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# Direct and indirect costs associated with nonoperative treatment for shoulder instability: an observational study in 132 patients

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## Abstract

**Background:** Shoulder instability is associated with decreased functioning. The associated costs could be substantial and interesting to clinicians, researchers, and policy makers. This prospective observational study aims to (1) estimate productivity losses and healthcare expenses following the nonoperative treatment of shoulder instability and (2) identify patient characteristics that influence societal costs.

**Methods:** One hundred and thirty-two patients completed a questionnaire regarding production losses and healthcare utilization following consecutive episodes of shoulder instability. Productivity losses were calculated using the friction cost approach. Healthcare utilization was evaluated using standard costs. analysis of variance test was used to assess which patient characteristics are related to productivity losses and healthcare expenses. Societal costs were assessed using multilevel analyses. Bootstrapping was used to estimate statistical uncertainty.

**Results:** Mean productivity losses are €1469, €881, and €728 and mean healthcare expenses are €3759, €3267, and €2424 per patient per dislocation for the first, second, and third dislocation. Productivity losses decrease significantly after the second (mean difference €−1969, 95%CI= −3680 to −939) and third (mean difference €−2298, 95%CI= −4092 to −1288) compared to the first dislocation.

**Conclusions:** Nonoperative treatment of shoulder instability has substantial societal costs.

**Level of Evidence:** III, economic analysis.

### Keywords

shoulder instability, societal costs, economic analysis, absenteeism, coping

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## Introduction

Cost of healthcare has become a focal point of healthcare policies.[1–3] In patients with shoulder instability, cost of healthcare and productivity losses could be substantial.

With an incidence of 23.1–56.3 per 100,000 person-years, shoulder instability generally affects young and active patients.[4–6] To decide for surgical or nonoperative treatment depends on many factors, including age, the type of instability (traumatic versus nontraumatic),

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participation in (contact) sports, and the presence of bony defects.[7–9] Nonoperative treatment in traumatic shoulder instability can lead to recurrent instability in 17–96%, with young patients having a higher risk.[10–12] Because young patients are presumably active in the job market and because each episode of instability is likely to temporarily decrease the patients' level of physical activity, the nonoperative treatment could result in considerable productivity losses. Productivity losses result from absenteeism (i.e. sick leave), presenteeism (i.e. less productive while attending work because of sickness), and the inability to perform unpaid work and represent the vast majority (>90%) of societal costs in other orthopaedic disorders.[13–16]

Cost of healthcare results from treatment in primary care (e.g. general practitioner and physical therapist) and secondary care (hospital care).

The aims of this study were (1) to estimate productivity losses and the healthcare costs following nonoperative treatment for shoulder instability and (2) to assess if patient characteristics influence productivity losses or healthcare costs.

## Methods

### Patients

This observational study was conducted in two hospitals in the Netherlands; the Onze Lieve Vrouwe Gasthuis (OLVG) in Amsterdam and the Waterlandziekenhuis in Purmerend. Ethical approval was provided by the ethical commission at the OLVG. We aimed to include at least 125 patients, similar to other studies in the same field.[3,13]

All consecutive patients that visited the hospital because of shoulder instability between 1 January and 1 August 2015 were evaluated for inclusion. Patients were initially selected on their treatment code in the hospital's database and their files were double checked for the correct diagnosis. Study information was provided and written informed consent was obtained when patients agreed to participate. Questionnaires were completed online or on a paper version. In the computer version, completion of an item was required to move to the next item. On paper, missing answers were verified by telephone.

Inclusion criteria were met if patients received nonoperative treatment for a history of either subjective or observed shoulder instability, thus including both patients with confirmed dislocations and patients with symptoms that they have perceived as instability. Both patients with traumatic and nontraumatic instability as well as patients with primary and recurrent instability and patients who suffered recurrent instability after surgical stabilization were included. Although recent evidence supports early surgical treatment in patients with traumatic shoulder instability, patients in this study did not receive surgical treatment unless they have recurrent episodes of instability.[17] Moreover, some patients with recurrent instability declined to have surgical stabilization. Patients who received surgical stabilization were excluded for the purpose of this study. Patients who did not speak Dutch, multitrauma patients, patients with preexisting severe disabilities (e.g. hemiparesis, frontal dementia), or patients with documented noncompliance to nonoperative treatment were also excluded.

