

Can shared care deliver better outcomes for patients undergoing total hip replacement?

A prospective assessment of patient outcomes and associated service use

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Abstract

Objectives: To assess whether shared care for patients undergoing total hip replacement delivers better outcomes compared to care as usual.

Design: Prospective, observational cohort study.

Setting: Two regions in the Netherlands where different organisational health care models have been implemented: a shared care setting (experimental group) and a care as usual setting (control group).

Patients: One hundred and fifteen patients undergoing total hip replacement: 56 in the experimental group and 59 in the control group.

Main measures: Functional health status according to the sickness impact profile, hip function, patient satisfaction and use of health care services.

Results: Two weeks before hip replacement both groups were comparable concerning patient characteristics, hip function and health status. The mean improvement of the total sickness impact profile score between two weeks before hip replacement and six months after was -1.92 in the shared care group, compared to -5.11 in care as usual group, a difference in favour of the control group ($p=0.02$). The mean length of hospital stay was comparable in both settings: 12.8 days in the shared care group and 13.2 days in the care as usual group. After hip replacement, compared to care as usual, patients in the shared care group received more homecare, with a higher frequency, and for a longer period of time. No differences in patient satisfaction between the two groups were found.

Conclusions: Six months after hip replacement, the health status of patients in the care as usual group, using significantly less home care, was better than the status of patients in the shared care group.

Discussion: The utilisation of home care after hip replacement should be critically appraised in view of the need to stimulate patients' independence.

Keywords

shared care, total hip replacement, effectiveness

Introduction

Total hip replacement is widely regarded as a very effective treatment for patients with hip joint failure [1]. The aims of total hip replacement, which is mainly delivered to patients with osteo-arthritis, are relief of

pain and improvement in function. Yearly about 14,000 people, which is almost 1‰ of the Dutch population, undergo total hip replacement in the Netherlands. Although there is no doubt about its positive effects, there is variability in the outcomes of total hip replacement [2, 3]. One of the aspects which possibly might have an impact on the outcome of total hip replace-

ment could be the way that health care for these patients is organised.

Patients receive health care on different levels, or stages, varying from informal home care by partners and family to (super-) specialised (university) hospital care. One of the present tendencies in Dutch health care is to try to provide care at the 'lowest' level where it can be delivered adequately. It is generally believed that it is better to deliver health care as close as possible to the patients' own living situation. Another factor is the widely spread belief that primary care, compared to secondary care, is less expensive and not per se less effective. In the treatment of some diseases, e.g. diabetes mellitus, it is possible to change the site of care-delivery in toto from a secondary to a primary care setting without loss of quality. In many other cases, such as total hip replacement, there is no doubt that the surgical procedure itself has to be carried out in a well-equipped hospital. In such cases a stronger role of primary care during the recovery phase can be realised by intensifying collaboration and communication between primary and secondary care. This alternative way of organising health care in the Netherlands is called transmural care. In other countries, more or less equivalent phenomena are known as integrated care or shared care. The aims of shared care, as summarised by Orton [4], are an earlier and safer discharge from hospital, more support to frail and elderly people in their own homes, a better co-ordinated and more flexible community care, an efficient use of acute hospital services and greater responsiveness to the needs of patients.

That shared care is beneficial for patients is merely an assumption. In case of diabetes [5] and hypertension [6] there is some evidence that shared care is as cost-effective as conventional secondary care. About the effects of shared care on patients undergoing total hip replacement we found no valid information in the literature at the time our study started. This paper presents the results of a prospective observational comparative study that was carried out to assess the effects of shared care for patients undergoing total hip replacement.

Patients and methods

Patients

Patients were selected based on the decision, made by the orthopaedic surgeon together with the patient, to do a total hip replacement. After this, patients were informed about the study and were subsequently asked to participate. They did not know whether their setting was considered as the experimental or the

control setting in this study. Patients who were not able to complete the questionnaires used in this study, for example non-Dutch speaking patients, or patients with severe illnesses like dementia, were excluded from the study. Patients with a first-ever hip replacement as well as patients with a second replacement were included in the study. The study was approved of by the Medical-Ethical Committee of TNO Prevention and Health.

