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Breast Reconstruction Post-Mastectomy: an Assessment of Rates, Limiting Factors and Attitudes at a Tertiary Care Center in Quebec

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RÉSUMÉ

La reconstruction mammaire post-mastectomie améliore le bien-être psychosocial, et l'image corporelle des patientes. Parcontre, la reconstruction mammaire demeure faiblement utilisée et même inaccessible à des patients dû à des facteurs limitants. Les taux de reconstruction et les facteurs qui influencent l'accès à la reconstruction n'ont pas été évalués dans la province du Québec.

Avec une revue de dossier rétrospective, l'objectif de notre étude est d'identifier les taux de reconstruction mammaire dans un centre tertiaire à Montréal et les facteurs qui influencent l'accès à la reconstruction, avec un revu de dossier rétrospective. Ensuite, nous avons évaluer directement dans la même cohorte de patientes, leur désire d'avoir une consultation en chirurgie plastique pour discuter d'une reconstruction.

Il y avait un taux total de reconstruction mammaire post-mastectomie de 21%, dont 14% était immédiat et 8% tardif. Les patientes qui ont eu une reconstruction étaient plus jeunes, plus de tendance à avoir une plus grande proportion de mastectomie bilatérale, avaient des cancers non-invasifs et habitaient plus loin de l'hôpital (>10km). Environ la moitié des patientes avec une mastectomie sont intéresser à avoir une consultation avec un chirurgien plasticien mais seulement 38% ont eu une reconstruction. Les chances d'avoir subi une reconstruction, augmentent lorsqu'une reconstruction est offerte et expliquée.

Présentement, il existe des barrières autres que les désires de la patiente qui empêchent l'accès à la reconstruction mammaire post-mastectomie.

Mot-clés : Québec, Canada, reconstruction mammaire, taux de reconstruction, hôpital universitaire, reconstruction autologue, reconstruction par prothèse, reconstruction immédiate, reconstruction tardive, Montréal, cancer du sein, désire d'avoir une reconstruction, intérêt pour une reconstruction, revue de dossiers, questionnaire téléphonique, accès.

ABSTRACT

Breast reconstruction post-mastectomy has been shown to improve psychosocial wellbeing, and body image. However, accessibility and acceptance of breast reconstruction is limited, with patients being unequally privileged based a number of limiting factors. To date, no evaluation on the rates of reconstruction and the factors that influence patient access has been performed in the province of Quebec.

The objective of the research was two-fold with the first component being to identify the rates of breast reconstruction at a tertiary care center in Montreal and the factors influencing the rates of reconstruction through a retrospective chart review. The second component was to directly evaluate in the same cohort of breast cancer patients; their interest in a consultation with plastic surgery through a telephone questionnaire.

There was a total rate of PMBR of 21%, where 14% of patients had an immediate reconstruction and 8% of eligible patients underwent a delayed reconstruction. Patients that received a PMBR were younger, more likely to have bilateral mastectomies, had non-invasive breast cancer and resided further then 10km from the hospital. Approximately half of patients with a mastectomy were interested in consulting a plastic surgeon but only 38% of all patients underwent a reconstruction. The offer and awareness of reconstruction increased the chance of opting to have a reconstruction.

There are barriers outside of the patient's own desires that impede their access to breast reconstruction.

Keywords : Quebec, Canada, breast reconstruction, rate of reconstruction, teaching hospital, autologous breast reconstruction, prosthetic breast reconstruction, immediate reconstruction, delayed reconstruction, Montreal, breast cancer, desire for reconstruction, interest in consultation, chart review, telephone questionnaire, access.

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LEGEND

BC : Breast cancer

BRA : Breast Reconstruction Awareness

HMR : Hopital Maisonneuve Rosemont

BMI : Body mass index

NCI-CCC : National Cancer Institute-designated Comprehensive Cancer Center

PMBR : Post-mastectomy breast reconstruction

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1 - INTRODUCTION

1.1 Breast Cancer

Breast cancer remains the most common non-skin cancer in women worldwide and the second leading cause of death in this population. There are an expected 24,400 new breast cancer cases (representing 26% of all cancers) in Canadian women in the year 2014.[1] According to the Canadian Cancer Statistics for 2014, there are an 6000 expected new cases of breast cancer to be diagnosed in the province of Quebec alone, representing 24.6% of new breast cancer cases in Canada.[1] Furthermore, breast cancer is the second leading cause of cancer-related death in women with an expected 5000 attributed deaths in 2014. Importantly, while the average life expectancy at birth is 81 years of age in Canada, the majority of women are diagnosed with breast cancer in between the ages of 40 and 79 years (83%, with 20 300 new cases) and their five-year relative survival ratio are excellent at 87-90%.[1] Given the advances in screening, diagnosis, and genetic testing, not only are there patients being diagnosed at earlier ages, but there are also healthy patients opting for prophylactic mastectomies.[2, 3] As such, the need to optimize breast cancer treatment continues to be at the forefront of scientific and clinical research. In addition, the care that is provided to these patients should reflect the extent of the disease burden. A breast cancer diagnosis can have a tremendous psychological impact and the mastectomy that follows can impair function, body image, and the patient's overall quality of life.[4-6]

1.2 Breast Reconstruction

Breast reconstruction following mastectomy has been the plastic surgeons' answer to improve the patients' quality of life. Initially, the quality of life outcomes following breast reconstruction were equivocal as were demonstrated in a systematic review published in 2010.[7] However, the systematic review deemed that the studies used incorrect methodology with instruments that failed to correctly assess the paradigms affected by a mastectomy (body image, sexuality) and were underpowered.[7, 8] Subsequently, the BREAST-Q, a patient-reported outcome questionnaire tailored for breast pathologies was developed to assess patient satisfaction, body image and multiple domains of a breast cancer patient's quality of life (physical, psychosocial, well-being).[9] In a prospective study following autologous breast reconstruction, the BREAST-Q demonstrated an improvement in physical, psychosocial and well-being domains.[10] Additionally, the patients with breast reconstructions are more satisfied with the appearance of their breast/chest, experienced less pain and had better physical functioning.[11]

Breast reconstruction has become widely adopted in the plastic surgery community. Plastic surgeons have defined the role and safety of breast reconstruction post-mastectomy, but the responsibility falls on the oncologic breast surgeons and oncologists who have the opportunity to refer breast cancer patients to plastic surgeons.[12-14] In 1998, the Women's Health and Cancer Rights Act became federal law in the United States and obligated insurance providers to extend mastectomy benefits to include breast reconstruction[15]. New York State has pushed the boundaries further and signed into state law the obligation of physicians/surgeons to discuss options for breast reconstruction with their patients prior to

performing a mastectomy.[16] The United Kingdom came out with the NICE guidelines that stated reconstruction should be available to all women with breast cancer at the time of their mastectomy.[17] In Canada, our universal health insurance system assures coverage of breast reconstruction post-mastectomy and subsequent symmetrization procedures for the contralateral breast. One would expect this to have a positive outcome on breast reconstruction awareness and acceptance of its role in breast cancer management. However, the rate of breast reconstruction in Canada, a marker for the quality of care provided in the treatment of breast cancer, has been lagging.[18, 19]

1.2.1 Rates of Breast Reconstruction

Rates of breast reconstruction have been examined globally. A literature review conducted by Platt and colleagues in 2011 demonstrated both a wide variation in rates of breast reconstruction but also a disparity in regional/national publications.[20] There were two population-based publications in Canada with rates ranging from 3.8% in Nova Scotia (1991-2001) to 7.9% in Ontario (1984-1985).[18, 19] A more recent population-based study in Ontario revealed more accurate findings of a gradual increase in yearly rates of reconstruction going from 9% in 2002 to 16% in 2011.[21] The rate of immediate breast reconstruction serves as a guide to question whether optimal breast cancer care is being provided.[22] A recent hospital-based study from England revealed a national increase in immediate breast reconstruction from 10% to 23.3% from 2005 to 2013-2014[23]. The United States, which is heavily represented in the literature, has population-based studies demonstrating rates of 9.1% up to 29.2%.[8, 24-31] Once again, the increase in the rates of reconstruction was noted in the newer studies. The hospital-based studies in the US ranged from 3.4% in 1985-1990 up to

42% from 1997-2002.[32-36] The 42% rate of reconstruction was from eight National Comprehensive Cancer Network centers. These centers likely represent a disproportionate amount of reconstruction due to their mandates of providing comprehensive cancer care with access to significant resources and acting as nationwide referral centers for reconstruction. It is difficult to determine if this is the benchmark for other tertiary care referral centers with dedicated breast reconstruction surgeons given that breast reconstruction remains a choice that should be offered to all eligible patients while keeping in mind that not all patients desire a reconstruction. Nonetheless, investigators have sought to determine what factors might be influencing the access to breast reconstruction.[20]

Patient and physician characteristics, and information regarding breast cancer stage, type and size, have been examined in epidemiologic studies on reconstruction rates in order to distinguish traits that set apart the patients that received breast reconstruction versus patients that had a mastectomy alone. The variables can be divided into three main categories: physician-related, patient-related and cancer-related.[20]

1.2.2 Physician-related factors affecting breast reconstruction

Physicians' personal beliefs and attitudes towards breast reconstruction can heavily influence which patients receive breast reconstruction. The initial issues that faced breast reconstruction following mastectomy were concerns of the reconstruction masking local recurrence, poor results following reconstruction and mastectomies that failed to achieve oncological safety.[37]

An early study on referral patterns of general surgeons for breast reconstruction using a postal questionnaire in 1998 revealed that of the surgeons who responded to the questionnaire, 76% usually referred for breast reconstruction.[37] In 2008, a survey of general surgeons in Wisconsin revealed that 40% of surgeons did not refer for breast reconstruction.[38] Although these studies have an inherent responder bias, this brings to question whether general surgeons have adapted to the more recent evidence and opened a discussion with their breast cancer patients regarding breast reconstruction.

The surgeon's age has been found to influence referral patterns. Older surgeons were less likely to have referred patients for breast reconstruction or even have discussed reconstruction with their patients.[39] They also had a tendency to feel that breast reconstruction was not important or an integral part of breast surgery[39].

Physicians' perception of their patients is another important factor influencing referrals. A survey conducted on general surgeons in Wisconsin by Stacey and colleagues revealed that 74% of the respondents discussed breast reconstruction with their patients.[38] Furthermore, they identified age, chance of recurrence, concern of sexual image as expressed by the patient and patient refusal, as factors influencing their referral for breast reconstruction.[38]

Characteristics specific to surgeons have been shown to affect referrals. A survey conducted in Detroit and Los Angeles in 2002 revealed that only 24% of surgeons fell into the greater than 75% referral rate.[40]The higher referral rates were associated with surgeons who

were women, those having a high clinical breast surgery volume and those working in cancer centers, according to the investigators' logistic regression model.[40] Some surgeons also reported that breast reconstruction was not important to patients (57%) or that patients were not interested (64%).[40]

Regional practices have been shown to influence breast cancer treatment and timing for reconstruction referral. A questionnaire of general surgeons and plastic surgeons in the province of Quebec and the state of Maryland identified that there was significant regional variation in practice patterns, especially with respect to the use of breast conserving therapy and referral to plastic surgeons.[41] There were regional variances in timing of reconstruction, with plastic surgeons in Maryland more often recommending immediate reconstruction while surgeons in Quebec discussing delayed reconstruction.[41]

A lack of knowledge and information on breast reconstructive surgery amongst oncologists, primary care physicians and general surgeons has also been suggested to have a negative impact on referrals. A study by Wanzel et al., in 2002 performed a comprehensive needs assessment through a literature review, focus groups, individual interviews, and a survey in order to determine the learning needs of physician specialties involved in breast cancer care (primary physicians, general surgeons, oncologist and plastic surgeons.[42] They found that 64.4 % and 68% of oncologists and primary care physicians, respectively, and 38. 6% of general surgeons believed that there was a lack of information available regarding reconstructive breast surgery. Between 31.1% to 45.3% of referring physicians reported that patients were not being offered breast reconstruction due to inadequate knowledge of the

physician. Surprisingly, there was no difference in opinion among the three referring physician specialties regarding having their own breast reconstructed.[42]

Lastly, an interesting finding by Paulson and colleagues from their work in 1994, showed that the more time that was dedicated to discussing any aspect of breast surgery increased the likelihood of undergoing breast reconstruction.[39] Additionally, the more time spent discussing reconstruction resulted in a higher likelihood of the patient undergoing breast reconstruction. Another finding was that 43.6% of surgeons stating that they discussed breast reconstruction on a selective basis and only when they thought that the patient might wish to have a reconstruction.[39] However, the survey did not assess what criteria would influence a surgeon to think that a patient might need a reconstruction.

1.2.3 Patient-related factors affecting breast reconstruction

With regards to patient-related factors, older age has been a constant negative predictor of breast reconstruction.[25, 27, 30-32, 36, 43-46] Authors have stratified patients a number of ways, including ≤50 years-old vs. >50 years-old, <65 years vs. ≥65 years, and by decade past 45 years of age. The odds vary from 4.3 times more likely to have breast reconstruction if ≤50 years-old to 0.04 odds of breast reconstruction if >75 years of age.[25, 32]

There are likely a number of factors that explain why older patients are less likely to have a breast reconstruction. One hypothesis is that older patients have a greater number of co-morbidities and therefore are more fragile and susceptible to complications. This has been

confirmed by a number of authors that have demonstrated a lower number of co-morbidities is associated with higher odds of breast reconstruction.[36, 45, 47]

Socioeconomic status also plays an important role in influencing receipt of breast reconstruction. Patients with an income of ≥ $40,000 US in 2000 had twice the odds of having a breast reconstruction than those with less than $40 000.[32] Increasing household income has been associated with increasing odds of breast reconstruction in the United States and Canada despite the different systems of healthcare coverage.[21, 31]

In keeping with income, patients with private insurance had significantly higher odds of receiving a breast reconstruction when compared to patients on medical assistance programs provided by the provincial or national government in the United States.[30, 34, 36, 44, 48] The odds were in some instances as high as 10 times in favor of patients with private insurance. [30]

Patients with a high school education or lower were less likely to have a breast reconstruction compared to those with a higher level of education.[34, 46] The variables are often intertwined, where patients with a higher level of education will have a higher income job with private insurance. However, it would be erroneous to assume that patients of lower socioeconomic status are being discriminated against due to lack of ability to pay. In the universal health coverage system in Canada, mastectomy and breast reconstruction including the consultation with the plastic surgeons and all subsequent revisions and symmetrization

procedures are fully covered by provincial governments. A more in-depth look into patient attitudes towards breast reconstruction is necessary to reach a more accurate conclusion.

