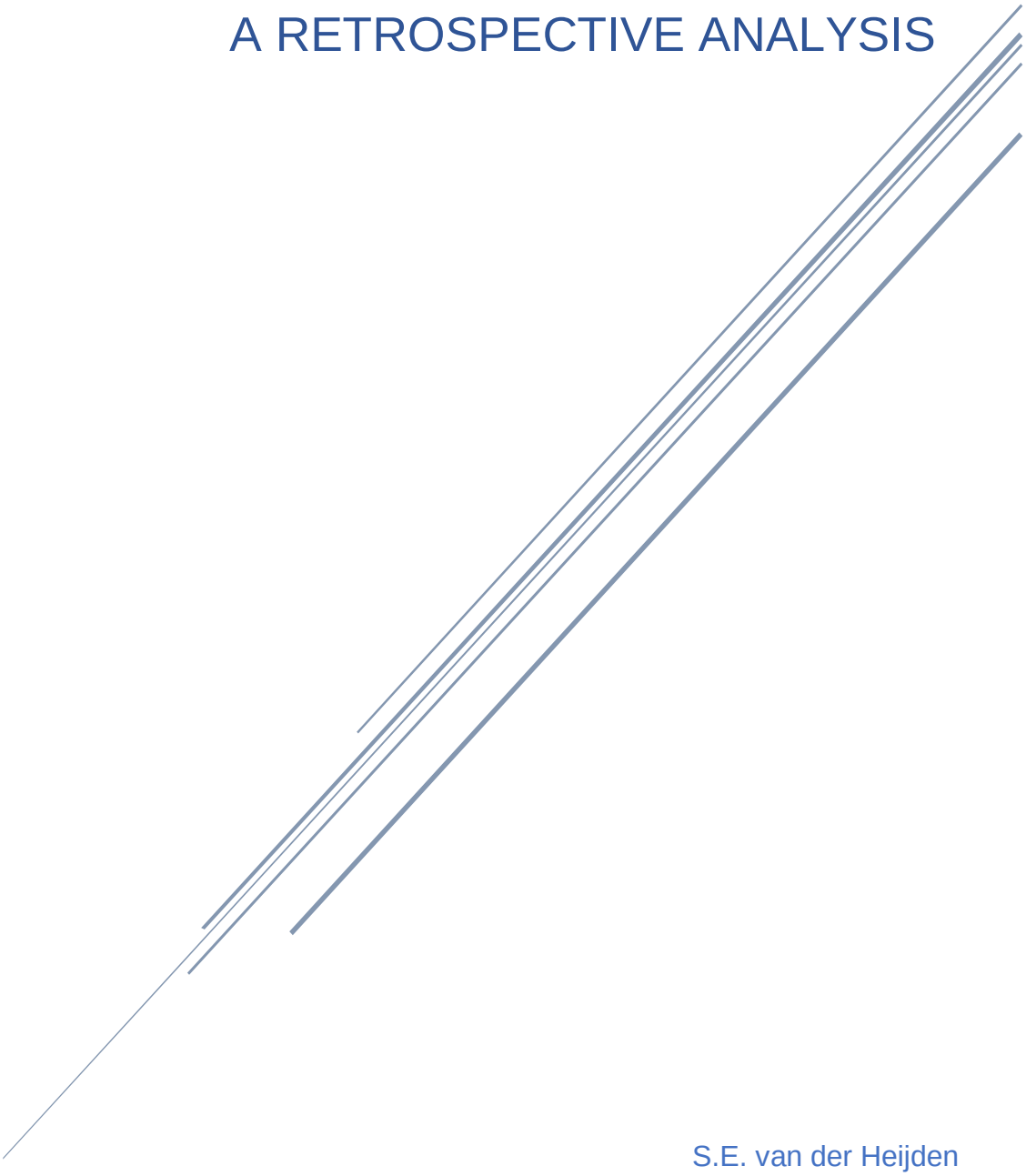
EFFECTS OF BREAST CANCER GUIDELINE SUPPORT USING ONCOGUIDE ON THE CARE PLAN DETERMINED IN MULTIDISCIPLINARY TEAM MEETINGS

A RETROSPECTIVE ANALYSIS



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PREFACE

This research was a collaboration between the University of Twente, the Netherlands Comprehensive Cancer Organization and the Northwest Clinics and was supervised by Sabine Siesling, Mathijs Hendriks and Jeannette van Manen. This research was conducted from March until August 2018 after already discussing the project with Mathijs for the first time on 24 October 2017.

First of all I would like to thank the Northwest Clinics, who provided me with all practical facilities to conduct my research as well as granted me access to their Electronic Health Record. The same accounts for the Netherlands Comprehensive Cancer Organization, which location was perfect for meetings and sometimes studying (next to Mathijs, where I could ask him all the questions I had), and of course for the University of Twente.

Regarding my supervisors from the University of Twente I could not have wished for a better collaboration. Jeannette and Sabine have supported me in the best way I could wish for, they were always very helpful and available when needed, even though their busy schedules. I would like to thank Jeannette for her willingness to come to Utrecht for meetings sometimes, the help regarding the statistics of this study and sitting with me in the afternoon at the university to try to figure out sample sizes and the presentation of results and I would like to thank Sabine for her extensive feedback which really helped me restructure my thesis, the ability to keep an overview of this study when discussing details and her very optimistic way of working together.

Of course I would also like to thank Mathijs, who has helped me throughout the whole process of this study. Mathijs was always available, I could send him a message at any time and he was always willing to help me. Mathijs' large interest in Oncoguide was really motivating during this study, this passionate approach really helped me and also made me passionate about Oncoguide. He really supported my from the beginning on; in October when we first started talking about this subject and I had to get familiar with the medical terminology and in March when I moved to Alkmaar and was very well taken in by the Northwest Clinics because Mathijs had arranged all facilities beforehand, but also in May when I moved back to Nijmegen because of my living situation in Alkmaar.

Overall I think I had a great team of supervisors who get along very well, which I think was a great advantage and really helped me and this study. I would like to thank Sabine, Mathijs and Jeannette for the very approachable collaboration, I was never hesitant to ask any of you for help, and also for the kindness and high level of involvement in this study.

Besides the collaboration with my supervisors I would also like to thank my friends and family for their support on a personal level. They were always there for me to motivate me to study hard or, on the other hand, take my mind of my thesis and do something completely different so that I could start again fresh the day after.

I would like to thank you all very much,

Sannah

Nijmegen, September 2018

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ABSTRACT

Introduction: The breast cancer care guideline is an extensive document which is not easy to apply in clinical practice, for example during multidisciplinary team (MDT) meetings in hospitals. Oncoguide provides an easily interpretable application presenting breast cancer guideline recommendations in clinical decision trees (CDTs). The aim of this study was fourfold: (1) to determine whether the procedure or treatment was recommended for a patient according to the guideline and was also discussed during MDTs and with the patient (as documented in MDT reports and in the electronic health record [EHR]), (2) and when it was not discussed with the patient, why not. Furthermore, (3) to determine what the treatment recommendation for the patient was provided through Oncoguide compared to the recommendation of the guideline and (4) whether there was any data missing in order to derive this treatment recommendation via the CDTs.

Methods: For this retrospective study female patients with primary breast cancer of 18 years and older diagnosed and treated at the Northwest Clinics in the Netherlands between 14 February 2012 and 13 February 2015 were selected from the Netherlands Cancer Registry. The data was retrieved from the EHR and collected in a database focussing on the following four procedure/treatment recommendations: MRI scan (MRI), neoadjuvant systemic treatment (NST), adjuvant systemic treatment (AST) and direct breast reconstruction (DBR). These four treatment recommendations were analysed for every included patient focusing on the four points of interest mentioned above.

Results: In total, 395 patients were selected of which 24 did not have surgery and thus were not eligible for AST or DBR. In 65 cases a diagnostic procedure or treatment was recommended according to the guideline but not performed/discussed with the patient (MRI: n = 12, NST: n = 8, AST: n = 3 and DBR: n = 42). Of these 65 cases, the motivation for deviating from the guideline was documented in 7 cases (MRI: n = 1, NST: n = 3, AST: n = 1 and DBR: n = 1). Treatment recommendations provided through Oncoguide were presented differently compared to the guideline with MRI in 71 cases; with NST in 146 cases and with AST in 13 cases (n = 220 recommendations in total). The different presentation of the treatment recommendations provided through Oncoguide could be seen in presenting multiple options (100.0% for neoadjuvant and adjuvant), indicating missing data to fill the CDT (56.3%, n = 40 for MRI) or presenting the recommendation elsewhere (43.7%, n = 31 for MRI).

Conclusion: Applying Oncoguide retrospectively shows effects on treatment decisions as reported by MDTs. These effects can be found in presenting multiple potential treatment options as well as in encouraging active documentation of motivations when deviating from the guideline. This could potentially lead to a decrease in unwanted practice variation and an increase in shared decision making by focussing more on patient's considerations and wishes. Oncoguide also shows effects on treatment decisions by detecting missing patient data, preventing unnecessarily discussed patients during MDTs which is an advantage, since care professional's time is precious.

Discussion: This study was limited by its retrospective lay out. The analysis was based on data as documented between 2013 and 2015 in the EHR and it can be assumed that information (such as motivation for deviating from the guideline) was present during MDT meetings but not documented at that moment.

