Rev Col Med Fis Rehab 2024;34(2):e443 - Julio - Diciembre de 2024 - http://revistacmfr.org
http://doi.org/10.28957/rcmfr.443

Asociación Colombiana de Medicina Física y Rehabilitación

Original

Sociodemographic and clinical characteristics and barriers of the health system in amputated patients with or without prostheses

Características sociodemográficas, clínicas y barreras del sistema de salud en pacientes amputados con o sin prótesis

Leandro Guillermo Realpe Cisneros[1], Jesús Alberto Plata Contreras[2], Luz Helena Lugo-Agudelo[3], Valeria Osorno Arroyave[4], Juan Carlos Velásquez Correa[5]

[1] Resident in Physiatry and Researcher of the Health Rehabilitation Group – Faculty of Medicine, Universidad de Antioquia, Medellín, Colombia.
[2] Master Degree in Clinical Sciences, Professor and Researcher of the Health Rehabilitation Group – Faculty of Medicine, Universidad de Antioquia, Medellín, Colombia.
[3] Master Degree in Clinical Epidemiology, Professor and Researcher of the Health Rehabilitation Group – Faculty of Medicine, Universidad de Antioquia, Medellín - Colombia.
[4] Student of Management in Health Information Systems, Colombia.
[5] Specialist in Statistics – Universidad Nacional de Colombia, Manager in Health Information Systems, Specialist in Statistics. Health Rehabilitation Group; Faculty of Medicine, Universidad de Antioquia, Medellín, Colombia.

Abstract

Introduction and Objective: Globally, only 5%-15% of those in need of assistive devices can access them. We identified the sociodemographic and clinical characteristics, as well as the barriers within the Colombian Health System for patients with lower limb amputation.
Methods: A 24-month longitudinal follow-up was conducted with 122 patients divided into two groups: those who received prostheses and those who did not. Of the initial 201 patients, 36 could not be contacted, and 43 passed away. Evaluations were performed at three intervals: 3-6 months, 6-12 months, and 12-24 months.
Results: 61.4% received prostheses; among those amputated due to trauma, this percentage was 90.4%. Prosthesis delivery gradually increased after 12 months. The average time from amputation to receiving the prosthesis was 425 days (IQR [297, 502]). Medical etiology accounted for 82.8% in both groups, with transfemoral level predominance (62.3%). The main barriers to prosthetic provision were availability of medical appointments, delays in authorizations by EPS, lack of economic resources for transportation, and distance to rehabilitation centers.
Conclusion: Barriers prolonging or, in some cases, preventing prosthesis delivery were identified. These include scarcity of medical appointments, authorization delays, and economic and geographical limitations.
Keywords. Amputation, lower limb prosthesis, Barriers to accessing healthcare services.

Resumen

Introducción y objetivo: A nivel mundial, solo el 5%-15% de quienes necesitan dispositivos de apoyo, pueden acceder a ellos. Se identifico las características sociodemográficas, clínicas y las barreras del Sistema de Salud de Colombia en pacientes con amputación de miembro inferior.

How to cite. Realpe Cisneros LG, Plata Contreras JA, Lugo-Agudelo LH, Osorno Arroyave V, Velásquez Correa JC. Sociodemographic and clinical characteristics and barriers of the health system in amputated patients with or without prostheses. Rev Col Med Fis Rehab. 2024;34(2), e443. http://doi.org/10.28957/rcmfr.443.

Corresponding author. Jesús Sánchez Lozano. Correo electrónico: jesus-dbz@hotmail.com
Received. 05.05.24. **Accepted.** 02.09.24. **Published.** 11.10.24.
ISSN impreso. 0121-0041. **ISSN electrónico.** 2256-5655.

Métodos: Se llevó a cabo un seguimiento longitudinal de 24 meses con 122 pacientes divididos en dos grupos: los que recibieron prótesis y los que no. De los 201 pacientes iniciales, 36 no se pudieron contactar y 43 fallecieron. Las evaluaciones se realizaron en tres intervalos: 3-6 meses, 6-12 meses y 12-24 meses.
Resultados: El 61.4% recibió prótesis; los amputados por trauma, este porcentaje fue del 90.4%. La entrega de prótesis aumentó gradualmente después de los 12 meses. El tiempo medio desde la amputación hasta la recepción de la prótesis fue de 425 días (RIQ [297, 502]). La etiología médica representó el 82.8% en ambos grupos, predomino el nivel transfemoral (62.3%). Las principales barreras para la protetización fueron la disponibilidad de citas médicas, demoras en autorizaciones por parte de las EPS, falta de recursos económicos para transporte y la distancia a centros de rehabilitación
Conclusión: Se identificaron barreras que prolongan la entrega de prótesis o, en algunos casos, la impiden. Entre estas, destacan la escasez de citas médicas, demoras en autorizaciones y limitaciones económicas y geográficas.
Palabras claves: Amputación, prótesis de miembro inferior, Barreras de Acceso a los Servicios de Salud.