Intervention

Patients were selected from two different hospitals. In one of them, the experimental setting, a form of shared care had been implemented for a number of years. In the other hospital, that was considered to be the reference site, care was given in the usual, conventional way. These equally sized hospitals are located in two regions in the Netherlands with comparable social and cultural circumstances. Surgical procedures and post hospital care are comparable in these hospitals. The only significant difference is the way in which health care for patients undergoing total hip replacement has been organised, which is the intervention under study.

Shared care (experimental) setting

Primary and secondary health care professionals have attuned their activities in such a way, that the care patients receive before, during and after their admission to the hospital has a high degree of continuity. This has been laid down in a protocol, which serves as a guideline for all health care providers involved. A few weeks before their admission, patients are visited by a home care co-ordinator, who informs patients and their family about things to happen, meanwhile assessing their home situation. Also assessed are the extent to which the family is able to take care of the patient after dismissal from hospital and whether or not any adjustments are needed in the house, such as bed-heighteners, etc. Subsequently, the co-ordinator takes care of organising whatever is needed to guarantee a well-prepared and safe home-situation once the patient returns home from the hospital after the operation. During the hospital-admission-period, this co-ordinator visits the patients and makes sure that everything goes as planned. By the time the patients are discharged from hospital, adjustments in the house have been arranged and the home care that is needed can start immediately. In this way, hospital-stay should be reduced to a minimum, for patients can return home as quickly as possible. It is believed that this has not only a positive effect on costs (reduced length of hospital stay), but

also on the effectiveness of care, for patients can start earlier with their rehabilitation. Furthermore, it is assumed that patients in this setting are better informed about their health care.

Care as usual (control) setting

The control group consists of patients, whose health care is organised as usual, implying no visit from home care before hospital admission. Furthermore, their needs for 'post-discharge-care' and home adjustments are being assessed not before, but during their stay in hospital, or sometimes even not before they have returned home after discharge from the hospital. In this model, there are no special workers to support patients' transition before, during and after their hospital admission period.

Assignment of patients

The assignment to either one of the settings is dependent on the place of residence of patients. The organisational settings in this study are located in two different cities in the Netherlands, about 30 miles apart.

Outcome measures

- General health status was measured with the SIP-68. The SIP-68 [7,8] is a short version of the Sickness Impact Profile, which originally consisted of 136 questions. The SIP-136, as well as its short version, is considered as a reliable and valid instrument for measuring functional status [9]. The questionnaire has six dimensions: somatic autonomy, motor control, psychological autonomy and communication, social behaviour, emotional stability and mobility range. For each dimension the scores are straightforwardly added up, a higher score indicating a higher impact on health, implying a lower health status.
- Hip function, a disease-specific measure, was assessed with a translation of the Hip-Rating-Questionnaire [10]. This 14-item questionnaire uses a 100-point scale in which equal weight is given to the domains of overall impact of arthritis, pain, walking and function. Here, in contrast to the SIP, a higher score indicates a better health status.
- Patient satisfaction was measured with a questionnaire developed especially for this study since no validated instrument for measuring patient satisfaction, which is also sensitive enough to detect any differences in patients who need total hip replacement, is available. The questionnaire focuses on the way patients are met by professionals, on the

information that was given to them (about their disease, treatment-modalities, home care, adjustments, etc.) and on the way health care is organised.

- Costs were approximated by an inventory of the type and number of adjustments realised in patients homes, the amount and type of home care after discharge from hospital and the length of stay in the hospital.

Data collection and statistical analysis

All patients who entered the study were asked to complete the SIP and hip-function questionnaires two times: two weeks before their admission to the hospital and six months after total hip replacement. Patient satisfaction was measured only six months after hip replacement. Beside the completed questionnaires, we used patient-records as important source of information about the length of hospital stay, the technique and material used by the orthopaedic surgeon, existing co-morbidity and complications.

Baseline clinical characteristics and outcome measures were analysed and tested (two-tailed) using chi-square or Fisher Exact test and unpaired T- or Mann-Whitney tests when appropriate. Whenever it was applicable and informative, the 95% CI for difference in proportions [11] and the effect sizes of the difference between the two groups [12] were calculated. A p-value equal to or less than 0.05 was considered statistically significant.

