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## Cost-Effectiveness Analysis of Early versus Late Total Hip Replacement in Italy

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### ABSTRACT

**Objective:** To assess the cost-effectiveness of early primary total hip replacement (THR) for functionally independent older adult patients with osteoarthritis (OA) versus 1) nonsurgical therapy followed by THR once the patient has progressed to a functionally dependent state (“delayed THR”) and 2) nonsurgical therapy alone (“medical therapy”), from the Italian National Health Service perspective. **Methods:** Individual patient data and evidence from published literature on disease progression, economic costs and THR outcomes in OA, including utilities, perioperative mortality rates, prosthesis survival, and costs of prostheses, THR, rehabilitation, follow-up, revision, and nonsurgical management, combined with population life tables, were synthesized in a Markov model of OA. The model represents the lifetime experience of a patient cohort following their treatment choice, discounting costs and benefits (quality-adjusted life-years) at 3% annually. **Results:** At age 65 years, the incremental cost per

quality-adjusted life-year of THR over delayed THR was €987 in men and €466 in women; the figures for delayed THR versus medical therapy were €463 and €82, respectively. Among 80-year-olds, early THR is (extended) dominant. With gradual utility loss after primary THR, delaying surgery may be more appealing in women than in men in their 50s, because longer female life expectancy implies longer latter periods of low health-related quality of life (HRQOL) with early THR. **Conclusions:** THR is cost-effective. Patients’ HRQOL benefits forgone with delayed THR are worth more than the costs it saves to the Italian National Health Service. This analysis might help to explain women’s consistently lower HRQOL by the time of primary operation.

**Keywords:** cost-effectiveness analysis, cost-utility analysis, disease progression, health-related quality of life, osteoarthritis.

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### Introduction

Primary total hip replacement (THR) is considered an effective and cost-effective treatment to relieve pain and restore physical functioning and mobility in patients with severe osteoarthritis (OA) [1]. In spite of the general opinion that patients with OA should be considered for surgery when other (pharmacological and nonpharmacological) treatment options provide no “adequate pain relief and functional improvement” [2], no consensus exists on the disease severity stage at which performing the operation is optimal [3]. This is reflected, for example, by the National Institute for Health and Clinical Excellence guidelines, which recommend that “referral should be made before there is prolonged and established functional limitation and severe pain” [4], without providing specific decision criteria. Initial attempts at developing decision rules to address this issue, using specific self-reported measures of quality of life, may yet prove to be of practical use [5].

While there are studies documenting the impact of delaying surgical treatment on the health status, quality of life [6–8], and costs [9,10] of eligible patients, no study has evaluated its implications for cost-effectiveness. Evidence on this issue may

help inform doctors’, policymakers’, and health care organizations’ decisions regarding surgery and its prioritization.

This study investigated the cost and cost-effectiveness of three options for treating functionally independent patients with severe OA: 1) primary THR in the first instance, 2) nonsurgical therapy followed by primary THR upon disease progression to a functionally dependent state, and 3) nonsurgical therapy with nonsteroidal anti-inflammatory drugs (NSAIDs). The treatment decision is analyzed from the perspective of the Italian National Health Service.

### Methods

The analytic framework and evidence analyzed were informed by a literature review on costs and outcomes of THR in OA. An electronic search in Ovid Medline using the terms “Osteoarthritis,” “Hip Replacement,” “Arthroplasty,” and “Arthrosis” combined with “Costs” or “Outcomes” identified the literature in English published between January 1995 and February 2011 on clinical events, health-related quality of life (HRQOL), resource utilization and cost implications of surgery and natural disease

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evolution. Complementary manual searches of bibliographies of identified studies were also made. Relevant studies on health outcomes had to have a minimum majority of patients with a diagnosis of OA, arbitrarily set at 70%, and include elective surgery patients only. Studies valuing resource use had to refer to economic costs. The content lists of scientific journals of health economic evaluation articles written in the Italian language were manually searched for studies on costs of THR and medical therapy, including HTA report catalogues. Relevant information on study design, population, methodology, and findings (including effectiveness parameter estimates and costs and quantities of health care service consumption) was extracted by using standard record and quality assessment forms.

A Markov model [11] was adapted to describe the experience of a cohort of functionally independent (American College of Rheumatologists [ACR] class III) patients with severe OA who may undergo primary THR surgery. The alternative, to remain under nonsurgical therapy with NSAIDs, involves two mutually exclusive options, namely, to delay therapy until disease progresses to functional dependency (ACR class IV) or a lifetime without operation.