In multiple studies, patients' ethnic backgrounds when not Caucasian proved to be a negative predictor of breast reconstruction. [30, 31] African-Americans have consistently been demonstrated to have lower rates of reconstruction with odds 0.64 to 0.34 that of Caucasian patients.[29, 35] Additionally, Tseng and colleagues identified in their retrospective chart-review that African-Americans were less likely to be offered referrals for reconstruction, less likely to accept offered referrals, less likely to be offered reconstruction and less likely to elect reconstruction if offered.[35] Fortunately, some of the comprehensive cancer centers in the United States have recently demonstrated no difference between ethnicities for receipt of breast reconstruction. This is likely due to the mandate of these centers to provide comprehensive breast cancer care and being a tertiary care referral center. Therefore, patients treated at these centers are more likely to be interested in the full spectrum of the management of breast cancer.[34]

Another patient characteristic that has influenced the receipt of reconstruction has been location.[24] Patients residing in a geographic region other than the Midwest or the South of the United States had 1.3 higher odds of breast reconstruction.[32] Additionally, patients residing in urban areas were more likely to have breast reconstruction than those in rural or near-metro areas.[36, 44] Amongst the explications for this phenomenon is the higher density of plastic surgeons in urban areas and also, tertiary care centers with greater resources being in more densely populated regions. This belief was confirmed by Platt and colleagues who found

a correlation between jurisdictions with low rates of reconstruction and having limited access to plastic surgeons.[49] Up to 46% of the variability in the rate of immediate breast reconstruction between counties was accounted for by access to a plastic surgeon. In keeping with the location is the influence of the type of hospital on breast reconstruction. Patients of national cancer institutes and teaching hospitals have higher odds of breast reconstruction than breast cancer patients treated in rural hospitals.[30, 32, 36, 44]

The initiative and self-efficacy of the patient has been proven to influence breast reconstruction. A study in 2002 by Matros and colleagues using patient questionnaires demonstrated that the majority of patients undergoing both microsurgical (48%) and non-microsurgical (72%) breast reconstruction were referred by a breast surgeon but that these percentages differed significantly. Surprisingly, 30% of patients undergoing microsurgical reconstruction were self-referred to a plastic surgeon while only 11% of patients undergoing non-microsurgical breast reconstruction were self-referred ($p<0.001$).[50]

1.2.4 Cancer-related factors affecting breast reconstruction

Characteristics specific to breast cancer have also been found to influence receipt of breast reconstruction. The cancer stage is the most predictive clinical factor of breast reconstruction in the United States.[18, 29, 32, 46] Patients have been found to have 2X the odds of having a reconstruction when the breast cancer was in situ. [32, 48] This correlated with referral practices from general surgeons who are more likely to refer patients with lower stage disease and therefore are more likely to receive a breast reconstruction. Importantly, the stage itself has not been a contraindication amongst plastic surgeons for reconstruction. The

need for radiation therapy has also been associated as a negative predictor for reconstruction.[38] This keeps with the idea that patients with more advanced disease are less likely to receive a reconstruction. However, when patients undergo bilateral mastectomy, they have been shown to be 2X more likely to be reconstructed.[29]

All these factors, whether physician-related, patient-related or cancer-related have been associated indirectly with the receipt of breast reconstruction. However, a more in-depth analysis on patients' attitudes and desire for breast reconstruction is lacking, and is essential to obtain a complete image of all factors affecting the receipt of breast reconstruction.

1.2.5 Attitudes toward breast reconstruction

Several authors have explored patients' attitudes toward breast reconstruction.[42, 46, 51, 52] In 1990, a survey conducted on patients with a mastectomy with or without a breast reconstruction revealed that patients with an advanced age at the time of the mastectomy, patients concerned about complications from further surgery, uncertainty about the outcome and a fear of the reconstruction affecting the breast cancer follow-up were the main factors negatively influencing a desire for breast reconstruction.[51] A study in 2005 conducted using information in the Surveillance, Epidemiology, and End Results (SEER) registries for Detroit and Los Angeles revealed that 78.2% of patients reported having discussed breast reconstruction with their surgical oncologist.[46] However, only 11.2% were able to correctly answer 3 basic knowledge questions regarding breast reconstruction. Patients described the desire to avoid more surgery as their primary reason for not pursuing a breast reconstruction. Finally, although it is an indirect observation, a documented discussion of breast

reconstruction post-mastectomy in the patients' medical record was found to be the greatest predictor of reconstruction.[52] These studies demonstrate the lack of accurate patient counselling regarding the risk/benefits of a breast reconstruction and gaps in the evidence on the effects of BR following mastectomy. However, a key finding was that a discussion of breast reconstruction can heavily influence the patients' decision process and that many patients were likely not even provided the opportunity to have such a discussion.[52]

The initial research efforts on breast reconstruction were directed towards patients that had undergone a total mastectomy. Alternatively, partial mastectomies leave smaller deficits and often exempt patients from having to undergo a complex reconstruction. Therefore, the aforementioned studies on breast reconstruction have all focused on patients that have undergone a total mastectomy. The majority of these studies were based in the United States, with only a handful examining the state of breast reconstruction in Canada.[18, 19, 21, 49] These studies are necessary to determine if patients are being provided comprehensive breast cancer care nationwide (Canada) and to identify disparities or barriers that are impeding the standard of care.

1.2.6 Breast reconstruction in Quebec

There are currently no studies on the state of breast reconstruction in the province of Quebec. A lot of progress has been made on all fronts to increase breast reconstruction awareness though nationwide campaigns (Breast Reconstruction Awareness day), centralization of care and multi-disciplinary teams working in close conjunction.[53, 54] In

order to examine the state of breast reconstruction, it is necessary to determine if the rates of reconstruction meet the national benchmarks.

1.3 Hypothesis and Objectives

We believe that despite the awareness that has been raised and the evidence that has been published regarding the safety and benefits, breast reconstruction is likely under-utilized in the province of Quebec.

The purpose of this research project will be to examine the rates of breast reconstruction in all patients undergoing a mastectomy, at a university affiliated tertiary care center with a comprehensive breast cancer care team on the island of Montreal. The objective is to publish the findings and to determine if quality breast cancer care is being provided at a high volume center in Quebec.

Subsequently, patient and breast cancer characteristics will be examined to determine if there are significant differences between patients that receive a breast reconstruction to patients that have a mastectomy alone. These factors, once identified, will be used to determine whether access to breast reconstruction under optimal conditions (university affiliated, tertiary care, comprehensive breast cancer care, high volume) at a hospital in Quebec, is comparable to similar centers in other provinces and the United States. These findings can help to identify barriers that patients may be facing in Quebec, and to help develop or focus awareness campaigns.

The project will also examine, in the same cohort of patients, the attitudes and interest in breast reconstruction. This will be performed through a telephone questionnaire. The objective will be to determine whether there are differences in patient and breast cancer characteristics that distinguish a patients' interest in consulting with a plastic surgeon for a breast reconstruction. Figure 1 demonstrates the timepoints at which a patient diagnosed with breast cancer can be referred to a plastic surgeon and the reconstructive options that would be available. The findings from the study will help to determine whether there are factors outside of the patients' own interest that dictate whether a patient is being offered a breast reconstruction.

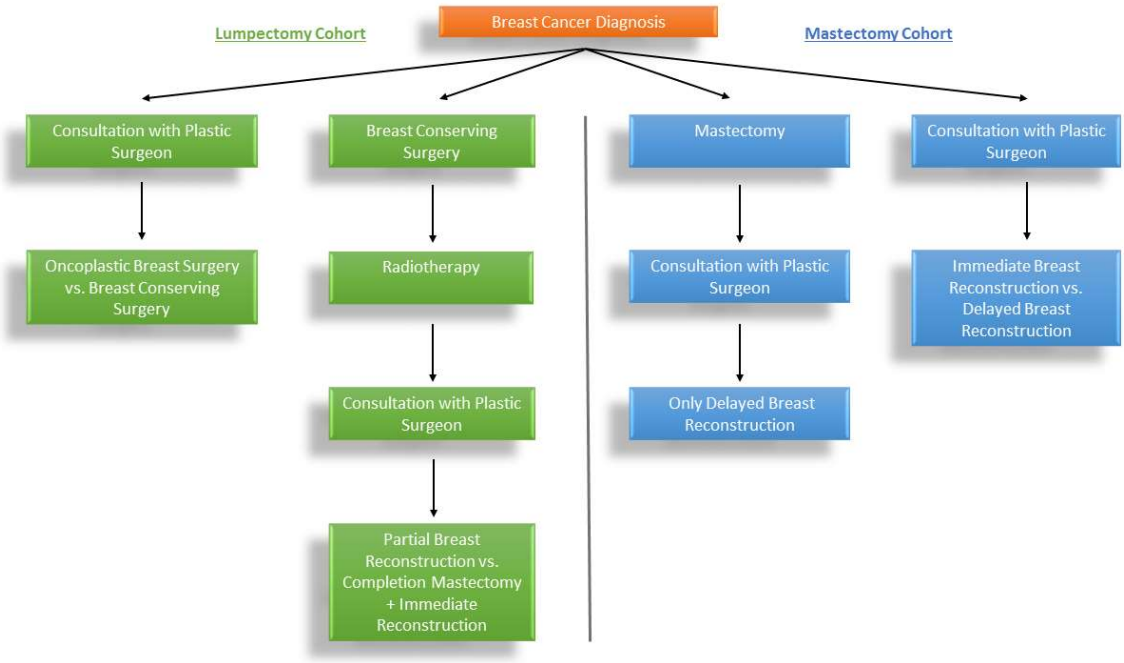

Figure 1. Breast Reconstruction Pathways Following a Diagnosis of Breast Cancer

2 – METHODOLOGY & RESULTS

A detailed description of the methods used for the project, as well the analysis and the results are presented in the following two articles, in this section.

2.1 ARTICLE 1

Rates of Breast Reconstruction Post-Mastectomy in a Canadian Teaching Hospital

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ABSTRACT

BACKGROUND: Post-mastectomy breast reconstruction (PMBR) can improve psychosocial wellbeing, quality of life and body image. Rates of reconstruction vary widely and have been reported as high as 42% in the United States, but the few studies available from Canada report rates of 3.8% to 7.9%. We sought to evaluate the current state of breast reconstruction in a Canadian teaching hospital given the increased awareness from national campaigns (BRA day) and the studies demonstrating the oncological safety of breast reconstruction.

METHODS: We performed a retrospective hospital-based chart review of all patients with breast cancer who underwent either mastectomy alone or mastectomy followed by reconstruction, at a Canadian tertiary care hospital between 2010 and 2013. We calculated the rates of breast reconstruction and compared patient characteristics between the two groups. We performed a multiple logistic regression to determine factors that increased the odds of receiving a breast reconstruction.

RESULTS: A total of 152 patients underwent 154 total and/or modified radical mastectomies. We calculated a total rate for PMBR of 21%, where 14% of patients had an immediate reconstruction and 8% of eligible patients underwent a delayed reconstruction. Statistical analysis showed that, when compared to patients with mastectomy alone, patients who received PMBR were significantly younger, with a larger percentage of patients that had bilateral mastectomies, non-invasive breast cancer and patients who resided further from the hospital. Patients who were less than 50 years old and those that had a bilateral mastectomy had significantly greater odds of having a reconstruction.

CONCLUSIONS: In a Canadian tertiary care institution, with a high volume of breast surgery and an active breast reconstruction team, the rate of immediate reconstruction remains comparatively low to neighbouring tertiary care centers in the United States. We recommend a united effort to increase awareness regarding PMBR, while denouncing common misconceptions hindering patients' rights to have access to breast reconstruction.

KEYWORDS: Quebec, Canada, breast reconstruction, rate of reconstruction, teaching hospital, autologous breast reconstruction, prosthetic breast reconstruction, immediate reconstruction, delayed reconstruction

INTRODUCTION

Post-mastectomy breast reconstruction (PMBR) is a procedure that can improve various dimensions of the patients' quality of life.[1-3] Undergoing a mastectomy is a traumatic experience that is compounded by its effects on the patients' appearance, social interactions and sexual life. Patients who receive PMBR are more satisfied with their appearance, have improved psychosocial and sexual well-being, while experiencing less pain and fewer functional limitations.[2]

A variety of factors have been demonstrated to influence patients' accessibility and receipt of PMBR. There are characteristics specific to the breast surgeon, racial/ethnic disparities, socioeconomic factors, patient's age, characteristics of the patient's residential area, and access to health insurance (such as in the US), which invariably influence rates of breast reconstruction.[4-7] Furthermore, a literature review conducted by Platt and colleagues demonstrated large variations across different countries and regions; 9.9% in Australia 1982-2000, 14% in Denmark,1999-2006, 16.5% in England 2006-2009, and up to 42% in a network of tertiary care centers in the United States 1997-2002.[8]

PMBR is covered under the provincial health insurance policies across Canada. Therefore, high rates of breast reconstruction are expected given the clear benefits and affordability. Furthermore, breast reconstruction, an essential component in the multi-disciplinary approach to breast cancer care, becomes a marker of quality of care. Breast reconstruction is not an essential service for breast cancer treatment with respect to survival but it requires resources, accessibility and a dedicated plastic surgery department.[9]

Unfortunately, there is scarce evidence regarding the rates of breast reconstruction in Canada. The province of Nova Scotia had an overall rate reported at 3.8% from 1991 to 2001, whereas in Ontario the rate was marginally higher at 7.9% (1984/1985) and 7.7% (1995-1996).[10,11] A more recent population-based study by Zhong and colleagues described an age-adjusted immediate breast reconstruction rate of 8.7 per 100,000 adult women in Ontario, and further emphasized the discrepancies whereby patients with higher median incomes, treated at a teaching hospital, or a hospital with more plastic surgeons, and patients willing to travel farther, were more likely to receive a reconstruction.[12] The comparatively low rates raise questions with regards to the factors influencing access and receipt of breast reconstruction in Canada.