Results

Patients

All patients who were to have a total hip replacement in either one of the hospitals in the period from December 1996 to June 1998 were informed about the study and were asked to participate. Patients who only completed the questionnaire once, were later excluded from the study. This resulted in a total of 115 patients entering the study, 56 in the shared care setting and 59 in the care as usual setting. The baseline characteristics of these patients are depicted in Table 1.

There was no statistically significant difference in any of these characteristics between the two patient groups. Also, concerning generic and disease specific health status as measured at baseline by the SIP and the Hip Rating Questionnaire, both groups were comparable, see Table 2.

Table 1. Baseline patient characteristics.

Patient characteristics	Shared care (n=56)	Control group (n=59)	p-Value (95%CI of the difference)
– Mean age (sd;95%CI)	69.8 (±10.1;67.3 to 72.4)	67.2 (±11.2;64.5 to 70.5)	n.s.* (-1.29 to 6.59)
– No. males (%)	11 (20)	10 (17)	n.s.**
– No. primary THR (%)	37 (66)	44 (75)	n.s.**
– No. living alone (%)	25 (45)	19 (32)	n.s.**
– No. waiting-days before admission (sd;95%CI)	70.9 (±32.2;62.1 to 80.9)	64.7 (±11.2;53.7 to 75.7)	n.s.* (-7.68 to 20.0)

* t-test.

** Chi-square test.

Health status

In general, the differences in scores on health status showed the same pattern in both settings in the period from two weeks before their hip replacement to six months afterwards: both patient groups tended to improve between these moments of measuring. However, patients in the control group improved more compared to patients in the shared care group on the subscale ‘mobility range’ (p=0.02) as well as on the total SIP-score (p=0.02). Likewise, both patient-

groups improved on the scores of the Hip Rating Questionnaire, but there was no difference in improvement between the two groups. Stratification for patients with a first-ever hip replacement resulted in similar findings. These results are depicted in [Table 2](#).

Costs/Use of service

There appeared to be no significant difference in the mean length of hospital stay between the two groups:

Table 2. Mean scores (sd) on generic and disease specific health status at baseline (t0) and at six months after hip replacement (t1).

	Shared care (n=56) t0	Control group (n=59) t0	p-Value * t0	Shared care (n=56) Δscore (sd)	Control group (n=59) Δscore (sd)	p-Value Δscore**	Effect size Δscore***
SIP-68							
somatic autonomy	1.00 (±1.45)	0.80 (±1.66)	n.s.	+0.18 (1.38)	-0.30 (1.22)	n.s.	0.37
motor control	5.03 (±2.51)	5.52 (±2.48)	n.s.	-1.26 (3.32)	-2.21 (2.43)	n.s.	0.33
psychological autonomy and communication	0.79 (±1.91)	0.37 (±0.81)	n.s.	-0.07 (1.17)	-0.11 (0.65)	n.s.	0.04
social behaviour	3.76 (±2.70)	3.50 (±2.65)	n.s.	-0.70 (2.84)	-1.38 (2.77)	n.s.	0.24
emotional stability	0.41 (±0.87)	0.54 (±0.90)	n.s.	-0.12 (0.61)	-0.38 (0.97)	n.s.	0.32
mobility range	1.68 (±2.62)	1.71 (±2.36)	n.s.	-0.18 (2.58)	-0.76 (1.99)	0.02	0.25
Total SIP	12.7 (±8.45)	12.4 (±7.59)	n.s.	-1.92 (7.46)	-5.11 (6.19)	0.02	0.56
Hip rating questionnaire							
overall impact	9.2 (±4.6)	10.0 (±4.5)	n.s.	+7.9 (6.11)	+7.8 (6.50)	n.s.	0.03
pain	12.5 (±4.7)	11.4 (±4.1)	n.s.	+7.8 (6.22)	+9.2 (5.86)	n.s.	0.24
walking	15.7 (±5.7)	15.5 (±4.6)	n.s.	+3.0 (5.50)	+3.8 (4.86)	n.s.	0.15
function	19.1 (±4.2)	19.5 (±3.7)	n.s.	+1.2 (3.36)	+2.1 (2.46)	n.s.	0.31
Total hip rating questionnaire	56.7 (±14.8)	56.4 (±13.1)	n.s.	+18.9 (15.64)	+24.3 (14.86)	n.s.	0.35

* Mann-Whitney U-test, shared care group vs. control group.