INTRODUCTION

The breast cancer guideline for the screening and the full care path of a patient in the Netherlands was published in 2012 by the Netherlands National Breastcancer Counsel (Nationaal Borstkanker Overleg Nederland, NABON) in collaboration with the Netherlands Comprehensive Cancer Organization (Integraal Kankercentrum Nederland, IKNL) [1]. This guideline consists of four areas: diagnosis, neoadjuvant treatment, adjuvant treatment and aftercare. The recommendations provided in this 200 page textual guideline, accessible on www.oncoline.nl, are applied in daily practice by health care professionals to provide the best care according to research. These recommendations are for example consulted during multidisciplinary team meetings (MDTs), during which all disciplines concerned with breast cancer care meet to discuss patients. Since care professionals' time is precious, these meetings should be designed as efficient as possible which leads to a high number of patients discussed in little time [2]. All necessary patient data should be present at the start of these meetings so that no patient is needlessly discussed and a well-considered treatment decision can be made (which should be according to the guideline or not, but then with documented reason). During these MDTs the extensive guideline is not scanned for every patient; this is not realistic and also not always necessary since care professionals are expected to have sufficient knowledge to discuss less complex patients without consulting the guideline. In cases which are more complex, not consulting the guideline due to a lack of time can lead to undesired practice variation as well as not considering all potential treatment options. Due to the ever growing amount of knowledge and application of personalized medicine the already extensive guideline is expected to become even more extensive. This might lead to care professionals no longer being able to provide the best care for every patient without consulting guidelines when discussing the patients [3].

The breast cancer guideline was recently translated into an application called Oncoguide [4]. Oncoguide is an online application (accessible on www.oncoguide.nl) which has translated the breast cancer guideline into clinical decision trees (CDTs). CDTs consist of nodes, branches and leaves; each node representing a data entry point resulting, via branches, in a leaf representing the recommendation according to the guideline [5]. Oncoguide was developed to model guideline recommendations as data driven CDTs that are both clinical and computer interpretable. This resulted in an easily interpretable visualized guideline for breast cancer care which registers individual patient routes, supports decision making, helps detecting missing patient data needed for these decisions and helps explicitly document motivations for intentionally deviating from guideline recommendations. The application also facilitates early detection of knowledge gaps, potentially leading to a continuous plan-do-check-act circle resulting in quicker improvement of the guideline [6]. The CDTs were designed as user friendly application to support care professionals in developing patient care plans, for example during MDTs.

As stated above, Oncoguide might help care professionals consult the guideline in a more efficient way potentially leading to a decrease in undesired practice variation and quicker guideline revision. At the moment, it is unknown how often a procedure or treatment recommendation is not followed without documented motivation and how the recommendations provided through Oncoguide are presented compared to those in the guideline in a way that could help care professionals detect missing data and knowledge gaps. Therefore, the aim of this study was to answer the following research

question: *'Does retrospective breast cancer guideline support using Oncoguide show effects on treatment decisions as reported by multidisciplinary team meetings?'* To answer this research question a retrospective study based on analysing individual patient routes in the electronic health record (EHR) was conducted, including only the information available at the moment the treatment recommendation had to be made. In this study, four sub questions were answered: (1) Was the procedure or treatment recommended for a patient according to the guideline and also discussed during MDTs and with the patient (as documented in MDT reports and in the EHR), (2) and when it was not discussed with the patient, why not? Furthermore, (3) what was the treatment recommendation for the patient provided through Oncoguide compared to the recommendation of the guideline and (4) was there any data missing in order to derive this treatment recommendation via the CDTs?

METHOD

A retrospective study was conducted focussing on four guideline recommendations covering the full care path of a patient; whether or not the patient had an indication for a MRI scan (diagnostic phase, MRI), neoadjuvant systemic treatment (NST), adjuvant systemic treatment (AST) and/or a direct breast reconstruction (aftercare, DBR). All four procedure/treatment recommendations were retrospectively analysed following the care path of an individual patient chronologically. An example of following the care path is to determine , based on the information available at the moment of the MDT (prior to the procedure/treatment), whether or not the patient should be recommended this procedure/treatment, determine by analysing the documents in the EHR whether or not this procedure/treatment option was discussed during the MDT and with the patient (if not with the patient, why), compare the recommendations provided through Oncoguide to the guideline and determine whether or not there was any data missing in the EHR at the moment of the MDT in order to make the procedure/treatment decision.

STUDY POPULATION

The study population was derived from a dataset (consisting patient ID, date of birth and incidence date) provided by the Netherlands Cancer Registry (Nationale Kankerregistratie, NKR), which is hosted by the IKNL. Since this study does not involve actions in which humans are subject to certain acts and thus is not subject to the Medical Research Involving Human Subjects Act (Wet Medisch-wetenschappelijk Onderzoek met mensen, WMO), it was not reviewed by the Medical Research Ethics Committee (Medisch Ethische Toetsings Commissie, METC) but was authorized by the Board of Directors of the hospital of which the EHR was consulted.

Oncoguide was developed based on the 2012 guideline and therefore it was decided to focus on women who were diagnosed within the first three years after the introduction of the 2012 guideline to potentially show a trend in the results regarding the documentation of motivation behind decisions and patient preferences over time. For the research period criterium the incidence date provided by the NKR was used. In order to potentially show a trend in the results the research period was divided into intervals of six months, resulting in a total of six periods. A sample size calculation was performed to reach a confidence interval of 95% and 5% accuracy. This retrospective study included female primary breast cancer patients without metastases of 18 years and older diagnosed and treated at the Northwest Clinics (Noordwest Ziekenhuisgroep, NWZ) in the Netherlands between 14 February 2012 and 13 February 2015 and discussed during at least one MDT meeting. A sample size was derived from this study population by first deleting double values, then conducting the power calculation followed by a random draft of 504 patient IDs. These steps are all extensively described in *Appendix I – Sample size,* in which the in- and exclusion criteria are also listed. *Figure 1* shows how the final sample size for the study population was created.

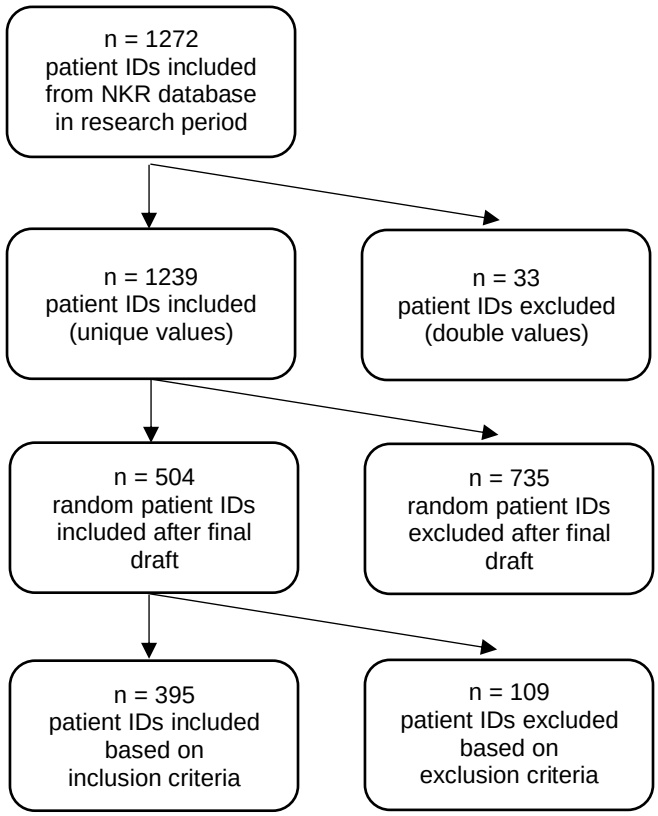

Figure 1 – Sample size based on unique values, random draft and inclusion criteria

DATA COLLECTION

The data was collected from patients diagnosed and treated at the NWZ in Alkmaar and Den Helder and was derived from the EHR including MDT reports and all data available at the time of each MDT meeting.

The database was filled with data of all included patients using patient IDs. The layout of this database can be seen in *Appendix II – Code book database.* This database consisted of five worksheets; the first worksheet with the general patient data and the following four focussing on all four procedure/treatment recommendations (MRI, NST, AST and DBR). In the first worksheet, all necessary data was collected that was needed to check whether or not the diagnostic procedure or treatment was recommended according to the guideline or Oncoguide. In the other four worksheets it was documented whether or not the procedure or treatment was recommended according to the guideline, whether or not this was discussed during the MDT and with the patient and what Oncoguide recommended. Registering the individual patient routes in Oncoguide with its recommendations was only conducted for MRI, NST and AST; this because Oncoguide does not provide a CDT but only textual information on direct breast reconstruction. The details of these four recommendations, when each procedure or treatment was recommended according to the guideline as well as according to the CDTs in Oncoguide, can be found in *Table 1.* A more extensive explanation of the recommendations in the guideline as well as in Oncoguide can be found in *Appendix III – Recommendations guideline and Oncoguide CDTs*. Complicated cases were listed and consulted together with a medical oncologist to make sure the data was not misinterpreted.