Presently, there is a scarcity of literature examining the state of breast reconstruction in the province of Quebec, Canada. As such, hospital and population-based studies are necessary to determine the rates of breast reconstruction, to identify areas of weakness in breast reconstruction awareness, to determine the quality of care with regards to breast reconstruction for patients with breast cancer and to improve access for all patients with breast cancer. We sought to identify using a hospital-based retrospective chart review, the rates and predictive factors for breast reconstruction in a teaching hospital serving a large basin of Montreal.

MATERIALS & METHODS

Study Design and Setting

We conducted a hospital-based retrospective chart review at Maisonneuve-Rosemont Hospital according to a protocol approved by the hospital's research ethics review board. The hospital archivist identified a total of 814 patients undergoing 845 mastectomies over the proposed study period of January 1st, 2010 to December 31st, 2012.

Maisonneuve-Rosemont Hospital is a tertiary care hospital affiliated to the University of Montreal involved in the training of medical students and residents across a large variety of specialties (Rapport annuel de gestion 2013-2014, HMR).

Study Population

We included patients that were aged 18 and older with a diagnosis of breast cancer (ductal carcinoma *in situ*, phyllodes tumour or invasive ductal or lobular carcinomas), undergoing a total mastectomy and/or modified radical mastectomy for the treatment or prevention of future breast cancer, between January 1st 2010 and December 31st 2012 at Maisonneuve-Rosemont Hospital. We excluded patients who underwent mastectomies for treatment other than breast cancer treatment or prevention, including breast-conserving surgeries.

Main Measurements

Five individuals, including the primary author, extracted the data from the hospital charts over a period of 6 months. We extracted information on age, BMI (calculated using

measures of height and weight), smoking status, laterality of breast surgery (unilateral vs. bilateral), and a diagnosis of diabetes. We classified radiotherapy and chemotherapy into the following categories: none, or if patient received neo-adjuvant (prior to mastectomy) or adjuvant (after mastectomy) therapy. We used the pathology report from the mastectomy specimen to classify patients into two groups under breast cancer status; non-invasive (no disease or in situ disease), or invasive disease (phyllodes tumour, infiltrating ductal or lobular carcinoma). Although we included patients receiving a prophylactic surgery for a positive BRCA status, they were not separately analyzed and were categorized in the non-invasive group for breast cancer status. The software calculator at GPS Visualizer (http://www.gpsvisualizer.com/calculators) calculated the great circle distance between the address of the patient at the time of the mastectomy and the hospital to provide a hospital-to-home distance.

We examined all patients that met the inclusion criteria, for any breast reconstructive procedures that they may have subsequently received at Maisonneuve-Rosemont Hospital up until July 31st, 2014. We classified the reconstructive procedures based on the timing (immediate vs. delayed) and by type of reconstruction (implant, autologous or combined).

Statistical Analysis

We performed all of the statistical analysis using SPSS© (Version 22, IBM™) and verified the methodology with a trained biostatistician. We calculated the total rate of reconstruction as the number of reconstructions (immediate + delayed) divided by the number of total and/or modified radical mastectomies. We considered a bilateral mastectomy as a

single procedure. The rate of delayed breast reconstruction was defined as the number of delayed reconstructions divided by the number of patients eligible for a reconstruction (total mastectomies - mastectomies with immediate breast reconstruction.

We divided patients into mastectomy alone vs. mastectomy + reconstruction for comparative reasons to try to identify factors that may influence the rates and access to breast reconstruction. We then performed a sub-group analysis for patients that received a breast reconstruction and examined for differences between patients undergoing immediate vs. delayed reconstruction. We assessed for normality of all continuous variables using the Shapiro-Wilk test and calculated means and 95% confidence intervals for all variables following a Gaussian distribution. We provided medians and ranges for non-normally distributed variables and calculated frequencies and percentages were for all categorical variables.

We used independent samples Student's t-test for comparison of means and Levene's test for equality of variance to assess for homogeneity of variances. We used a Mann-Whitney *U* Test to compare non-normally distributed continuous variables. We compared categorical variables using a chi-squared test or a Fisher's exact test when there were only two categories in each variable and when there were one or more expected cell frequencies less than five.

We created a multiple logistic regression model to determine if there were patient characteristics that can predict the probability of receiving a breast reconstruction. We measured the statistical significance of the model using a chi-squared test, a Hosmer-

Lemeshow test for goodness-of-fit and the Nagelkerke's R squared for the models ability to explain the variation in the dependent variable. We reported the percentage accuracy in classification for the prediction model. We employed a Wald test to determine the statistical significance for each of the independent variables and reported the odds ratios along side their 95% confidence intervals. Statistical significance was considered as p-value <0.05.

RESULTS

Hospital statistics for mastectomies and reconstructions

Once we reviewed the initial database and applied the exclusion criteria, we identified 656 patients undergoing 743 mastectomies (breast conserving surgery, total mastectomy and modified radical mastectomy) for the treatment or the prevention of future breast cancer. After excluding breast-conserving mastectomies, 152 patients undergoing 154 total mastectomies and/or modified radical mastectomies (20.7% of all mastectomies) were included in the study. We present the hospital statistics for mastectomies and breast reconstruction in Table 1. The total rate of reconstruction was 21% with 14% of patients receiving an immediate breast reconstruction and while 8% of eligible patients underwent a delayed breast reconstruction at the same institution.

Comparison of patients who received a mastectomy alone vs. mastectomy + reconstruction

We compared patients undergoing mastectomy alone or mastectomy + reconstruction and the results are presented in Table 2. Patients who received a breast reconstructions were significantly younger (48 years mastectomy + reconstruction vs. 66 years mastectomy alone, $p<0.0005$), and had a higher percentage of bilateral mastectomies (37.5% mastectomy + reconstruction vs. 9.8% mastectomy alone, $p<0.0001$), patients with non-invasive disease (51.6% mastectomy + reconstruction vs. 23.0% mastectomy alone, $p<0.002$) and patients residing further from the hospital (25% mastectomy + reconstruction vs. 8.2% mastectomy alone for >20km, $p<0.014$). We did not identify a difference between groups, in the remaining variables.

Predicting odds of receiving breast reconstruction post-mastectomy

We created a multiple logistic regression model to determine if there were variables capable of predicting the odds of receiving a breast reconstruction and the results are presented in Table 3. Patients under 50 years of age (OR 5.71, 95% CI;2.02-16.2) or undergoing a bilateral mastectomy (OR 5.04, 95% CI;1.54-16.5) had significantly higher odds of receiving a breast reconstruction. Patients with non-invasive disease (OR 2.56, 95% CI;0.972-6.75) demonstrated higher odds but the adjusted OR did not reach significance.

Comparison of patients undergoing immediate vs. delayed breast reconstruction

A sub-group analysis comparing immediate breast reconstruction vs. delayed breast reconstruction is presented in table 4. Patients who had immediate breast reconstruction had significantly smaller BMIs (22.70 vs. 28.73, $p<0.001$) and a lower percentage of patients receiving radiotherapy (15.0% vs. 72.7%, $p=0.004$) and chemotherapy (20% vs. 72.7%, $p=0.007$). The results for the type of breast reconstruction are presented in Table 5. The majority of immediate breast reconstruction was implant-based (85.7%) where as in delayed breast reconstruction, it was with autologous tissue (63.7%).

DISCUSSION

Maisonneuve-Rosemont Hospital is a high volume breast surgery center with an immediate breast reconstruction rate of 14%. The majority of immediate breast reconstructions were implant-based in comparison to autologous tissue comprising a larger percentage of delayed breast reconstructions. Although this rate of breast reconstruction is higher in comparison to the rates reported in Canadian population-based studies on breast reconstruction (3.8-7.9%), these rates are substantially lower than that of other tertiary care centers in the United States (up to 42%).[10,11,13] Our findings indicate that patients receiving breast reconstruction are significantly younger, and are more likely to have bilateral mastectomies, less invasive disease and greater hospital-to-home distance. In fact, younger age and a bilateral mastectomy had five times the odds of receiving a breast reconstruction according to our findings. All these factors have already been demonstrated to influence rates and access to breast reconstruction in the literature, and there is a growing body of evidence addressing the underlying reasons responsible for the stark contrast between these two patient populations.[10-12]

Age over 50 years has been shown to be the most consistent negative predictor for breast reconstruction.[8] Our findings are in line with the literature as patients younger than 50 years of age had 5.71 times the odds of having a breast reconstruction. It is commonly perceived that older patients are less likely to desire breast reconstruction and are more at risk from complications. However, recent evidence from two large scale studies have demonstrated that older age is not associated with increased risk of 30-day post-operative complications for

tissue-expander immediate breast reconstruction when compared to patients undergoing mastectomy alone or when patients >65-years-old were compared to patients <65-years-old in a cohort of patients that received breast reconstruction.[14,15] There was a higher rate of venous thromboembolism with autologous reconstructions in older women (OR, 3.67; p=0.02). Patients that have had a breast reconstruction overwhelmingly (91.8%) report that age should not be considered when offering the option for breast reconstruction.[15]

The high percentage of bilateral mastectomy patients undergoing breast reconstruction is most likely in line with the prophylactic nature of the surgery, with patients more inclined to be informed and seek prospective reconstructive options.[16] Nonetheless, all patients with breast cancer should be provided with the choice of undergoing a breast reconstruction and referred to a plastic surgeon, as the benefits are universal. Ultimately, this would enable all patients to make an informed decision regarding their breast cancer treatment.

The presence of a larger proportion of patients with a breast reconstruction travelling further distances may be indicative of referral patterns, more advanced disease requiring specialized services or the desire of the patient to obtain both a mastectomy and reconstruction at the same institution or in institutions thought to deliver better care. This raises questions regarding centralization of care to optimize resources and efficiency. However, the current evidence provides only speculation and no in-depth analysis on this pattern of behaviour.

Regarding the invasiveness of the breast cancer on the rate of breast reconstruction, our findings appear to be in line with the literature from the United States. The stage of the disease

is the most predictive clinical factor associated with the rate of reconstruction, with advanced disease having a strong negative predictive value.[8] Advanced disease is likely to require adjuvant therapy and there are concerns on compromising oncological safety when performing breast reconstruction. However, it has been shown that there is no increased frequency of local breast cancer recurrence with immediate breast reconstruction in advanced disease compared with mastectomy alone.[17] Presently, the need to proceed with adjuvant therapy is not considered a contraindication for immediate breast reconstruction, and reconstructive options are available to optimize outcomes. However, higher-level of evidence studies are necessary to confirm the effect of immediate breast reconstruction on the timing of adjuvant therapy and the subsequent outcomes. Whether immediate reconstruction causes a delay in beginning adjuvant therapy, and the potential significance or not of this delay remains to be ascertained. The significantly lower percentage of patients requiring adjunctive radiotherapy and chemotherapy in the immediate breast reconstruction group likely reflect breast surgeons' preference to refer patient with less aggressive disease for reconstruction.

Our study is limited in our ability to generalize our findings to the province of Quebec. Given that Maisonneuve-Rosemont Hospital is a tertiary care center in a large urban city, there is a patient selection bias and the rates are expected to be higher then that of the provincial average. Population-based studies would complement these findings and provide a more global image on patterns of PMBR. Furthermore, despite the clear distinction between patients who received a mastectomy + reconstruction and those that had a mastectomy alone, the design of the study does not allow us to assess whether these patterns are secondary to physician or patient preferences. However, hospital-based studies provide an important

overview of region-specific quality-of-care. They serve as benchmarks for comparison and help guide local and regional healthcare policy-making. Future research endeavors should focus on physician attitudes and patient preferences to identify the current shortfalls in PMBR.

CONCLUSION

PMBR is essential to the multi-disciplinary approach to breast cancer care and given the low rates demonstrated in a high volume breast surgery center in Quebec, the medical community should maintain a continued effort to increase awareness in the general population and amongst colleagues in healthcare. Furthermore, they must focus on invalidating longstanding misconceptions with respect to risks of immediate breast reconstruction in older patients, safety, and outcomes of breast reconstruction in patients with advanced disease that require adjuvant treatment, as these are the factors that appear to greatly influence access and rates of breast reconstruction.

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REFERENCES

1. Alderman AK, Wilkins EG, Lowery JC, Kim M, Davis JA. Determinants of patient satisfaction in postmastectomy breast reconstruction. *Plastic and reconstructive surgery.* 2000;106:769-76.
2. Eltahir Y, Werners LL, Dreise MM, et al. Quality-of-life outcomes between mastectomy alone and breast reconstruction: comparison of patient-reported BREAST-Q and other health-related quality-of-life measures. *Plastic and reconstructive surgery.* 2013;132:201e-9e.
3. Wilkins EG, Cederna PS, Lowery JC, et al. Prospective analysis of psychosocial outcomes in breast reconstruction: one-year postoperative results from the Michigan Breast Reconstruction Outcome Study. *Plastic and reconstructive surgery.* 2000;106:1014-25; discussion 26-7.
4. Callaghan CJ, Couto E, Kerin MJ, Rainsbury RM, George WD, Purushotham AD. Breast reconstruction in the United Kingdom and Ireland. *The British journal of surgery.* 2002;89:335-40.
5. Rosson GD, Singh NK, Ahuja N, Jacobs LK, Chang DC. Multilevel analysis of the impact of community vs patient factors on access to immediate breast reconstruction following mastectomy in Maryland. *Archives of surgery.* 2008;143:1076-81; discusion 81.
6. Sisco M, Du H, Warner JP, Howard MA, Winchester DP, Yao K. Have we expanded the equitable delivery of postmastectomy breast reconstruction in the new millennium? Evidence from the national cancer data base. *Journal of the American College of Surgeons.* 2012;215:658-66; discussion 66.

7. Hershman DL, Richards CA, Kalinsky K, et al. Influence of health insurance, hospital factors and physician volume on receipt of immediate post-mastectomy reconstruction in women with invasive and non-invasive breast cancer. *Breast cancer research and treatment.* 2012;136:535-45.

8. Platt J, Baxter N, Zhong T. Breast reconstruction after mastectomy for breast cancer. *CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne.* 2011;183:2109-16.

9. Smith BD. Differences in rates of immediate breast reconstruction in Canada and the United States: what can we learn? *Journal of clinical oncology : official journal of the American Society of Clinical Oncology.* 2014;32:2119-21.

10. Barnsley GP, Sigurdson L, Kirkland S. Barriers to breast reconstruction after mastectomy in Nova Scotia. *Canadian journal of surgery. Journal canadien de chirurgie.* 2008;51:447-52.