** Δscore = score t1-score t0, shared care vs. control group (Mann-Whitney U-test).

** Δscore = score t1-score t0, shared care vs. control group; effect size γ ($\gamma = (\mu_1 - \mu_2) / \sigma$).

Table 3 Number (%) of patients that received adjustments in their home and home care.

	Shared care (n=56)	Control group (n=59)	P-Value *	95% CI**
Adjustments present at:				
– one month after hip replacement	42 (75)	39 (66)	n.s.	–0.08 to 2.5
– six months after hip replacement	35 (62)	24 (41)	0.02	0.04 to 0.40
Home care at:				
– one month after hip replacement	30 (54)	19 (32)	0.03	0.04 to 0.39
– six months after hip replacement	11 (20)	11 (19)	n.s.	–0.13 to 0.15

* Chi-square test; ** 95% CI for difference in proportions.

12.8 (± 7.4) days in the shared care group versus 13.2 (± 3.5) in the control group. All patients were asked whether they judged that the hospital admission period was too long, just good, or too short. Compared to the control group, somewhat more patients in the shared care group tended to judge this period either too short or too long, whereas a greater percentage of patients in the control group judged this period just good. This difference, however, was not statistically significant (Mann–Whitney U-test, $p=0.08$).

After discharge from hospital, patients can be supported by having different kinds of adjustments installed in their houses or by receiving home care. Examples of these adjustments are bed—en toilet heighteners, handgrips and shower-chairs. The number of patients in both settings that received adjustments and home care is given in [Table 3](#).

The results indicate that adjustments remain longer in the houses of patients in the shared care group. Concerning home care, it appears that, compared to the control group, this was received by more patients in the shared care group in the early period after discharge from the hospital. However, six months later this difference has disappeared. Not only did patients in the shared care group receive more home care, but this care seems to start earlier compared to the care as usual group also. Especially the percentage of

patients that received home care the day they were discharged from hospital, was higher in the shared care group. This difference is illustrated in [Table 4](#).

This difference was not reflected in patients' judgements about the time needed for home care to start after discharge: about 90% in both groups said this was all right whereas 5–10% felt that this took too long. Patients in the shared care group were earlier informed ($p=0.01$) about receiving home care after discharge from hospital compared to patients in the control group: 87% of patients in the shared care group were informed before hospital admission, compared to 26% in the control group. Almost half of the patients (47%) in the control group were informed during their hospital stay, compared to 10% in the shared care group. Only 3% of patients in the shared care group was informed after discharge, compared to 10% in the control group.

The type of home care that patients received after discharge from hospital is summarised in [Table 5](#). The totals do not necessarily sum up to 100% here because many patients received different types of care.

Not only did patients in the shared care group receive more home care, they also received more different types of care. Furthermore, there was also a difference

Table 4. Time needed for home care to start for patients (%) in both settings.

Time needed before home care started after discharge:	Shared care (n=30)	Control group (n=19)	95% CI*
– same day	11 (37)	1 (5)	0.11 to 0.51
– next day	13 (43)	6 (32)	–0.16 to 0.39
– a few days	4 (13)	6 (32)	–0.42 to 0.06
– a week	1 (3)	5 (26)	–0.44 to 0.02
– more than a week	1 (3)	1 (5)	–0.14 to 0.10

*95% CI for difference in proportions.

Table 5. Type of home care delivered to patients (%) in both settings at one month after total hip replacement.

Type of home care:	Shared care (n=30)	Control group (n=19)	P-Value *
– household	21 (70)	14 (74)	n.s
– body care (bathing, clothing)	28 (93)	8 (42)	0.00
– nursing (wound)	18 (60)	3 (16)	0.00

*Fisher Exact test.

between the two groups in the frequency of home care, see [Table 6](#).

