



## Original Article

# Social profile and cost analysis of deep infection following total hip replacement surgery



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## ABSTRACT

**Objective:** To characterize the socio-economic and demographic profile of patients undergoing surgery for revision total hip arthroplasty regarding the diagnosis of deep prosthetic infection.

**Methods:** Twenty patients were retrospectively studied, admitted in the period between 2009 and 2010 by the Hip Surgery Group with the diagnosis of deep prosthetic infection, whose proposed treatment was surgical. This study was carried out in the presence of the patient by completing two forms applied by the social worker of the Group.

**Results:** In a 20-patient sample, 40% were male, 45% were working age, 50% of patients originated from the capital, 85% depended on benefits, 70% were retired, 60% of patients were from this hospital, and 40% were from other services. The average cost of patients to the public system was R\$ 55,821.62 per patient and the total spent on treatment of patients in the study exceeded one million Brazilian reals, totalling R\$ 1,116,432.40.

**Conclusion:** Infection from total hip arthroplasty generates a major expense to the social security system and to the public healthcare system. Physicians must always be alert to the possible risk factors and perioperative care, striving to minimize this complication.

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## Perfil social e análise de custo da infecção pós-operatória da artroplastia total do quadril

## RESUMO

**Objetivo:** Caracterizar o perfil socioeconômico e demográfico de pacientes submetidos à cirurgia de revisão de artroplastia total do quadril por diagnóstico de infecção protética profunda.

## Palavras-chave:

Artroplastia de quadril

Infecção

Análise de custo

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**Métodos:** Análise de 20 pacientes internados entre 2009 e 2010 pelo Grupo de Quadril com diagnóstico de infecção protética profunda cujo tratamento proposto foi cirúrgico. O trabalho foi feito com preenchimento na presença do paciente de dois formulários aplicados pela assistente social do grupo.

**Resultados:** Na amostra de 20 pacientes, 40% pertenciam ao sexo masculino, 45% estavam em idade produtiva, 50% eram originários da capital, 85% previdenciários, 70% aposentados, 60% provenientes do próprio hospital e 40% de outros serviços. A média de custo dos pacientes ao sistema público foi de R\$ 55.821,62 por paciente, o gasto total no tratamento dos pacientes do estudo totalizou R\$ 1.116.432,40.

**Conclusão:** Conclui-se que a artroplastia total do quadril infectada gera um grande gasto ao sistema previdenciário e ao sistema de saúde público, deve-se, portanto, sempre atentar para os possíveis fatores de risco e cuidados perioperatórios para que esse problema seja evitado.

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## Introduction

Among the possible complications of total hip arthroplasties, prosthetic infection is one of the most devastating, with serious consequences for patients, since most of them will require further surgical interventions; furthermore, they are associated with high costs for the paying sources. They are also associated with periods of work leaves, also overburdening the social security system.

A number of factors are related to the increased risk of prosthetic infection, including obesity, diabetes, immunosuppression, previous large hip surgeries, smoking, malnutrition, prolonged corticoid therapy, and prolonged surgical time, among others.<sup>1,2</sup>

In Brazil, Law 9.431/97 has made hospital infection surveillance mandatory, in order to systematically reduce the prevalence of this complication as a whole in the various medical specialties.<sup>3</sup> The Pan American Health Organization coordinated the *Study on the efficacy of nosocomial infection control*, conducted in Atlanta (United States). That study concluded that hospital stay increases the duration of the infection by a mean of four days, with an additional cost per patient of \$ 1800 on admission.<sup>4</sup>

The present study is aimed at establishing the socioeconomic and demographic profile of patients who underwent total hip arthroplasty revision at this medical service due to a diagnosis of deep prosthetic infection, and to identify the costs involved in the treatment of these patients.

## Methods

After approval by the Research Ethics Committee, a retrospective descriptive study was conducted with qualitative and quantitative analysis.

The study included patients admitted between 2009 and 2010 by The Hip Group of a quaternary university hospital, with a diagnosis of deep prosthetic infection in whom the proposed treatment was surgical. Patients with infection resulting from total hip arthroplasty revision surgery and

those who required intravenous antibiotic therapy as definitive treatment without the need for surgical treatment were not included. Furthermore, patients who did not agree to sign the informed consent form to participate in the project were also excluded.

The study was carried out by completing, in the patient's presence, two forms applied by the social worker of the group, the main author of this study.

Questionnaire 1 (*Appendix*) addressed the social and family data of patients, as well as those inherent to treatment.

Questionnaire 2 (*Appendix*) addressed the socioeconomic issues based on the Brazil Economic Classification, a criterion adopted by the Brazilian Association of Research Companies (Associação Brasileira de Empresas de Pesquisa [Abep]),<sup>5</sup> which assesses the purchasing power of the population and the degree of education of the head of the family, stratifying the population at the following levels: A1, A2, B1, B2, C1, C2, D, and E. Both forms were pre-tested in five patients, attempting to solve possible execution and reproducibility issues.