Introduction

Worldwide, only between 5% and 15% of people who need assistive devices, such as prostheses and orthoses, have the possibility of obtaining them.[1] This disparity in access can be attributed to various factors, including the shortage of specialized personnel and the lack of effective rehabilitation policies. This problem is especially aggravated in low- and middle-income countries, where resources are limited and rarely allocated to rehabilitation services or to the provision of prosthetic devices.[2]

In nations affected by armed conflict, with deteriorated health systems and a decrease in the prioritization of rehabilitation services, the statistics are even more worrying. A study conducted by the International Committee of the Red Cross in five countries in protracted conflict or post-conflict (Afghanistan, Cambodia, Iraq, Myanmar, Sudan) between 2009 and 2018 revealed a total of 28,446 new amputations. The majority of these amputations were traumatic (20,890, 73.4%), and almost half (13,801, 48.6%) were conflict-related. The average age for men and women who underwent traumatic amputations was 26.9 and 24.1 years, respectively; while for non-traumatic amputations it was 49.1 and 45.9 years, respectively.[3]

In the specific case of Colombia, figures similar to those mentioned were observed between the years 2011 and 2014. During this period, 3,229 hospital admissions were registered in the Military Hospital of Bogota, which included both the civilian population and the military.[4]

In contrast, in developed countries without conflicts, the causes of amputations show differences. In the United States, diabetes mellitus and peripheral artery disease (PAD) are the main etiologies of lower limb amputations. Similarly, in Canada, PAD and diabetes account for more than 80% of lower limb amputations.[5]

Individuals who have experienced amputations face barriers to accessing programs of rehabilitation and prosthetic adaptation.[7] These barriers may be related to the lack of knowledge by the health professionals, the process of medical care by their health system and patient characteristics, such as the presence of comorbidities, lack of personal motivation and the absence of support from their families.[6,7] The complexity of these barriers, along with others not yet identified, generates a challenging landscape for those seeking to restore functionality, reintegrate back into daily activities, and participate fully in social life.

The objective of this study was to compare the sociodemographic and clinical characteristics and the barriers of the General Health and Social Security System in Colombia between those patients over 16 years of age with lower limb amputation due to traumatic and vascular causes, or diabetes mellitus who received prostheses and those with did not in the department of Antioquia between the years 2017 and 2022.

Methodology and population

It was a follow-up study of a cohort of lower limb amputated patients from five high-complexity institutions in Medellín (Colombia), between 2016 and 2022, with follow-up for 24 months since the amputation. Each institution was contacted and the

project was presented to them. After approval, each institution was asked to provide a list of patients who were amputated between 2016 and 2022. The lists were reviewed by physiatrists to verify the inclusion criteria. Data were taken from the medical records of the eligible patients and they received a telephone call in which the study was explained to them and they were asked if they agreed to participate in the research.

The number of patients included were those who were invited to participate in the project "Effectiveness of a strategy based on Telehealth to improve the implementation of the Clinical Practice Guide for the diagnosis and preoperative, intraoperative and postoperative treatment of the amputee, the prescription of prosthesis and comprehensive rehabilitation in health institutions in Antioquia: a randomized intervention study by hospital clusters", which was financed by the Ministry of Science, Technology and Innovation - Minciencias code 111577757229, contract 738-2017 of call 777 of 2017.

The inclusion criteria were amputation of the lower limb due to diabetes mellitus, traumatic or vascular causes in selected institutions. The exclusion criteria were patients who had undergone amputation for causes not contemplated in the target population of the Clinical Practice Guide for the Preoperative, Intraoperative and Postoperative Diagnosis and Treatment of the Amputee, the Prescription of the Prosthesis and Comprehensive Rehabilitation (GPCAMP),8 such as oncological and congenital amputations. Patients under 16 years of age and those who died during follow-up or were lost from contact were excluded.

201 patients were identified, 36 could not be contacted, 5 of them due to lack of response and 31 because contact numbers were out of service. 43 patients passed away. This resulted in a total of 122 individuals who completed the 24-month longitudinal follow-up. During this period, three follow-up intervals were established: 3 to 6 months, 6 to 12 months, and 12 to 24 months.

The cohort of patients we followed was divided into two groups: those who did not receive a prosthesis and those who received it. Data collection was done using a previously designed form that contained sociodemographic information, Data on access to a rehabilitation program and delivery of prostheses for lower limb amputees were obtained in accordance with the recommendations of GPCAMP.8 In addition, the barriers that limit the delivery of prostheses were identified, using the same classification made by Patiño Lugo, which includes aspects related to the patient, the health professionals and the Colombian health system that influence such access.[6]

Statistical analysis

A descriptive analysis was carried out for each group, which allowed us to describe the population considering the following variables: sociodemographic, clinical, and of prescription and delivery of the prostheses, as well of the barriers to accessing the prosthesis and comprehensive rehabilitation. Qualitative variables were analyzed using absolute and relative frequencies; for the analysis of quantitative variables, it was calculated whether these variables followed a normal distribution and, if this was the case, the mean and standard deviation (SD) were reported; for those without a normal distribution, the median and interquartile range (IQR) were provided.

Three Kaplan-Meier graphs were developed to visualize and quantify the time span in which patients have the opportunity to receive the prosthesis after amputation, the moment in which the prosthesis is prescribed to them after amputation, and finally, the period in which the prosthesis is actually delivered to them after prescription.

For the rehabilitation analysis, the number of appointments per each professional and the number of sessions attended were considered; these activities were described in each period between 0 and 12 months and the second measurement was more than 12 months. For the prescription and delivery of the prostheses, measurements at 0 and 6 months, 6 to 12 months and 12 to 24 months were made.

