

ORIGINAL RESEARCH

# Discrepant Trajectories of Impairment, Activity, and Participation Related to Upper-Limb Function in Patients With Breast Cancer



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## Abstract

**Objectives:** To explore upper-limb disability with respect to health outcomes, operationalized by Disabilities of the Arm, Shoulder, and Hand, and to identify factors associated with each element of upper-limb disability over a 2-year period in breast cancer survivors.

**Design:** Prospective cohort study.

**Setting:** University hospital cancer center.

**Participants:** Individuals (N=191) recruited from all the patients with newly diagnosed breast cancer before cancer surgery at a university hospital between April 2006 and March 2007.

**Interventions:** Not applicable.

**Main Outcome Measures:** We evaluated demographics, social variables, and upper-limb disability in a baseline assessment preoperatively. Follow-up evaluations were conducted in outpatient clinics 3 months after surgery and at 12 and 24 months after surgery. Linear regression models with the generalized estimating equations of the compound symmetry covariance structure were used.

**Results:** Time since surgery was inversely associated with the impairment items score ( $\beta = -.20$ ; 95% confidence interval [CI],  $-.49$  to  $-.08$ ) and positively associated with the activity limitation items score ( $\beta = .59$ ; 95% CI,  $.29$ – $.88$ ). The impact of upper-limb disability preoperatively on the items involving both the activity limitation and participation restrictions scores was positive ( $\beta = 2.89$ ; 95% CI,  $.76$ – $5.02$ ) after adjusting for demographic, treatment type, and socioeconomic factors.

**Conclusions:** Our study revealed that upper-limb impairment recovered with time after breast cancer surgery; however, upper-limb function-related activity and participation were reduced through 2 years after surgery.

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Upper-limb disability has been reported as the most common problem after breast cancer, and it appears to occur more frequently in persons with breast cancer than in the nondisabled population<sup>1,2</sup> or in stroke survivors,<sup>3</sup> with estimates varying from 10% to 64%.<sup>4</sup> The presence of upper-limb disability in patients with breast cancer has been associated with poorer outcomes (eg, decreased quality of life,<sup>5</sup> depression, social isolation, vocational and hobby limitations<sup>1</sup>). Upper-limb disability has also been

attributed to several other factors, including age,<sup>6</sup> depression, fatigue,<sup>7</sup> and availability of social support. Upper-limb disability can impede the performance of daily activities and may have other important effects, including social and economic repercussions.

The reported prevalence of specific forms of upper-limb disability after breast cancer surgery varies. Previous research has suggested that patients with breast cancer are more likely to suffer from lymphedema over time. A 5-year follow-up study found 36% of breast cancer patients suffered from arm pain after surgery, but this improved significantly in the period from 6 months to 5 years after surgery.<sup>8</sup>

Measures of outcomes after cancer and cancer-related treatment need to be able to index the impact of cancer, not only in

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terms of the impairment itself but also in terms of the level of associated disability. The *International Classification of Functioning, Disability and Health* (ICF)<sup>9</sup> is a common framework and standard language for the description of health and health-related states in rehabilitation.<sup>10</sup>

To facilitate a systematic description of functioning and encourage the use of the ICF in clinical practice and research,<sup>11</sup> new measures specifically designed to assess each ICF outcome are needed. However, the development and validation of new measures is a time-consuming and expensive process. Another approach is to examine the compatibility between the ICF and currently used outcome measures.<sup>12</sup> A systematic review recommended administering the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire to assess patient-reported upper-extremity function in breast cancer survivors.<sup>13</sup> By examining the correspondence between the items' content and elements of the ICF conceptual model, a theoretical foundation can be established.<sup>12,14</sup>

Although overall upper-limb disability varies over time, the trajectories of impairment, activity, and participation related to upper-limb disability may differ as a result of changing circumstances in the patients' lives. Despite the overall improvements in arm morbidity, breast cancer survivors' difficulties with recreational activities and participation may persist over time.<sup>15</sup> After operationalizing impairment using the ICF, we sought to determine which health outcome(s) recovered over time. The purpose of this study was to evaluate upper-limb disability using the DASH questionnaire with the 3 health outcomes identified by the ICF over a 2-year period in breast cancer survivors. We also assessed risk factors for upper-limb disability over time.