11. Baxter N, Goel V, Semple JL. Utilization and regional variation of breast reconstruction in Canada. *Plastic and reconstructive surgery.* 2005;115:338-9.

12. Zhong T, Fernandes KA, Saskin R, et al. Barriers to immediate breast reconstruction in the Canadian universal health care system. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology.* 2014;32:2133-41.

13. Canadian Institute for Health Information. Breast Cancer Surgery in Canada, 2007-2008 to 2009-2010. *Ottawa, Ont.*CIHI : 2012.

14. Fischer JP, Wes AM, Tuggle CT, et al. Mastectomy with or without immediate implant reconstruction has similar 30-day perioperative outcomes. *Journal of plastic, reconstructive & aesthetic surgery : JPRAS.* 2014;67:1515-22.

15. Bowman CC, Lennox PA, Clugston PA, Courtemanche DJ. Breast reconstruction in older women: should age be an exclusion criterion? *Plastic and reconstructive surgery.* 2006;118:16-22.

16. Preminger BA, Trencheva K, Chang CS, et al. Improving access to care: breast surgeons, the gatekeepers to breast reconstruction. *Journal of the American College of Surgeons.* 2012;214:270-6.

17. Gieni M, Avram R, Dickson L, et al. Local breast cancer recurrence after mastectomy and immediate breast reconstruction for invasive cancer: a meta-analysis. *Breast.* 2012;21:230-6.

Table 1. Hospital Statistics for Mastectomies and Reconstructions from 2010-2012

	Yearly			Total	
	2010	2011	2012	# Mastectomies	BR, n (%)
# of TM	25	24	14	63	15 (24)
# of MRM	17	28	22	67	5 (7.5)
# of BM	10	7	7	24	12 (50)
Total	52	59	43	154	-
BR, n (%)					
Total	12 (23)	10 (17)	10 (23)	32 (21)	
Immediate	8 (15)	6 (10)	7 (16)	21 (14)	-
Delayed	4 (9.1)	4 (7.5)	3 (8.3)	11 (8.3)	

Table 2. Comparison of Patients Undergoing Mastectomy Alone to Patients with a Mastectomy and Reconstruction

	n	MA	n	MR	*p-value*
Age (years)*	122	66 (26-93)	32	48 (33-75)	***< 0.0005***
BMI (kg/m^2)*	118	27.33 (10.76-58.77)	31	24.75 (18.56-36.73)	*0.068*
Diabetes$^{\phi}$					
Non-diabetic, n (%)	122	108 (88.5)	32	31 (96.9)	*0.198*
Smoking Status$^{\phi}$					
Ex- or Never, n (%)	122	101 (82.8)	32	27 (84.4)	*0.831*
Laterality$^{\phi}$					
Bilateral, n (%)	122	12 (9.8)	32	12 (37.5)	***< 0.0001***
Radiotherapy$^{\phi}$					
None, n (%)	122	55 (45.1)	31	20 (64.5)	*0.053*
Chemotherapy$^{\phi}$					
None, n (%)	122	61 (50.0)	31	19 (61.3)	*0.261*
Breast Cancer Status$^{\phi}$					
Non-invasive, n (%)	122	19 (23.0)	31	9 (51.6)	***0.002***
Hospital-to-home distance,$^{\phi}$ n (%)					
0-20 km	122	112 (91.8)	32	24 (75)	***0.014***
>20 km		10 (8.2)		8 (25)	

*The median and range was provided for non-normally distributed continuous variables and the Mann Whitney U test was used to compare the distributions.

$^{\phi}$Chi-square or Fisher's exact test (2X2, with expected cell counts less than 5) was used to measure associations between frequencies.

p-value < 0.05 was considered statistically significant.

Abbreviations: MA, mastectomy alone; MR, mastectomy and reconstruction, BMI, body mass index

Table 3. Logistic Regression Model Predicting Probability of Reconstruction based on the Patients' Characteristics at the Moment of the Hospital Admission

	Adjusted*			Unadjusted		
	OR	**95% CI**	***p-value***	**OR**	**95% CI**	***p-value***
Age, years						
≤50	5.71	[2.02;16.2]	0.001	5.86	[2.55;13.5]	<0.0001
>50	1.0	Referent		1.0	Referent	
BMI, kg/m^2						
≤25	1.71	[0.649;4.51]	0.277	2.04	[0.918;4.54]	0.080
>25	1.0	Referent		1.0	Referent	
Laterality						
Unilateral	1.0	Referent	0.008	5.50	[2.167;13.957]	<0.0005
Bilateral	5.04	[1.54;16.5]		1.0	Referent	
Smoking Status						
Ex or Non-Smoker	0.603	[0.166;2.19]	0.443	1.123	[0.388;3.25]	0.831
Current	1.0	Referent		1.0	Referent	
Diabetes						
No	1.99	[0.225;17.63]	0.536	4.019	[0.508;31.8]	0.187
Yes	1.0	Referent		1.0	Referent	
Radiotherapy						
No	2.36	[0.760;7.32]	0.138	2.22	[0.978;5.02]	0.057
Yes	1.0	Referent		1.0	Referent	
Chemotherapy						
No	1.09	[0.366;3.24]	0.879	1.58	[0.708;3.54]	0.263
Yes	1.0	Referent		1.0	Referent	
Breast Cancer Status						
Non-invasive	2.56	[0.972;6.75]	0.057	3.15	[1.19;8.32]	0.021
Invasive	1.0	Referent		1.0	Referent	

*The Chi-square for the model (8) = 36.471, p-value < 0.0001. The coefficient of determination (Nagelkerke R^2)= 0.344. The goodness of fit test Hosmer and Lemeshow Test was not significant (Chi-square = 5.9787, p-value = 0.665). The percentage accuracy in classification was 84.5%.

A p-value <0.05 was considered statistically significant.

Abbreviations: OR, odds ratio; CI, confidence interval; BMI, body mass index.

Table 4. Comparison of Patients Undergoing Immediate vs. Delayed Breast Reconstruction

	Immediate Reconstruction (n=21)	**Delayed Reconstruction (n=11)**	***p-value***
Age (years)[ψ]	49.65±1.89 (39-69)	52.82±3.81 (33-75)	*0.466*
BMI (kg/m^2)*	22.70 (18.56-34.60)	28.73 (22.15-36.73)	***0.001***
Diabetes[ϕ]			
Non-diabetic, n (%)	21 (95.2)	11 (1.00)	*1.00*
Smoking Status[ϕ]			
Ex- or Never, n (%)	18 (85.7)	9 (81.8)	*1.00*
Laterality[ϕ]			
Unilateral, n (%)	12 (57.1)	8 (72.7)	*0.465*
Radiotherapy[ϕ]			
None, n (%)	17 (85.0)	3 (27.3)	***0.004***
Chemotherapy[ϕ]			
None, n (%)	16 (80.0)	3 (27.3)	***0.007***

[ψ]Independent Samples Student's T-test was performed to compare means for normally distributed variables. Means, standard deviation and range was provided for continuous variables.

*The median and range was provided for non-normally distributed continuous variables and the Mann Whitney U test was used to compare the distributions.

[ϕ]Chi-square or Fisher's exact test (2X2, with expected cell counts less than 5) was used to measure associations between frequencies.

P-value < 0.05 was considered statistically significant.

Table 5. Type of Reconstruction for Immediate vs. Delayed Reconstruction

	Immediate Reconstruction (n=21)	**Delayed Reconstruction (n=11)**
Type of Reconstruction, n (%)		
Prosthetic	18 (85.7)	2 (18.2)
Autologous	2 (9.5)	7 (63.6)
Combined	1 (4.8)	2 (18.2)

2.2 ARTICLE 2

A Comprehensive Assessment of Attitudes Towards Breast Reconstruction Post-Total Mastectomy in a Canadian Teaching Hospital

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ABSTRACT

BACKGROUND: Breast reconstruction post-mastectomy is at the forefront of plastic surgery due to the psychological and body image benefits for breast cancer patients. There is a void in the literature regarding the patients' own interests and the reasons from the patients' perspective that influence their access and receipt of a breast reconstruction. As such, we sought to determine which patients were interested in a consultation with a plastic surgeon regarding breast reconstruction, from a cohort of breast cancer patients that underwent a total mastectomy.

METHODS: An epidemiologic study centered on breast reconstruction following mastectomy from 2010 to 2012, divided into two components (chart review and telephone questionnaire), was conducted at a comprehensive breast cancer center. The telephone questionnaire addressed factors about patients' mastectomy, their awareness of, and accessibility to breast reconstruction, effect on quality of life and a demographic section. The primary outcome of interest was if the patient was interested in being referred to plastic surgery. The secondary outcomes were comparisons of patients with a "positive interest" vs. "no interest" in a plastic surgery consultation and between patients with a reconstruction vs. mastectomy alone.

RESULTS: Thirty-one patients with a total mastectomy, unilateral or bilateral, agreed to participate in the telephone questionnaire. An interest in a consultation in plastic surgery (positive interest) was stated by 51.7% (15/29) of patients, while 35.5% (11/31) of patients received a reconstruction. Patients who claimed not to be interested in a reconstruction, there were 21% (3/14) who were not informed and 7% (1/14) who were told they were not eligible.

Age, BMI, civil status, education, household income, laterality, radiotherapy, chemotherapy and pathological diagnosis of the breast cancer were not traits that influenced whether the patient was interested in pursuing a reconstruction. In the group that received a reconstruction, a significantly higher percentage of patients were “offered a breast reconstruction” (81.8% vs. 30.8%, p=0.009) and “aware of breast reconstruction” (100.0% vs. 55.6%, p=0.012).

CONCLUSIONS: At least half of all patients with a mastectomy were interested in a consultation with a plastic surgeon. Patients that are offered a reconstruction or aware of reconstruction are more likely to be interested and receive a reconstruction. Nonetheless, there are barriers outside of the patient’s own desires that impede their access to breast reconstruction, likely as a result of improper or incomplete patient and referring physician education. Therefore, future studies should aim to investigate the shortcomings in physician and patient knowledge of breast reconstruction and identify the reasons for non-referrals.

KEYWORDS: breast reconstruction, Quebec, Montreal, breast cancer, mastectomy, desire for reconstruction, interest in consultation, chart review, telephone questionnaire, access.

INTRODUCTION

Breast reconstruction post-mastectomy is at the forefront of plastic surgery due to the psychological and body image benefits for breast cancer patients. National awareness campaigns such as BRA (Breast Reconstruction Awareness) day and centralization of breast cancer care have attempted to address the deficits in access to breast reconstruction nationwide.[1] The rates of reconstruction have served as a marker of the quality of breast cancer care.[2]

Across Canada, the rates have been increasing from 3.8%-7.9% in the 1980s and -90s up to 16% in 2011.[3-5] Our recent retrospective study in Montreal demonstrated a total reconstruction rate of 21% yearly, at a tertiary care center.[6] These values fail to compare to the rates reported in national comprehensive care centers in the United States with rates as high as 42%.[7] In these studies comparing patients that received breast reconstruction to those that received a mastectomy alone, multiple variables including age, socioeconomic status, level of education, cancer stage, and physician gender have all been shown to influence the receipt of breast reconstruction.[4, 8-15] However, the variation in reconstruction rates both nationally and regionally and the associated influencing factors only provide a partial understanding of the quality of comprehensive breast cancer care.

The option to undergo breast reconstruction is an intricate process that requires a thorough discussion with a plastic surgeon. Breast reconstruction should be integrated into the decision making process when the patient is deemed to need a total mastectomy. The standard of care would involve the breast cancer patient being offered a consultation in plastic surgery

to discuss their options regardless of their co-morbidities and the preferences of the surgical oncologist, as it has been shown to be safe from an oncological aspect and provides improved psychological outcomes for the patient.[16-20]

Effectively, researchers have altered their investigations to look at the current attitudes of both physicians and patients with regards to breast reconstruction post-mastectomy. Patients who did not have a reconstruction were in large part (80.4%) satisfied with their decision but 59.3% of these patients still believed they were not adequately informed about their options for a reconstruction[21]. Furthermore, the recommendation of the surgical oncologist and discussion with other breast cancer patients considering breast reconstruction have been described to significantly influence a patients' desire for breast reconstruction.[22]

There is a void in the literature regarding the patients' own interests and the reasons from the patients' perspective that influence their access and receipt of a breast reconstruction. Breast cancer patients who have had a mastectomy have not been directly questioned regarding their awareness of breast reconstruction, if they were offered a reconstruction and most importantly, if they were interested in seeing a plastic surgeon. Presently, what is known about access to breast reconstruction is based on comparisons between patients that received a reconstruction to those that had a mastectomy alone. The characteristics that have been identified as significantly different between these two groups are presumed to be barriers that prevent patients from receiving a reconstruction. As such, we sought to determine which patients were interested in a consultation with a plastic surgeon regarding breast reconstruction, from a cohort of breast cancer patients that underwent a total mastectomy.

Furthermore, we will explore for both groups, the reasons why they did not receive a reconstruction. These findings will help to clarify whether the barriers to reconstruction are due to physician bias or a result of the patients' own wishes. Additionally, it will provide clarification on the percentage of patients that are interested in breast reconstruction, which can serve as a benchmark for determining the ideal rate of breast reconstruction.

MATERIALS & METHODS

Study Design and Setting

An epidemiologic study centered on breast reconstruction following mastectomy, divided into two components, was conducted at Maisonneuve-Rosemont Hospital (a comprehensive breast cancer center in Montreal, Canada) from June 2014 until May 2016. The first component consisted of a retrospective chart review of all patients that received a prophylactic total mastectomy or that underwent a total mastectomy for breast cancer from January 1st, 2010 to December 31st, 2012.[6] The second component was comprised of a telephone questionnaire addressing factors about patients' mastectomy, their awareness of, and accessibility to, breast reconstruction, effect on quality of life and a demographic section. Both components were reviewed and approved by the hospital's ethics review board.

The hospital archivist identified a total of 814 patients undergoing 845 total and partial mastectomies over the proposed study period of January 1st, 2010 to December 31st, 2012.

Maisonneuve-Rosemont Hospital is a tertiary care hospital affiliated to the University of Montreal involved in the training of medical students and residents across a large variety of specialties (Rapport annuel de gestion 2013-2014, HMR). The hospital provides comprehensive breast cancer care with oncologic breast surgeons working closely with oncologists and breast reconstruction surgeons. It is a referral center for breast cancer and receives patients from all over the province of Quebec.

