health NZ, *Cancer: New registrations and Deaths 2012*. 2015, Ministry of Health NZ: Wellington, NZ.
15. Ministry of Health NZ, *Cancer: New registrations and Deaths 2013*. 2016, Ministry of Health NZ: Wellington, NZ.
16. Ministry of Health NZ, *New cancer registrations 2014*. 2016, Ministry of Health NZ: Wellington.
17. Ministry of Health NZ, *New cancer registrations 2015*. 2017, Ministry of Health NZ: Wellington, NZ.
18. Ministry of Health NZ, *New Cancer Registrations 2016*. 2018: Wellington, NZ.
19. Ministry of Health NZ, *New Cancer Registrations 2017*. 2019: Wellington, NZ.
20. Ministry of Health NZ, *New Cancer Registrations 2018*. 2020: Wellington, NZ.
21. Teng, A.M., et al., *Ethnic inequalities in cancer incidence and mortality: census-linked cohort studies with 87 million years of person-time follow-up*. BMC cancer, 2016. **16**(1): p. 1-14.
22. Environmental Health Intelligence NZ. *Urban–rural profile*. 2020 [cited 2021 10 November 2021]; Available from: https://www.ehinz.ac.nz/indicators/population-vulnerability/urbanrural-profile/.
23. Ministry of Health NZ, *Cancer: New registrations and Deaths 2008*. 2011, Ministry of Health NZ: Wellington, NZ.
24. Ministry of Health NZ, *Cancer: New Registrations and Deaths 2006*. 2010, Ministry of Health NZ: Wellington, NZ.
25. Ministry of Health NZ, *Cancer: New Registrations and Deaths 2007*. 2010, Ministry of Health NZ: Wellington, NZ.
26. Seneviratne, S., et al., *Ethnic differences in breast cancer survival in New Zealand: contributions of differences in screening, treatment, tumor biology, demographics and comorbidities*. Cancer Causes & Control, 2015. **26**(12): p. 1813-1824.
27. Gurney, J., et al., *Disparities in Cancer-Specific Survival Between Māori and Non-Māori New Zealanders*, 2007-2016. JCO Global Oncology, 2020(6): p. 766-774.
28. Ministry of Health NZ, *BreastScreen Aotearoa DHB Coverage Report*. 2021, Ministry of Health NZ.
29. Ministry of Health NZ, *Cohort and case control analyses of breast cancer mortality: BreastScreen Aotearoa 1999-2011*. 2015, Ministry of Health NZ: Wellington, NZ.
30. Cunningham, R., et al., *Ethnic and socioeconomic trends in breast cancer incidence in New Zealand*. BMC Cancer, 2010. **10**(1): p. 674.
31. Tin Tin, S., et al., *Ethnic disparities in breast cancer survival in New Zealand: which factors contribute?* BMC Cancer, 2018. **18**(1): p. 58.
32. Morrell, S., et al., *Cohort and Case Control Analyses of Breast Cancer Mortality: BreastScreen Aotearoa 1999-2011*, M.o. Health, Editor. 2015.
33. Stats NZ. *National and subnational period life tables: 2017–2019*. 2021; Available from: stats.govt.nz/information-releases/national-and-subnational-period-life-tables-2017-2019.

34. Ministry of Health NZ, *BSA New Zealand All District Health Board Coverage Report For the period ending 30 June 2018. 2018*, Ministry of Health NZ: Wellington, NZ.
35. Lawrenson, R., et al., *Urban Rural Differences in Breast Cancer in New Zealand*. Int J Environ Res Public Health, 2016. **13**(10).
36. Te Aho o Te Kahu, Cancer Control Agency, *He Pūrongo Mate Pukupuku o Aotearoa 2020, The State of Cancer in New Zealand 2020*. 2021, Te Aho o Te Kahu, Cancer Control Agency: Wellington, NZ.
37. Cancer Research UK. *One-, Five-, Ten-year Survival for Breast Cancer.* [cited 2021; Available from: https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/breast-cancer/survival#heading-Zero.
38. Australian Government, *Cancer Data in Australia 2021*, A.I.o.H.a. Welfare, Editor. 2021.
39. Ministry of Health NZ. *BreastScreen Aotearoa*. Available from: https://www.timetoscreen.nz/breast-screening/.
40. Morrell, S., et al., *Mammography service screening and breast cancer mortality in New Zealand: a National Cohort Study 1999-2011*. Br J Cancer, 2017. **116**(6): p. 828-839.
41. Ministry of Health NZ, *Impact Analysis: Extending BreastScreen Aotearoa to include women aged 70-74 years*. 2019, Ministry of Health: Wellington.
42. Duffy, S.W., et al., *Effect of mammographic screening from age 40 years on breast cancer mortality (UK Age trial): final results of a randomised, controlled trial*. The Lancet Oncology, 2020. **21**(9): p. 1165-1172.
43. Kwok, H., *Breast Cancer Screening Beyond 70 Years Old*. 2015, BreastScreen Aotearoa Counties Manukau.
44. Wildiers, H., et al., *Pertuzumab and trastuzumab with or without metronomic chemotherapy for older patients with HER2-positive metastatic breast cancer (EORTC 75111-10114): an open-label, randomised, phase 2 trial from the Elderly Task Force/Breast Cancer Group*. The Lancet Oncology, 2018. **19**(3): p. 323-336.
45. Malone, K.E., et al., *Prevalence and predictors of BRCA1 and BRCA2 mutations in a population-based study of breast cancer in white and black American women ages 35 to 64 years*. Cancer Res, 2006. **66**(16): p. 8297-308.
46. Cropper, C., et al., *Evaluating the NCCN Clinical Criteria for Recommending BRCA1 and BRCA2 Genetic Testing in Patients With Breast Cancer*. Journal of the National Comprehensive Cancer Network J Natl Compr Canc Netw, 2017. **15**(6): p. 797-803.
47. NSW Government. *Breast cancer - referring to genetics*
48. Cancer Australia. *Breast screening rates* 2020; Available from: https://ncci.canceraustralia.gov.au/screening/breast-screening-rates/breast-screening-rates.
49. Office for Health Improvement & Disparities, *Cancer Services*
50. Breast Cancer Foundation NZ. *What We Do - The Missing Women*. Available from: https://www.breastcancerfoundation.org.nz/what-we-do/advocacy/missing-women.
51. Schwartz, A.M., et al., *Histologic grade remains a prognostic factor for breast cancer regardless of the number of positive lymph nodes and tumor size: a study of 161 708 cases of breast cancer from the SEER Program*. Arch Pathol Lab Med, 2014. **138**(8): p. 1048-52.
52. Elston, C.W., I.O. Ellis, and S.E. Pinder, *Pathological prognostic factors in breast cancer*. Crit Rev Oncol Hematol, 1999. **31**(3): p. 209-23.
53. Harris, J.R., et al., *Diseases of the breast: Fifth edition*. Diseases of the Breast: Fifth Edition. 2014. 1-1224.
54. Ministry of Health NZ. *Faster Cancer Treatment*. 2012 2018 [cited 2021; Available from: https://www.health.govt.nz/our-work/diseases-and-conditions/cancer/previous-cancer-initiatives/faster-cancer-treatment.
55. Australian Institute of Health and Welfare. *Elective surgery access*. 2020; Available from: https://www.aihw.gov.au/reports-data/myhospitals/intersection/access/eswt.
56. NHS England, *Waiting times for suspected and diagnosed cancer patients, Q4 2019/20 (Provider based).* 2020: UK.
57. Department of Health, *Cancer waiting times data: annual report 2009-10*. 2010, Department of Health.
58. The New Zealand ANAESTHESIA RESOURCE REVIEW GROUP (AARG), *Anaesthesia 2020 A Report on how to provide Sufficient Anaesthesia Resources in New Zealand for the Next Decade and Beyond* 2010, The New Zealand ANAESTHESIA RESOURCE REVIEW GROUP (AARG).
59. Hanna, T.P., et al., *Mortality due to cancer treatment delay: systematic review and meta-analysis*. BMJ, 2020. **371**: p. m4087.
60. Kummerow, K.L., et al., *Nationwide Trends in Mastectomy for Early-Stage Breast Cancer*. JAMA Surgery, 2015. **150**(1): p. 9-16.
61. Tan, M.P., *Is there an Ideal Breast Conservation Rate for the Treatment of Breast Cancer?* Ann Surg Oncol, 2016. **23**(9): p. 2825-31.
62. Cardoso, F., et al., *Early breast cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up†*. Ann Oncol, 2019. **30**(8): p. 1194-1220.
63. Garcia-Etienne, C.A., et al., *Mastectomy trends for early-stage breast cancer: A report from the EUSOMA multi-institutional European database*. European Journal of Cancer, 2012. **48**(13): p. 1947-1956.