## Methods

### Participant selection

This study is part of a longitudinal study of outcomes after breast cancer. Study participants were recruited from among breast cancer patients before cancer surgery between April 2006 and March 2007 at Seoul National University Bundang Hospital in Gyeonggi, Korea. Eligible participants were women with breast cancer who were at least 18 years old and who had planned to undergo surgical treatment with or without adjuvant therapy. Patients with other previously diagnosed cancers or with bilateral or recurrent breast cancer and those who were not literate were excluded.

When patients visited our outpatient clinic for planning of cancer surgery, they were provided with a brief description of the study. In this period, a total of 243 women underwent breast cancer surgery; of these, 52 were excluded because of a diagnosis of bilateral breast cancer (n=12), recurrent breast cancer (n=10), other previously diagnosed cancers (n=8), illiteracy (n=7), and refusal to participate in the study (n=25). All participants were fully informed regarding study participation and provided written

informed consent. The protocol was approved by the Seoul National University Bundang Hospital Institutional Review Board.

### Procedures

To conduct this prospective cohort study, the participants were evaluated preoperatively and at regular intervals postoperatively. Baseline (t0) demographics, clinical and social variables, and upper-limb functional evaluations were performed preoperatively. Follow-up evaluations were conducted in outpatient clinics 3 months after surgery (t1), at which point primary cancer treatment ended routinely if radiation therapy was not given, and at 12 months (t2) and 24 months (t3) after surgery.

### Upper-limb disability

Shoulder disability was measured using a self-reported questionnaire (ie, a validated Korean version of the widely used DASH questionnaire),<sup>16</sup> which is used to measure the functional status and symptoms associated with different degrees and levels of upper-extremity disability.<sup>17</sup> The DASH global score was considered to indicate the overall disability caused by upper-limb disability. The participants answered the questionnaire with the aid of nurses previously trained in rehabilitation surveys.

Dixon et al used discriminant content validity to allocate the items of the DASH questionnaire to the theoretical definition of  $\geq 1$  ICF outcome.<sup>14</sup> The World Health Organization identifies 3 health outcomes in its ICF taxonomy of the consequences of disease: impairment, activity limitation, and restrictions in social participation.<sup>9</sup> The DASH questionnaire contains 5 pure impairment items, 19 activity limitation items, and 3 participation restriction items. Seven other items measure both activity limitation and participation restrictions.<sup>14</sup> The standard method of scoring the DASH questionnaire, which generates a simple mean score across all items and converts this mean score to a 0 to 100 scale, was used. A 5-point Likert scale with scores of 1 to 5 was used for each item, for a total score range of 5 to 25 for impairment items, 19 to 95 for activity limitation items, 3 to 15 for participation restriction items, and 7 to 35 for activity limitation and participation restrictions. This raw score was then recalculated for expression on a 100-point scale for each health outcome, according to Dixon<sup>14</sup> (fig 1).

The scale is usually dichotomized to reflect upper-limb disability versus non-upper-limb disability. Our outcome variable, DASH, was categorized as upper-limb disability (DASH score  $> 20$ ) and non-upper-limb disability (DASH score  $\leq 20$ ). It has been suggested that scoring  $\geq 20$  out of 100 may indicate a significant loss of function.<sup>18</sup>

The measurement of arm circumference at predefined positions, 10cm proximal and distal relative to the olecranon, was used for diagnosing secondary lymphedema.<sup>19</sup> Measurements recorded within the first 3 months after surgery were not used for lymphedema assessment because patients may experience transient increases in measured arm volume related to postsurgical changes during this period.

### Medical record review

Patient characteristics, including age, level of education, income, place of residence, marital status, and side of dominance/handedness, and treatment characteristics, including cancer stage, type of surgery, type of axillary procedure, pathologic findings, and

#### List of abbreviations:

CI	confidence interval
DASH	Disabilities of the Arm, Shoulder, and Hand
ICF	<i>International Classification of Functioning, Disability and Health</i>

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