Study Population

The inclusion criteria for the initial retrospective chart review was comprised of patients who were aged 18 years and older with a diagnosis of breast cancer (ductal carcinoma *in situ*, lobular carcinoma *in situ*, phyllodes tumour or invasive ductal or lobular carcinoma) undergoing a total mastectomy for the treatment or prevention of future breast cancer, between January 1st 2010 and December 31st 2012 at Maisonneuve-Rosemont Hospital. A telephone questionnaire was conducted on all patients that were initially included in the chart review. The chart review identified a total of 152 patients that underwent 154 total mastectomies fitting the inclusion and exclusion criteria. A total of 31 patients with a total mastectomy agreed to participate in the telephone questionnaire (20% participation rate). The exclusion criteria for the study were all patients that only received a breast conserving surgery or a biopsy within the proposed study period.

Main Measurements

Retrospective Chart Review

Five individuals, including the primary author, extracted the data from hospital charts over a period of 6 months. Information on the patient's age, BMI (calculated using measures of height and weight), and laterality of breast surgery (unilateral vs. bilateral) was extracted. The pathology report from the mastectomy specimen was used to classify patients into two groups under breast cancer status; non-invasive (no disease or in situ disease), or invasive disease (phyllodes tumour, infiltrating ductal or lobular carcinoma).

The initial retrospective review extracted multiple variables that were not used in the current study including smoking status, alcohol consumption, medical co-morbidities

(diabetes, chronic renal failure, coronary artery disease, peripheral vascular disease and heart failure), the use of immunosuppression or corticosteroids, and receipt of radiotherapy/chemotherapy. The information on radiotherapy and chemotherapy extracted from the charts were omitted as these variables were also addressed during the telephone questionnaire.

The focus of the current article was to examine attitudes, referral patterns and markers of quality of life, of the patients studied in the retrospective review. The information reported by the patients was considered as the most up-to-date.

Telephone Questionnaire

A telephone questionnaire was created to confirm the findings of the chart review and to assess attitudes and access to breast reconstruction following a total mastectomy. The questionnaire was divided into five sections. The first section addressed the patient's mastectomy including the type, laterality, axillary lymph node dissection, receipt of radiotherapy/chemotherapy, complications, and utilization of an external prosthesis. The second section was focused on whether the patient received a reconstruction and information regarding their reconstruction or the reason for not having a reconstruction. The third section was specific for obtaining information surrounding a consultation in plastic surgery. The fourth section extracted information on the effect of the diagnosis, the mastectomy and the reconstruction (if received) on different domains in quality of life (self-esteem, sexuality, family life, personal life). The final section was to obtain information on patient demographics including education, civil status and income.

Once the questionnaires were completed with the patients that agreed to participate, the information from the chart review was matched for a more comprehensive analysis.

Data Organization

Patient Characteristics

The initial analysis was a calculation of the frequencies and percentages for each variable in the questionnaire. The age at the time of the mastectomy from the retrospective review was used and was stratified into <60 years or ≥60 years. Similarly, the BMI was stratified into <30 vs. ≥30 kg/$m^{2.}$. The civil status was stratified into married vs. not married. Education was stratified into university level education vs. no university. The yearly household income was classified into <50K vs. ≥50K. Work status was divided into no return to work, returned to work (following mastectomy or reconstruction) or retired. Smoking was categorized into smoker or non-smoker (including ex-smoker).

Breast Cancer Characteristics

The results for radiotherapy and chemotherapy were based on the questionnaire and categorized dichotomously where receipt of any form of radiotherapy or chemotherapy was classified as a yes response. Pathological diagnosis was categorized into invasive (ductal carcinoma, lobular carcinoma, phyllodes tumour) and non-invasive (ductal carcinoma in-situ, lobular carcinoma in-situ).

Breast Reconstruction Consultation Characteristics

There were seven main variables that were examined in this section. The first variable was whether the patient received a reconstruction or had a mastectomy alone. The second variable was for the group of patients that did not receive a reconstruction. They were questioned regarding the reason for not having received reconstruction, and this was classified into three categories: patient didn't want, patient was not informed, or patient was told they were not eligible. The third variable examined the reason why patients claimed they were considered non-eligible for a reconstruction. This was divided into "not needed" (when a physician deemed that the patient did not require a reconstruction), "not necessary" (when the patient themselves believed they did not require a breast reconstruction) and "age" (when the patient believed they were too old for a reconstruction). The fourth variable was if the patient was offered the choice to have reconstruction by a plastic surgeon from a third-party (oncologist, surgical oncologist, family physician). The fifth variable was if the patient received a referral to a plastic surgeon. The sixth variable was if the patient was aware of the option to undergo a breast reconstruction. The seventh variable was an interest in a consultation in plastic surgery and the main outcome of interest to the study. This variable was dichotomized into "positive interest" and "no interest", and it will be referred to by these two groups throughout the manuscript to avoid repetition.

Quality of Life Measures

Patient self-esteem, sexuality, family life and personal life were assessed based on a 5-point Likert scale (very bad; bad; no change; good; very good). The assessments were based at three time points: the first after the breast cancer diagnosis, the second after the mastectomy and the third after the reconstruction if it took place. The results for each measure of quality of

life based on the Likert scale were categorized into whether there was a worsening or no change/improvement.

Outcomes

The primary outcome is the variable "interest in a consultation with a plastic surgeon." This will define the percentage of patients that are interested in at least discussing their options for a breast reconstruction. The "positive interest" group will be explored to determine the percentage of patients that were offered a breast reconstruction, aware of breast reconstruction and if a reconstruction was performed. The "no interest" group will be examined to determine why they declined a reconstruction.

The secondary outcomes will be to compare the "positive interest" group to the "no interest" group with respect to patient, physician and breast cancer characteristics. Additionally, the change in the quality of life measures (self-esteem, sexuality, family life, professional life) will be compared between the "positive interest" group and the "no interest" group. Patients with a reconstruction vs. mastectomy alone will be compared with an emphasis on socio-demographic factors.

Statistical Analysis

All of the statistical analyses were performed using SPSS© (Version 22, IBM^{TM}). The frequencies and percentages were calculated for all categorical variables. Statistical significance was considered as p-value <0.05. The comparisons of interest were between

patients with a positive interest vs. no interest in a plastic surgery consultation, and patients that had a breast reconstruction and those that had a mastectomy alone. The retrospective chart review submitted for publication on the same cohort compared patients that underwent a post-mastectomy breast reconstruction to patients with a mastectomy alone.[6] As such, the comparison of reconstructed vs. mastectomy alone patients in the present study will exclude the following variables: age, BMI, diabetes, smoking status, laterality, chemotherapy, radiotherapy, and pathological diagnosis.

Categorical variables were compared using a chi-squared test or a Fisher's exact test when there were only two categories in each variable and when there were one or more expected cell frequencies less than five.

RESULTS

As stated previously, 31 patients with a total mastectomy, unilateral or bilateral, (out of 152 patients that met the inclusion criteria and that were contacted to participate in the study) agreed to participate in the telephone questionnaire. This equates to a 20% participation rate.

Patient and Breast Cancer Characteristics

The characteristics of the patients that received a total mastectomy between 2010-2012 are depicted in Table 1. The majority of patients that answered the survey were greater than 60 years of age (61.3%), married (64.5%), without a university education (73.3%), with a total household income of less than 50K (74.2%), non-smoking (71.0%) and non-diabetic (77.4%).

The characteristics of the breast cancer diagnosis and treatment can be found in Table 2. The majority of cases were unilateral (80.6%) and were invasive cancers (73.3%) while treatment with radiotherapy (58.1%) and chemotherapy (54.8%) were similarly distributed. Half of patients described wearing an external prosthesis.

Primary Outcome

Breast Reconstruction and Consultation Characteristics

An interest in a consultation in plastic surgery (positive interest) was stated by 51.7% (15/29) of patients. A total of 86.7% (13/15) of patients in the "positive interest" group were aware of plastic surgery, however only 73% (11/15) of patients were offered a reconstruction. In the "positive interest" group, 80% of patients received a referral to plastic surgery. There

was one patient who self referred, hence the discrepancy between percentage of patients that were offered and actually referred to plastic surgery.

A total of 73% (11/15) of patients were reconstructed in the positive interest group. There were 4 patients with a "positive interest" that did not receive a reconstruction for the following reasons: 1 patient didn't want a reconstruction because they thought it to be unnecessary, two patients didn't want a reconstruction because of "other issues", and one patient was not informed.

As for the 14 patients (48.3%) that were not interested in a plastic surgery consult ("no interest" group), ten patients (78%) stated that they didn't want a reconstruction, three (21%) were not informed and one patient (7%) was told they were not eligible by their surgical oncologist. When the patients in the "no interest" group were questioned as to why they didn't want a reconstruction, it was revealed that three patients (21%) thought they were too old, two patients (14%) were told by their surgical oncologist it was not necessary, one patient (7%) thought they didn't need a reconstruction, and five patients (36%) had other reasons. The characteristics relating to breast reconstruction and consultation can be found in Table 3.

Secondary Outcomes

Patient Characteristics

The results are outlined in Table 4. There was no significant difference between "positive interest" vs. "no interest" group with respect to patient age, BMI, marriage status, university level education, household income ≥50K, laterality, receipt of radiotherapy, receipt

of chemotherapy and the pathological grade of the tumour. For the variable "offer of reconstruction", there was a significantly higher percentage of patients offered a reconstruction in the "positive interest" group (28.5% vs. 73.3%, p=0.027). There was a significant difference in the work status with a larger percentage of patients who returned to work (following mastectomy or reconstruction) in the "positive interest" group compared to the "no interest" group (40.0% vs. 0%, p=0.042).

Quality of Life Measures

The results of the comparison are depicted in Table 5. Following a breast cancer diagnosis, there was no significant difference between "positive interest" vs. "no interests" in self-esteem, sexuality, family life and personal. In other words, patients with a "positive interest" were not found to have lower scores for any quality of life measures that were examined. Similarly, there was no significant difference between "positive interest" and "no interest" following a mastectomy in the different measures of quality of life. However, there was higher percentage of patients with worsened self-esteem (77.8% vs. 30.8%, p=0.080) and sexuality (66.7% vs. 30.8%, p=0.192) in the "positive interest" group, although significance was not met.

Breast Reconstruction vs. Mastectomy Alone

The results of the comparison can be found in Table 6. There was a significantly higher percentage of patients "offered a breast reconstruction" (81.8% vs. 30.8%, p=0.009) and "aware of breast reconstruction" (100.0% vs. 55.6%, p=0.012) in the group of patients that had a breast reconstruction. Marriage status, a university level of education and total household

income ≥50K was not significantly different between patients with a breast reconstruction compared to mastectomy alone.

DISCUSSION

The current study set out to determine the percentage of patients, from a cohort of women that underwent a mastectomy, that were interested in a consultation with a plastic surgeon to discuss their options for breast reconstruction. Subsequently, we wanted to explore the reasons why patients with either a "positive interest" or "no interest" did not receive a reconstruction. Although numerous studies have explored the factors that affect the receipt of breast reconstruction, they have failed to distinguish access from an *a priori* element which is the patients' own desire for a reconstruction.[4, 8-15] Although there is a strong emphasis on improving the rates of reconstruction post-mastectomy due to the psychosocial benefits, it is presumable that not all patients desire a reconstruction despite being fully informed of their options.[23-25] Nonetheless, there is a clear trend towards an increase in the overall rates of breast reconstruction post-mastectomy, but the ideal rate remains to be elucidated.[26, 27]

On examining our cohort of patients that responded to the telephone questionnaire, the characteristics were not evenly distributed. The majority of patients were older than 60 years of age, married, with a total household income less than 50K, undergoing unilateral mastectomies for invasive cancers. This is not unexpected given that the national cancer statistics have demonstrated that over 80% of breast cancers occur in women over the age of 50 years.[28] Additionally, more breast cancer patients undergoing a total mastectomy have unilateral disease, and involve invasive cancers as was demonstrated from our retrospective chart review of all total mastectomies between 2010-2012.[6] Otherwise, the results represent the demographic characteristics of our patient population and should be taken into consideration when extrapolating the results.

The patients' desire for a consultation in plastic surgery was deemed the primary outcome for this study, as this is a variable that has not been examined in depth in the literature. The goal of comprehensive breast cancer care is that all patients are aware of breast reconstruction and for those who are interested, after being appropriately and adequately informed, have access and are referred to a plastic surgeon to discuss their options. It is evident that not all patients will be interested in a reconstruction but the concern stemming from the literature is that there are factors (characteristics of the patient, physician and breast cancer) outside of the patients' personal interests that influence whether a patient receives a breast reconstruction.[4, 8-15] The results of our study demonstrated that 51.7% (15/29) of patients that answered the questionnaires would have wanted a consultation in plastic surgery. Given that only 38% (11/29) of patients who responded regarding their interest in a reconstruction received a breast reconstruction, this raises concern regarding barriers to reconstruction. When the "positive interest" group was examined more closely, it was discovered that the reasons why patients did not receive a reconstruction, was due to them being not informed, told that it was unnecessary, or for other reasons such as concerns regarding follow-up of breast cancer recurrence and additional surgeries. Furthermore, there were patients who were not offered (26.7%, 4/15) or referred (20.0%, 3/15) for breast reconstruction and therefore never had the chance to address their concerns directly with a plastic surgeon. These findings confirm that there remain barriers (referring surgeon, lack of proper education on risks/benefits of breast reconstruction), outside of patient interest, in access to breast reconstruction. Our findings are corroborated by the literature as both Wanzel et al. in 2000, and Stacey et al, in 2008 have already demonstrated that inadequate referring

physician knowledge can negatively impact referrals to plastic surgeons.[15, 29] Despite the awareness campaigns and comprehensive breast cancer teams, there remains work to be done in terms of educating the medical community and patients, such that all patients who are interested, after being adequately informed, are offered and made aware of breast reconstruction.

When the "no interest" group was examined more in depth, it was interesting to note that 21% (3/14) of patients were not informed regarding breast reconstruction. An additional 21% (3/14) believed it was not needed while another 21% (3/14) believed they were too old for a reconstruction. Lastly, one patient was told that they were ineligible. Although it is perfectly understandable that some women are not interested in a breast reconstruction, there remains the fact that this disinterest can stem from improper or incomplete education regarding the benefits of a breast reconstruction. There are no absolute contraindications for a breast reconstruction as it has been shown to be safe from an oncological aspect, and no clinically significant delay in adjuvant therapy has been found following an immediate breast reconstruction.[16-19] Therefore, no patient should be told they are ineligible or be under the impression that their age should keep them from at least discussing their options with a plastic surgeon.