### Questionnaire

Patients completed a 25-item questionnaire that was adapted from the "**T**rimbos and **i**MTA (*i*nstitute for *M*edical *T*echnology *A*ssessment) questionnaire on **C**osts associated with **P**sychiatric illness" (TiC-P) questionnaire. The TiC-P is originally used to estimate healthcare utilization and productivity losses by self-report from patients with mental health problems[18] and was modified according to the authors' consensus to suit patients with shoulder instability (online Appendix 1). The questionnaire that was used was first presented to five patients who were treated nonoperative for shoulder instability and who confirmed its face validity. These patients were not included in the study cohort.

The first part included 10 questions that address baseline characteristics and specific complaints associated with shoulder instability. The second part included eight questions that address sports participation, chronic comorbid disorders, the patients' highest attained educational level, and the patients' primary occupation during the day is (paid work, student, no work, retired). The final part included seven questions that address absenteeism and presenteeism, the inability to perform unpaid work, and healthcare utilization due to shoulder instability. Healthcare utilization included visits to the emergency department, the general practitioner, the company doctor, the outpatient clinic, the physical therapist, the manual therapist, the Mensendieck therapist (therapeutic exercises on posture and movement), the Cesar therapist (active practice therapy focussing on posture and movement), or other therapists. Presence of chronic comorbid disorders was assessed with a list of 27 disorders used by the Dutch Central Office of Statistics,[19,20] including cardiovascular disorders (e.g. high blood pressure, cardiovascular event), gastrointestinal disorders (e.g. gastric ulcer, cholecystolithiasis), urogenital disorders (e.g. recurrent urological infections, prolapse), respiratory disorders (e.g. asthma), musculoskeletal disorders (e.g. to the spine or other joints), neurological disorders (e.g.

epilepsy, migraine), other diseases (e.g. cancer, diabetes mellitus, skin disorders > 3 months), other physical disorders (e.g. contused rib, fractured wrist), or psychological disorders (e.g. burnout, depression).

We aimed to have an interval of approximately 2–4 months between the most recent episode of shoulder instability and completion of the questionnaire. This approach enables patients to remember their limitations and healthcare utilization reliably, while it is likely to encompass the bulk of productivity losses and healthcare utilization following the episode of shoulder instability.

### Costs

All costs were calculated for the year 2015. Productivity losses from paid work were valued using the friction cost approach using average lost productivity costs per hour stratified for age and gender in the Netherlands. The friction period used was 160 days. Productivity losses from unpaid work were valued using a shadow price, which is based on the hourly wage of a legally employed cleaner. Productivity losses were calculated only in those patients that actually participated in paid or unpaid work, and three subgroups were categorized; patients who suffered at least 1, 2, or 3 episodes of shoulder instability.

Use of healthcare services was valued using Dutch standard costs.[21] In the Dutch healthcare system, visits to the medical practitioner and hospital are covered by the patients' insurance company, whereas coverage for physical therapist visits depends on the level of insurance coverage.

### Statistical analysis

Mean cost estimates and standard deviation (SD) were described for different categories (primary care, secondary care, lost productivity). Although costs are generally not normally distributed, estimates of the mean (SD) costs allow decision makers to easily estimate budget impact, and, therefore, are considered more useful to decision makers than estimates of the median (IQR).

ANOVA analyses were used to assess if patient characteristics are associated with the total societal costs, with healthcare costs and with lost productivity separately. Bootstrapping was used to estimate statistical uncertainty, 95% CI are presented. IBM SPSS Statistics, version 22 was used.

Differences in societal costs between subsequent episodes of shoulder instability were assessed in multilevel analyses using STATA, version 12 in a subgroup of patients who experienced at least three episodes of shoulder instability. Bootstrapping was used to estimate statistical uncertainty. A p-value of $<0.05$ is interpreted as statistically significant.

## Results

### Patients

Figure 1 illustrates the flowchart of the included patients. There were 245 potentially eligible patients. Eighty-one patients were unable to participate (25 tourists, 40 patients could not be contacted, 16 patients were excluded based on the exclusion criteria) and 32 patients were unwilling to participate. Thus, a total of 132 patients completed the questionnaire. All patients suffered from anterior shoulder instability. Demographic data of participating patients are summarized in Table 1. Twenty-two patients experienced only subluxations. The interval between the most recent episode of shoulder instability and completion of the questionnaire was not normally distributed; the median is 43 (IQR: 18–90) days.