Procedure/ treatment	Is indicated/ considered	
MRI	is indicated	with patients ≤ 70 years AND not pregnant AND
		○ DCIS ≤ grade II AND suspected invasive component AND patient preference for breast conserving treatment (BCT), or
		○ DCIS grade III AND patient preference for BCT, or
		○ invasive lobular carcinoma AND patient preference for BCT, or
		○ discrepancy in tumour size in clinical, mammographic and ultrasound examination, or
		○ indication neoadjuvant treatment
NST	is indicated	with cTNM stage III breast cancer
	is considered	with cTNM stage II breast cancer IF there is already an indication for adjuvant systemic treatment AND tumour reduction is needed to increase the possibility of BCT
AST	is indicated	N+ status (according to the pTNM)
		high risk N0 status (according to the pTNM), which is defined as
		○ aged < 35 AND pT ≥ 1c, or
		○ aged < 35 AND pT ≤ 1b AND stage ≥ II breast cancer, or
		○ aged ≥ 35 AND pT1b AND Her2neu positive, or
		○ aged ≥ 35 AND pT1c AND stage ≥ II breast cancer, or
		○ aged ≥ 35 AND pT ≥ 2, or
		○ tumour ≥ 1b AND Her2neu positive
DBR	is indicated	with patients who have an indication for ablative treatment (ablatio or modified radical mastectomy) AND no large possibility of adjuvant radiotherapy
	is considered	with patients who have an indication for breast surgery AND no larger possibility of adjuvant radiotherapy

Table 1 - Recommendations (MRI, NST, AST or DBR) indicated or considered according to the 2012 breast cancer guideline

DATA ANALYSIS

The final dataset was analysed using Microsoft Excel and IBM SPSS Statistics 23. Before the analysis was conducted the dataset in which the data was collected was cleaned and transcribed into the dataset suitable for data analysis. The data then was analysed focussing mainly on four points of interest: (1) to determine whether the procedure or treatment was recommended for a patient according to the guideline and was also discussed during MDTs and with the patient (as documented in MDT reports and in the EHR), (2) and when it was not discussed with the patient, why not. (3) To determine what the treatment recommendation for the patient was provided through Oncoguide compared to the recommendation of the guideline and (4) whether there was any data missing in order to derive this treatment recommendation via the CDTs.

RESULTS

The data analysis resulted in data about the descriptive statistics of the study population as well as the results regarding the research aim. All tables that were derived from SPSS on which the tables are based can be found in *Appendix IV – SPSS output tables*. *Table 2* shows the patient characteristics of the 395 included patients.

		Total
Total number of patients	*n (% total)*	395
Location Alkmaar	"	297 (75.2)
Location Den Helder	"	98 (24.8)
Number of patients per period		
Period 1 (February 12 – August 12)	*n*	67
Period 2 (August 12 – February 13)	"	61
Period 3 (February 13 – August 13)	"	66
Period 4 (August 13 – February 14)	"	68
Period 5 (February 14 – August 14)	"	62
Period 6 (August 14 – February 15)	"	71
Age	*mean ± st.dev.*	61.8 ± 13.0
	min – max	30.6 – 93.0
Disease stage (cTNM)		
Stage I	*n (% total)*	211 (53.4)
Stage II	"	158 (40.0)
Stage III	"	26 (6.6)
Procedures/treatments performed/prescribed		
MRI scan	"	57 (14.4)
Neoadjuvant systemic treatment	"	60 (15.2)
Adjuvant systemic treatment	"	236 (59.7)
Direct breast reconstruction	"	17 (4.3)

Table 2 - Descriptive statistics study population retrospective study Oncoguide 14-2-2013 – 13-2-2015

The study population consisted of 395 female breast cancer patients aged 30.6 – 93.0 years (61.8 ± 13.0 on average) of which 75.2% (n = 297) was diagnosed and treated in Alkmaar and 24.8% (n = 98) in Den Helder. Of these patients, 53.4% was diagnosed with cTNM stage I breast cancer, 40.0% with stage II and 6.6% with stage III. When looking at the procedures/treatments that were performed or prescribed, it can be seen that adjuvant treatment was prescribed to 59.7% (n = 236) of the patients and direct breast reconstruction was performed on 4.3% (n = 17).

The total eligible patients per recommendation were 395 for the first two recommendations and 371 for the last two, since 24 patients did not have surgery and thus were not eligible for adjuvant systemic treatment or direct breast reconstruction. Below, in *Table 3,* the results of the data analysis

showing the total eligible patients, the recommendations according to the 2012 guideline and whether or not these were discussed/performed and the recommendations provided through Oncoguide that were presented differently compared to the guideline can be found.

		MRI	**NST**	**AST**	**DBR**
Total eligible patients	*n*	395	395	371	371
Recommended according to guideline	*n (% total)*	55 (13.9)	47 (11.9)	189 (50.9)	66 (17.8)
Recommended and performed/ discussed with patient	*n (% total recom.)*	43 (78.2)	39 (83.0)	186 (98.4)	24 (36.4)
Recommended and not performed/ discussed with patient	*“*	12 (21.8)	8 (17.0)	3 (1.6)	42 (63.6)
Not performed/discussed, reason;					
reason not mentioned	*n (% total not perf./disc.)*	11 (91.7)	5 (62.5)	1 (33.3)	41 (97.6)
“wish patient”	*“*	1 (8.3)			
“BCT already possible”	*“*		3 (37.5)		
“comorbidity”	*“*			1 (33.3)	
“no adjuvant treatment possible”	*“*			1 (33.3)	
“breast prostheses”	*“*				1 (2.4)
Recommendation according to Oncoguide compared to guideline presented differently	*n (% total)*	71 (17.8)	146 (37.0)	13 (3.5)	
Difference compared to guideline;					
missing data to follow CDT	*n (% total dif. recom.)*	40 (56.3)			
multiple options presented	*“*		146 (100.0)	13 (100.0)	
recommendation presented elsewhere	*“*	31 (43.7)			

Table 3 - Recommendations according to the 2012 guideline, whether or not performed/discussed with patient and recommendations provided through Oncoguide

With the recommendations according to the guideline it can be see that in 357 cases a diagnostic procedure or treatment was prescribed, the majority of which being AST (n = 189, 52.9%). When direct breast reconstruction (treatment recommendation 4) was recommended according to the guideline it was discussed with the patient in 36.4% (n = 24) of the cases. Of the 63.6% cases (n = 42) in which this option was recommended and not discussed with the patient (compared to 21.8% for MRI, 17.0% for NST and 1.6% for AST), the reason not to discuss this option was not mentioned in 97.6% (n = 41) of these cases.

The largest number where the recommendations provided through Oncoguide were presented differently compared to the guideline were found in neoadjuvant systemic treatment. Within this recommendation, 37.0% (n = 146) of the Oncoguide recommendations differed from those of the guideline by presenting multiple treatment options (with the main difference being the recommendation surgery OR neoadjuvant and MRI (91.8%, n = 134)). For the MRI scan, 56.3% (n = 40 out of 71) of the cases in which Oncoguide recommendations differed could be attributed to missing data (missing information about tumour distribution 47.9%, n = 34 and about patient preference 8.5%, n = 6).

Besides these results it was also checked whether a trend could be seen in the documentation of the motivation behind deviating from the guideline (recommended, but deliberately not performed/ discussed) and the patient preferences. In *Figure 2* it can be seen whether or not the motivation to not follow the guideline was documented per period per procedure/treatment recommendation.

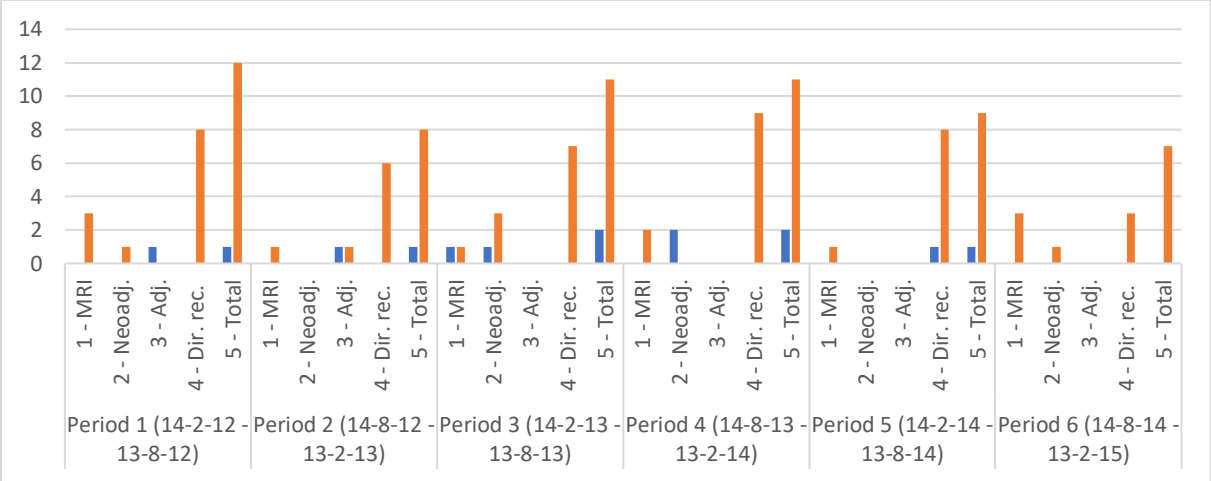

Figure 2 - Motivation documented (orange: not documented, blue: documented) when deviating from guideline per period per procedure/treatment recommendation

Here it can be seen that when guideline recommendations are not followed, the motivation is not documented in 58 out of 65 cases in total; the least motivations were documented in the final period, August 2014 – February 2015 (100.0%, 7 out of 7 not documented). In period 3 and 4 (February 2013 – February 2014) most motivations were documented; 84.6% (11 out of 13 for both periods). In *Figure 3 – Trend patient preference documented per period* it can be seen whether or not the preference of the patient regarding breast conserving therapy (BCT) was documented.