A univariate logistic regression analysis was performed to identify the factors associated with the receipt of prostheses during the study period. The dependent variable was whether or not the patient

received the prosthesis. The Odds Ratio (OR), which indicated the probability and opportunity of delivery of the prosthesis according to each of the independent variables was taken into account for the interpretation of the data. The estimation of 95% confidence intervals (95%CI) was also considered in the analysis. All statistical analyses were performed using the R software.

The project was approved by the Ethics Committee of the Institute of Medical Research of the Faculty of Medicine of the Universidad de Antioquia, with minutes number 008 of May 18, 2017. In addition, the project was approved by the Ethics Committee of each of the participating institutions and each patient agreed to participate in the research.

Results

122 patients were admitted, in the population to whom the prosthesis was delivered, 70.7% of the participants were men and in the population that did not receive the prosthesis the percentage was 55.3%. In terms of level of education, only 13.1% had higher education, 36.9% had up to elementary school and 23.8% were illiterate. When comparing the groups according to the educational level, in the group that received the prosthesis, 24% of the patients completed high school, while in the group that did not receive it, this percentage was 8.5%. The other educational levels show a similar distribution. See Table 1.

With respect to socioeconomic status, 90.2% belong to a low or medium socioeconomic level according to the classification of the strata in Colombia.[9] In terms of employment, 54.9% continue working after the amputation. A higher percentage of employment was observed in the group that received the prosthesis compared to those who did not receive it, 64% vs. 40.4%. Only (4.1%) of the total population receives a pension and 14.8% do not work or are not pensioned (Table 1).

Table 1. Sociodemographic characteristics of a cohort of amputated patients in Medellín and the metropolitan area between 2019-2020.

Characteristics	Categories	Prosthesis delivery		
		Yes n:75	No n:47	Total n:122
Sex	Man	53 (70.7%)	26 (55.3%)	79 (64.8%)
	Woman	22 (29.3%)	21 (44.7%)	43 (35.2%)
Age*		58.3 (15.9)	71.4 (15.2)	63.3 (16.8)
Stratum	Low and middle	64 (85.3%)	46 (97.9%)	110 (90.2%)
	High	11 (14.7%)	1 (2.1%)	12 (9.8%)
Schooling	Elementary	26 (34.7%)	19 (40.4%)	45 (36.9%)
	High School	18 (24.0%)	4 (8.5%)	22 (18.0%)
	Higher education	11 (14.7%)	5 (10.6%)	16 (13.1%)
	Without any level of education	13 (17.3%)	16 (34.0%)	29 (23.8%)
	No information	7 (9.3%)	3 (6.4%)	10 (8.2%)
Regime	Contributory	36 (48.0%)	21 (44.7%)	57 (46.7%)
	Subsidized	35 (46.7%)	25 (53.2%)	60 (49.2%)
	Special	4 (5.3%)	1 (2.1%)	5 (4.1%)
Occupation	Housewife	15 (20.0%)	17 (36.2%)	32 (26.2%)
	Laid off or not working	9 (12.0%)	9 (19.1%)	18 (14.8%)
	Pensioner	3 (4.0%)	2 (4.3%)	5 (4.1%)
	Works	48 (64.0%)	19 (40.4%)	67 (54.9%)

*Age: calculation of the mean (standard deviation); People belonging to the rural sector were entered into the middle and low strata.

Rev Col Med Fis Rehab 2024-34(1):e443 - Julio - Diciembre de 2024 http://revistacmfr.org
http://doi.org/10.28957/rcmfr.443

Of the amputations due to traumatic causes, 90.4% received prostheses. The transfemoral amputation level predominated (62.3%) and was higher in those who did not receive the prosthesis (78.7%). However, in the group of those to whom the prosthesis was delivered, transtibial and transfemoral amputations had a similar distribution 46.7% vs. 52%. In relation to the ability to ambulate prior to amputation, in the group that received the prosthesis, 77.3% of the patients could walk outside the house, in those who did not receive the prosthesis, a higher percentage of patients was observed who could only move inside the house (29.8% vs 13.3%) or make transfers (21.3% vs 9.35%).

In both groups, the medical cause represented the main cause in 82.8% of the cases. In the group that did not receive the prosthesis, this cause was predominant (95.7%), while in the group that did receive it, it was 74.7%. See table 2.

Table 2. Clinical characteristics of the amputee patients in a cohort of Medellin and the metropolitan area between the years 2019 and 2020.