64. Jonczyk, M.M., et al., Surg*ical trends in breast cancer: a rise in novel operative treatment options over a 12 year analysis*. Breast Cancer Res Treat, 2019. **173**(2): p. 267-274.
65. Paluch-Shimon, S., et al., *ESO–ESMO 4th International Consensus Guidelines for Breast Cancer in Young Women (BCY4).* Annals of Oncology, 2020. **31**(6): p. 674-696.
66. New Zealand Guidelines Group, *Management of early breast cancer*, M.o. Health, Editor. 2009: Wellington.
67. Ferrucci, M., G. Franceschini, and M. Douek, *New techniques for sentinel node biopsy in breast cancer*. Translational Cancer Research, 2018: p. S405-S417.
68. Morrow, M., et al., *Society of Surgical Oncology-American Society for Radiation Oncology-American Society of Clinical Oncology Consensus Guideline on Margins for Breast-Conserving Surgery with Whole-Breast Irradiation in Ductal Carcinoma In Situ*. Ann Surg Oncol, 2016. **23**(12): p. 3801-3810.
69. Royal Australasian College of Surgeons, *BreastSurgANZ Quality Audit Annual Report 2018*. 2020.
70. Jeevan, R., et al., *Reoperation rates after breast conserving surgery for breast cancer among women in England: retrospective study of hospital episode statistics*. BMJ : British Medical Journal, 2012. **345**: p. e4505.
71. Brennan, M.E., K. Flitcroft, and A.J. Spillane, *General practitioners are key to increasing Australia's low rate of breast reconstruction*. Aust J Gen Pract, 2020. **49**(7): p. 452-454.
72. Burstein, H.J., et al., *Estimating the benefits of therapy for early-stage breast cancer: the St. Gallen International Consensus Guidelines for the primary therapy of early breast cancer 2019*. Ann Oncol, 2019. **30**(10): p. 1541-1557.
73. Lagendijk, M., et al., *Breast conserving therapy and mastectomy revisited: Breast cancer-specific survival and the influence of prognostic factors in 129,692 patients.* Int J Cancer, 2018. **142**(1): p. 165-175.
74. de Boniface, J., R. Szulkin, and A.L.V. Johansson, *Survival After Breast Conservation vs Mastectomy Adjusted for Comorbidity and Socioeconomic Status: A Swedish National 6-Year Follow-up of 48 986 Women*. JAMA Surgery, 2021. **156**(7): p. 628-637.
75. Abrahimi, M.S., et al., *Associated Factors and Survival Outcomes for Breast Conserving Surgery versus Mastectomy among New Zealand Women with Early-Stage Breast Cancer*. International journal of environmental research and public health, 2021. **18**(5): p. 2738.
76. Dean, L.T., et al., *Healthcare System Distrust, Physician Trust, and Patient Discordance with Adjuvant Breast Cancer Treatment Recommendations*. Cancer Epidemiology Biomarkers & Prevention, 2017. **26**(12): p. 1745-1752.
77. Huijer, M. and E. van Leeuwen, *Personal values and cancer treatment refusal*. J Med Ethics, 2000. **26**(5): p. 358-62.
78. Ministry of Health NZ, *Selected Cancers 2014, 2015, 2016*. 2018: Wellington, NZ.
79. Ministry of Health NZ, *Selected Cancers 2011, 2012 & 2013*. 2014: Wellington, NZ.
80. Ministry of Health NZ, Cancer: Selected Sites 2009, 2010, 2011. 2012, Ministry of Health.
81. Ministry of Health NZ, *Cancer: New registrations and deaths 2008. Cancer: New registrations and deaths 2008. , M.o. Health, Editor. 2011*, Ministry of Health: Wellington.
82. Park, T.S. and E.S. Hwang, *Current Trends in the Management of Ductal Carcinoma In Situ*. Oncology (Williston Park), 2016. **30**(9).
83. Bleyer, A. and H.G. Welch, *Effect of three decades of screening mammography on breast-cancer incidence*. New England Journal of Medicine, 2012. **367**(21): p. 1998-2005.
84. Ministry of Health NZ, *Standards of Service Provision for Breast Cancer Patients in New Zealand*. 2013.
85. Sanders, M.E., et al., *Continued observation of the natural history of low-grade ductal carcinoma in situ reaffirms proclivity for local recurrence even after more than 30 years of follow-up*. Mod Pathol, 2015. **28**(5): p. 662-9.
86. Kong, I., et al., *Age at diagnosis predicts local recurrence in women treated with breast-conserving surgery and postoperative radiation therapy for ductal carcinoma in situ: a population-based outcomes analysis*. Curr Oncol, 2014. **21**(1): p. e96-e104.
87. Vicini, F.A., et al., *Long-term impact of young age at diagnosis on treatment outcome and patterns of failure in patients with ductal carcinoma in situ treated with breast-conserving therapy*. Breast J, 2013. **19**(4): p. 365-73.
88. Schnitt, S.J., M.S. Moran, and A.E. Giuliano, *Lumpectomy Margins for Invasive Breast Cancer and Ductal Carcinoma in Situ: Current Guideline Recommendations, Their Implications, and Impact*. J Clin Oncol, 2020. **38**(20): p. 2240-2245.
89. Elshof, L.E., et al., *Feasibility of a prospective, randomised, open-label, international multicentre, phase III, non-inferiority trial to assess the safety of active surveillance for low risk ductal carcinoma in situ - The LORD study*. European Journal of Cancer, 2015. **51**(12): p. 1497-1510.
90. Francis, A., et al., *Abstract OT2-3-01: The LORIS trial: A multicentre, randomized phase III trial of standard surgery versus active monitoring in women with newly diagnosed low risk ductal carcinoma in situ*. Cancer Research, 2013. **73**(24 Supplement): p. OT2-3-01-OT2-3-01.
91. Hwang, E.S., et al., *The COMET (Comparison of Operative versus Monitoring and Endocrine Therapy) trial: a phase III randomised controlled clinical trial for low-risk ductal carcinoma in situ (DCIS).* BMJ Open, 2019. **9**(3): p. e026797.