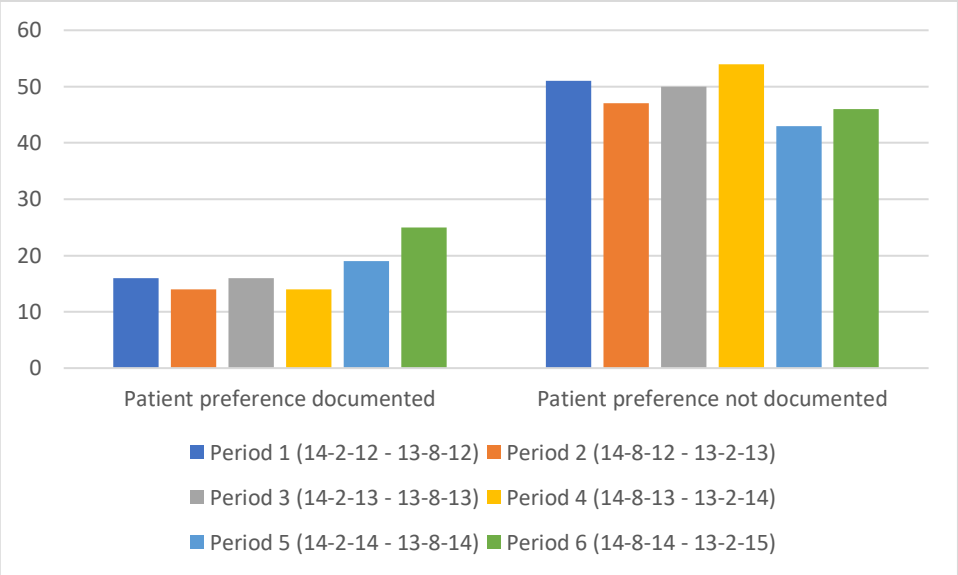

Figure 3 – Trend patient preference documented per period

Figure 3 shows that patient preference was not often documented, but an increasing trend can be seen when comparing the documented patient preferences in February - August 2012 (23.9%, n = 16) to August 2014 – February 2015 (35.2%, n = 25).

SUMMARY OF RESULTS

In conclusion 357 recommendations according to the guideline prescribing a diagnostic procedure or treatment were made during between February 2012 – February 2015 for this study population (MRI: n = 55, NST: n = 47, AST: n = 189 and DBR: n = 66). It can be seen that when a procedure/ treatment was recommended according to the guideline, in 16.5% of the cases (n = 65) the option was not performed or discussed with the patient. Of the not performed/discussed options the motivation was not documented in 89.2% (n = 58) of the cases, mainly with direct breast reconstruction (42 recommended but not discussed cases, with no documented motivation in 41 cases). As can be seen in the bottom section of *Table 3*, the different recommendations provided through Oncoguide presented extra options to consider (e.g. surgery OR neoadjuvant treatment, 91.8% of the different neoadjuvant recommendations presented by Oncoguide) or indicated missing information when following the CDT (e.g. missing data on tumour distribution and patient preferences, 56.3% of the different MRI scan recommendations presented by Oncoguide).

DISCUSSION

Reviewing the structure of this study, the retrospective lay out was a limiting factor. It was decided to study this subject retrospectively since it considered the 2012 guideline and the period after its introduction. Since the data collection had to take place on files available from the EHR it is likely that some missing information in the data was not missing at the time the MDT took place (discussed but not documented). This does indicate that the documentation was not always complete (58 of 65 cases where the guideline was not followed without documented motivation) in which Oncoguide can help, but it was a limiting factor for this study. One of the great strengths of this study was that the full care path of every included patient was checked, from the beginning until the end of the treatment, which provided this study with information available at the time the procedures/treatments were discussed.

Reflecting on the four points of interest it can be concluded that regarding the first point (to determine whether the procedure or treatment was recommended for a patient according to the guideline and was also discussed during MDTs and with the patient [as documented in MDT reports and in the EHR]) that recommendations were not followed or discussed with the patient in 65 cases, often without documented reason (n = 58). This indicates that motivations behind treatment decisions are not systematically documented though this provides essential feedback regarding potential guideline improvement or undesired practice variation.

When looking at the second point of interest (if the recommendation was not discussed with the patient, why not) recommendations regarding DBR also show remarkable results: the option was not discussed with the patient in 63.6% of the cases with eligible patients (not discussed indicating that there was no documentation found in the EHR about patient involvement about this subject). The study population in which direct breast reconstruction was recommended but not discussed with the patient without documented motivation was aged slightly older than the total study population (64.7 ± 13.8 compared to 61.8 ± 13.0 for the total study population). As stated in the method section, direct breast reconstruction is not shown in a CDT directly since all information guideline recommendations indicate that it should be considered with every patient who has surgery and it should be indicated with every patient who has ablative surgery (in both cases there should not be a large possibility of radiotherapy after the surgery, see *Table 1*). At the moment, information about direct breast reconstruction in Oncoguide is shown as textual information when a patient is recommended to have surgery. It is possible that Oncoguide could have increased value if direct breast reconstruction is more visibly integrated in the CDTs.

Furthermore, looking at the third point of interest (to determine what the treatment recommendation for the patient was provided through Oncoguide compared to the recommendation of the guideline) this presented multiple treatment options or presented a recommendation elsewhere. Comparing the recommendations according to the guideline to Oncoguide for MRI presented the recommendation elsewhere in 31 cases. The 2012 guideline states that a MRI scan is recommended with neoadjuvant treatment to capture the tumour size before and after (unless the tumour can sufficiently be measured based on the mammo- and echography). The recommendation in Oncoguide regarding MRI with neoadjuvant therapy is presented differently: it can be found in the neoadjuvant CDT as optional, as can be seen in *Appendix III.* Oncoguide presented multiple treatment recommendations

to consider with NST (n = 146) and AST (n = 13) which could potentially stimulate the health care professional to discuss all options during MDTs and with patients and might increase patient involvement in the care path. With NST the largest number of times multiple options were presented can be found. This can be partly explained by stating that this study only recommended a treatment when the guideline explicitly indicated this treatment for this patient, not when the guideline stated that it should be considered. Oncoguide presents treatment options to be considered, which with NST is the case with cTNM stage II breast cancer if there is already an indication for adjuvant systemic treatment and tumour reduction is needed to increase the possibility of BCT (see *Table 1*).

Discussing the fourth and final point of interest (whether there was any data missing in order to derive the treatment recommendation via the CDTs) it can be concluded that there was data missing. This was the cases with MRI, in 40 cases the CDT could not be filled (missing information about tumour distribution 47.9%, n = 34 and about patient preference 8.5%, n = 6). Besides the missing information to fill the CDT, there was also missing information about the motivation not to follow guideline recommendations in 89.2% (58 out of 65 cases). The documentation of this information is important in order to gain insight in why a decision was made, decrease unwanted practice variation and potentially identify knowledge gaps if a recommended treatment is often not prescribed. The breast cancer guideline was recently revised and this version was published in January 2018, leading to the guideline being more focused on shared decision making and quality of life [7]. Since Oncoguide indicates missing information about for example patient preference and presents multiple treatment options to discuss with the patient, this aligns with the new guideline focussing more on patient involvement.

The trend per period was focussed on the documentation of the motivation when deviating from the guideline as well as patient preferences. This was conducted in order to study whether the documentation increased in time, since shared decision making in health care is increasing and is associated with documenting patient's considerations and wishes [8]. This was not the case for the documentation of the reasons to deviate from the guideline (in 7 of the 7 cases in period 6 this was not documented), but with patient preference regarding BCT documentation a slight increase could be seen when comparing period 1 to period 6. All in all, this trend line did not show the expected increase in documentation over time.

In conclusion it can be said that when looking at the research question *'Does retrospective breast cancer guideline support using Oncoguide show effects on treatment decisions as reported by multidisciplinary team meetings?',* Oncoguide does retrospectively show effects on treatment decisions. These effects can be found in presenting multiple potential treatment options as well as in encouraging active documentation of motivations when deviating from the guideline. This could potentially lead to a decrease in unwanted practice variation and an increase in shared decision making by focussing more on patient's considerations and wishes. Oncoguide also shows effects on treatment decisions by detecting missing patient data, preventing unnecessarily discussed patients during MDTs which is an advantage, since care professional's time is precious.

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APPENDIX I – SAMPLE SIZE

The Excel files in which all random numbers were drawn and all excluded patients can be found are named "2018 Excel - Retrospective study Oncoguide - sample size - random numbers" and "2018 Excel - Retrospective study Oncoguide - sample size - deleted patient IDs".

The final sample of included patient IDs consisted of n = 395 patients. Below, the process of creating this sample is described. The NKR database was first cleaned by deleting double values. Then, 150 random patient IDs were chosen (using =RANDBETWEEN in Excel) and analysed. Of these 150 patients, 37 patients (24.67%) were excluded. Then a formula was used determining the sample size needed with a 95% confidence interval and 5% accuracy ($n = \frac{z^2 * p(1-p)}{d^2}$, were n = sample size, z = z value for 95%-CI = 1.96, p = largest possible proportion = 0.5 and d = accuracy of 5% = 0.05). This resulted in n = 384.16 patients to include. This was multiplied with the percentage of patients that was excluded (n = 384.16 * 1.2467) resulting in 476.36 patients to include. It was decided to include over 500 patients to make sure the target of 380 patients was reached. Since the patients had to be equally distributed amongst the six sub research periods it was decided to include 504 random patient IDs, since this is the first value over 500 that can be divided by six, needed for the six intervals of each six months. Below it can be seen how many patients were in- and excluded per period.