Obviously, compared to the control group, the frequency of home care in the shared care group was higher, especially for patients who received home care twice a day. Besides the type of care and its frequency, the total period that patients received home care after hip replacement was inventorised also. It appeared that in both settings, whenever home care continued to be delivered until three months after hip replacement, this was retained up to six months. At that time, the type of care did not differ between the two groups: about 65% consisted of household care and about 35% of household care together with body care e.g. help with bathing. Overall, patients in the shared care group received home care for a longer period compared to the control group (Mann-Whitney test, $p=0.04$).

Patient satisfaction

On both measuring-moments patients were asked to grade the overall care they received with a mark from 0 (very bad) to 10 (excellent). This did not result in any significant difference between the two groups. Furthermore, patients were also asked whether or not they judged improvements desirable on various aspects of the care they had received. The results are visualised in [Table 7](#).

Although patients in the shared care group tended to be somewhat more satisfied on every aspect we measured, this difference was never significant.

Table 6. The frequency of patients (%) receiving home care in both settings at one month after total hip replacement.

Frequency of home care	Shared care (n=30)	Control group (n=19)	95% CI*
– twice a day	10 (33)	1 (5)	0.08 to 0.45
– once a day	12 (40)	4 (21)	–0.06 to 0.44
– a few times a week	5 (17)	3 (16)	–0.20 to 0.22
– once a week	3 (10)	10 (53)	–0.67 to –0.18
– other	–	1 (5)	–

*95% CI for difference in proportions.

Conclusions

The results of this study indicate that shared care for patients undergoing total hip replacement, as organised in the experimental setting studied, compared to care as usual does not perform better. In fact, six months after hip replacement the health status of patients in the control group was better compared to patients in the shared care group. Also, the patients in the control group used significantly less home care. Based on our findings, this particular form of shared care is not cost-effective.

Discussion

Total hip replacement can be considered as a highly effective medical treatment. Most patients in both organisational settings improved significantly on health status after six months. This finding is coherent with other findings in literature. However, this study was not carried out to assess the effects of the surgical procedure, but to find out whether another way of organising health care for these patients would have positive effects on patient outcomes. For this purpose, we compared the effectiveness between a shared care setting with care as usual. As our study did not primarily intend to measure the effects of the clinical intervention as such, but merely the way that health care was organised, we supplemented the measurement of clinical outcomes with measurement of other outcomes such as health status, patient satisfaction and efficiency.

Table 7. Number of patients (%) that consider improvements desirable on several aspects of care at six months after total hip replacement.

Improvements desirable on:	Shared care (n=56)	Control group (n=59)	p-Value*
– information about things to happen	5 (9)	11 (19)	n.s
– information about behaviour after discharge	5 (9)	12 (20)	n.s
– listening to patients	6 (11)	8 (14)	n.s
– organising adjustments	2 (4)	5 (8)	n.s
– organising home care	6 (11)	8 (14)	n.s
– deliberation between different care providers	5 (9)	12 (20)	n.s
– taking their wishes into account	4 (7)	7 (12)	n.s

*Chi-square test

Assessing the organisation of care is complicated because the intervention to be evaluated is a complex change in the delivering of health care, with many different actors involved. To address this issue, it was not feasible to carry out a randomised trial for practical as well as for ethical reasons. Randomisation of patients in order to eliminate selection bias within one setting was not possible as two different ways of organisation within one setting is not workable in daily practice. Randomisation between both hospitals in different cities was not feasible either, as this would imply long travels for patients and their relatives during the hospital stay, as well as for providers of home care after discharge. For these reasons, we designed a prospective observational study to assess the effects of shared care by comparing the outcomes of care as usual with the outcomes of this new shared care model for patients undergoing total hip replacement. We concluded that care as usual compared to shared care performed better: six months after hip replacement, patients in the control group performed better on the total SIP-score. As this instrument measures the impact of health problems on the actual behaviour of patients, a better (lower) score implies less restriction in daily activities. Patients with lower scores develop more daily activities compared to patients with higher scores. It was surprising that differences found in the subscale ‘mobility range’ were not found in any of the subscales of the Hip Rating Questionnaire, for example: ‘walking’ or ‘function’. As disease specific questionnaires are considered to be more sensitive than generic instruments, one would expect that differences on the SIP would also, in some way, be found in the Hip Rating Questionnaire. This is also illustrated by the difference between the two groups in change over time, expressed in effect sizes, see [Table 2](#). Only the difference in the total SIP-score can be considered as a moderate effect, most other effects as small [12]. These results indicate that, compared to the Hip Rating Questionnaire, the SIP-68 is more sensitive.