92. Xu, S., et al., *The Global, Regional, and National Burden and Trends of Breast Cancer From 1990 to 2019: Results From the Global Burden of Disease Study 2019*. Front Oncol, 2021. **11**: p. 689562.
93. Ruddy, K.J. and E.P. Winer, *Male breast cancer: risk factors, biology, diagnosis, treatment, and survivorship*. Ann Oncol, 2013. **24**(6): p. 1434-43.
94. Zehr, K.R., et al., *Diagnosis and Treatment of Breast Cancer in Men Image-based screening for men at high risk for breast cancer: Benefits and drawbacks*. Radiol Technol, 2019. **91**(1): p. 51M-61M.
95. Deb, S., et al., *The cancer genetics and pathology of male breast cancer*. Histopathology, 2016. **68**(1): p. 110-8.
96. Campos, F.A.B., et al., *Genetic Landscape of Male Breast Cancer*. Cancers (Basel), 2021. **13**(14).
97. Cardoso, F., et al., *Characterization of male breast cancer: results of the EORTC 10085/TBCRC/BIG/NABCG International Male Breast Cancer Program*. Ann Oncol, 2018. **29**(2): p. 405-417.
98. Hassett, M.J., et al., *Management of Male Breast Cancer: ASCO Guideline*. J Clin Oncol, 2020. **38**(16): p. 1849-1863.
99. Salindera, S., M. Ogilvy, and A. Spillane, *What are the appropriate thresholds for High Quality Performance Indicators for breast surgery in Australia and New Zealand?* Breast, 2020. **51**: p. 94-101.
100. Lao, C., et al., *Use and results of systemic treatments for de novo and recurrent metastatic breast cancer: a population-based cohort study*, NZMJ, 2021. Vol **134** No 1545.
101. Seneviratne, S., et al, Adherence to adjuvant endocrine therapy: Is it a factor for ethnic differences in breast cancer outcomes in New Zealand?, *The Breast, 2015*. **24**: *62e67.*

13. Appendices

13.1 Appendix A – Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register Processes

13.1.1 Patient eligibility and consent

Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register identifies female and male patients with a confirmed diagnosis of invasive breast cancer, DCIS or LCIS, and other breast lesions (sarcomas and borderline/malignant Phyllodes tumours) as possible cases for inclusion. Eligible patients must meet the following criteria:

- The patient has a new diagnosis of breast cancer and normally resides within the district health board (DHB) catchment area(s) of the region at the time of their diagnosis (regardless of residency status), taking into consideration the inception dates of the regional registers.
- As of January 2017, any patient with a previous history of breast cancer before the regional register inception dates, diagnosed with a new breast primary in the contralateral breast or in the same breast, but of different morphology, is also eligible. Previous history includes: invasive, ductal carcinoma *in situ* (DCIS) or pleomorphic lobular carcinoma *in situ* (PLCIS).
- Patients with a previous diagnosis of lobular carcinoma *in situ* (LCIS) are eligible for the Register. LCIS has only been collected from 1 January 2018 and there are low cases numbers on the Register.
- The patient has not opted- out.
- Patients who meet the above criteria and are diagnosed at death or time of autopsy are included.

Before the consolidation of the four registers, eligibility criteria differed slightly between the four regions. Prior to 2017 to be included in the Auckland register a patient must have had:

- Permanent New Zealand residency (including Cook Islands resident) at time of diagnosis.
- Auckland region residency at first surgery. An Auckland region resident who had first surgery outside Auckland and came back to Auckland for an adjuvant treatment was eligible.
- A diagnosis with invasive carcinoma or DCIS, but not LCIS.
- No breast cancer history prior to 1 June 2000.

For Waikato, Wellington and Christchurch patients there was no criteria for permanent residency, and instead of residency at first surgery a patient must be:

- Resident in the DHB(s) covered by their register at time of diagnosis.
- Diagnosed with invasive carcinoma or DCIS, but not LCIS (although Waikato and Christchurch collected LCIS, sarcomas and intermediate/malignant Phyllodes tumours).

Te Rēhita Mate Ūtaetae - Breast Cancer Foundation National Register is an opt-out register with an overall opt-out rate of 0.65% from 2003 to 2020. Opt-out was 1.6% for the period 2003-2012, and 0.1% from 2012-2020. All patients are included in the register automatically, unless the patient advises the register in writing or by telephone that they do not wish to be included. Patients may choose to opt-out

at any time, and this will not affect their breast cancer care in any way. A Patient Information Sheet with information on how to opt-out shall be given to all patients in their breast care pack, at all breast clinics, both private and public. The Patient Information Sheet can also be viewed or downloaded from the website breastcancerregister.org.nz.

13.1.2 Data entry and quality

Data is manually entered by highly experienced data management staff, based at a DHB in each region, who abstract synoptic information from free text-based clinical notes. This is necessary as there is very limited New Zealand-based clinical data that is recorded synoptically by DHBs and private hospital systems.

Data completeness: Breast cancer registrations are collected from MDM (multi-disciplinary meeting) patient lists and other sources, e.g. histopathology reports, and cross-referenced against the Ministry of Health NZ Cancer Registry to ensure capture of all cases and review of discordant data. Data completeness reports are routinely run to identify missing data on treatment records. All eligible patient records are routinely followed up every 12 to 36 months by data management staff by reviewing GP and hospital records to ensure any changes to patient status, recurrence or new procedures, treatment or medication are captured. The NHI link automatically records mortality and cause of death. In addition the Ministry of Health Mortality register is cross-referenced annually for any discordant or missing data.

Data audit: Four types of quality assurance (QA) are performed:

1. In-field validation: The majority of fields have validations limiting the type of data that may be entered into a field. This includes mandatory fields (where the data entry person must give an answer before leaving the field), desirable fields (where the user can leave the field but the system will prompt for an answer; alpha characters cannot be entered into a numeric field; ranges are set on numeric fields; option fields are limited to defined lists with no free-text allowed; conditional branching validation so that if a question is answered "No" then no further fields will be visible for this page; and cross-field validations where, for example, treatment dates cannot be before the diagnosis date.