The study included 20 patients, from an initial population of 24 patients, who met the inclusion criteria in the study period. Two patients died due to causes unrelated to the initial diagnosis, one continued treatment in the Supplementary Health System, and one did not sign the Informed Consent Form.

## Results

Patient's sociodemographic and family data are shown in *Table 1*.

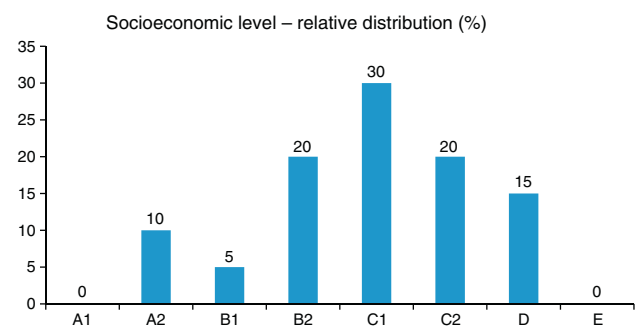
*Fig. 1* stands for patient distribution according to socioeconomic level.

The mean number of days on antibiotic therapy, whether intravenous or oral, was 266 days (30–376).

The mean cost of patients to the public system, considering the entire hospitalization period, surgical material, and medication, including home treatment, was R\$ 55,821.62 (R\$ 3,472 to R\$ 109,456) per patient. The total cost of treatment of patients in the study was R\$ 1,116,432.40.

**Table 1 – Patients sociodemographic and family aspects.**

Gender	Male 40%	Female 60%		
Age	Productive (30–55 years) 45%	Nonproductive (<30 years) 5%	Elderly (over 60 years) 50%	
Marital status	Single 20%	Married and similar 45%	Widowed 20%	Divorced 15%
Place of birth	SP – capital 50%	Greater SP 20%	SP – countryside 25%	Others 5%
Social Security	Social Security Beneficiaries 85%	Non-social security beneficiaries 15%		
Religion	Catholics 55%	Evangelicals 30%	Without religion 10%	Buddhists 5%
Education	College or University Degree 15%	Elementary 55%	High School 25%	Never attended school. 5%
Social security situation	Retired 70%	Sickness aid 10%	Pensioner 10%	Did not receive social security aid 10%
Housing	Own 70%	Rented 10%	Assigned 20%	
Quality of the housing	Adequate 100%	Inadequate 0%		
Family support	Extended family 90%	Caregiver 10%		
Initial diagnosis	Primary osteoarthritis 10%	Secondary 90%		
Patient's origin	This hospital 60%	Other medical services 40%		
Date of diagnosis	Up to 4 weeks 35%	1–6 months 15%	6 m to 2 years 30%	Over 2 years 20%
Number of surgeries required	Single (debridement) 40%	Two (spacer and revision) 30%	>2 (spacer change and revision) 30%	
Length of hospital stay	Up to 2 weeks 50%	2–4 weeks 25%	>4 weeks 25%	



**Fig. 1 – Patient distribution according to socioeconomic level.**

**Discussion**

Prosthetic infection is one of the most serious of complications, with severe consequences for patients, since it results in new surgical interventions, prolonged hospital stays, and the need for long-term antibiotic therapy.<sup>6</sup> Moreover, revisions

of infected arthroplasties are costly to healthcare and social security systems.

The initial diagnosis of infected patients treated at the medical service, primary osteoarthritis in 10% and osteoarthritis secondary to another previous pathology in 90%, is probably due to the profile of patients referred to this reference service; it might also be due to the age distribution of the Brazilian population, notably younger than that of other countries, which justifies a higher prevalence of secondary osteoarthritis.

Of the patients, 40% were male and 60% female. According to Bozig et al.,<sup>7</sup> white women aged between 70 and 74 years with comorbidities such as alcoholism, depression, cardiopulmonary disease, and peripheral vascular insufficiency are more prone to periprosthetic infection. However, according to Poultsides et al.,<sup>8</sup> comorbidity-associated infection may also be observed male patients with the same probability.

The time lapsed to the diagnosis ranged from up to four weeks in 35% of patients, one to six months in 15%, six months to two years in 30%, and over two years in 20%. The importance of early diagnosis, provided the infection is not late hematogenous, is noteworthy. Early diagnosis is paramount in acute

**Table 2 – Mean cost of hospitalization according to region.**

Present study (BR)	US\$ 23,857
Europe	US\$ 40,485
United States	US\$ 11,494
United Kingdom	US\$ 36,728

cases, in which a simple debridement surgery might save the original implant and cause less harm to the patient, in addition to a lower social cost. The authors therefore emphasize the importance of initial outpatient follow-up consultations, which should always be conducted under the supervision of a physician experienced in the matter.