When considering only patients with either paid or unpaid work; 113 patients suffered at least one episode of shoulder instability, 72 patients suffered at least two episodes of shoulder instability, and 65 patients suffered three or more episodes of shoulder instability.

### Productivity losses

Table 2 presents the mean (SD) days of absenteeism and presenteeism, and the mean (SD) hours of missed unpaid work for each consecutive episode of shoulder instability, with the resulting costs. Fifty-nine patients reported to be employed when their shoulder dislocated for the first time. The mean (SD) number of days missed as a result of absenteeism was 8.1 (16.7) and the mean (SD) number of days missed as a result from presenteeism was 11.8 (18.7). Results are presented similar for the second and third and following

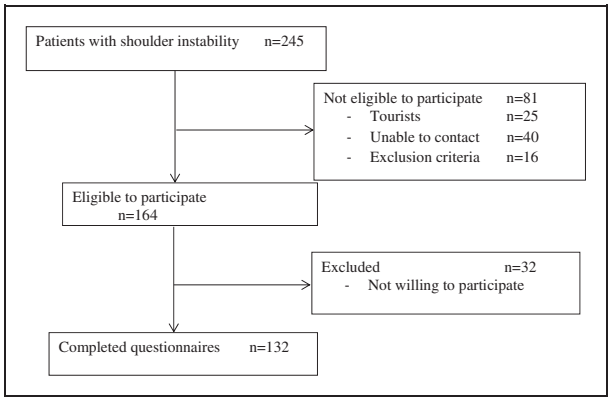


**Figure 1.** Flowchart of all patients.

**Table 1.** Demographic data.

| Total number of patients | Number 132 | Percentage (100) |
|---|---|---|
| Age in years (mean SD) | | |
| At the time of completion | 36 (16) | |
| When the shoulder first dislocated | 30 (16) | |
| Gender (m) | 95 | (72) |
| Dominant side | | |
| Right | 122 | (92) |
| Left | 6 | (5) |
| Both sides equally | 4 | (3) |
| Dominant side is affected side (y) | 82 | (62) |
| Highest level of education[a] | | |
| High | 90 | (69) |
| Middle | 30 | (23) |
| Low | 11 | (8) |
| Work at the time of completion | | |
| Employed | 101 | (77) |
| Unemployed | 3 | (2) |
| School/ study | 9 | (7) |
| Retired | 12 | (9) |
| Other[b] | 7 | (5) |
| Work days[a] | | |
| 5–7 days/wk | 59 | (59) |
| 4 days | 19 | (19) |
| 3 days | 7 | (7) |
| 2 days | 10 | (10) |
| 1 day | 5 | (5) |
| Type of work | | |
| Physical | 31 | (31) |
| Nonphysical | 41 | (40) |
| 50/50 (non)-physical | 29 | (29) |

(continued)

**Table 1.** Continued.

| Total number of patients | Number 132 | Percentage (100) |
|---|---|---|
| Other chronic disorders (y) | 57 | (43) |
| Number of dislocations (incl. subluxations) | | |
| 1 dislocation | 49 | (37) |
| 2 dislocations | 9 | (7) |
| 3 or more dislocations | 74 | (56) |
| Patients with only subluxations (one or more) | 22 | (17) |
| Patients after failed surgery | 17 | (13) |

[a]One patient missing data.
[b]Including unfit to work (3), housewife (3), and gap year (1).

dislocation. Absenteeism and presenteeism decrease after the second and third shoulder dislocation compared to the first.

When considering patients with paid or unpaid work, mean productivity losses are €3578 (SD 8826), €2048 (SD 6461), and €1662 (SD 4981) per patient per dislocation, respectively, reported by 113, 72, and 65 patients.