2. Training: All new users must undergo comprehensive training to ensure the Data Dictionary is followed. A new user's first five cases shall be audited by another data manager to check for systematic errors and other data entry errors. Further random cases audits will performed throughout the new user's trial period. Any errors found are discussed with the new user and further training undertaken to ensure high quality data entry.

3. Data cleaning reports: Standard data cleaning queries and reports are used to look at outliers, missing data and inconsistent data to ensure standardisation within and across fields. An annual review is also undertaken.

4. Six-monthly and annual QA audit: To ensure consistency and completeness across the different data entry sites a Data Manager from each region audits randomly selected cases from another region for completeness and accuracy. Any errors found are discussed and further training undertaken to ensure high quality data entry.

13.2 Appendix B – Supplementary tables

Unless otherwise stated, tables are for invasive breast cancer, and exclude DCIS / *in situ* disease. Additional supplementary tables can be accessed online at www.breastcancerregister.org.nz.

13.2.1 Demographics

Cases

	In-Situ (N= 4,446)	Invasive (N=25,921)	Total (N=30,367)
Gender			
Female	4,426 (99.6%)	25,744 (99.3%)	30,170 (99.4%)
Male	20 (0.4%)	177 (0.7%)	197 (0.6%)
Ethnicity			
Māori	368 (8.3%)	2,718 (10.5%)	3,086 (10.2%)
Pacific	216 (4.9%)	1,751 (6.8%)	1,967 (6.5%)
Asian	639 (14.4%)	2,187 (8.4%)	2,826 (9.3%)
European	3,141 (70.6%)	18,864 (72.8%)	22,005 (72.5%)
Other Ethnicity	82 (1.8%)	399 (1.5%)	481 (1.6%)
Region			
Auckland	2,582 (58.1%)	14,585 (56.3%)	17,167 (56.5%)
Waikato	702 (15.8%)	4,298 (16.6%)	5,000 (16.5%)
Christchurch	690 (15.5%)	3,867 (14.9%)	4,557 (15.0%)
Wellington	472 (10.6%)	3,171 (12.2%)	3,643 (12.0%)
Age at diagnosis (years)			
19-24	1 (0.0%)	22 (0.1%)	23 (0.1%)
25-29	9 (0.2%)	122 (0.5%)	131 (0.4%)
30-34	29 (0.7%)	427 (1.6%)	456 (1.5%)
35-39	92 (2.1%)	987 (3.8%)	1,079 (3.6%)
40-44	260 (5.8%)	1,895 (7.3%)	2,155 (7.1%)
45-49	832 (18.7%)	3,535 (13.6%)	4,367 (14.4%)
50-54	822 (18.5%)	3,547 (13.7%)	4,369 (14.4%)
55-59	683 (15.4%)	3,292 (12.7%)	3,975 (13.1%)
60-64	677 (15.2%)	3,380 (13.0%)	4,057 (13.4%)
65-69	639 (14.4%)	3,112 (12.0%)	3,751 (12.4%)
70-74	177 (4.0%)	1,746 (6.7%)	1,923 (6.3%)
75-79	118 (2.7%)	1,641 (6.3%)	1,759 (5.8%)
80+	107 (2.4%)	2,215 (8.5%)	2,322 (7.6%)

Table 13.2-1. In situ *and invasive breast cancers by sex, ethnicity region and age.*

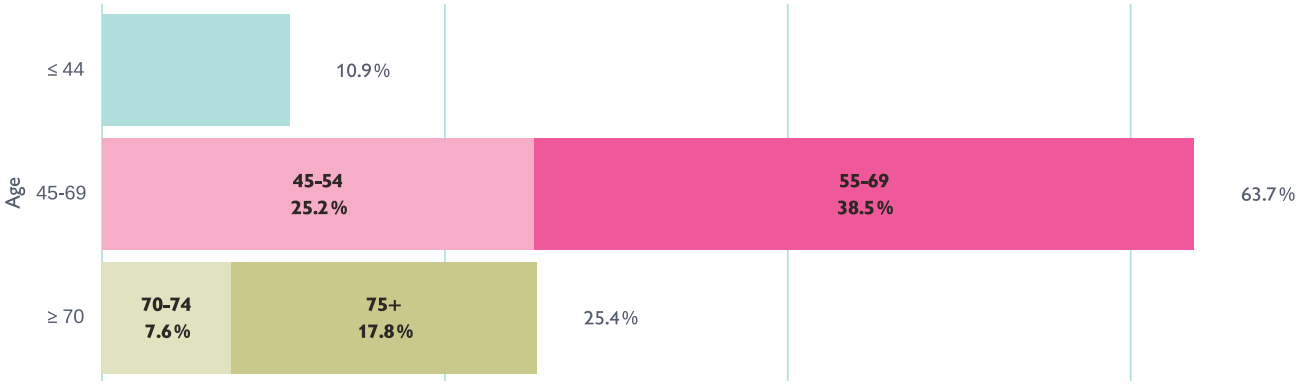
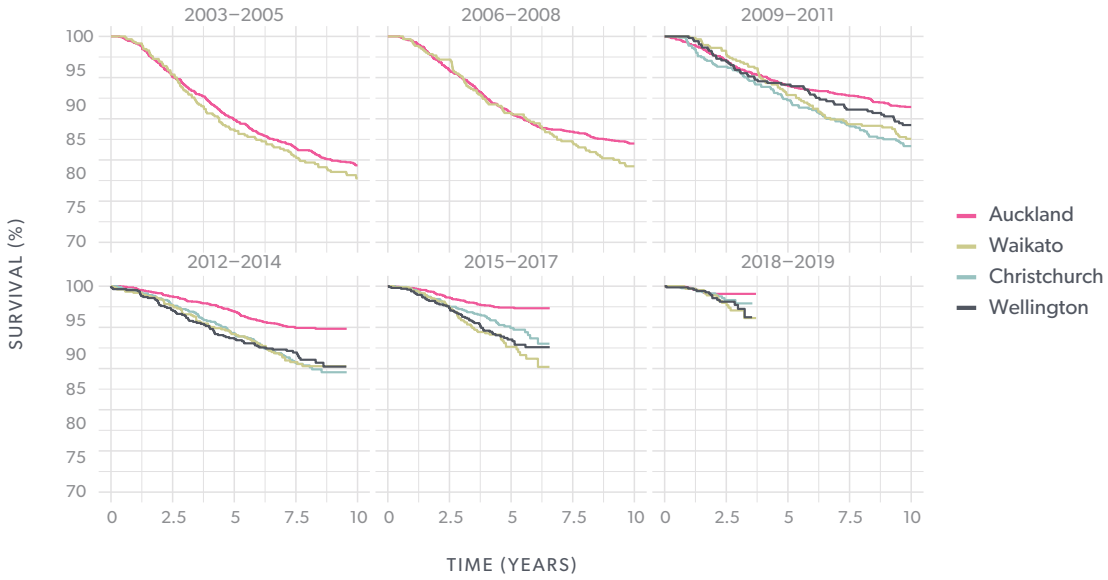


Fig. 13.2-1. *Invasive breast cancer diagnoses in European women, by age at diagnosis.*

Māori, Pacific and Asian diagnoses are broken down by age in Section 3. Figure 13.2-1 provides the same breakdown for European women.