In a study of the Department of Orthopedic Surgery, University of North Carolina (United States), Clement et al.<sup>9</sup> reported mean costs of \$ 11,494 in the treatment of patients readmitted with a diagnosis of periprosthetic infection. Vanhegan et al.,<sup>10</sup> in a study performed at the orthopedic department of the University of London, observed a mean cost of £ 21,937 in the treatment of this complication. Data from the University of Rostock, Germany, in a study by Haenle et al.,<sup>11</sup> showed a mean cost of € 29,331 for the treatment of an infected arthroplasty vs. € 6265 for primary arthroplasty. Other studies also show that this cost is greatly increased when the etiological agent responsible for the infection is a multiresistant microorganism; according to Filice et al., these costs can double in the case of an infection caused by a multisensitive bacterium.<sup>12</sup>

Table 2 stands for the mean cost of arthroplasties in the aforementioned places.

Despite the variations observed, due to tax differences (leading to different costs of medication and implants) as well as from the unequal healthcare systems, it is noted that even the lowest observed value was significant, especially when considering this data collectively in the whole country.

In addition to expenses with hospital services and materials, it is important to emphasize the deficit in the social security system. In most cases, it is caused by disability retirement due to illness and the prolonged period of hospitalization. In the present study, 90% of the patients were insured by the social security system, of whom 45% were of working-age, which demonstrates the serious consequences of arthroplasty infection for this system.

Another serious socioeconomic problem found in this study was the origin of the patients: 40% were referred from other medical services, which may be associated with a lack of adequate distribution of hospitals capable of treating high complexity cases, that require adequate equipment for surgical procedures, experienced surgeons, hospital infrastructure, and drug availability. The problem of the centralization of high complexity services remains a challenge to be solved in Brazil, a country of continental dimensions.

In the present study, the causes or risk factors for periprosthetic infection were not studied, but a large part of the population was stratified into socioeconomic classes B2,

C1, and C2, according to the Abep Classification (2007).<sup>5</sup> These social classes have lower purchasing power, which may be related to some of the main risk factors associated with periprosthetic infections found in other studies, such as malnutrition, preoperative anemia, and hydroelectrolytic disorders.<sup>13</sup>

Of the patients included in the present study, 15% had a college or university degree, 55% elementary school degree, 25% high school degree, and 5% never attended school, which identifies the patients of this sample as having low purchasing power and low schooling, as indicated by Ong et al.<sup>14</sup> in their work on the correlation between periprosthetic infection and the socioeconomic status of patients.

## Conclusion

Infected total hip arthroplasty is a postoperative complication the treatment of which generates great expense to the social security and public healthcare systems, because it frequently involves relatively young patients of working-age. Therefore, in order to avoid the issue, the possible risk factors and the quality of perioperative care should always be taken into account.

## Conflicts of interest

The authors declare no conflicts of interest.

## Appendix.

### Questionnaire 1 – Patients social and family data

- Identification: name, age, gender, religion, schooling, marital status, and place of origin.
- Social security situation: association and social security benefit.
- Housing: area, property, type of housing, number of rooms, number of inhabitants, sanitation, selective garbage collection, drinking water, and healthcare service near the residence. A satisfactory housing was defined as one with at least two rooms, with sanitation, and garbage and sewage collection, as well as a private bathroom, all of these factors concomitant with the presence of an accessible healthcare service near the residence.
- Family support: family dynamics during treatment and homecare. The concept of an extended family denotes a unit beyond parents and children formed by close relatives with affective ties and able to give support to the patient.
- Hospitalization: initial diagnosis, date, number of surgeries, period of hospitalization for antibiotic use, cost of treatment (retrieved from the Hospital Planning and Management Unit data).

Questionnaire 2 – Socioeconomic level (questionnaire to obtain the Brazilian Economic Classification data – new Abep – 2008).

#### Ownership of certain items

Items	Does not own	1	2	3	4
Color TVs	0	1	2	3	4
VCR/DVD player	0	2	2	2	2
Radios	0	1	2	3	4
Bathrooms	0	4	5	6	7
Vehicles	0	4	7	9	9
Monthly-paid housemaids	0	3	4	4	4
Washing machine	0	2	2	2	2
Refrigerator	0	4	4	4	4
Freezer <sup>a</sup>	0	2	2	2	2

<sup>a</sup> Independent appliance or a 2nd door on the refrigerator.

#### Level of schooling of head of the household

Old nomenclature	Points	Current nomenclature
Illiterate/incomplete elementary school	0	Illiterate/up to 3rd year of elementary school
Complete elementary school	01	4th grade elementary school
Complete high school	02	Complete elementary school
Complete high school	04	Complete high school
College or University Degree	08	College or University Degree

Classes	Score
A1	42 to 46 points
A2	35 to 41 points
B1	29 to 34 points
B2	23 to 28 points
C1	18 to 22 points
C2	14 to 17 points
D	8 to 13 points
E	0 to 7 points

Minimum score: 0

Maximum score: 46

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