### *Healthcare utilization*

Table 2 also presents the healthcare utilization and the associated costs. Following the first dislocation, 36 patients (27%) were transported by ambulance, 92 patients (70%) visited the emergency department, 46 patients (35%) visited the general practitioner because of their shoulder between on average 1.5 times, eight patients (6%) visited their company doctor on average 3.1 times, 77 patients (58%) visited the outpatient clinic on average 1.6 times, and 61 patients (46%) visited a physical therapist on average 9.5 times. Data are presented similar for the consecutive episodes of shoulder instability.

The mean (SD) healthcare expenses are €3336 (SD 20,049), €3236 (20,098), and €2399 (16,013) after the first, the second, or the third and following episode of shoulder instability, respectively.

### *Societal costs*

The mean (SD) societal costs that result from productivity losses and healthcare utilization together are €6914 (21,448), €5284 (21,306), and €4061 (16,997) per patient for the first, second, and third dislocation, respectively. These costs include patients with paid or unpaid work.

### *Cost differences between subsequent dislocations*

A subgroup of 74 patients (56%) experienced at least three dislocations. Figure 2 illustrates the mean costs that result from healthcare utilization and lost productivity (total productivity loss and specified for paid and unpaid work). Compared to the first dislocations, productivity losses decreased significantly after the second (mean difference −1969, 95% CI= −3680 to −939) and after the third dislocation (mean difference −2298, 95% CI= −4092 to −1288). There are no statistically significant differences in healthcare costs between subsequent dislocations.

## Discussion

The societal costs following shoulder instability are substantial: €6914 (21,448), €5284 (21,306), and €4061 (16,997) per patient for the first, second, and third or following dislocation, respectively. These costs include productivity losses and healthcare utilization.

The costs following consecutive episodes of instability decrease significantly.

These costs are significant and should be taken into consideration in our practice when treating patients with shoulder instability. Especially in times when cost of healthcare is the focal point of healthcare policies and the need for "expensive" surgical treatment is questioned. A true financial comparison between both treatment modalities remains to be controversial however, especially due to the high variance in (subtle) differences between patients, doctors, healthcare systems, and social security within countries.

For example, young male patients who have the highest risk of recurrent instability would (purely

**Table 2.** Estimation of costs based on productivity losses and healthcare utilization per dislocation.

| | First shoulder dislocation | | | Second shoulder dislocation | | | Third and following shoulder dislocation | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Missed time[a] | Costs[b] | N | Missed time[a] | Costs[b] | N | Missed time[a] | Costs[b] |
| **Productivity losses (€)** after the patients': | | | | | | | | | |
| Total number of patients | 132 | | | 83 | | | 74 | | |
| Patients with paid work | 59 | | | 41 | | | 39 | | |
| missed days due to absenteeism | | 8.1 (16.7) | €3350 (5395) | | 3.1 (7.5) | €1882 (4074) | | 3.0 (6.1) | €1458 (3067) |
| missed days due to presenteeism | | 11.8 (18.7) | | | 5.9 (13.9) | | | 3.4 (7.2) | |
| Missed hours of unpaid work | 93 | 12.3 (22.0) | €1256 (4130) | 63 | 3.9 (9.5) | €372 (922) | 60 | 13.0 (63.8) | €386 (938) |
| **Total productivity losses** | 113 | | **€3578 (8826)** | 72 | | **€2048 (6461)** | 65 | | **€1662 (4981)** |

| | First shoulder dislocation~ | | | Second shoulder dislocation~ | | | Third and following shoulder dislocation~ | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Mean no. of visits[c] | Costs[b] | N | Mean no. of visits[c] | Costs[b] | N | Mean no. of visits[c] | Costs[b] |
| **Healthcare utilization** after the patients': | | | | | | | | | |
| Patients transported by ambulance | 36 | | | 12 | | | 11 | | |
| Patients that visited the | | | | | | | | | |
| emergency department | 92 | (1.0) | | 36 | (1.0) | | 38 | (1.0) | |
| general practitioner | 46 | (1.5) | | 24 | (1.6) | | 33 | (2.4) | |
| company doctor | 8 | (3.1) | | 4 | (3.3) | | 6 | (1.5) | |
| outpatient clinic[d] | 77 | (1.6) | | 29 | (1.6) | | 50 | (1.8) | |
| physical therapist | 61 | (9.5) | | 24 | (10.7) | | 31 | (5.6) | |
| manual therapist | 7 | (4.6) | | 2 | (4.0) | | 4 | (63) | |
| mensendieck therapist | 1 | (3.0) | | 1 | (3.0) | | 0 | | |
| cesar therapist | 0 | | | 0 | | | 2 | (5.5) | |