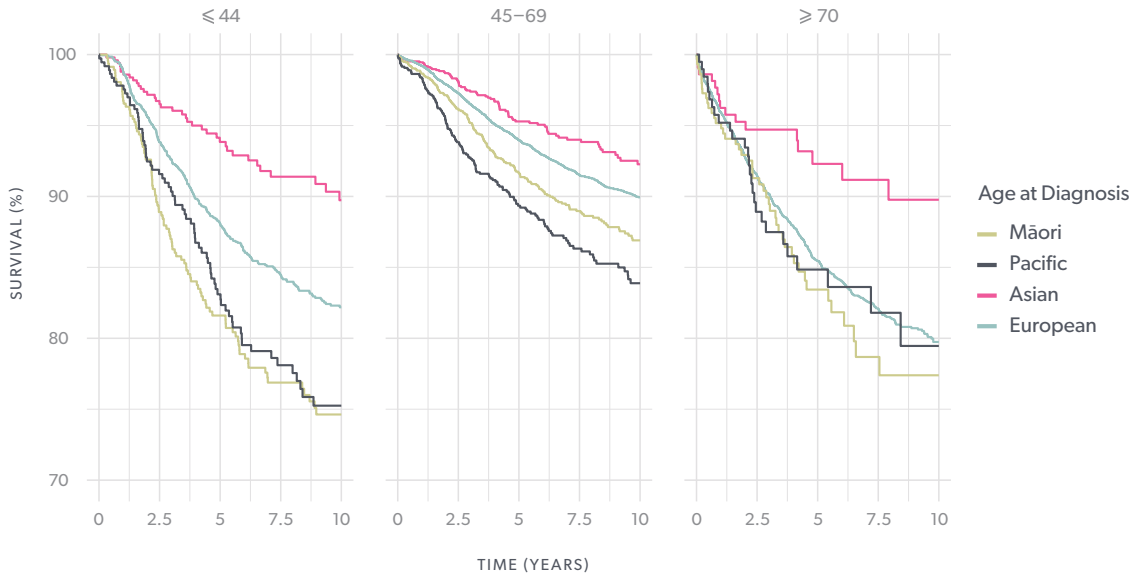
13.2.2 Breast cancer-specific survival



REGION	5-YEAR SURVIVAL	10-YEAR SURVIVAL
Auckland		
2003-2005	90% (88-91)	84% (83-86)
2009-2011	94% (93-95)	91% (90-93)
2015-2017	97% (97-98)	
Waikato		
2003-2005	89% (86-91)	83% (80-86)
2009-2011	93% (91-95)	88% (85%-90)
2015-2017	93% (91-95)	
Christchurch		
2009-2011	92% (90-94)	87% (84-89)
2015-2017	95% (94-96)	
Wellington		
2009-2011	94% (92-96)	89 (87-92)
2015-2017	94% (92-95)	

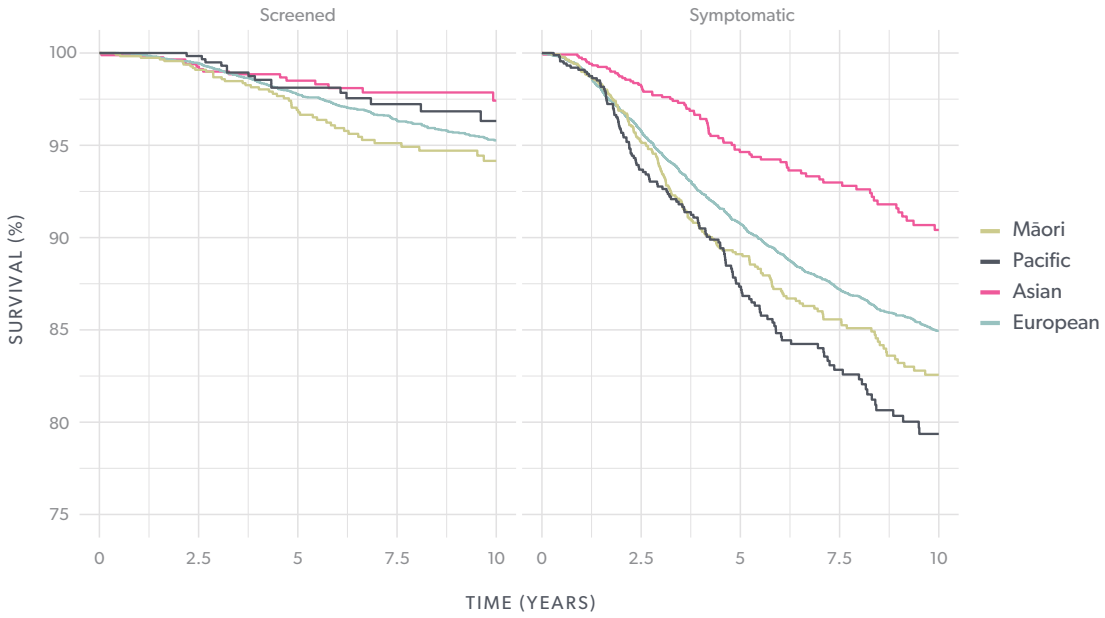
Fig. 13.2-2. *Five- and 10-year invasive breast cancer survival by region over time.*

Survival is similar across the regions, though Auckland showed significantly better five-year survival in the latest cohort. There can be several reasons for regional variation, besides variation in treatment. For example, some regions have higher Māori or Pacific populations, or socioeconomically deprived populations with more comorbidities and more advanced stage at diagnosis. These and other factors can contribute to worse outcomes; a multivariate analysis would help assess where there are genuine differences between regions.