Characteristics	Categories	Delivery of prostheses		
		Yes n:75	No n:47	Total n:122
Etiology	Traumatic	19 (25.3%)	2 (4.3%)	21 (17.2%)
	Medical	56 (74.7%)	45 (95.7%)	101 (82.8%)
Medical etiology	Neurovascular	25 (33.3%)	30 (63.8%)	55 (45.1%)
	Neurovascular and infection	18 (24.0%)	12 (25.5%)	30 (24.6%)
	Infection	13 (17.3%)	3 (6.4%)	16 (13.1%)
Traumatic etiology	Trauma and infection	2 (2.7%)	1 (2.1%)	3 (2.5%)
	Traffic accident	9 (12.0%)	1 (2.1%)	10 (8.2%)
	Aggression	1 (1.3%)	-	1 (0.8%)
	Occupational accident	1 (1.3%)	-	1 (0.8%)
	Anti-personnel mine	2 (2.7%)	-	2 (1.6%)
	Other traumatic cause	4 (5.3%)	-	4 (3.3%)
Current amputation level	Transtibial	35 (46.7%)	9 (19.1%)	44 (36.1%)
	Transfemoral	39 (52.0%)	37 (78.7%)	76 (62.3%)
	Hip disarticulation	1 (1.3%)	1 (2.1%)	2 (1.6%)
Ambulation*	In bed	-	1 (2.1%)	1 (0.8%)
	Only transfers	7 (9.3%)	10 (21.3%)	17 (13.9%)
	Ambulates within the house	10 (13.3%)	14 (29.8%)	24 (19.7%)
	Ambulates outside the house	58 (77.3%)	22 (46.8%)	80 (65.6%)

*Ambulation: indicates ambulation prior the study.

In relation to the prescription of prostheses, the prosthesis was prescribed to 63.9% of the patients. With respect to delivery, in the two-year follow-up, the prosthesis was given to 61.5% of the total amputee population studied. As follow-up continued over the months, a progressive increase in the percentage of people who received prostheses was observed. The follow-up of 6 to 12 months and more than 12 months were the time intervals with the highest delivery of the prosthesis, 18.9% and 38.5% respectively.

As for the access to comprehensive rehabilitation, it was observed that those who were given a prosthesis attended physical therapy more frequently before twelve months compared to those who did not receive the prosthesis (48% vs. 21.3%). This trend was maintained at twenty-four months, with 34.7% versus 10.6%, respectively (see Table 3).

Before twelve months, 41.3% of the patients who were given the prosthesis attended physiatry

vs. 19.1% who did not receive it, despite the fact that the order for the appointment had been delivered in a higher percentage in both groups (73.3% vs. 53.2%).

Accessibility to services such as occupational therapy, psychology and cardiopulmonary rehabilitation at 24 months was very low among those who were and were not given the prosthesis was very low. (Table 3).

Table 3. Description of the comprehensive rehabilitation appointments for amputee patients at 3, 6 and more than 12 months.

Rehabilitation	Categories	Rehabilitation Activities			
		0-12 months		More than 12 months	
		Prosthesis delivery	No-prosthesis delivery	Prosthesis delivery	No-prosthesis delivery
Physical therapy	Attended	36 (48.0%)	10 (21.3%)	26 (34.7%)	5 (10.6%)
	Prescription	56 (74.7%)	30 (63.8%)	14 (18.7%)	5 (10.6%)
	Number of sessions*	15.5 (11.5)	15.0 (9.96)	21.5 (11.5)	16.4 (9.01)
Physiatry	Attended	31 (41.3%)	9 (19.1%)	40 (53.3%)	7 (14.9%)
	Prescription	55 (73.3%)	25 (53.2%)	18 (24.0%)	5 (10.6%)
	Number of sessions*	1.93 (1.16)	1.39 (0.608)	3.32 (2.48)	2.00 (0.943)
Occupational therapy	Attended	3 (4.0%)	1 (2.1%)	11 (14.7%)	1 (2.1%)
	Prescription	21 (28.0%)	7 (14.9%)	7 (9.3%)	1 (2.1%)
	Number of sessions*	9.67 (11.0)	8.67 (2.31)	7.69 (4.84)	-
Psychology	Attended	6 (8.0%)	2 (4.3%)	14 (18.7%)	2 (4.3%)
	Prescription	19 (25.3%)	8 (17.0%)	20 (26.7%)	4 (8.5%)
	Number of sessions*	3.40 (3.18)	3.00 (1.26)	3.20 (1.47)	3.00 (1.41)
Cardiopulmonary rehabilitation	Attended	-	-	3 (4.0%)	2 (4.3%)
	Prescription	7 (9.3%)	2 (4.3%)	6 (8.0%)	2 (4.3%)
	Number of sessions*	-	5.50 (6.36)	35.0 (21.2)	-

*Number of sessions: calculation of the mean (standard deviation)

The mean time since the amputation until the delivery of the prosthesis in the entire population was 425 days, with an interquartile range (IQR) of [297, 502]. Regarding the period of time between the amputation and prescription of the prosthesis, the average was 264 days, with an IQR of [134, 361]. Finally, the time elapsed in days from the prescription of the prostheses to its delivery was 153 days, with an IQR of [100, 189]. No significant differences were observed when comparing groups with traumatic amputation and due to medical causes. (Table 4)

Table 4. Characteristics of the timing of prescription and receipt of the prosthesis from the moment of amputation in the amputee patients. In addition to the days of hospital stay.

Prostheses (N:122)	Traumatic cause	Medical cause	Total
	Median [Q1 , Q3]	Median [Q1 , Q3]	Median [Q1 , Q3]
Time in days for prescription of the prosthesis since the amputation	291 [116, 384]	252 [162, 352]	264 [134, 361]
Time in days to receive the prosthesis since the amputation	430 [270, 507]	420 [297, 500]	425 [297, 502]
Time in days between the prescription and receipt of the prosthesis	151 [123, 183]	153 [95.8, 192]	153 [100, 189]

Rev Col Med Fis Rehab 2024-34(1):e443 - Julio - Diciembre de 2024 http://revistacmfr.org
http://doi.org/10.28957/rcmfr.443

92.5% of the prostheses were prescribed in the first 500 days IQR [134, 361], after amputation. 90% of patients obtained a prosthesis within 600 days after the amputation, 50% received one within the first 425 days IQR [297, 502]. Only 5% of participants acquired a prosthesis in the first 180 days, the period recommended by the GPCAMP. (Figure 1).