	Total patients *n (% of row)*	**Excluded patients** *n (% of row)*	**Included patients** *n (% of row)*
First random draft	150 (100.0)	37 (24.7)	113 (75.3)
Final random draft	504 (100.0)	109 (21.6)	395 (79.4)
Period 1 (14-2-12 – 13-8-12)	84 (100.0)	17 (20.2)	67 (79.8)
Period 2 (14-8-12 – 13-2-13)	84 (100.0)	23 (27.4)	61 (72.6)
Period 3 (14-2-13 – 13-8-13)	84 (100.0)	18 (21.4)	66 (78.6)
Period 4 (14-8-13 – 13-2-14)	84 (100.0)	16 (19.0)	68 (81.0)
Period 5 (14-2-14 – 13-8-14)	84 (100.0)	22 (26.2)	62 (73.8)
Period 6 (14-8-14 – 13-2-15)	84 (100.0)	13 (15.5)	71 (84.5)

Below the inclusion criteria for this retrospective study can be found.

Inclusion criteria	*Notes*
Female	
Aged 18 years or older at time of diagnosis	
Diagnosed and treated with primary breast cancer	*Thus: excluded when diagnosed with benign lesions, recurring breast cancer or having (had) another form of cancer. The only exception for this last criterium is basal cell carcinoma.*
Diagnosed and treated at the NWZ	*Thus: excluded when patient decides not to be treated or patient decides to be treated elsewhere*
Diagnosed within the research period	
Not diagnosed with breast cancer M1	
Discussed during at least one MDT meeting	

Below it can be seen based on what exclusion criteria the n = 106 patients were excluded.

Exclusion criterium	**Number of patients** *n (% total excluded patients)*
Male	4 (3.7)
Not diagnosed with primary breast cancer	57 (52.3)
Earlier diagnosis with cancer	55 (50.5)
Diagnosed with Tis	2 (1.8)
Not diagnosed and treated at the NWZ	13 (11.9)
Not diagnosed within the research period	1 (0.9)
Diagnosed with breast cancer M1	31 (28.4)
Not discussed during at least one MDT meeting	3 (2.8)
Total excluded patients	109

APPENDIX II – CODE BOOK DATABASE

The Excel files in which the data collection database and the data analysis database can be found are named "2018 Excel - Retrospective study Oncoguide - database data collection" and "2018 Excel - Retrospective study Oncoguide - database data analysis".

The data analysis Excel file consisted of five worksheets, which are all separately mentioned below: general patient data, recommendation 1 – MRI, recommendation 2 – neoadjuvant, recommendation 3 – adjuvant and recommendation 4 – direct rec. Below the column names are listed in order to give an overview of the layout of the database that was used for this study, as well as the values corresponding these columns. In all worksheets, the value "999" indicated "not mentioned in EHR" and empty values indicated "not applicable".

WORKSHEET 1: GENERAL PATIENT DATA

Column name	**Value(s)**
Period	Numerical value for every period 14/2/12 – 13/8/12 = 1 14/8/12 – 13/2/13 = 2 14/2/13 – 13/8/13 = 3 14/8/13 – 13/2/14 = 4 14/2/14 – 13/8/14 = 5 14/8/14 – 13/2/15 = 6
Number	Numerical value giving to each individual patient
Patient ID 1	Numerical value as stated in EHR at the NWZ (location Alkmaar or Den Helder), consisting of 7 numbers
Patient ID 2 *If there was a patient ID 2, the patient was always diagnosed and treated in Den Helder (ID 1) and had to go to Alkmaar for radiotherapy and/or plastic surgery (ID 2). The only exception was the last patient, she was diagnosed and mostly treated at Alkmaar (ID 1) except for her neoadjuvant treatment in Den Helder (ID 2).*	Numerical value as stated in EHR at the NWZ (location Alkmaar or Den Helder), consisting of 7 numbers
Incidence date	dd-mm-yyyy
Date of birth	dd-mm-yyyy
NWZ location of diagnosis and treatment	Alkmaar = 0 Den Helder = 1
Date first discussed in MDT	dd-mm-yyyy
Date last discussed in MDT	dd-mm-yyyy
Age (at time first MDT)	Numerical value

Number of times discussed in MDT before primary treatment	Numerical value
If >1 times discussed in MDT before primary treatment, reason	Not mentioned = 999 PET/CT = 1 New biopsy = 2 Second MRI = 3
Date (MRI discussed in MDT)	dd-mm-yyyy
Age (at time MRI discussed in MDT)	Numerical value
Pregnant	No = 0 Yes = 1
DCIS	No DCIS = 0 DCIS grade I = 1 DCIS grade II = 2 DCIS grade III = 3
DCIS grade ≤ 2 and suspected invasive component	No = 0 Yes = 1
Lobular carcinoma	No = 0 Yes = 1
Patient preference for BCT	Not mentioned = 999 No = 0 Yes = 1
Discrepancy in tumour size in clinical, mammographic and ultrasound examination	No = 0 Yes = 1
Indication neoadjuvant systemic treatment	No = 0 Yes = 1
Assessability mammography	Good = 0 Bad = 1
Tumour distribution	Not mentioned = 999 Unifocal = 0 Multicentric or different = 1
MRI scan recommended according to guideline	No = 0 Yes = 1
MRI scan performed	No = 0 Yes = 1

cT stage	cTis = 0 cT1a = 1 cT1b = 2 cT1c = 3 cT2 = 4 cT3 = 5 cT4 = 6
cN stage	cN0 = 0 cN1 = 1 cN2 = 2 cN3 = 3
Breast cancer cTNM stage	Stage I = 1 Stage II = 2 Stage III = 3
Indication adjuvant systemic treatment	No = 0 Yes = 1
Patient preference for BCT	Not mentioned = 999 No = 0 Yes = 1
Neoadjuvant systemic treatment recommended according to guideline	No = 0 Yes = 1
Neoadjuvant systemic treatment prescribed	No = 0 Yes = 1
Date (adjuvant treatment discussed in MDT)	dd-mm-yyyy
Age (at time adjuvant treatment discussed in MDT)	Numerical value
pT stage	pTis = 0 pT1a = 1 pT1b = 2 pT1c = 3 pT2 = 4 pT3 = 5 pT4 = 6
pN stage	pN0 = 0 pN1 = 1 pN2 = 2 pN3 = 3
Breast cancer pTNM stage	Stage I = 1 Stage II = 2 Stage III = 3

Her2neu status	Negative = 0 Positive = 1
ER status	Negative = 0 Positive = 1
Adjuvant systemic treatment recommended according to guideline	No = 0 Yes = 1
Adjuvant systemic treatment prescribed	No = 0 Yes = 1
Ablative treatment performed	No = 0 Yes = 1
Large possibility of adjuvant radiotherapy	No = 0 Yes = 1
Direct breast reconstruction recommended according to guideline	No = 0 Yes = 1
Direct breast reconstruction performed	No = 0 Yes = 1

WORKSHEET 2: RECOMMENDATION 1 – MRI

Column name	**Value(s)**
Period	Numerical value for every period 14/2/12 – 13/8/12 = 1 14/8/12 – 13/2/13 = 2 14/2/13 – 13/8/13 = 3 14/8/13 – 13/2/14 = 4 14/2/14 – 13/8/14 = 5 14/8/14 – 13/2/15 = 6
Patient ID 1	Numerical value as stated in EHR at the NWZ (location Alkmaar or Den Helder), consisting of 7 numbers
Date of birth	dd-mm-yyyy
MRI scan recommended according to guideline	No = 0 Yes = 1
Recommendations provided through Oncoguide compared to guideline	Similar = 0 Different = 1
If different, how	Tumour distribution dependent (not given): not indicated or to consider = 1 MRI not indicated because neoadjuvant treatment in other Oncoguide CDT = 2 Patient preference dependent (not given): not indicated or to consider = 3 MRI not indicated = 4
MRI scan recommended according to guideline and discussed in MDT	No = 0 Yes = 1
MRI scan recommended according to guideline and performed	No = 0 Yes = 1
MRI scan recommended according to guideline and not performed; reason	Not mentioned = 999 Wish patient = 1
Other remarks	TEXT

WORKSHEET 3: RECOMMENDATION 2 – NEOADJUVANT

Column name	**Value(s)**
Period	Numerical value for every period 14/2/12 – 13/8/12 = 1 14/8/12 – 13/2/13 = 2 14/2/13 – 13/8/13 = 3 14/8/13 – 13/2/14 = 4 14/2/14 – 13/8/14 = 5 14/8/14 – 13/2/15 = 6
Patient ID 1	Numerical value as stated in EHR at the NWZ (location Alkmaar or Den Helder), consisting of 7 numbers
Date of birth	dd-mm-yyyy
Neoadjuvant systemic treatment recommended according to guideline	No = 0 Yes = 1
Recommendations provided through Oncoguide compared to guideline	Similar = 0 Different = 1
If different, how	Surgery or neoadj. + MRI = 1 Surgery + RTx or neoadj. + MRI = 2
Neoadjuvant systemic treatment recommended according to guideline and discussed in MDT	No = 0 Yes = 1
Neoadjuvant systemic treatment recommended according to guideline and discussed with patient	No = 0 Yes = 1
Neoadjuvant systemic treatment recommended according to guideline and not discussed with patient; reason	Not mentioned = 999 BCT already possible = 1 Wish patient = 2
If patient received neoadjuvant treatment, then what treatment	Chemo = 1 Hormonal = 2 Chemo+immuno = 3
Other remarks	TEXT