ETHNICITY & AGE AT DIAGNOSIS		5-YEAR SURVIVAL	10-YEAR SURVIVAL
Māori	⩽ 44	82% (78-85)	75% (70-79)
	45-69	92% (90-93)	87% (85-89)
	⩾ 70	83% (79-88)	77% (71-84)
Pacific	⩽ 44	83% (79-87)	75% (70-81)
	45-69	89% (87-91)	84% (81-87)
	⩾ 70	85% (79-91)	79% (72-88)
Asian	⩽ 44	94% (92-96)	90% (86-93)
	45-69	95% (94-96)	92% (90-94)
	⩾ 70	92% (88-96)	90% (85-95)
European	⩽ 44	88% (87-90)	82% (80-84)
	45-69	94% (94-94)	90% (89-91)
	⩾ 70	85% (84-87)	80% (78-81)

Fig. 13.2-3. *Five- and 10-year invasive breast cancer survival by ethnicity and age.*



ETHNICITY	5-YEAR SURVIVAL	10-YEAR SURVIVAL
Screened		
Māori	97% (96-98)	94% (92-96)
Pacific	98% (97-99)	98% (97-99)
Asian	99% (98-99)	97% (96-99)
European	98% (97-98)	95% (95-96)
Symptomatic		
Māori	89% (87-91)	83% (80-85)
Pacific	87% (85-90)	79% (76-83)
Asian	95% (93-96)	90% (88-93)
European	91% (90-91)	85% (84-86)

Fig. 13.2-4. *Five- and 10-year breast cancer-specific survival by ethnicity and detection method.*

13.2.3 Receptor status

	Auckland (N=12,664)	Waikato (N= 3,695)	Christchurch (N= 3,203)	Wellington (N= 2,910)	Total (N=22,472)
Receptor Status					
ER+/HER2-	9,346 (73.8%)	2,811 (76.1%)	2,369 (74.0%)	2,204 (75.7%)	16,730 (74.4%)
ER+/HER2+	1,198 (9.5%)	487 (13.2%)	432 (13.5%)	273 (9.4%)	2,390 (10.6%)
ER-/HER2+	752 (5.9%)	142 (3.8%)	146 (4.6%)	121 (4.2%)	1,161 (5.2%)
Triple Negative	1,368 (10.8%)	255 (6.9%)	256 (8.0%)	312 (10.7%)	2,191 (9.8%)

	Auckland (N=12,664)	Waikato (N= 3,695)	Christchurch (N= 3,203)	Wellington (N= 2,910)	Total (N=22,472)
ER status					
Positive	10,544 (83.3%)	3,298 (89.3%)	2,801 (87.4%)	2,477 (85.1%)	19,120 (85.1%)
Negative	2,120 (16.7%)	397 (10.7%)	402 (12.6%)	433 (14.9%)	3,352 (14.9%)
PR status					
Positive	9,010 (71.1%)	2,491 (67.4%)	2,539 (79.3%)	2,202 (75.7%)	16,242 (72.3%)
Negative	3,654 (28.9%)	1,204 (32.6%)	664 (20.7%)	708 (24.3%)	6,230 (27.7%)
HER2 status					
Positive	1,950 (15.4%)	629 (17.0%)	578 (18.0%)	394 (13.5%)	3,551 (15.8%)
Negative	10,714 (84.6%)	3,066 (83.0%)	2,625 (82.0%)	2,516 (86.5%)	18,921 (84.2%)
Triple Negative					
Yes	1,368 (10.8%)	255 (6.9%)	256 (8.0%)	312 (10.7%)	2,191 (9.8%)

Table 13.2-2 *Receptor status of women diagnosed with invasive breast cancer by region, a) by surrogate biomarker subtype and b) by individual receptor.*

	Māori (N= 2,409)	Pacific (N= 1,438)	Asian (N= 1,952)	European (N=16,342)	Other Ethnicity (N= 330)
Receptor Status					
ER+/HER2-	1,799 (74.7%)	998 (69.4%)	1,411 (72.3%)	12,284 (75.2%)	237 (71.8%)
ER+/HER2+	289 (12.0%)	208 (14.5%)	226 (11.6%)	1,627 (10.0%)	40 (12.1%)
ER-/HER2+	141 (5.9%)	138 (9.6%)	120 (6.1%)	747 (4.6%)	15 (4.5%)
Triple Negative	180 (7.5%)	94 (6.5%)	195 (10.0%)	1,684 (10.3%)	38 (11.5%)

	Māori (N= 2,409)	Pacific (N= 1,438)	Asian (N= 1,952)	European (N=16,342)
ER status				
Positive	2,088 (86.7%)	1,206 (83.9%)	1,637 (83.9%)	13,911 (85.1%)
Negative	321 (13.3%)	232 (16.1%)	315 (16.1%)	2,431 (14.9%)
PR status				
Positive	1,825 (75.8%)	1,070 (74.4%)	1,392 (71.3%)	11,721 (71.7%)
Negative	584 (24.2%)	368 (25.6%)	560 (28.7%)	4,621 (28.3%)
HER2 status				
Positive	430 (17.8%)	346 (24.1%)	346 (17.7%)	2,374 (14.5%)
Negative	1,979 (82.2%)	1,092 (75.9%)	1,606 (82.3%)	13,968 (85.5%)
Triple Negative				
Yes	180 (7.5%)	94 (6.5%)	195 (10.0%)	1,684 (10.3%)

Table 13.2-3 *Receptor status for invasive breast cancer by ethnicity, a) by surrogate biomarker subtype and b) by individual receptor.*

Age at Diagnosis (years)	⩽ 44 (N= 3,050)	45-69 (N=15,235)	⩾ 70 (N= 4,187)
Receptor Status			
ER+/HER2-	1,812 (59.4%)	11,627 (76.3%)	3,291 (78.6%)
ER+/HER2+	545 (17.9%)	1,522 (10.0%)	323 (7.7%)
ER-/HER2+	254 (8.3%)	759 (5.0%)	148 (3.5%)
Triple Negative	439 (14.4%)	1,327 (8.7%)	425 (10.2%)

Age at Diagnosis (years)	⩽ 44 (N= 3,050)	45-69 (N=15,235)	⩾ 70 (N= 4,187)
ER status			
Positive	2,357 (77.3%)	13,149 (86.3%)	3,614 (86.3%)
Negative	693 (22.7%)	2,086 (13.7%)	573 (13.7%)
PR status			
Positive	2,031 (66.6%)	11,237 (73.8%)	2,974 (71.0%)
Negative	1,019 (33.4%)	3,998 (26.2%)	1,213 (29.0%)
HER2 status			
Positive	799 (26.2%)	2,281 (15.0%)	471 (11.2%)
Negative	2,251 (73.8%)	12,954 (85.0%)	3,716 (88.8%)
Triple Negative			
Yes	439 (14.4%)	1,327 (8.7%)	425 (10.2%)

Table 13.2-4 *Receptor status by age for invasive breast cancer, a) by surrogate biomarker subtype and b) by individual receptor.*

13.2.4 Age-adjusted ethnicity

Age adjustment in these tables is a direct proportional adjustment by age distribution within each ethnic group. See Section 1.3 for more details.