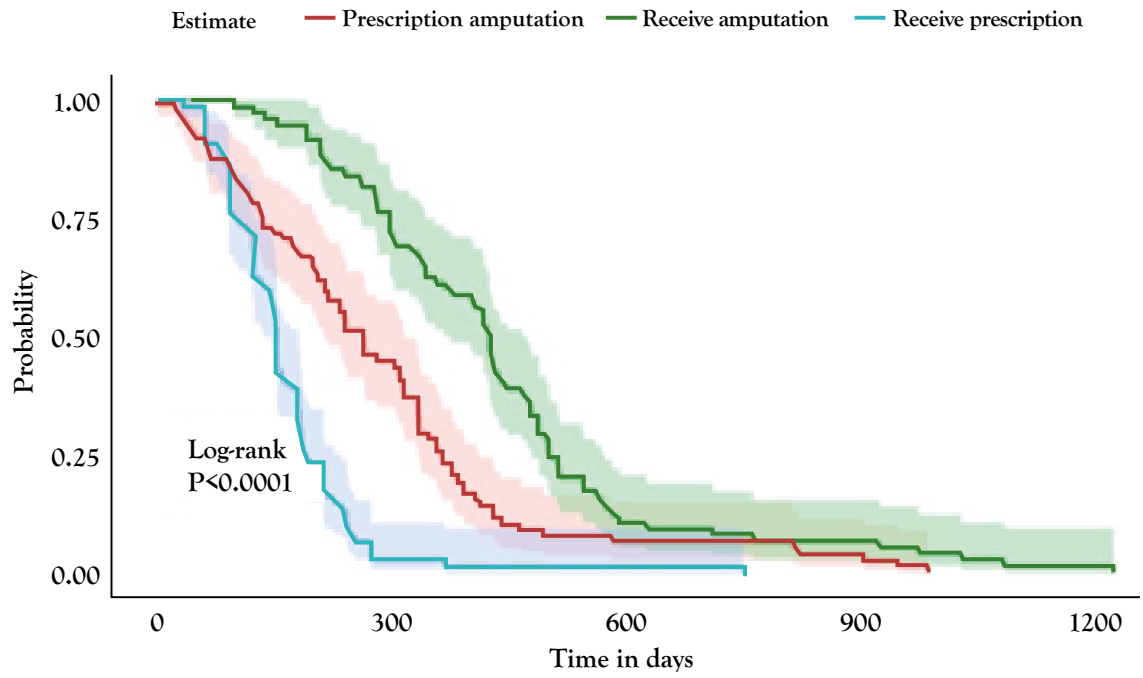

Figure 1. Survival graph to analyze the time to prescription and reception of prosthesis
Prescription-amputation, probability in days since the amputation to prescribe the prosthesis; Receive amputation, probability in days since the amputation to receive the prosthesis
Receipt-prescription, probability in days to receive the prosthesis since the prescription.

For access to rehabilitation, various barriers have been identified in the entire population that completed the two-year follow-up. Among the barriers of the health system, two stand out: the limited availability of medical appointments (21.3%) for the participants, and the delays in authorizations by the health-providing entities (EPS), in 19.6 %. In addition, two patient-related barriers are the lack of resources for transportation to the rehabilitation center and the distance from their homes to the rehabilitation site in 18%. See Figure 2.

For the prescription of prostheses, barriers in the health system were identified, such as: limited availability of medical appointments (30.7%), and delays in authorizations by the EPS, (33.3%). As for the patient's barriers, the lack of resources for transportation to the center where the prostheses are delivered (30.8%) and the distance from the patient's home to the rehabilitation site were evidenced (21,8%) (Figure 2).

Additional health problems, such as a new amputation, strokes or ulcers in the contralateral limb are observed, among others. These problems explain 10.26% of the barriers to the delivery of prostheses.

The univariate logistic regression model (Table 5) applied in the study indicates that age over 60 years is related to an Odds Ratio (OR) of 4.71 (95% CI: 2.10-11.29, $p < 0.001$) for non-delivery of the prosthesis, a similar situation being observed in patients who undergo amputations of medical origin, with an OR of 7.63 (95% CI: 2.7-49.52, $p = 0.008$).