The analysis comparing the characteristics of patients with a "positive interest" to those with "no interest" failed to demonstrate a significant difference in multiple patient and breast-cancer characteristics. However, age, education, household income, laterality, radiotherapy, pathological diagnosis have all been previously shown to be significantly

different amongst patients that receive a breast reconstruction compared to patients with a mastectomy alone.[4, 8-15] These findings emphasize the importance of integrating breast reconstruction surgeons into the breast cancer care pathways. Also, that not all patients that desire a reconstruction are being given the choice due to physician bias. Furthermore, the current findings have to be examined in the context of the hospital where the patients have been treated. Given that this retrospective review was performed in a tertiary care center with a multi-disciplinary team for breast cancer care with ease of access to plastic surgeons, this effectively removes multiple barriers that patients in rural areas treated by surgeons practicing in a community hospital would face.[30, 31] Referral practices have been examined and clearly demonstrate that surgeons with high clinical breast surgery volume and working in cancer centers have the highest referral patterns.[30] Furthermore, comprehensive breast cancer centers have been shown to improve rates of referral and breast reconstruction.[32] Therefore, our findings are under optimal practice settings for tertiary care centers.

There were two characteristics that proved to be significantly different between patients with a "positive interest" compared to "no interest." There was a significantly higher percentage of patients that were offered a reconstruction in the "positive interest" group. This is in keeping with the previous findings when examined by receipt of reconstruction where documentation or a discussion with the surgical oncologist were positive predictors of breast reconstruction.[30, 33] Additionally, there was a significantly higher percentage of patients that returned to work either post-mastectomy or reconstruction in the "positive interest" group. Women that are part of the labour force may fall within a higher socioeconomic status, which

has been strongly correlated with receipt of reconstruction and now may be correlated with an increased interest in breast reconstruction.[33]

When the "positive interest" group was compared to the "no interest" group for changes in quality of life measures, it was demonstrated that there was a significant difference between the two groups. The analysis was meant to determine if patients in one group had lower scores in the quality of life domains. However, it appears that the changes in quality of life are similar between patients those that are interested and those that are not. Previous studies have shown that sexuality is the primary motivation for breast reconstruction in only 7.7% of patients[22]. Alternatively, a balanced appearance (76%) and to continue to feel feminine (34%) were the major reasons stated for opting for a breast reconstruction. Therefore, preserving body image is one of the primary driving forces for a reconstruction. These statistics were pooled from a cohort of patients that were referred to and consented for a breast reconstruction. Furthermore, the desire to improve marital and sexual relations are not influential factors in choosing breast reconstruction.[34] These findings indicate that the effect of breast cancer or a mastectomy on self-esteem, sexuality, family life and personal life may not be important predictors or driving forces in leading patients to pursue a breast reconstruction.

The comparison of patients with a reconstruction to mastectomy alone was performed only on variables that were not addressed in our previous retrospective chart review, submitted separately for publication.[6] Interestingly, patients that were offered a reconstruction or who were aware of breast reconstruction had significantly higher rates of reconstruction. These

variables although similar, are at different time points during the breast cancer care pathway. They are not mutually exclusive, as patients who are aware of breast reconstruction are not necessarily offered a reconstruction. However, what these results demonstrate is that the act of raising awareness or a discussion of breast reconstruction positively influences a patients' decision to pursue a breast reconstruction. A study by Preminger et al., confirmed that all patients (100%) who were not referred for a reconstruction, did not have a reconstruction.[35] Greenberg and colleagues demonstrated that a documented discussion was a strong positive predictor of breast reconstruction.[33] Furthermore, breast cancer patients have claimed directly that being urged to consider breast reconstruction by their treating physician had an important influence in their decision to pursue a breast reconstruction.[22] Ultimately, the onus falls on the surgical oncologists, oncologists and primary care physicians to advocate for their breast cancer patients by properly informing and referring them to obtain comprehensive cancer care.

Older age has been a constant negative predictor of breast reconstruction.[8-12, 31, 36-39] In the present study, there was a wide gap between patients over the age of 60 years with a "positive interest" (46.6%) compared to the "no interest" group (78.6%) study. However, the difference did not prove to be statistically significant. It is possible that older women are less likely to be interested in reconstruction but there were women in their mid-70s that were still interested in discussing their options with a plastic surgeon. Furthermore, it has been shown that a documented discussion of reconstructive surgery is a strong predictor of breast reconstruction.[33] Additionally, patients who discuss breast reconstruction with their surgical oncologist have higher rates of reconstruction.[30] Our results further establish the notion that

informing and actively promoting ones patients to consider a breast reconstruction as part of their treatment plan, influences the patients' desire and the rates of reconstruction.

The study has a number of limitations including the low participation rate of 20% and the retrospective nature of the study. The study is susceptible to recall bias as patients' perception of their illness, body image, treatment may change with time and don't always reflect their perspective at the time of the breast cancer diagnosis and initial mastectomy. Nonetheless, even if these opinions reflect the patients' current state, the findings still raise important questions as to why certain women who are or might have been interested in a breast reconstruction were not offered a consultation with a reconstructive breast surgeon. Although a significant difference was not demonstrated in multiple variables in the comparison of patients with a desire for a consultation, this might be in part due to the small sample size. Despite the likelihood there may be a difference between patient and cancer characteristics, the important conclusion to takeaway is that there are elderly patients with unilateral disease and invasive cancers that are still interested in a breast reconstruction. Given the psychosocial benefits and the clear benefit of an immediate breast reconstruction, a referral pre-mastectomy is crucial.[26, 40, 41]

Our findings demonstrate that approximately 50% of patients from a cohort of women that underwent a mastectomy were interested in consulting with a plastic surgeon but only 38% had a reconstruction. Furthermore, patients that are offered a reconstruction are more likely to be interested and receive a reconstruction. Therefore, there are barriers outside of the patient's own desires that impede their access to breast reconstruction, likely as a result of

improper or incomplete patient and referring physician education. Therefore, future studies should aim to investigate the shortcomings in physician and patient knowledge of breast reconstruction and identify the reasons for non-referrals. The plastic surgery community must continue to raise awareness about breast reconstruction and incorporate teaching the basics of breast reconstruction into medical and surgical curriculums.

REFERENCES

1. Chao, A.H., et al., *Processes of Care in Breast Reconstruction and the Long-Term Impact of a Comprehensive Breast Center.* Ann Surg Oncol, 2015. **22 Suppl 3**: p. S1256-62.
2. Kruper, L., et al., *Utilization of mastectomy and reconstruction in the outpatient setting.* Ann Surg Oncol, 2013. **20**(3): p. 828-35.
3. Baxter, N., V. Goel, and J.L. Semple, *Utilization and regional variation of breast reconstruction in Canada.* Plast Reconstr Surg, 2005. **115**(1): p. 338-9.
4. Barnsley, G.P., L. Sigurdson, and S. Kirkland, *Barriers to breast reconstruction after mastectomy in Nova Scotia.* Can J Surg, 2008. **51**(6): p. 447-52.
5. Zhong, T., et al., *Barriers to immediate breast reconstruction in the Canadian universal health care system.* J Clin Oncol, 2014. **32**(20): p. 2133-41.
6. Karunanayake, M., et al., *Rates of Breast Reconstruction Post-Mastectomy in a Canadian Teaching Hospital.* Submitted for Publication, 2016.
7. Platt, J., N. Baxter, and T. Zhong, *Breast reconstruction after mastectomy for breast cancer.* CMAJ, 2011. **183**(18): p. 2109-16.
8. Alderman, A.K., L. McMahon, Jr., and E.G. Wilkins, *The national utilization of immediate and early delayed breast reconstruction and the effect of sociodemographic factors.* Plast Reconstr Surg, 2003. **111**(2): p. 695-703; discussion 704-5.
9. Jeevan, R., et al., *Regional variation in use of immediate breast reconstruction after mastectomy for breast cancer in England.* Eur J Surg Oncol, 2010. **36**(8): p. 750-5.

10. Morrow, M., et al., *Correlates of breast reconstruction: results from a population-based study.* Cancer, 2005. **104**(11): p. 2340-6.

11. Rosson, G.D., et al., *Multilevel analysis of the impact of community vs patient factors on access to immediate breast reconstruction following mastectomy in Maryland.* Arch Surg, 2008. **143**(11): p. 1076-81; discusion 1081.

12. Morrow, M., et al., *Factors influencing the use of breast reconstruction postmastectomy: a National Cancer Database study.* J Am Coll Surg, 2001. **192**(1): p. 1-8.

13. Christian, C.K., et al., *A multi-institutional analysis of the socioeconomic determinants of breast reconstruction: a study of the National Comprehensive Cancer Network.* Ann Surg, 2006. **243**(2): p. 241-9.

14. Joslyn, S.A., *Patterns of care for immediate and early delayed breast reconstruction following mastectomy.* Plast Reconstr Surg, 2005. **115**(5): p. 1289-96.

15. Stacey, D.H., et al., *Exploring the effect of the referring general surgeon's attitudes on breast reconstruction utilization.* WMJ, 2008. **107**(6): p. 292-7.

16. Alderman, A.K., et al., *The impact of breast reconstruction on the delivery of chemotherapy.* Cancer, 2010. **116**(7): p. 1791-800.

17. Patani, N., et al., *Oncological safety and patient satisfaction with skin-sparing mastectomy and immediate breast reconstruction.* Surg Oncol, 2008. **17**(2): p. 97-105.

18. Rozen, W.M., M.W. Ashton, and G.I. Taylor, *Defining the role for autologous breast reconstruction after mastectomy: social and oncologic implications.* Clin Breast Cancer, 2008. **8**(2): p. 134-42.

19. Zhong, T., et al., *A comparison of surgical complications between immediate breast reconstruction and mastectomy: the impact on delivery of chemotherapy--an analysis of 391 procedures.* Ann Surg Oncol, 2012. **19**(2): p. 560-6.

20. Elder, E.E., et al., *Quality of life and patient satisfaction in breast cancer patients after immediate breast reconstruction: a prospective study.* Breast, 2005. **14**(3): p. 201-8.

21. Alderman, A.K., et al., *Receipt of delayed breast reconstruction after mastectomy: do women revisit the decision?* Ann Surg Oncol, 2011. **18**(6): p. 1748-56.

22. Duggal, C.S., et al., *Patient motivations for choosing postmastectomy breast reconstruction.* Ann Plast Surg, 2013. **70**(5): p. 574-80.

23. Nano, M.T., et al., *Psychological impact and cosmetic outcome of surgical breast cancer strategies.* ANZ J Surg, 2005. **75**(11): p. 940-7.

24. Wilkins, E.G., et al., *Prospective analysis of psychosocial outcomes in breast reconstruction: one-year postoperative results from the Michigan Breast Reconstruction Outcome Study.* Plast Reconstr Surg, 2000. **106**(5): p. 1014-25; discussion 1026-7.

25. Atisha, D., et al., *Prospective analysis of long-term psychosocial outcomes in breast reconstruction: two-year postoperative results from the Michigan Breast Reconstruction Outcomes Study.* Ann Surg, 2008. **247**(6): p. 1019-28.

26. Sisco, M., et al., *Have we expanded the equitable delivery of postmastectomy breast reconstruction in the new millennium? Evidence from the national cancer data base.* J Am Coll Surg, 2012. **215**(5): p. 658-66; discussion 666.

27. Roughton, M.C., et al., *Distance to a Plastic Surgeon and Type of Insurance Plan Are Independently Predictive of Postmastectomy Breast Reconstruction.* Plast Reconstr Surg, 2016. **138**(2): p. 203e-11e.

28. *Canadian Cancer Statistics 2015*, in *Canadian Cancer Society's Adivsory Committee on Cancer Statistics*. 2015, Canadian Cancer Society: Toronto, ON.

29. Wanzel, K.R., et al., *Reconstructive breast surgery: referring physician knowledge and learning needs.* Plast Reconstr Surg, 2002. **110**(6): p. 1441-50; discussion 1451-4.

30. Alderman, A.K., et al., *Correlates of referral practices of general surgeons to plastic surgeons for mastectomy reconstruction.* Cancer, 2007. **109**(9): p. 1715-20.

31. Reuben, B.C., J. Manwaring, and L.A. Neumayer, *Recent trends and predictors in immediate breast reconstruction after mastectomy in the United States.* Am J Surg, 2009. **198**(2): p. 237-43.

32. Chao, A.H., et al., *Process outcomes in breast reconstruction and the impact of a comprehensive breast center.* Plast Reconstr Surg, 2014. **134**(5): p. 675e-681e.

33. Greenberg, C.C., et al., *Do variations in provider discussions explain socioeconomic disparities in postmastectomy breast reconstruction?* J Am Coll Surg, 2008. **206**(4): p. 605-15.

34. Reaby, L.L., L.K. Hort, and J. Vandervord, *Body image, self-concept, and self-esteem in women who had a mastectomy and either wore an external breast prosthesis or had breast reconstruction and women who had not experienced mastectomy.* Health Care Women Int, 1994. **15**(5): p. 361-75.

35. Preminger, B.A., et al., *Improving access to care: breast surgeons, the gatekeepers to breast reconstruction.* J Am Coll Surg, 2012. **214**(3): p. 270-6.

36. Polednak, A.P., *How frequent is postmastectomy breast reconstructive surgery? A study linking two statewide databases.* Plast Reconstr Surg, 2001. **108**(1): p. 73-7.

37. Kruper, L., et al., *Disparities in reconstruction rates after mastectomy: patterns of care and factors associated with the use of breast reconstruction in Southern California.* Ann Surg Oncol, 2011. **18**(8): p. 2158-65.

38. Desch, C.E., et al., *A sociodemographic and economic comparison of breast reconstruction, mastectomy, and conservative surgery.* Surgery, 1999. **125**(4): p. 441-447.

39. Hall, S.E. and C.D. Holman, *Inequalities in breast cancer reconstructive surgery according to social and locational status in Western Australia.* Eur J Surg Oncol, 2003. **29**(6): p. 519-25.