Concerning costs associated with both models of health care, we concluded that shared care was more expensive compared to care as usual. Firstly, despite the original goals of shared care, the length of hospital stay appeared to be comparable in both settings. Secondly, in the shared care model significantly more home care was brought into service to reach equal (patient satisfaction) or even less (health status) results. The latter finding brings the cost-effectiveness of home care after total hip replacement under discussion. Our results suggest that the greater amount of home care in the shared care setting did not stimulate the independence of patients, but on the contrary may have prevented them from developing more independent daily activities.

Does this all lead to the recommendation to abandon shared care totally and stick to care as usual in case of total hip replacement? No, we think it is far too early for that. In fact, the study reported upon here should be seen as merely a study of just a single case of shared care. In order to come to a conclusion about shared care for this group of patients in general, more of these cases should be studied. Also, the results of this study should be interpreted with caution as, due to the design, selection bias cannot be ruled out. Nevertheless, we think this particular case can teach us some lessons. First of all, we would suggest to carry out more trials such as the one reported upon here, with larger numbers of patients and whenever possible, a stronger design than the one we were restricted to. Further, there might be other advantages of shared care that were not subject of our study, such as satisfaction of health care providers. We suggest to include assessment of these aspects of care in future studies also. Finally, and maybe even more important, we recommend strongly to critically appraise the targets and utilisation of home care after total hip replacement. It seems obvious from our results that optimisation of the effectiveness of home care could be of decisive importance in the ever

continuing strive for improving the quality of care and reducing its costs.

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References

1. Total Hip Replacement. NIH consensus statement 1994;Sep 12–14;12(5):1–31.
2. Williams MH, Frankel SJ, Nanchahal K, Coast J, Donovan JL. Total hip replacement. In: Stevens A, Raftery J, editors. Health care needs assessment. the epidemiological based needs assessment review. Vol 1. Oxford: Radcliffe Medical Press; 1994. p. 448–523.
3. Bulstrode CJ, Murray DW, Carr AJ, Pynsent PB, Carter SR. Designer hips. *British Medical Journal* 1993 Mar 20;306(6880):732–3.
4. Orton P. Shared care. *The Lancet* 1994;344:1413–5.
5. Diabetes Integrated Care Evaluation Team. Integrated care for diabetes: clinical, psychological and economic evaluation. *British Medical Journal* 1994;308:1208–12.
6. McGhee SM, McInnes GT, Hedley AJ, Murray TS, Reid JL. Coordinating and standardizing long-term care: evaluation of the west of Scotland shared-care scheme for hypertension. *The British Journal of General Practice: the journal of the Royal College of General Practitioners* 1994 Oct;44(387):441–5.
7. de Bruin AF, Diederiks JP, de Witte LP, Stevens FC, Philipsen H. The development of a short generic version of the Sickness Impact Profile. *Journal of Clinical Epidemiology* 1994;47:407–18.
8. de Bruin AF, Buys M, de Witte LP, Diederiks JPM. SIP68. Een verkorte versie van de Sickness Impact profile. [The Sickness impact profile: SIP68, a short generic version] Hoensbroek/Maastricht: Instituut voor Revalidatievraagstukken/Vakgroep Medische Sociologie, Universiteit Limburg; 1994 [in Dutch].
9. Bergner M, Bobbitt RA, Carter WB, Gilson BS. The Sickness Impact Profile: development and final revision of a health status measure. *Medical Care* 1981 Aug;19(8):787–805.
10. Johanson NA, Charlson ME, Szatrowski TP, Ranawat CS. A self-administered hip-rating questionnaire for the assessment of outcome after total hip replacement. *The Journal of Bone and Joint Surgery. American volume* 1992 Apr;74(4):587–97.
11. Gardner MJ, Altman TG. *Statistics with confidence. Confidence intervals and statistical guidelines*. London: BMJ; 1989.
12. Cohen J. *Statistical power analysis for the behavioural sciences*. New York: Academic Press; 1977.