WORKSHEET 4: RECOMMENDATION 3 – ADJUVANT

Column name	**Value(s)**
Period	Numerical value for every period 14/2/12 – 13/8/12 = 1 14/8/12 – 13/2/13 = 2 14/2/13 – 13/8/13 = 3 14/8/13 – 13/2/14 = 4 14/2/14 – 13/8/14 = 5 14/8/14 – 13/2/15 = 6
Patient ID 1	Numerical value as stated in EHR at the NWZ (location Alkmaar or Den Helder), consisting of 7 numbers
Date of birth	dd-mm-yyyy
Adjuvant systemic treatment recommended according to guideline	No = 0 Yes = 1
Recommendations provided through Oncoguide compared to guideline	Similar = 0 Different = 1
If different, how	Chemo and/or hormonal = 1
Adjuvant systemic treatment recommended according to guideline and discussed in MDT	No = 0 Yes = 1
Adjuvant systemic treatment recommended according to guideline and discussed with patient	No = 0 Yes = 1
Adjuvant systemic treatment recommended according to guideline and not discussed with patient; reason	Not mentioned = 999 Comorbidity = 1 No adjuvant treatment possible = 2
If patient received adjuvant treatment, then what treatment	Hormonal = 1 Chemo+hormonal = 2 Chemo = 3 Chemo+immuno+hormonal = 4 No treatment = 5 Chemo+immuno = 6 Immuno+hormonal = 7 Immuno = 8
Other remarks	TEXT

WORKSHEET 5: RECOMMENDATION 4 – DIRECT REC.

Column name	**Value(s)**
Period	Numerical value for every period 14/2/12 – 13/8/12 = 1 14/8/12 – 13/2/13 = 2 14/2/13 – 13/8/13 = 3 14/8/13 – 13/2/14 = 4 14/2/14 – 13/8/14 = 5 14/8/14 – 13/2/15 = 6
Patient ID 1	Numerical value as stated in EHR at the NWZ (location Alkmaar or Den Helder), consisting of 7 numbers
Date of birth	dd-mm-yyyy
Age (at time first MDT)	Numerical value
Direct breast reconstruction recommended according to guideline	No = 0 Yes = 1
Direct breast reconstruction recommended according to guideline and discussed in MDT	No = 0 Yes = 1
Direct breast reconstruction recommended according to guideline and discussed with patient	No = 0 Yes = 1
Breast reconstruction recommended according to guideline and not discussed with patient; reason	Not mentioned = 999 Breast prostheses = 1
Other remarks	TEXT

APPENDIX III – RECOMMENDATIONS GUIDELINE AND ONCOGUIDE CDTS

Below all procedure/treatment recommendations are defined according to the guideline and the CDTs derived from this on which Oncoguide was based.

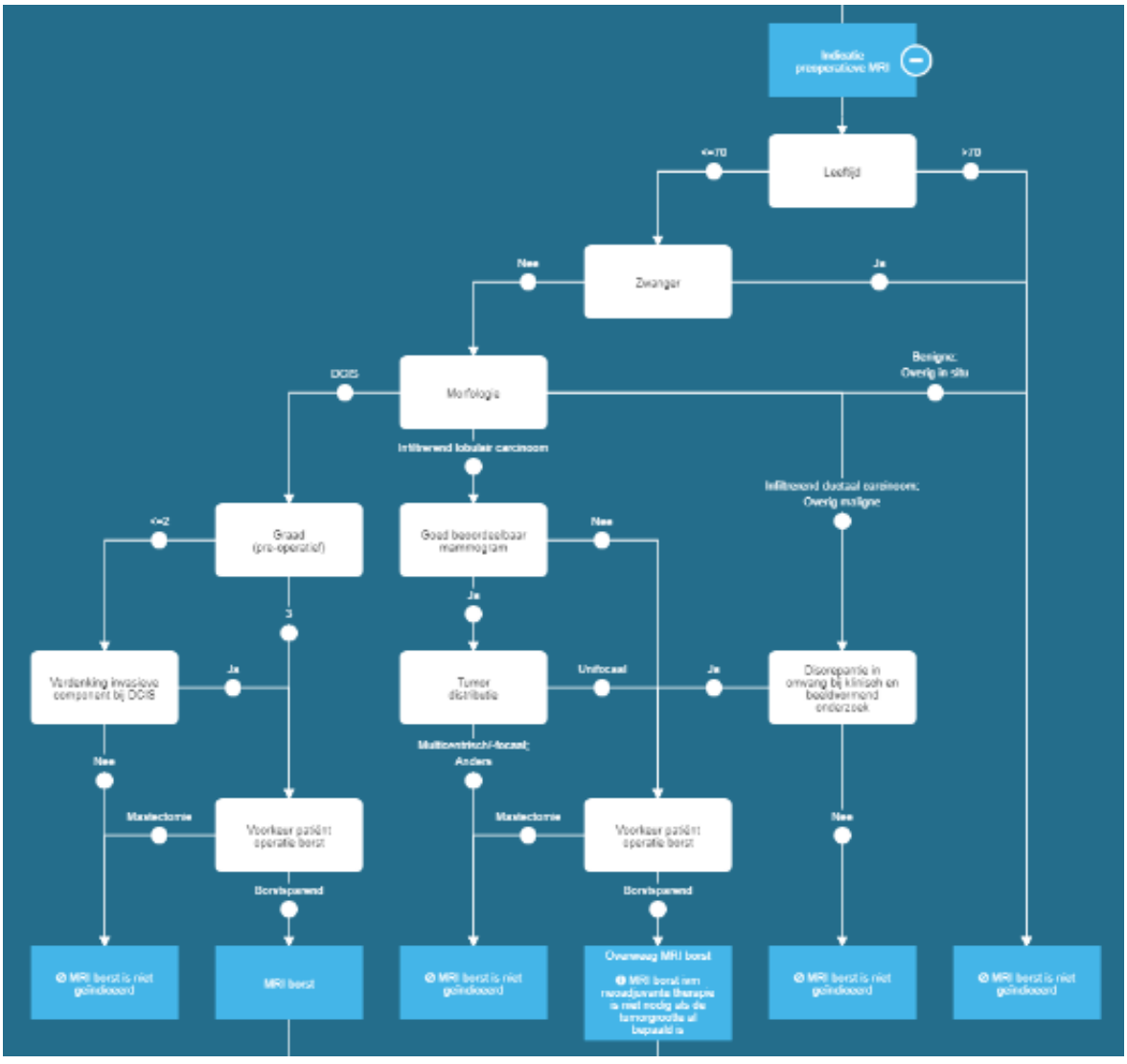
RECOMMENDATION 1 – MRI SCAN

Definition MRI scan – a MRI scan in the diagnostic phase as additional imaging technique

According to the guideline a MRI scan is indicated with patients ≤ 70 years AND not pregnant AND

a. DCIS ≤ grade II AND suspected invasive component AND patient preference for breast conserving treatment (BCT)
b. DCIS grade III AND patient preference for BCT
c. Invasive lobular carcinoma AND patient preference for BCT
d. Discrepancy in tumour size in clinical, mammographic and ultrasound examination
e. Indication neoadjuvant treatment

The recommendation according to the CDT on Oncoguide regarding a MRI scan can be seen below.



This CDT can be reached via www.oncoguide.nl → Borstkanker richtlijn 2012 MDO → Primaire behandeling → Indicatie preoperatieve MRI (when clicking on the "+" with "+/- MRI borst").

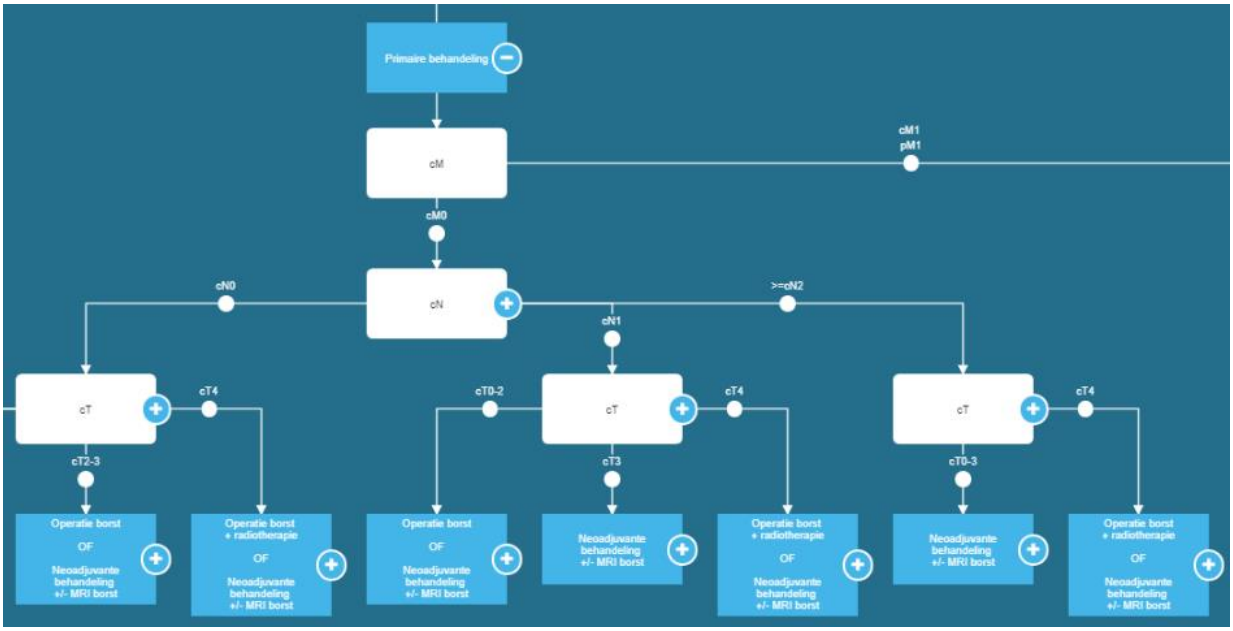
RECOMMENDATION 2 – NEOADJUVANT SYSTEMIC TREATMENT

Definition neoadjuvant systemic treatment – treatment pre-surgery which can be hormonal or chemotherapy

According to the guideline neoadjuvant systemic treatment

a. Is indicated with cTNM stage III breast cancer
b. Is considered with cTNM stage II breast cancer IF there is already an indication for adjuvant systemic treatment AND tumour reduction is needed to increase the possibility of BCT

The recommendation according to the CDT on Oncoguide regarding neoadjuvant systemic treatment can be seen below.