40. Nelson, J.A., et al., *Delayed autologous breast reconstruction: factors which influence patient decision making.* J Plast Reconstr Aesthet Surg, 2013. **66**(11): p. 1513-20.

41. Teo, I., et al., *Body image and quality of life of breast cancer patients: influence of timing and stage of breast reconstruction.* Psychooncology, 2015.

Table 1. Characteristics of Patients with Total Mastectomy from 2010-2012

Variable	Frequency	Percentage
Age[ϕ]		
<60 years	12	38.7
≥60 years	19	61.3
BMI[ϕ]		
<30	24	80.0
≥30	6	20.0
Civil Status[Ω]		
Married	20	64.5
Not Married	11	35.5
Education[Ω]		
University	8	26.7
No University	20	73.3
Yearly Household IncomeΩ		
<50K	23	74.2
≥50K	8	25.8
Work Status[Ω]		
No return	14	48.3
Returned	7	24.1
Retired	8	27.6
Smoking[Ω]		
No	22	71.0
Yes	9	29.0
Diabetes[Ω]		
No	24	77.4
Yes	7	22.6

[ϕ]Values were obtained from the patients' medical records.
[Ω]Values were obtained from the patients' response during the telephone questionnaire.

Table 2. Management of Breast Cancer for Patients with Total Mastectomy from 2010-

2012

Variable	Frequency	Percentage
Date of Operation[ϕ]		
2010	10	32.3
2011	8	25.8
2012	13	41.9
Laterality of Mastectomy[ϕ]		
Unilateral	25	80.6
Bilateral	6	19.4
Axillary Lymph Node Dissection[Ω]		
No	7	23.3
Yes	23	76.7
Radiotherapy[Ω]		
No	13	41.9
Yes	18	58.1
Chemotherapy[Ω]		
No	14	45.2
Yes	17	54.8
External Prosthesis[Ω]		
No	15	50.0
Yes	15	50.0
Pathological Diagnosis[ϕ]		
Non-invasive	8	26.7
Invasive	22	73.3

[ϕ]Values were obtained from the patients' medical records.
[Ω]Values were obtained from the patients' response during the telephone questionnaire.

Table 3. Characteristics Regarding Reconstruction and Consultation in Patients with Total Mastectomy from 2010-2012

Variable	Frequency	Percentage
Desire for Consultation in Plastic Surgery[Ω]		
No Interest	14	48.3
Positive Interest	15	51.7
"Positive Interest" Group		
Awareness of Breast Reconstruction[Ω]		
No	2	13.3
Yes	13	86.7
Offer for Reconstruction[Ω]		
No	4	26.7
Yes	11	73.3
Referral to Plastic Surgery[Ω]		
No	3	20.0
Yes	12	80.0
Breast Reconstruction[Ω+ϕ]		
No	4	26.7
Yes	11	73.3
Reason for no Reconstruction[Ω]		
Didn't want - Not necessary	1	25.0
Didn't want - Other	2	50.0
Not informed	1	25.0
"No Interest" Group		
Reason for no Reconstruction[Ω]		
Didn't want	10	78.0
Not informed	3	21.0
Not eligible	1	7.0
Reason for "Didn't Want" [Ω]		
Not needed	1	7.0
Not necessary	2	14.0
Age	3	21.0
Other	5	36.0

[ϕ]Values were obtained from the patients' medical records.
[Ω]Values were obtained from the patients' response during the telephone questionnaire.

Table 4. Comparison of Patients That Would Have Wanted a Consultation in Plastics to Patients Not Interested in at Least a Consultation that Underwent a Total Mastectomy from 2010-2012

	n	No Interest	n	Positive Interest	*p-value*
Age$^{\phi\alpha}$					
≥60 years, n (%)	14	78.6	15	46.6	*0.128*
BMI (kg/m^2) $^{\phi\alpha}$					
≥30 kg/m^2	13	7.7	15	33.3	*0.173*
Civil Status$^{\phi\Omega}$					
Married, n (%)	14	71.4	15	60.0	*0.70*
Education$^{\phi\Omega}$					
University, n (%)	14	21.4	14	28.6	*1.0*
Household Income$^{\phi\Omega}$ ≥50K, n (%)	14	14.3	15	40.0	*0.215*
Laterality$^{\phi\Omega}$					
Bilateral, n (%)	14	7.1	15	26.7	*0.33*
Radiotherapy$^{\phi\Omega}$					
None, n (%)	14	71.4	15	40.0	*0.139*
Chemotherapy$^{\phi\Omega}$					
None, n (%)	14	57.1	15	46.7	*0.573*
Pathological Diagnosis$^{\phi\alpha}$					
Non-invasive, n (%)	14	85.7	14	57.1	*0.209*
Offer for Reconstruction$^{\phi\Omega}$					
No, n (%)	14	28.6	15	73.3	***0.027***
Return to Work$^{\phi\Omega}$					
No return		58.3		40.0	
Returned	12	0	15	40.0	***0.042***
Retired		41.7		20.0	

$^{\alpha}$Values were obtained from the patients' medical records.

$^{\Omega}$Values were obtained from the patients' response during the telephone questionnaire.

$^{\phi}$Chi-square or Fisher's exact test (2X2, with expected cell counts less than 5) was used to measure associations between frequencies.

p-value < 0.05 was considered statistically significant.

Abbreviations: BMI, body mass index

Table 5. Comparison of Quality of Life Measures in Patients That Would Have Wanted a Consultation in Plastics to Patients Not Interested in at Least a Consultation that Underwent a Total Mastectomy from 2010-2012

	n	No Interest	n	Positive Interest	*p-value*
Breast Cancer Diagnosis					
Self Esteem[ϕ]					
Worsened, n (%)	13	53.8	15	60.0	*0.743*
Sexuality[ϕ]					
Worsened, n (%)	12	33.3	15	53.3	*0.441*
Family Life[ϕ]					
Worsened, n (%)	13	23.1	15	33.3	*0.686*
Personal Life[ϕ]					
Worsened, n (%)	11	9.1	15	33.3	*0.197*
Mastectomy					
Self Esteem[ϕ]					
Worsened, n (%)	13	30.8	9	77.8	*0.080*
Sexuality[ϕ]					
Worsened, n (%)	13	30.8	9	66.7	*0.192*
Family Life[ϕ]					
Worsened, n (%)	13	0.0	9	22.2	*0.156*
Personal Life[ϕ]					
Worsened, n (%)	12	0.0	9	11.1	*0.429*

All values were obtained from the patients' response during the telephone questionnaire.
[ϕ]Chi-square or Fisher's exact test (2X2, with expected cell counts less than 5) was used to measure associations between frequencies.
p-value < 0.05 was considered statistically significant.

Table 6. Comparison of Patient and Physician Characteristics on Breast Reconstruction

	n	No Reconstruction	n	Reconstruction	*p-value*
Offered Reconstruction[ϕ] Yes, n (%)	20	30.8	11	81.8	***0.009***
Awareness of Breast Reconstruction[ϕ] Yes, n (%)	18	55.6	11	100.0	***0.012***
Civil Status[ϕ] Married, n (%)	20	70.0	11	54.5	*0.390*
Education[ϕ] University, n (%)	19	26.3	11	27.3	*1.00*
Household Income[ϕ] ≥50K, n (%)	20	15.0	11	45.5	*0.095*

All values were obtained from the patients' response during the telephone questionnaire.
[ϕ]Chi-square or Fisher's exact test (2X2, with expected cell counts less than 5) was used to measure associations between frequencies.
p-value < 0.05 was considered statistically significant.

3 - DISCUSSION

We sought to examine the current state of breast reconstruction in the province of Quebec. We used a hospital-based cohort of breast cancer patients that underwent a mastectomy from 2010-2012 at a university-affiliated tertiary care center in the city of Montreal. The initial study was comprised a retrospective chart review to determine the rates of breast reconstruction and to identify barriers to reconstruction by comparing patients that had a reconstruction to patients with a mastectomy alone. The chart review demonstrated that on average there was a 21% yearly rate of mastectomies that underwent a reconstruction. This was further divided into 14% being immediate breast reconstructions while the remaining 7% were delayed breast reconstructions.

These results are comparable to a more recent publication examining the Canadian healthcare system.[21] Zhong and colleagues have examined in-depth the barriers to reconstruction in the province of Ontario.[21] They demonstrated a gradual increase, through a population-based study, from 2002 to 2012 with the un-adjusted immediate reconstruction rates increasing from 8.9% to 16.0%. Unfortunately, there is an important disparity of studies on rates and access to reconstruction in Canada. Ultimately, it becomes difficult to compare whether comprehensive breast cancer care is being provided, as there are no national benchmarks.

Alternatively, when the results are compared to tertiary care hospital-based studies in the United States, there is marked room for improvement. Examination of breast

reconstruction from a multi-institutional database of comprehensive cancer centers demonstrated that 42% of patients had a reconstruction.[34] Similarly, a study out of St. Louis, Missouri, demonstrated 54% of women with a mastectomy received a reconstruction from 2000 to 2012.[55] Once again, this was at a designated comprehensive cancer center by the National Cancer Institute. Another study out of the Beth Israel Medical Center in New York, identified 56.59% reconstruction in women that received a mastectomy from 2011 to 2012.[56] These are amongst the highest reported rates of reconstruction in the literature and serve as benchmarks for all comprehensive cancer centers. The success of these centers (National Cancer Institute-designated Comprehensive Cancer Centers) in providing such high rates of reconstruction have been attributed to their standardized care pathways, increased financial resources, access to multiple reconstructive surgeons and awareness amongst physicians of the benefits of breast reconstruction.[36, 55, 57] Although there is no equivalent body as the NCI-CCC in Canada, there is universal health coverage where breast reconstruction procedures are covered by the provincial healthcare system. Similarly, tertiary care centers have designated surgical oncologists and breast reconstructive surgeons working in multi-disciplinary teams to afford comprehensive cancer care. A closer examination of access, referral patterns and attitudes towards breast reconstruction through both population-based and hospital-based studies are necessary to determine the barriers that patients are facing in receiving post-mastectomy breast reconstruction in Quebec and across Canada.

Our study, along with the studies by Zhong and colleagues, examined factors that might be influencing access to comprehensive breast cancer care in Canada.[21, 49] Our study revealed that when compared to patients with a mastectomy alone, patients that received a

post-mastectomy breast reconstruction were found to be significantly younger, undergoing a bilateral mastectomy, had non-invasive breast cancers, and was more prevalent in patients that resided further from the hospital. Furthermore, age under 50 years and bilateral mastectomies were significant positive predictors of breast reconstruction. These results coincide with the majority of the literature from both Canada and the United States.[21, 25, 27, 29-32, 36, 43-46] An extensive discussion on these findings is presented in the discussion of the first article. The important conclusion to draw from these findings and that should be disseminated throughout the medical community, is that there are no absolute contra-indications for a breast reconstruction.[58-61] Although it is believed that older women are less likely to be interested in a breast reconstruction, it is not true that all older women share this opinion. The psychological and body image benefits from a reconstruction are universal.[10, 11] Furthermore, a unilateral mastectomy creates an important asymmetry of the thorax and it should not be considered less traumatizing psychologically and functionally to the patient. Lastly, it has been shown that immediate breast reconstruction is safe from an oncological aspect and does not create a significant clinical delay in receipt of adjuvant therapy.[58-60] Therefore, all breast cancers are amenable to breast reconstruction and breast cancer patients with more aggressive cancers should not be falsely denied access to breast reconstruction. Ultimately, there are certain barriers to breast reconstruction in Quebec which appear to be universal. However, the shortcomings in the literature and from the retrospective review have been that authors have not directly addressed breast cancer patients that underwent a mastectomy with or without a reconstruction regarding their personal desire for a reconstruction and obstacles that they may have perceived in obtaining a reconstruction.

Hence, we decided for the second component of the study to directly examine the patient's interest in having a plastic surgery consultation to discuss their options for a reconstruction. We decided to use the same cohort of patients identified in the retrospective chart review with a mastectomy from 2010 to 2012. The premise for the study was that it was necessary that a patient be interested in at least consulting with a plastic surgeon if they are to receive a reconstruction. In determining the percentage of patients that were interested in a plastic surgery consultation, we would be able to clarify if the reason why patients didn't receive a reconstruction was due to the patients' own desire or if it was secondary to physician preference. Furthermore, we would be able to identify for both, patients interested and not interested in plastic surgery consult, if they were aware of breast reconstruction, offered a reconstruction, provided a referral and the reasons why they didn't have a reconstruction. These findings would provide novel information regarding the personal preference of patients in pursuing a path to reconstruction and if patients are being adequately informed, offered a reconstruction and referred to plastic surgeons.

The second article provides an in-depth analysis of the results. In summary, we found that approximately half (51.7%) of patients that responded were or had been interested in consulting with a plastic surgeon. When compared to the percentage of patients that received a reconstruction (35.5%), it was apparent that not all patients that were interested were being reconstructed. We were further able to demonstrate that not all patients were made aware (13.3%), or offered a reconstruction (26.7%), or referred to a plastic surgeon (20.0%) even when they were interested. Additionally, there were patients who claimed not to be interested in a reconstruction but they were not informed (21%) or told they were not eligible (7%). The

findings are affected by recall bias and the responses might not represent with certitude the discussions that the patients had with their general surgeons or oncologists. The results provide the perspective of patients with hindsight (complications, cosmetic and quality of life following mastectomy, interactions with healthcare workers). Their opinions can nevertheless aid in guiding the discussion regarding the quality of care that breast cancer patients are provided. If an interest for a reconstruction developed further on in their treatment or following their treatment, those patients should still have a means of accessing a plastic surgeon to discuss their options.

These findings establish that we have not yet achieved the ideal rate of breast reconstruction. Furthermore, in a tertiary care center, the ideal rate resembles the rates published by the National Cancer Institute-designated Comprehensive Cancer Centers, which is close to 50%.[34, 55] There remain patients that are not being made aware of, offered and referred for breast reconstruction. Therefore, there is work to be done to increase awareness regarding the safety and benefits of breast reconstruction. Even for patients that claim not to be interested, they also need to be properly informed of the potential body image and psychological benefits of a breast reconstruction.[10, 11]

When we compared the patients with a “positive interest” to those with “no interest”, we found it interesting that the barriers that were previously demonstrated (outlined in the introduction) to hinder access to breast reconstruction, were no longer found to be statistically significant. This raises an important point, which is that the age, BMI, civil status, education, household income, laterality, radiotherapy, chemotherapy and pathological diagnosis of the

breast cancer were not traits that distinguished whether the patient was interested in pursuing a reconstruction. Once again, there needs to be clear consensus guidelines based on the evidence that outline how immediate breast reconstruction is safe and beneficial to breast cancer patients.