(continued)

**Table 2.** Continued.

| | First shoulder dislocation~ | | | Second shoulder dislocation~ | | | Third and following shoulder dislocation~ | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Mean no. of visits[c] | Costs[b] | N | Mean no. of visits[c] | Costs[b] | N | Mean no. of visits[c] | Costs[b] |
| other therapist | 3 | (2.7) | | 1 | (2.0) | | 3 | (1.7) | |
| **Total healthcare expenses** | | | **€3336 (20,049)** | | | **€3236 (20,098)** | | | **€2399 (16,013)** |
| **Overall costs per patient per dislocation** | | | **€6914 (21,448)** | | | **€5284 (21,306)** | | | **€4061 (16,997)** |

[a]The mean (SD) number of missed days or hours per patient per dislocation.
[b]The mean (SD) costs in euro's (€) per patient per dislocation. This number includes patients with and without absenteeism or presenteeism.
[c]The mean number of visits per patient per dislocation.
[d]Includes only outpatient visits due to shoulder instability (e.g. to the orthopaedic, neurology, or radiology department).

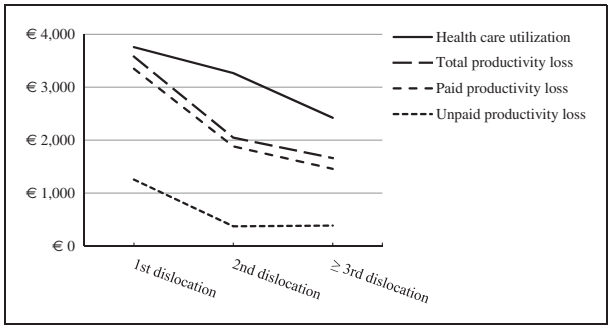


**Figure 2.** Lost productivity costs and healthcare costs per patient per subsequent dislocation.

from a cost perspective) benefit more from surgery compared to elderly patients. However, due to the sample size in this study we were unable to evaluate these differences.

A theoretical study that calculated the cost-effectiveness of various treatments for first time shoulder dislocations has been published by Crall et al. Using a Markov model and a willingness-to-pay threshold of $25,000 per quality-adjusted life-year, primary arthroscopic stabilization was considered cost effective as compared to nonoperative treatment of shoulder instability.[22,23] This model only included costs resulting from surgery, closed reduction, capsular release, incisional drainage, antibiotics, CT scans, MRI scans, MR arthrography, and physical therapy,[22] but costs as a result from productivity losses were not included. Considering the importance of lost productivity costs in patients with shoulder instability as shown by this study, this can be a limitation of this particular study.

Kraus et al.[24] previously reported that the mean incapacity to work after surgical treatment for shoulder instability is 2.73 months (equals 54.6 workdays with 20 workdays each month). In this study, the number of workdays that are missed is substantially lower (i.e. absenteeism 8.1 + presenteeism 11.8 = 19.9 days in total).

This may be explained by the fact that the nonoperative treatment does not include a strict long lasting immobilization or that nonoperative treatment may be less painful.

Hakkaart-van Roijen et al.[19] identified that workload influences productivity losses but did not assess comorbidity.

In this study the societal costs decrease following consecutive shoulder dislocations. This may indicate that patients adapt to their disability by developing coping strategies. Regarding productivity losses, patients might engage alternative activities at work until their shoulder function improves after the second dislocation. Regarding healthcare utilization, 70% (92 out of 132) of the patients were transported

by ambulance after the first dislocation, compared to 42% (36 out of 84) after the second dislocation. Similarly, patients might restart physical exercises that were provided previously by their physical therapist. Another explanation could be that a first shoulder dislocation causes more damage to the shoulder anatomy compared to following dislocations, leading to more pain and relatively more healthcare utilization and greater disability, which results in increased absenteeism and presenteeism.

There are several strengths to this study. To our knowledge, it is the first to assess the societal costs for shoulder instability. Moreover, both productivity losses as well as healthcare expenses were addressed. Finally, because the nonoperative treatment (length of immobilization, referral to the physical therapist) was not standardized, the results represent the routine daily practice in the Netherlands.