	Auckland (N = 13,624)			Waikato (N = 3,925)			Christchurch (N = 3,619)			Wellington (N = 2,972)			Total (N = 24,140)	
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %		
Māori	1,302	(9.6%)	49.9	710	(18.1%)	28.5	210	(5.8%)	8.1	339	(11.4%)	13.6	2,561	(10.6%)
Pacific	1,291	(9.5%)	82.2	74	(1.9%)	5.1	47	(1.3%)	2.8	161	(5.4%)	9.9	1,573	(6.5%)
Asian	1,682	(12.3%)	79.9	92	(2.3%)	4.4	128	(3.5%)	6	194	(6.5%)	9.7	2,096	(8.7%)
European	9,349	(68.6%)	52.4	3,049	(77.7%)	16.9	3,234	(89.4%)	17.9	2,278	(76.6%)	12.8	17,910	(74.2%)

Table 13.2-5. *Proportion of registrations by ethnicity and region in the Register.*

	Māori (N = 364)			Pacific (N = 214)			Asian (N = 628)			European (N = 3,056)		
Method of Detection												
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
Screened	280	(76.9%)	75.7	175	(81.8%)	78.9	488	(77.7%)	75.8	2,456	(80.4%)	80.7
Symptomatic	84	(23.1%)	24.3	39	(18.2%)	18.5	140	(22.3%)	24.3	600	(19.6%)	19.3

Table 13.2-6. *Detection method of* in situ *disease by ethnicity.*

	Māori (N= 2,540)			Pacific (N= 1,555)			Asian (N= 2,056)			European (N=17,642)		
Method of Detection												
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
Screened	1,157	(45.6%)	42.1	667	(42.9%)	41.9	855	(41.6%)	42.1	8,010	(45.4%)	45.6
Symptomatic	1,383	(54.4%)	57.9	888	(57.1%)	58.1	1,201	(58.4%)	57.9	9,632	(54.6%)	54.4

Table 13.2-7. *Detection method of invasive disease by ethnicity.*

	Māori (N = 2,561)			Pacific (N = 1,573)			Asian (N = 2,096)			European (N = 17,909)		
Tumour size (mm)												
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
⩽ 20	1,469	(57.4%)	57.5	779	(49.5%)	49.8	1,256	(59.9%)	60.8	11,431	(63.8%)	63.8
21 - 50	941	(37.7%)	37.1	626	(39.8%)	39.6	728	(34.7%)	34.2	5,581	(31.2%)	31.1
⩾ 50	151	(5.9%)	5.4	168	(10.7%)	10.5	112	(5.3%)	5	897	(5%)	5.1

Table 13.2-8. *Invasive tumour size by patient ethnicity.*

	Māori (N = 2,541)			Pacific (N = 1,595)			Asian (N = 2,047)			European (N = 17,448)		
Tumour Stage												
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
1	1,082	(42.6%)	41.8	508	(31.8%)	31.8	940	(45.9%)	47	8,567	(49.1%)	49
2	953	(37.5%)	37.8	609	(38.2%)	38.2	767	(37.5%)	36.7	6,001	(34.4%)	34.4
3	358	(14.1%)	14.1	315	(19.7%)	18.6	261	(12.8%)	12.2	2,064	(11.8%)	12.1
4	148	(5.8%)	6.4	163	(10.2%)	11.4	79	(3.9%)	4.1	816	(4.7%)	4.5

Table 13.2-9. *Invasive tumour stage by patient ethnicity.*

	Māori (N = 2,418)			Pacific (N = 1,444)			Asian (N = 1,988)			European (N = 16,956)		
Tumour Grade												
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
1	539	(22.3%)	22.1	249	(17.2%)	18	458	(23%)	24.5	4,078	(24.1%)	23.9
2	1,223	(50.6%)	51.7	658	(45.6%)	46.7	879	(44.2%)	44.6	8,038	(47.4%)	47.1
3	656	(27.1%)	26.2	537	(37.2%)	35	651	(32.7%)	30.9	4,840	(28.5%)	29

Table 13.2-10 *Invasive tumour grade by patient ethnicity.*

	Māori (N = 2,409)			Pacific (N = 1,438)			Asian (N = 1,952)			European (N = 16,342)			Other Ethnicity (N = 330)		None Reported (N = 1)	
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %		%		Adjusted %
ER+/HER2-	1,799	(74.7%)	75.5	998	(69.4%)	71.9	1,411	(72.3%)	74.1	12,284	(75.2%)	74.6	237	(71.8%)	1	(100%)
ER+/HER2+	289	(12%)	11.5	208	(14.5%)	12.3	226	(11.6%)	10.1	1,627	(10%)	10.3	40	(12.1%)	0	(0%)
ER-/HER2+	141	(5.9%)	5.5	138	(9.6%)	8.8	120	(6.1%)	5.8	747	(4.6%)	4.7	15	(4.5%)	0	(0%)
Triple Negative	180	(7.5%)	7.5	94	(6.5%)	6.9	195	(10%)	10	1,684	(10.3%)	10.5	38	(11.5%)	0	(0%)

Table 13.2-11. *Receptor status by patient ethnicity.*

	Māori (N = 2,709)			Pacific (N = 1,736)			Asian (N = 2,175)			European (N = 18,726)		
***De Novo* Metastatic Disease**												
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
Yes	128	(4.7%)	5.1	148	(8.5%)	9.8	81	(3.7%)	3.9	711	(3.8%)	3.7
No	2,581	(95.3%)	94.9	1,588	(91.5%)	90.2	2,094	(96.3%)	96.1	18,015	(96.2%)	96.3

Table 13.2-12. De novo *status by patient ethnicity.*

	Māori (N = 2,429)			Pacific (N = 1,450)			Asian (N = 2,010)			European (N = 16,800)		
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
N0	1,482	(61%)	61	837	(57.7%)	59.1	1,347	(67%)	67.8	11,151	(66.4%)	66
N1	666	(27.4%)	27.2	368	(25.4%)	24.4	459	(22.8%)	22.6	3,954	(23.5%)	23.8
N2	185	(7.6%)	7.9	154	(10.6%)	10.3	136	(6.8%)	6.5	1,102	(6.6%)	6.7
N3	96	(4%)	3.8	91	(6.3%)	6.1	68	(3.4%)	3.2	593	(3.5%)	3.6

Table 13.2-13. *Nodal status of patients with invasive disease by ethnicity.*

	Māori (N = 2,561)			Pacific (N = 1,573)			Asian (N = 2,096)			European (N = 17,910)		
SNB performed												
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
Yes	1,645	(64.2%)	62.5	848	(53.9%)	53.3	1,490	(71.1%)	70	12,593	(70.3%)	70.8
No	916	(35.8%)	37.5	725	(46.1%)	46.7	606	(28.9%)	30	5,317	(29.7%)	29.2

Table 13.2-14. *Patients with invasive disease having sentinel node biopsy by ethnicity.*

	Māori (N = 1,569)			Pacific (N = 815)			Asian (N = 1,441)			European (N = 11,938)		
Number of Positive Sentinel Nodes												
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
0 nodes	1,186	(75.6%)	75.4	618	(75.8%)	76.8	1,144	(79.4%)	80.5	9,456	(79.2%)	79
1 node	278	(17.7%)	18	135	(16.6%)	15.9	215	(14.9%)	14.4	1,798	(15.1%)	15.2
2 nodes	80	(5.1%)	5.1	43	(5.3%)	5.2	61	(4.2%)	3.9	475	(4%)	4.1
3 nodes	19	(1.2%)	1.1	8	(1%)	0.9	15	(1%)	0.8	121	(1%)	1
>3 nodes	6	(0.4%)	0.4	11	(1.3%)	1.2	6	(0.4%)	0.3	88	(0.7%)	0.8