Ultimately, given the barriers to reconstruction that were identified and the findings that not all patients interested in a plastic surgery consultation are being referred to plastic surgery, there is further work to be done to identify the reasons behind these shortcomings. The future directions for research involve examining why there are shortcomings in the referrals of breast cancer patients undergoing mastectomies. This would require directly addressing surgical oncologists to examine their comprehension of breast reconstruction, their referral patterns and identifying gaps in understanding of the safety and benefits of breast reconstruction. These findings can help to develop awareness campaigns, and determine which surgical oncologists need to be targeted. The impact of waiting time for a consult in plastic surgery or for the reconstruction should also be evaluated. There need to be benchmarks for optimal breast cancer care and it needs to be determined whether patients have equal access to reconstructive surgeons and if they have the opportunity to receive an immediate reconstruction at the time of their mastectomy. With this information, it can be established if it is a lack of resources, reconstructive surgeons or both that is impeding optimal breast cancer care. Another area that needs to be evaluated is regarding the benefits of breast reconstruction for unilateral mastectomies compared to bilateral mastectomies. This will help to determine whether patients have worse body image, satisfaction and quality of life following a bilateral mastectomy and if the benefits of a breast reconstruction are equal for both procedures. The

purpose of these studies would be to help clarify if unilateral and bilateral mastectomies have similar impacts on psychological wellbeing and body image and that both types of patients deserve equal opportunities for receiving a breast reconstruction.

4 – CONCLUSION

There is a scarcity of studies on rates and access to breast reconstruction post-mastectomy in other provinces and also population-based studies in Quebec. Given the universal health coverage system in Canada, it would be beneficial to determine if the centralization of care such as in the province of Manitoba provides higher rates of reconstruction with better outcomes in satisfaction, body image and with lower complications. Furthermore, population-based studies in the province of Quebec can identify if breast cancer patients treated in rural regions are being provided the same comprehensive cancer care. Ultimately, the findings can help create health policies to improve referral rates, centralize care if necessary and provide comprehensive breast cancer care to all breast cancer patients regardless of where they reside in the province of Quebec.

5 – REFERENCES

1. *Canadian Cancer Society's Advisory Committee on Cancer Statistics. Canadian Cancer Statistics 2014. .* Canadian Cancer Society.
2. Schrag, D., et al., *Life expectancy gains from cancer prevention strategies for women with breast cancer and BRCA1 or BRCA2 mutations.* JAMA, 2000. **283**(5): p. 617-24.
3. Newman, L.A., et al., *Educational review: role of the surgeon in hereditary breast cancer.* Ann Surg Oncol, 2001. **8**(4): p. 368-78.
4. Shimozuma, K., et al., *Quality of life in the first year after breast cancer surgery: rehabilitation needs and patterns of recovery.* Breast Cancer Res Treat, 1999. **56**(1): p. 45-57.
5. Ganz, P.A., et al., *Life after breast cancer: understanding women's health-related quality of life and sexual functioning.* J Clin Oncol, 1998. **16**(2): p. 501-14.
6. Ganz, P.A., et al., *Quality of life in long-term, disease-free survivors of breast cancer: a follow-up study.* J Natl Cancer Inst, 2002. **94**(1): p. 39-49.
7. Winters, Z.E., J.R. Benson, and A.L. Pusic, *A systematic review of the clinical evidence to guide treatment recommendations in breast reconstruction based on patient- reported outcome measures and health-related quality of life.* Ann Surg, 2010. **252**(6): p. 929-42.
8. Tseng, W.H., et al., *Sacramento area breast cancer epidemiology study: use of postmastectomy breast reconstruction along the rural-to-urban continuum.* Plast Reconstr Surg, 2010. **126**(6): p. 1815-24.

9. Pusic, A.L., et al., *Development of a new patient-reported outcome measure for breast surgery: the BREAST-Q.* Plast Reconstr Surg, 2009. **124**(2): p. 345-53.

10. Zhong, T., et al., *Patient satisfaction and health-related quality of life after autologous tissue breast reconstruction: a prospective analysis of early postoperative outcomes.* Cancer, 2012. **118**(6): p. 1701-9.

11. Eltahir, Y., et al., *Quality-of-life outcomes between mastectomy alone and breast reconstruction: comparison of patient-reported BREAST-Q and other health-related quality-of-life measures.* Plast Reconstr Surg, 2013. **132**(2): p. 201e-209e.

12. Slavin, S.A., et al., *Skin-sparing mastectomy and immediate reconstruction: oncologic risks and aesthetic results in patients with early-stage breast cancer.* Plast Reconstr Surg, 1998. **102**(1): p. 49-62.

13. Spiegel, A.J. and C.E. Butler, *Recurrence following treatment of ductal carcinoma in situ with skin-sparing mastectomy and immediate breast reconstruction.* Plast Reconstr Surg, 2003. **111**(2): p. 706-11.

14. Peled, A.W., et al., *Patient-reported outcomes and satisfaction after total skin-sparing mastectomy and immediate expander-implant reconstruction.* Ann Plast Surg, 2014. **72 Suppl 1**: p. S48-52.

15. *Women's Health and Cancer Rights Act of 1998*, P. Law, Editor., Omnibus Appropriations bill FY 99 Conference Report 105-825. p. 105-277.

16. Lentol, J., *Information and access to breast reconstructive surgery law*, in *A.* 2010.

17. *Early and locally advanced breast cancer: diagnosis and treatment.*, N.I.f.H.a.C.E. (NICE), Editor. 2009, NICE: London.

18. Barnsley, G.P., L. Sigurdson, and S. Kirkland, *Barriers to breast reconstruction after mastectomy in Nova Scotia.* Can J Surg, 2008. **51**(6): p. 447-52.

19. Baxter, N., V. Goel, and J.L. Semple, *Utilization and regional variation of breast reconstruction in Canada.* Plast Reconstr Surg, 2005. **115**(1): p. 338-9.

20. Platt, J., N. Baxter, and T. Zhong, *Breast reconstruction after mastectomy for breast cancer.* CMAJ, 2011. **183**(18): p. 2109-16.

21. Zhong, T., et al., *Barriers to immediate breast reconstruction in the Canadian universal health care system.* J Clin Oncol, 2014. **32**(20): p. 2133-41.

22. Kruper, L., et al., *Utilization of mastectomy and reconstruction in the outpatient setting.* Ann Surg Oncol, 2013. **20**(3): p. 828-35.

23. Jeevan, R., et al., *National trends and regional variation in immediate breast reconstruction rates.* Br J Surg, 2016.

24. Polednak, A.P., *Geographic variation in postmastectomy breast reconstruction rates.* Plastic and Reconstructive Surgery, 2000. **106**(2): p. 298-301.

25. Alderman, A.K., L. McMahon, Jr., and E.G. Wilkins, *The national utilization of immediate and early delayed breast reconstruction and the effect of sociodemographic factors.* Plast Reconstr Surg, 2003. **111**(2): p. 695-703; discussion 704-5.

26. Polednak, A.P., *Postmastectomy breast reconstruction in Connecticut: trends and predictors.* Plast Reconstr Surg, 1999. **104**(3): p. 669-73.

27. Polednak, A.P., *How frequent is postmastectomy breast reconstructive surgery? A study linking two statewide databases.* Plast Reconstr Surg, 2001. **108**(1): p. 73-7.

28. Alderman, A.K., Y. Wei, and J.D. Birkmeyer, *Use of breast reconstruction after mastectomy following the Women's Health and Cancer Rights Act.* JAMA, 2006. **295**(4): p. 387-8.

29. Joslyn, S.A., *Patterns of care for immediate and early delayed breast reconstruction following mastectomy.* Plast Reconstr Surg, 2005. **115**(5): p. 1289-96.

30. Kruper, L., et al., *Disparities in reconstruction rates after mastectomy: patterns of care and factors associated with the use of breast reconstruction in Southern California.* Ann Surg Oncol, 2011. **18**(8): p. 2158-65.

31. Rosson, G.D., et al., *Multilevel analysis of the impact of community vs patient factors on access to immediate breast reconstruction following mastectomy in Maryland.* Arch Surg, 2008. **143**(11): p. 1076-81; discusion 1081.

32. Morrow, M., et al., *Factors influencing the use of breast reconstruction postmastectomy: a National Cancer Database study.* J Am Coll Surg, 2001. **192**(1): p. 1-8.

33. Desch, C.E., et al. *A sociodemographic and economic comparison of breast reconstruction, mastectomy, and conservative surgery (Structured abstract)*. Surgery, 1999. **125**, 441-447.

34. Christian, C.K., et al., *A multi-institutional analysis of the socioeconomic determinants of breast reconstruction: a study of the National Comprehensive Cancer Network.* Ann Surg, 2006. **243**(2): p. 241-9.

35. Tseng, J.F., et al., *The effect of ethnicity on immediate reconstruction rates after mastectomy for breast cancer.* Cancer, 2004. **101**(7): p. 1514-23.

36. Reuben, B.C., J. Manwaring, and L.A. Neumayer, *Recent trends and predictors in immediate breast reconstruction after mastectomy in the United States.* Am J Surg, 2009. **198**(2): p. 237-43.

37. Spyrou, G.E., et al., *A survey of general surgeons' attitudes towards breast reconstruction after mastectomy.* Ann R Coll Surg Engl, 1998. **80**(3): p. 178-83.

38. Stacey, D.H., et al., *Exploring the effect of the referring general surgeon's attitudes on breast reconstruction utilization.* WMJ, 2008. **107**(6): p. 292-7.

39. Paulson, R.L., F.C. Chang, and S.D. Helmer, *Kansas surgeons' attitudes toward immediate breast reconstruction: a statewide survey.* Am J Surg, 1994. **168**(6): p. 543-6.

40. Alderman, A.K., et al., *Correlates of referral practices of general surgeons to plastic surgeons for mastectomy reconstruction.* Cancer, 2007. **109**(9): p. 1715-20.

41. Thompson, T.A., et al., *Surgeon perspectives on surgical options for early-stage breast cancer.* Plast Reconstr Surg, 2000. **105**(3): p. 910-8.

42. Wanzel, K.R., et al., *Reconstructive breast surgery: referring physician knowledge and learning needs.* Plast Reconstr Surg, 2002. **110**(6): p. 1441-50; discussion 1451-4.

43. Desch, C.E., et al., *A sociodemographic and economic comparison of breast reconstruction, mastectomy, and conservative surgery.* Surgery, 1999. **125**(4): p. 441-447.

44. Hall, S.E. and C.D. Holman, *Inequalities in breast cancer reconstructive surgery according to social and locational status in Western Australia.* Eur J Surg Oncol, 2003. **29**(6): p. 519-25.

45. Jeevan, R., et al., *Regional variation in use of immediate breast reconstruction after mastectomy for breast cancer in England.* Eur J Surg Oncol, 2010. **36**(8): p. 750-5.

46. Morrow, M., et al., *Correlates of breast reconstruction: results from a population-based study.* Cancer, 2005. **104**(11): p. 2340-6.

47. Wolfswinkel, E.M., et al., *Predictors of post-mastectomy reconstruction in an underserved population.* J Plast Reconstr Aesthet Surg, 2013. **66**(6): p. 763-9.

48. Kruper, L., et al., *Disparities in reconstruction rates after mastectomy for ductal carcinoma in situ (DCIS): patterns of care and factors associated with the use of breast reconstruction for DCIS compared with invasive cancer.* Ann Surg Oncol, 2011. **18**(11): p. 3210-9.

49. Platt, J., et al., *Geographic Variation Immediate and Delayed Breast Reconstruction Utilization in Ontario, Canada and Plastic Surgeon Availability: A Population-Based Observational Study.* World J Surg, 2015. **39**(8): p. 1909-21.

50. Matros, E., et al., *Sociodemographics, referral patterns, and Internet use for decision-making in microsurgical breast reconstruction.* Plast Reconstr Surg, 2010. **125**(4): p. 1087-94.

51. Handel, N., et al., *Reasons why mastectomy patients do not have breast reconstruction.* Plast Reconstr Surg, 1990. **86**(6): p. 1118-22; discussion 1123-5.

52. Greenberg, C.C., et al., *Do variations in provider discussions explain socioeconomic disparities in postmastectomy breast reconstruction?* J Am Coll Surg, 2008. **206**(4): p. 605-15.

53. Chao, A.H., et al., *Process outcomes in breast reconstruction and the impact of a comprehensive breast center.* Plast Reconstr Surg, 2014. **134**(5): p. 675e-681e.

54. Chao, A.H., et al., *Processes of Care in Breast Reconstruction and the Long-Term Impact of a Comprehensive Breast Center.* Ann Surg Oncol, 2015. **22 Suppl 3**: p. S1256-62.

55. Connors, S.K., et al., *Breast reconstruction after mastectomy at a comprehensive cancer center.* Springerplus, 2016. **5**(1): p. 955.

56. Iskandar, M.E., et al., *Factors influencing incidence and type of postmastectomy breast reconstruction in an urban multidisciplinary cancer center.* Plast Reconstr Surg, 2015. **135**(2): p. 270e-6e.

57. Greenberg, C.C., et al., *Institutional variation in the surgical treatment of breast cancer: a study of the NCCN.* Ann Surg, 2011. **254**(2): p. 339-45.

58. Alderman, A.K., et al., *The impact of breast reconstruction on the delivery of chemotherapy.* Cancer, 2010. **116**(7): p. 1791-800.

59. Patani, N., et al., *Oncological safety and patient satisfaction with skin-sparing mastectomy and immediate breast reconstruction.* Surg Oncol, 2008. **17**(2): p. 97-105.

60. Rozen, W.M., M.W. Ashton, and G.I. Taylor, *Defining the role for autologous breast reconstruction after mastectomy: social and oncologic implications.* Clin Breast Cancer, 2008. **8**(2): p. 134-42.

61. Zhong, T., et al., *A comparison of surgical complications between immediate breast reconstruction and mastectomy: the impact on delivery of chemotherapy--an analysis of 391 procedures.* Ann Surg Oncol, 2012. **19**(2): p. 560-6.