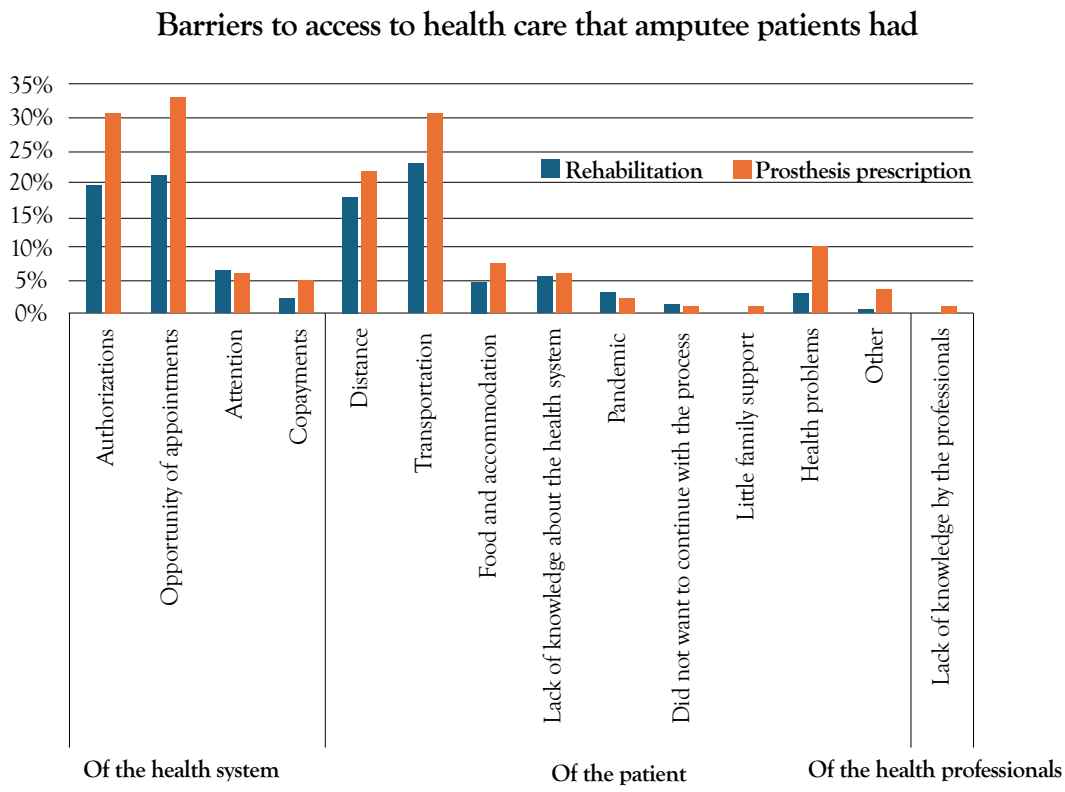

Figure 2. Barriers to access to health care that amputee patients had

Table 5. Univariate logistic regression model to evaluate the association between patient characteristics and not receiving the prosthesis.

Characteristic of the patient	Category	OR (95% CI)	p-value
Age group	Less than 60 years	Referent	-
	More than 60 years	4.71(2.10 – 11.29)	<0.001
Etiology	Traumatic	Referent	-
	Medical	7.63(2.07 – 49.52)	0.008
Sex	Woman	Referent	-
	Man	0.51(0.24 – 1.10)	0.086
Regime	Contributory	Referent	-
	Subsidized	1.22(0.58 – 2.59)	0.594
	Special	0.43(0.02 – 3.14)	0.462

OR, Odds Ratio; CI, confidence interval.

Discussion

In this study it was observed that, of the total population, 61.4% received prostheses, in the group of traumatic amputations 90.4% received prostheses. The delivery of prostheses gradually increased during follow-up, mainly after 12 months. The mean time since the amputation until the receipt of the prosthesis was 425 days IQR [297, 502], and from the prescription, 153 days IQR [100, 189]. The medical etiology represented 82.8% in both groups, the transfemoral level predominated in 62.3% of the population. It was identified that the main barriers to prosthetization were the availability of medical appointments, delays in authorizations by the EPS, economic resources for transportation and distance to the rehabilitation centers. Although the

pandemic had a slight impact, the lack of knowledge of the health system and additional health problems also had an effect. In addition, the scarce family support was also a contributing factor for the non-delivery of the prosthesis.

The mean age at amputation was 63.3 years, with a higher proportion of men (64.8%). This contrasts with the study conducted by Gustav Jarl in Sweden, where the mean age of amputation was 77.9 years and the percentage of men was 54.4%.9 In addition, 49.2% of the participants were affiliated to a government social security program (Subsidized). This result is partially consistent with the research of Misty D. Humphries *et al.*, who observed that in a similar population, but with a higher percentage, 69% of cases were covered by a state health insurance in the United States.[10]

The causes of amputation experienced a change compared to a Colombian study that analyzed a sample collected between 2007 and 2017.4 In that study, the main etiology was of traumatic origin in 57.8%, while in this study the medical etiology prevailed in 82.8%. This discrepancy is possibly explained by a growing trend in the incidence of pathologies such as diabetes and vascular disease worldwide and in Colombia.[11] The data obtained in this research regarding the etiology of the amputation are more closely related to statistics found in developed countries such as Canada, where it was observed that the medical cause of amputation accounted for 91%.

Variations were also observed in the level of amputation. While Matamoros4 described the level below the knee as the most frequent, the transfemoral level predominated in this cohort (62.3%). These results reflect similarities with developed countries such as the US.[12,5]

The time between the amputation and the receipt of the prothesis was 425 days, IQR [297, 502], exceeding the recommendations of the GPCAMP.(8) Compared to a study conducted in Madrid, Spain, where the average wait time was 155.4 days,[13] we noticed a significant disparity. As for the delivery of the prosthesis, we reached 23% in the first year after the amputation and 63.9%a after two years, in contrast to the 43.7% in the first year reported by Moreno Palacios.[14] These results show the long times that patients must wait in Colombia and the low percentage of prosthetization exceeding the mean suggested in the scientific literature and what has been seen in developed countries.