Although other countries might lack a national rehabilitation protocol too, the absence of a standardized nonoperative treatment protocol could also be regarded as a weak point: no immobilization or strict immobilization for six weeks is likely to result in different productivity losses.

Second, although the questionnaire that we used is the best available instrument for our purpose, it has not been validated for trauma or orthopaedic patients.

Third, productivity losses and healthcare utilization can be influenced by the national system. Regarding productivity losses, Dutch employees are paid 70% minimum of their salary in case of sick leave during at least 107 weeks. Patients will thus probably resume work, only if they are actually able to. Subsequently, this is likely to result in an accurate reflection of productivity losses based on physical limitations. Regarding healthcare utilization, Dutch residents are obliged to have a healthcare insurance that covers hospital visits and visits to the general practitioner. Reimbursement for physical therapy, however, depends on the patients' level of coverage; patients without coverage might end their physical therapy treatment sooner, leading to an underestimation of these costs.

Fourth, this cohort includes both patients with primary instability, as well as patients that suffer from recurrent instability after surgical stabilization as well as patients with subluxations or symptoms that they have perceived to be instability. Although subluxations are for some patients the initial reason to seek medical attention,[25] their nonoperative treatment and recurrence rate could differ. Moreover, patients who experienced only subluxations have lower mean societal costs compared to the group as a whole (€1747 compared to €6914) and inclusion of these patients could lead to an underestimation of the healthcare expenses. This heterogeneity also accounts for age; the coexisting injuries that occur with shoulder instability might be different for patients aged 18 years old, compared to patients aged 60 years old. Older patients may also be more vulnerable to sustain accompanying lesions (such as rotator cuff tears) that could have an impact on the ability to perform physical activities and subsequently overestimate the societal costs. Although the presence of such lesions is unlikely in patients with a mean age of 30 years at the time of their first dislocation, ultrasound or MRI was not routinely used to confirm the absence of these lesions. Whereas the heterogeneity in this cohort is a weak point, it does reflect the broad population of patients with shoulder instability that we treat on a daily base in our clinical practice.

Fifth, the observational, retrospective design of the study has some limitations. There could be selection bias because some patients might seek medical attention sooner than others. This may lead to an overestimation of the societal costs. Selection bias could also occur because specific patients might be eligible to have early surgical treatment, based on their sports ambition, physical workload, or own preferences.

Sixth, specific diagnostic tests (e.g. MRI or CT scans) are not included in the costs estimates in this study. This might give an underestimation of the total costs resulting from healthcare utilization.

Finally, the median interval between the most recent episode of shoulder instability and the questionnaire completion was 43 (IQR: 18–90) days. Although we aimed for an interval of 2–4 months, this interval was often less due to the recurrent nature of shoulder instability especially in patients with subluxations. Because the physical therapy treatment for shoulder instability might continue even after 43 days, this could lead to an underestimation of the healthcare expenses.

In conclusion, societal costs of shoulder instability inform clinicians, researchers, and policy makers. However, costs change continuously following economic changes and differ between patients and countries. Moreover, it should be noted that although societal costs decrease with subsequent shoulder dislocations, discomfort or pain do not necessarily decrease. The patients' specific characteristics and desires are thus important factors that should be taken into account when treating these patients.

Future research could include a randomized prospective study that includes differences in the shoulder function following consecutive episodes of shoulder instability in a homogeneous population of patients that are treated nonoperative. When the shoulder function is equally affected each time, then a decrease in societal costs is more likely the result of coping strategy development, instead decreased damage to the shoulder anatomy following consecutive dislocations.

## Conclusions

In the nonoperative treatment of shoulder instability, the societal mean costs per patient per dislocation were estimated to be €6914, €5284, and €4061 for the first, second, and third dislocation, respectively. Costs associated with productivity losses decrease significantly following the second and third, compared to the first episode of instability. This may indicate that patients develop coping strategies.

### Declaration of Conflicting Interests

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### Ethical Review and Patient Consent

Ethical approval was provided by the Ethical Commitee at the Onze Lieve Vrouwe Gasthuis and all patients signed an informed consent form.

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