This CDT can be reached via www.oncoguide.nl → Borstkanker richtlijn 2012 MDO → Primaire behandeling.

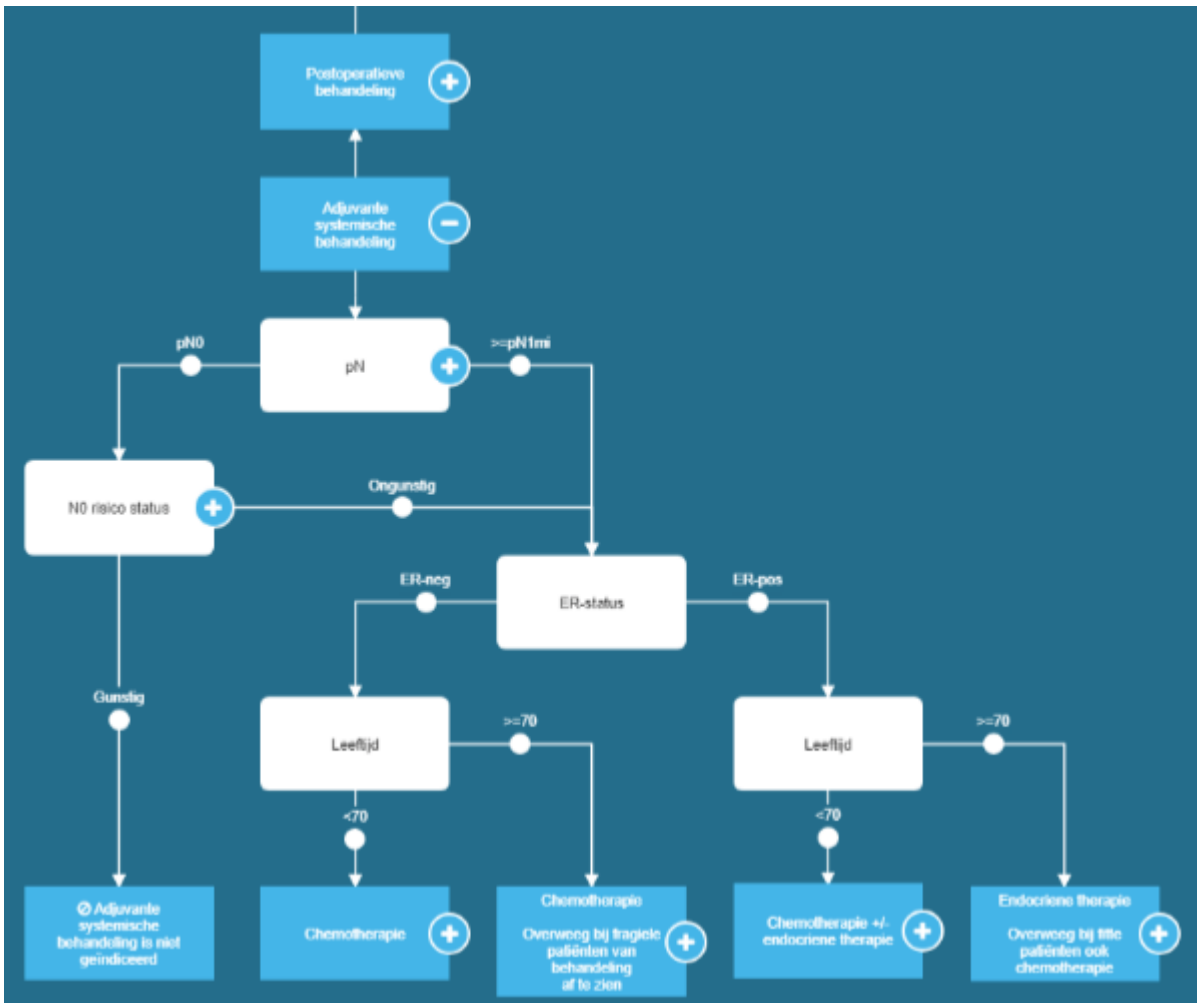
RECOMMENDATION 3 – ADJUVANT SYSTEMIC TREATMENT

Definition adjuvant systemic treatment – treatment post-surgery which can be hormonal, chemotherapy or immunotherapy

According to the guideline adjuvant systemic treatment is indicated with

a. N+ status (according to pTNM)
b. High risk N0 status (according to pTNM), which is defined as (as can be seen in the CDT below)
    - Aged < 35 AND pT ≥ 1c
    - Aged < 35 AND pT ≤ 1b AND stage ≥ II breast cancer
    - Aged ≥ 35 AND pT1b AND Her2neu positive
    - Aged ≥ 35 AND pT1c AND stage ≥ II breast cancer
    - Aged ≥ 35 AND pT ≥ 2
    - Tumour ≥ 1b AND Her2neu positive

The recommendation according to the CDT on Oncoguide regarding adjuvant systemic treatment can be seen below.



This CDT can be reached via www.oncoguide.nl → Borstkanker richtlijn 2012 MDO → Postoperatieve behandeling → Adjuvante systemische behandeling (when clicking on the "+" with "+/- adjuvante systemische behandeling").

General remarks for (neo)adjuvant systemic treatment - these can consist of the following (combinations of) treatments:

- *Endocrine (hormonal) therapy: if ER and/or PR positive (tamoxifen, anastrozol, letrozol, exemestane)*
- *Chemotherapy: if age ≤ 70 (can be considered in fit patient of 70 years or older)*
- *Immunotherapy: if Her2neu positive (trastuzumab, pertuzumab)*

RECOMMENDATION 4 – DIRECT BREAST RECONSTRUCTION

Definition direct breast reconstruction – placing a tissue expander, DIEAP (deep inferior epigastric artery perforator) flap or LD (latissimus dorsi) flap (thus, oncoplastic surgery or lipofilling is not regarded as direct reconstructive breast surgery)

According to the guideline direct breast reconstruction

a. Is indicated with patients who have an indication for ablative treatment (ablatio or modified radical mastectomy) AND no large possibility of adjuvant radiotherapy
b. Is considered with patients who have an indication for breast surgery AND no larger possibility of adjuvant radiotherapy

There is no CDT for direct breast reconstruction on Oncoguide, this information is provided as extra information when surgery is recommended which can be seen below.

Borstsparende operatie
Borstsparende operatie (inclusief radiotherapie) dient alleen aan de patiënt te worden aangeboden als een goed cosmetisch resultaat en een evenzeer goede lokale tumorcontrole kan worden verwacht. Indien borstsparende operatie (inclusief radiotherapie) gecontraïndiceerd wordt geacht en in geval van voorkeur van de patiënt, is mastectomie inclusief adequate okselstadiëring de aangewezen behandeling.

Mastectomie
Een mastectomie wordt verricht, indien het de voorkeur van patiënt heeft of indien er een contra-indicatie bestaat voor MST door een verwacht slecht cosmetisch resultaat of een hoge kans op een lokaal recidief. Patiënten die een mastectomie moeten ondergaan, dienen tevoren geïnformeerd te worden omtrent de mogelijkheden van borstreconstructie. Borstreconstructie moet overwogen worden bij elke patiënt met borstkanker die geopereerd wordt. Het direct uitvoeren van de reconstructie verdient een lichte voorkeur. Uitstel van reconstructie moet overwogen worden indien de kans groot is dat radiotherapie geïndiceerd zal zijn.

This extra information can be reached via www.oncoguide.nl → Borstkanker richtlijn 2012 MDO → Preperatieve behandeling → Meer informatie (when clicking on the "+" with "mastectomie" or "borstbesparende operatie").

General remark for direct breast reconstruction – breast reconstruction is recommended to be considered for every patient undergoing breast surgery. In practice this did not happen following the 2012 guideline, and since it is only recommended to consider this recommendation will not be taken into account in this study.

APPENDIX IV – SPSS OUTPUT TABLES

The Excel file in which the information for the trend line can be found is named "2018 Excel - Retrospective study Oncoguide - database data analysis - trend per period". The SPSS dataset files used for these tables are named "2018 SPSS - Retrospective study Oncoguide - dataset general patient data", "2018 SPSS - Retrospective study Oncoguide - dataset recommendation 1 MRI", "2018 SPSS - Retrospective study Oncoguide - dataset recommendation 2 neoadjuvant", "2018 SPSS - Retrospective study Oncoguide - dataset recommendation 3 adjuvant" and "2018 SPSS - Retrospective study Oncoguide - dataset recommendation 4 direct rec.". The SPSS output file where all tables can be found is named "2018 SPSS - Retrospective study Oncoguide - output".