Various barriers that hinder access to rehabilitation and the delivery of prostheses were identified.[15] Following the classification proposed by Patiño Lugo6 we observed that the barriers of the health system and those of the patient are the most frequent, both in rehabilitation and in the delivery of the prosthesis.

Regarding the barriers of the health system, patients mainly pointed to a low availability of medical appointments and delays in authorizations by the EPS.[15] This problem was also identified in a qualitative study conducted in Colombia and published in 2020, in which it was shown that the opportunity for care can be affected by the institutions that provide the health service.[6]

In relation to the barriers faced by the patients, we mainly observed the difficulty that some experience due to the lack of resources for transportation to rehabilitation centers, as well as the considerable distance between their homes and these centers. This situation is similar to that found in a population in South Africa,[16] where similar environmental barriers were reported, including long distances to rehabilitation centers and scarcity of economic resources for transportation.

Among the less frequent but relevant barriers, the lack of knowledge of the national health system, additional health problems and little family support in accessing rehabilitation stand out, with similarities in various studies.[16-19] Only one patient mentioned a lack of knowledge about rehabilitation by health professionals, in stark contrast to the lack of access to health services due to lack of trained personnel, as observed in a study in Zambia, Malawi and Kenya.[17]

The barriers identified in this study contrast with those observed in developed countries. In the Netherlands, for example, amputees receive comprehensive rehabilitation while being institutionalized in a specialized center.[20] Upon discharge, they face challenges different than those found in this study, such as climate and housing

conditions. A scoping review conducted in developing countries in Asia,[21] the barriers are more related to economic, environmental factors, as well as to transportation accessibility. There is also a lack of awareness about the need for rehabilitation[22] and low availability of services due to lack of government support,[23] barriers that are more similar to those found in this study conducted in Colombia, a developing country.

Implications for the health system: It is very important to communicate to government entities the main barriers identified in this study that patients with lower limb amputations face in the Colombian health system. Proposing modifications and prioritizing the care of these patients could radically transform their panorama. It is essential to insist on the comprehensive care of amputees by different professionals and in the same place so that, according to other studies in developed countries,20 the time of rehabilitation, prescription and delivery of prostheses can be reduced, likewise, on all authorization processes and opportunity in the care of the different professionals that would be improved if the interventions were contracted by care packages in institutions of higher complexity that have intervention and monitoring protocols and the development of indicators such as those proposed in the GPC AMP.[8] It is also important to consider in Colombia the out-of-pocket expenses of patients with fewer resources and who live in remote areas. These actions would not only improve access to rehabilitation, but would also contribute to improving the quality of life and well-being of the amputees in Colombia.

Conclusion

Several barriers that contribute to prolonged wait times for delivery of prosthesis or, in some cases, to the absence of this delivery, were identified. Among these barriers, the most frequent include the shortage of available medical appointments, delays in the authorization processes and the economic and geographical limitations of the patients; another of the most important aspects is the fragmentation of care in patients' rehabilitation. It is important to promote comprehensive rehabilitation among decision makers, Health Promotion Companies and Health Provider Institutions, health professionals and families. The foregoing is to have a significant impact on improving access to care and the quality of life of amputees in Colombia.

Authors' contribution

Leandro Realpe: Main author. Responsible for the design of the protocol, collection of information, analysis of results and writing of the manuscript.

Jesús Plata: Advisor on the development of the preliminary project, data collection, analysis of results and review of the article.

Luz Helena Lugo: Methodological advisor, data analysis and review of the article.

Valeria Osorno and Juan Carlos: Responsible for the generation of the database and the statistical analysis.

Funding

The work did not receive funding.

Acknowledgements

Thanks to the Hospital Alma Máter de Antioquia, Hospital Pablo Tobón Uribe, Hospital San Vicente Fundación, Hospital General de Medellín, and Clínica Las Américas Auna for facilitating the development of this project. Without their contribution it would not have been possible to do it.

Conflict of interest

The authors declare that they have no conflict of interest.

BIBLIOGRAPHY

1. OMS. Normas de ortoprostesica [Internet]. Vol. 4. 2017. 57–71 p. Available from: http://marefateadyan.nashriyat.ir/node/150

2. Griffiths B, Diment L, Granat MH. A machine learning classification model for monitoring the daily physical behaviour of lower-limb amputees. Sensors. 2021;21(22):1–14.

3. Barth CA, Wladis A, Blake C, Bhandarkar P, Aebischer Perone S, O'Sullivan C. Retrospective observational study of characteristics of persons with amputations accessing International Committee of the Red Cross (ICRC) rehabilitation centres in five conflict and postconflict countries. BMJ Open. 2021;11(12).

4. Matamoros-Villegas A, Plata-Contreras J, Payares-Álvarez K. Correlation among tests and functional assessment scales in the follow-up of prosthetic adaptation in people with lower limb amputation. Rehabilitacion [Internet]. 2021;(xxxx). Available from: https://doi.org/10.1016/j.rh.2020.11.001

5. Hussain MA, Al-Omran M, Salata K, Sivaswamy A, Forbes TL, Sattar N, *et al.* Population-based secular trends in lower-extremity amputation for diabetes and peripheral artery disease. Cmaj. 2019;191(35):E955–61.