Six cohorts defined by sex and age (50–59 years, 60–74 years, and 75 years and older) with distinct revision risk profiles were modeled. Transitions occur until 100 years of age, at which point

remaining cohort survivors are assumed to die. Conditional on the choice of treatment and an initial age, the model represents a series of annual contingent transitions to different health states until death. In each cycle, the patient incurs costs and accrues benefits according to the state occupied. Benefits are measured as quality-adjusted life-years (QALYs), whereby each annual cycle is assigned a utility payoff, a preference-based valuation of HRQOL in the occupied health state, on a scale ranging from a negative number (for states worse than death), including zero (states equivalent to death), to one (representing full health). Under each treatment option, total benefits and costs are the sum of QALYs and costs over the modeled life span of the cohort and are discounted at an annual 3% rate.

Following primary THR, the patient may die (incurring neither costs nor utility thereafter) as a result of surgery or survive the operation (“success” state). The following year the same person may experience implant failure, and therefore the need for revision operation, or remain in the success state. The former eventuality would be associated with a temporary (1-year period) deterioration in self-reported HRQOL and an increase in costs of health care while awaiting revision surgery, which carries an increased mortality risk (over background general population mortality risks independent of the health state occupied) (Fig. 1B).

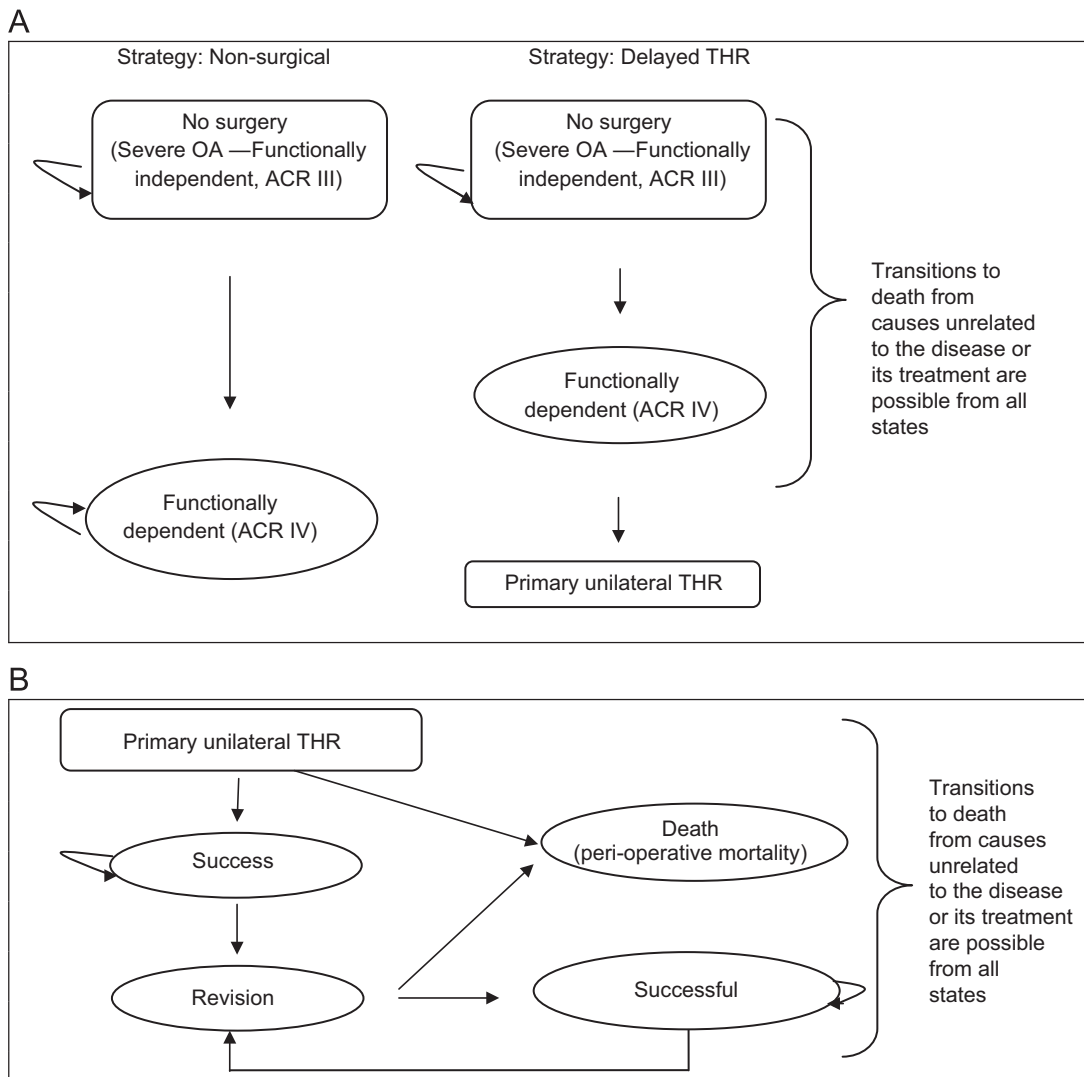


Fig. 1 – (A) Markov chain with annual cycles. (B) Markov model with annual cycles for THR. ACR, American College of Rheumatologists; OA, osteoarthritis; THR, total hip replacement.

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