In this appendix, all tables derived from SPSS can be found on which the tables and figures in this article were based.

SPSS OUTPUT TABLES – DESCRIPTIVE STATISTICS

		Count	Table N %
NWZ location of diagnosis and treatment (Alkmaar = 0, Den Helder = 1)	0	297	75,2%
	1	98	24,8%

	Mean	Minimum	Maximum	Standard Deviation
Age (at time first MDT)	61,8	30,6	93,0	13,0

		Count	Table N %
Breast cancer cTNM stage (stage I = 1, stage II = 2, stage III = 3)	1,0	211	53,4%
	2,0	158	40,0%
	3,0	26	6,6%

		Count	Table N %
MRI scan performed (no = 0, yes = 1)	,0	338	85,6%
	1,0	57	14,4%
Neoadjuvant systemic treatment prescribed (no = 0, yes = 1)	,0	335	84,8%
	1,0	60	15,2%
Adjuvant systemic treatment prescribed (no = 0, yes = 1)	,0	159	40,3%
	1,0	236	59,7%
Direct breast reconstruction performed (no = 0, yes = 1)	,0	378	95,7%
	1,0	17	4,3%

SPSS OUTPUT TABLES – RESULTS – MRI SCAN

		Count	Table N %
MRI scan recommended according to guideline (no = 0, yes = 1)	,0	340	86,1%
	1,0	55	13,9%
MRI scan recommended according to guideline and performed (no = 0, yes = 1)	,0	12	21,8%
	1,0	43	78,2%

		MRI scan recommended according to guideline and performed (no = 0, yes = 1)	
		,0	
		Count	Table N %
MRI scan recommended according to guideline and not performed; reason (not mentioned = 999, wish patient = 1)	1,0	1	8,3%
	999,0	11	91,7%

		Recommendations according to Oncoguide compared to guideline (similar = 0, different = 1)	
		1,0	
		Count	Table N %
If different, how (tumour distribution dependent (not given): not indicated or to consider = 1, MRI not indicated because neoadjuvant treatment in other Oncoguide CDT = 2, patient preference dependent (not given): not indicated or to consider = 3, MRI not indicated = 4)	1,0	34	47,9%
	2,0	28	39,4%
	3,0	6	8,5%
	4,0	3	4,2%

SPSS OUTPUT TABLES – RESULTS – NEOADJUVANT SYSTEMIC TREATMENT

		Count	Table N %
Neoadjuvant systemic treatment recommended according to guideline (no = 0, yes = 1)	,0	348	88,1%
	1,0	47	11,9%
Neoadjuvant systemic treatment recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	8	17,0%
	1,0	39	83,0%

		Neoadjuvant systemic treatment recommended according to guideline and discussed with patient (no = 0, yes = 1)	
		,0	
		Count	Table N %
Neoadjuvant systemic treatment recommended according to guideline and not discussed with patient; reason (not mentioned = 999, BCT already possible = 1)	1,0	3	37,5%
	999,0	5	62,5%

		Recommendations according to Oncoguide compared to guideline (similar = 0, different = 1)	
		1,0	
		Count	Table N %
If different, how (surgery or neoadj. + MRI = 1, surgery + RTx or neoadj. + MRI = 2)	1,0	134	91,8%
	2,0	12	8,2%

SPSS OUTPUT TABLES – RESULTS – ADJUVANT SYSTEMIC TREATMENT

		Count	Table N %
Adjuvant systemic treatment recommended according to guideline (no = 0, yes = 1)	,0	182	49,1%
	1,0	189	50,9%
Adjuvant systemic treatment recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	3	1,6%
	1,0	186	98,4%

		Adjuvant systemic treatment recommended according to guideline and discussed with patient (no = 0, yes = 1)	
		,0	
		Count	Table N %
Adjuvant systemic treatment recommended according to guideline and not discussed with patient; reason (not mentioned = 999, comorbidity = 1, no adjuvant treatment possible = 2)	1,0	1	33,3%
	2,0	1	33,3%
	999,0	1	33,3%

		Recommendations according to Oncoguide compared to guideline (similar = 0, different = 1)	
		1,0	
		Count	Table N %
If different, how (chemo and/or hormonal = 1)	1,0	13	100,0%

SPSS OUTPUT TABLES – RESULTS – DIRECT BREAST RECONSTRUCTION

		Count	Table N %
Direct breast reconstruction recommended according to guideline (no = 0, yes = 1)	0	305	82,2%
	1	66	17,8%
Direct breast reconstruction recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	42	63,6%
	1,0	24	36,4%

		Direct breast reconstruction recommended according to guideline and discussed with patient (no = 0, yes = 1)	
		,0	
		Count	Table N %
Direct breast reconstruction recommended according to guideline and not discussed with patient; reason (not mentioned = 999, breast prostheses = 1)	1,0	1	2,4%
	999,0	41	97,6%

				Age (at time first MDT)	
				Mean	Standard Deviation
Direct breast reconstruction recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	Direct breast reconstruction recommended according to guideline and not discussed with patient; reason (not mentioned = 999, breast prostheses = 1)	1,0	50,9	.
			999,0	64,7	13,8

SPSS OUTPUT TABLES – RESULTS – TREND PER PERIOD

				MRI scan recommended according to guideline and not performed; reason (not mentioned = 999, wish patient = 1)	
				1,0	999,0
				Count	Count
Period (14/2/12 – 13/8/12 = 1, 14/8/12 – 13/2/13 = 2, 14/2/13 – 13/8/13 = 3, 14/8/13 – 13/2/14 = 4, 14/2/14 – 13/8/14 = 5, 14/8/14 – 13/2/15 = 6)	1,0	MRI scan recommended according to guideline and performed (no = 0, yes = 1)	,0	0	3
	2,0	MRI scan recommended according to guideline and performed (no = 0, yes = 1)	,0	0	1
	3,0	MRI scan recommended according to guideline and performed (no = 0, yes = 1)	,0	1	1
	4,0	MRI scan recommended according to guideline and performed (no = 0, yes = 1)	,0	0	2
	5,0	MRI scan recommended according to guideline and performed (no = 0, yes = 1)	,0	0	1
	6,0	MRI scan recommended according to guideline and performed (no = 0, yes = 1)	,0	0	3

				Neoadjuvant systemic treatment recommended according to guideline and not discussed with patient; reason (not mentioned = 999, BCT already possible = 1)	
				1,0	999,0
				Count	Count
Period (14/2/12 – 13/8/12 = 1, 14/8/12 – 13/2/13 = 2, 14/2/13 – 13/8/13 = 3, 14/8/13 – 13/2/14 = 4, 14/2/14 – 13/8/14 = 5, 14/8/14 – 13/2/15 = 6)	1,0	Neoadjuvant systemic treatment recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	0	1
	3,0	Neoadjuvant systemic treatment recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	1	3
	4,0	Neoadjuvant systemic treatment recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	2	0
	6,0	Neoadjuvant systemic treatment recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	0	1

				Adjuvant systemic treatment recommended according to guideline and discussed with patient (no = 0, yes = 1)
				,0
				Count
Period (14/2/12 – 13/8/12 = 1, 14/8/12 – 13/2/13 = 2, 14/2/13 – 13/8/13 = 3, 14/8/13 – 13/2/14 = 4, 14/2/14 – 13/8/14 = 5, 14/8/14 – 13/2/15 = 6)	1,0	Adjuvant systemic treatment recommended according to guideline and not discussed with patient; reason (not mentioned = 999, comorbidity = 1, no adjuvant treatment possible = 2)	2,0	1
	2,0	Adjuvant systemic treatment recommended according to guideline and not discussed with patient; reason (not mentioned = 999, comorbidity = 1, no adjuvant treatment possible = 2)	1,0	1
			999,0	1

				Direct breast reconstruction recommended according to guideline and not discussed with patient; reason (not mentioned = 999, breast prostheses = 1)	
				1,0	999,0
				Count	Count
Period (14/2/12 – 13/8/12 = 1, 14/8/12 – 13/2/13 = 2, 14/2/13 – 13/8/13 = 3, 14/8/13 – 13/2/14 = 4, 14/2/14 – 13/8/14 = 5, 14/8/14 – 13/2/15 = 6)	1,0	Direct breast reconstruction recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	0	8
	2,0	Direct breast reconstruction recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	0	6
	3,0	Direct breast reconstruction recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	0	7
	4,0	Direct breast reconstruction recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	0	9
	5,0	Direct breast reconstruction recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	1	8
	6,0	Direct breast reconstruction recommended according to guideline and discussed with patient (no = 0, yes = 1)	,0	0	3

		Patient preference for BCT (not mentioned = 999, no = 0, yes = 1)		
		,0	1,0	999,0
		Count	Count	Count
Period (14/2/12 – 13/8/12 = 1, 14/8/12 – 13/2/13 = 2, 14/2/13 – 13/8/13 = 3, 14/8/13 – 13/2/14 = 4, 14/2/14 – 13/8/14 = 5, 14/8/14 – 13/2/15 = 6)	1,0	12	4	51
	2,0	8	6	47
	3,0	10	6	50
	4,0	10	4	54
	5,0	13	6	43
	6,0	11	14	46