6. Patiño-Lugo DF, Pastor Durango MDP, Lugo-Ag41udelo LH, Posada Borrero AM, Ciro Correa V, Plata Contreras JA, *et al.* Implementation of the clinical practice guideline for individuals with amputations in Colombia: A qualitative study on perceived barriers and facilitators. BMC Health Serv Res. 2020;20(1):1–9.

7. Batten H, Lamont R, Kuys S, McPhail S, Mandrusiak A. What are the barriers and enablers that people with a lower limb amputation experience when walking in the community? Disabil Rehabil [Internet]. 2020;42(24):3481–7. Available from: https://doi.org/10.1080/09638288.2019.1597177

8. Salinas F, Ahunca L, Muñoz D, Vélez D, Sierra J, Lugo L, *et al.* Guía de práctica clínica para el diagnóstico y tratamiento preoperatorio, intraoperatorio y posoperatorio de la persona amputada, la prescripción de la prótesis y la rehabilitación integral [Internet]. Vol. 29, Iatreia. 2016. 82–95 p. Available from: https://aprendeenlinea.udea.edu.co/revistas/index.php/iatreia/article/view/26864/20784853

9. Bogliacino F, Jiménez Lozano L, Reyes D. Socioeconomic stratification and stereotyping: lab-in-the-field evidence from Colombia. Int Rev Econ. 2018;65(1):77–118.

10. Humphries MD, Brunson A, Hedayati N, Romano P, Melnkow J. Amputation Risk in Patients with Diabetes Mellitus and Peripheral Artery Disease Using Statewide Data. Ann Vasc Surg [Internet]. 2016;30:123–31. Available from: http://dx.doi.org/10.1016/j.avsg.2015.04.089

11. Yammine K, Hayek F, Assi C. A meta-analysis of mortality after minor amputation among patients with diabetes and/or peripheral vascular disease. J Vasc Surg [Internet]. 2020;72(6):2197–207. Available from: https://doi.org/10.1016/j.jvs.2020.07.086

12. Nouira S, Ach T, Bellazreg F, Ben Abdelkrim A. Predictive Factors for Lower Limb Amputation in Type 2 Diabetics. Cureus. 2023;15(6).

13. Zamora JM, López de Dicastillo BPM, Nistal MG, Rodríguez NAC, Angulo JDZ, Turégano BM, *et al.* Outcomes and prosthesis procedure of major amputations in patients with peripheral arterial disease in our center. Angiologia. 2022;74(6):278–85.

14. Moreno Palacios JA, Moreno Martínez I, Casallo Cerezo M, Maitín Noguera V, Cid Bassaletti C, Vidal Millet C. Factores relacionados con el éxito en la protetización de amputados de extremidad inferior de etiología vascular. Rehabilitación. 2022;56(3):188–94.

15. Giraldo Castaño L, Pinto Maquilon JK, Lugo-Agudelo LH, Velásquez Correa JC, Pastor M del P, Posada Borrero AM, *et al*. Ruta integral de atención en salud para personas con amputaciones de miembro inferior, para mejorar el funcionamiento y la calidad de vida. Vol. 40, Revista Facultad Nacional de Salud Pública. 2022. e342981 p.

16. Naidoo U, Ennion L. Barriers and facilitators to utilisation of rehabilitation services amongst persons with lower-limb amputations in a rural community in South Africa. Prosthet Orthot Int. 2019;43(1):95–103.

17. Adugna MB, Nabbouh F, Shehata S, Ghahari S. Barriers and facilitators to healthcare access for children with disabilities in low and middle income sub-Saharan African countries: A scoping review. BMC Health Serv Res. 2020;20(1):1–11.

18. Stuckey R, Draganovic P, Ullah MM, Fossey E, Dillon MP. Barriers and facilitators to work participation for persons with lower limb amputations in Bangladesh following prosthetic rehabilitation. Prosthet Orthot Int. 2020;44(5):279–89.

19. Wees T, Pandey M, Nicolay S, Windigo J, Bitternose A, Kopriva D. Identifying barriers to preventive care among First Nations people at risk of lower extremity amputation: a qualitative study. C Open. 2023;11(5):E906–14.

20. Van Twillert S, Stuive I, Geertzen JHB, Postema K, Lettinga AT. Functional performance, participation and autonomy after discharge from prosthetic rehabilitation: Bariers, facilitators and outcomes. J Rehabil Med. 2014;46(9):915–23.

21. Sayeed MSI, Oakman J, Dillon MP, Stuckey R. Influential factors for access to and participation in rehabilitation for people with lower limb amputation in East, South, and Southeast Asian developing countries: a scoping review. Disabil Rehabil [Internet]. 2022;44(25):8094–109. Available from: https://doi.org/10.1080/09638288.2021.1994025

22. Magnusson L. Professionals' perspectives of prosthetic and orthotic services in Tanzania, Malawi, Sierra Leone and Pakistan. Prosthet Orthot Int. 2019;43(5):500–7.

23. Järnhammer A, Andersson B, Wagle PR, Magnusson L. Living as a person using a lower-limb prosthesis in Nepal. Disabil Rehabil [Internet]. 2018;40(12):1426–33. Available from: https://doi.org/10.1080/09638288.2017.1300331