Table 13.2-15. *Number of positive sentinel nodes by patient ethnicity.*

	Māori (N = 2,481)			Pacific (N = 1,488)			Asian (N = 2,061)			European (N = 17,298)			Total (N = 23,328)	
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %	%	Adjusted %
Axillary Node Dissection	962	(38.8%)	37.3	657	(44.2%)	42.1	640	(31.1%)	29.8	5,367	(31%)	31.5	7,626	(32.7%)
None	1,519	(61.2%)	62.7	831	(55.8%)	58	1,421	(68.9%)	70.2	11,931	(69%)	68.5	15,702	(67.3%)

Table 13.2-16. *Patients receiving axillary node dissection by ethnicity.*

	Māori (N = 1,153)			Pacific (N = 581)			Asian (N = 845)			European (N = 8,984)		
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
Received radiation therapy	1,032	(89.5%)	87.4	501	(86.2%)	81.2	766	(90.7%)	88	8,069	(89.8%)	90.4
Referred - deemed not necessary	13	(1.1%)	1.5	6	(1.0%)	1.7	5	(0.6%)	1.3	118	(1.3%)	1.2
Referred - treatment declined	50	(4.3%)	5.2	54	(9.3%)	11.7	28	(3.3%)	4.3	318	(3.5%)	3.4
Not referred	58	(5.0%)	5.9	20	(3.4%)	5.4	46	(5.4%)	6.5	479	(5.3%)	5

Table 13.2-17. *Radiation therapy after breast conserving surgery by ethnicity.*

	Māori (N = 1,082)			Pacific (N = 555)			Asian (N = 794)			European (N = 8,387)		
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
Received radiation therapy	1,032	(95.4%)	94.5	501	(90.3%)	88.1	766	(96.5%)	95.2	8,069	(96.2%)	96.4
Referred - treatment declined	50	(4.6%)	5.5	54	(9.7%)	11.9	28	(3.5%)	4.8	318	(3.8%)	3.6

Table 13.2-18. *Radiation therapy declined by ethnicity.*

	Māori (N = 314)			Pacific (N = 277)			Asian (N = 230)			European (N = 1,789)		
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
Not referred	29	(9.2%)	9.8	32	(11.6%)	14.1	20	(8.7%)	12.6	176	(9.8%)	9.2
Received radiation therapy	257	(81.8%)	80.5	206	(74.4%)	70.3	194	(84.3%)	81.2	1,496	(83.6%)	84.6
Referred - deemed not necessary	6	(1.9%)	2.1	4	(1.4%)	1.9	5	(2.2%)	1.7	42	(2.3%)	2.3
Referred - treatment declined	22	(7%)	7.6	35	(12.6%)	13.7	11	(4.8%)	4.5	75	(4.2%)	4

Table 13.2-19. *Radiation therapy for high-risk patients after mastectomy by ethnicity.*

	Māori (N = 1,703)			Pacific (N = 973)			Asian (N = 1,291)			European (N = 10,576		
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
Received endocrine therapy	1,644	(96.5%)	96.8	932	(95.8%)	95.8	1,255	(97.2%)	97.3	10,293	(97.3%)	97.3
Referred - deemed not necessary	4	(0.2%)	0.2	1	(0.1%)	0.1	4	(0.3%)	0.3	27	(0.3%)	0.3
Referred - treatment declined	21	(1.2%)	1.1	6	(0.6%)	0.5	11	(0.9%)	0.8	82	(0.8%)	0.8
Not Referred	34	(2%)	1.8	34	(3.5%)	3.5	21	(1.6%)	1.7	174	(1.6%)	1.7

Table 13.2-20. *Patients with HR+ tumours receiving endocrine therapy by ethnicity.*

	Māori (N = 2,400)			Pacific (N = 1,432)			Asian (N = 1,985)			European (N = 16,630)		
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
Received chemotherapy	965	(40.2%)	34.9	652	(45.5%)	37.9	860	(43.3%)	35.2	5,646	(34%)	36.2
Referred - deemed not necessary	142	(5.9%)	6.3	71	(5%)	5.3	120	(6%)	6.7	1,002	(6%)	6
Referred - treatment declined	156	(6.5%)	6.6	132	(9.2%)	9.3	103	(5.2%)	5.4	956	(5.7%)	5.7
Not Referred	1,137	(47.4%)	52.3	577	(40.3%)	47.4	902	(45.4%)	52.7	9,026	(54.3%)	52.2

Table 13.2-21. *Patients referred for adjuvant chemotherapy by ethnicity.*

	Māori (N = 1,121)			Pacific (N = 784)			Asian (N = 963)			European (N = 6,602)		
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
Received chemotherapy	965	(86.1%)	83.8	652	(83.2%)	79.9	860	(89.3%)	86.1	5,646	(85.5%)	86.5
Referred - treatment declined	156	(13.9%)	16.2	132	(16.8%)	20	103	(10.7%)	13.4	956	(14.5%)	13.6

Table 13.2-22. *Patients declining adjuvant chemotherapy by ethnicity.*

	Māori (N = 1,323)			Pacific (N = 837)			Asian (N = 1,196)			European (N = 8,926)		
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
Received neoadjuvant chemotherapy	115	(8.7%)	7.6	78	(9.3%)	7.3	101	(8.4%)	6.1	538	(6%)	6.7
Referred - deemed not necessary	1	(0.1%)	0.1	2	(0.2%)	0.3	2	(0.2%)	0.1	8	(0.1%)	0.1
Referred - treatment declined	3	(0.2%)	0.26	0	(0%)	0	0	(0%)	0	9	(0.1%)	0.1
Not Referred	1,204	(91%)	92.1	757	(90.4%)	92.2	1,093	(91.4%)	93.8	8,371	(93.8%)	93.1

Table 13.2-23. *Patients referred for neoadjuvant chemotherapy by ethnicity.*

	Māori (N = 287)			Pacific (N = 230)			Asian (N = 251)			European (N = 1,620)		
		%	Adjusted %		%	Adjusted %		%	Adjusted %		%	Adjusted %
Received anti-HER2 therapy	229	(79.8%)	77.6	201	(87.4%)	81	225	(89.6%)	85.6	1,310	(80.9%)	82.9
Referred - deemed not necessary	11	(3.8%)	4.5	3	(1.3%)	2.5	4	(1.6%)	1.5	47	(2.9%)	2.6
Referred - treatment declined	18	(6.3%)	7	11	(4.8%)	5	7	(2.8%)	2.9	88	(5.4%)	4.9
Not Referred	29	(10.1%)	10.9	15	(6.5%)	9.1	15	(6%)	7.6	175	(10.8%)	9.6

Table 13.2-24. *Patients referred for anti-HER2 therapy by ethnicity.*

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