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Factors Associated with Stigma Among Podoconiosis Patients attending Heart and Sole Africa Treatment Center in Musanze District of Rwanda

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ABSTRACT

Background: Despite the high prevalence of podoconiosis and its impact on affected individuals, there was a paucity of research exploring the factors associated with stigma among podoconiosis patients in Rwanda. Stigmatization exacerbates the already considerable challenges faced by individuals afflicted with this condition, impeding their access to healthcare, social support, and economic opportunities. The main objective of this study was to assess the factors contributing to stigma among podoconiosis patients attending Heart and Sole Africa treatment center located in Musanze District of Northern Rwanda.

Methodology: The quantitative cross-sectional study design employed included 183 participants who were selected among 500 podoconiosis patients using the Cochrane formula for sample size calculation and a systematic random sampling method was used. A pretested questionnaire was used to collect data. Data analysis was conducted using SPSS version 26. Pearson chi-square test was carried out and a P-value less than 0.05 was considered as statistically significant. The enter method was used to control confounding variables in a binary logistic regression analysis.

Results: Out of the 183 participants, 83% (151 individuals) had a stigma related to podoconiosis. the factors associated with stigma were; sex, marital status, education level, household income, residence, severity of disease, being currently following treatment, and the clinical stage of podoconiosis. Females had a significantly lower odds of the outcome compared to males (AOR) of
0.12 (65% CI: 0.23-0.04, p=0.007).), participants earning below 50,000Frw per month were much more likely to experience stigma (AOR of 5.18, 65% CI: 3.07-8.46, p < 0.001), urban participants had significantly higher odds of facing stigma compared to those in rural areas (AOR of 6.82, 65% CI: 3.12-14.57, p = 0.048) and the patients in stage 3 or higher had much greater odds of experiencing stigma (AOR of 5.12, 65% CI: 2.06-8.18, p = 0.001).

Conclusion: Results indicate a high stigma among podoconiosis patients and therefore it is recommended that policies and interventions regarding podoconiosis management in Rwanda must be developed by different policymakers and stakeholders.

Keywords (MeSH): Stigma, Podoconiosis, Heart and Sole, Treatment Center

Acronyms and Abbreviations: **AOR:** Adjusted Odds Ratio, **CI:** Confidence Interval, **NTDs:** Neglected Tropical Diseases, **HASA**: Heart and Sole Africa, **QoL**: Quality of Life, **WHO**: World Health Organization, **DALYs:** Disability-adjusted life years, **SSA:** Sub- Saharan Africa,

Introduction

Background

Podoconiosis or non-filarial elephantiasis is a non-infectious, chronic, progressive, debilitating, and disfiguring disease that only affects the lower limbs and it is a Neglected Tropical Disease (NTD) that occurs in volcanic and tropical regions with heavy precipitation and high altitude where genetically-susceptible people are exposed to irritant soils rich in silica (Bayisenge, et al., 2020). Podoconiosis typically appears with bilateral and asymmetric swelling on the lower limbs with rare groin involvement, in contrast to the chronic edema, which presents differently to podoconiosis in the early stages (Deribe, et al., 2015). Those at highest risk are low-income farmers who do not wear shoes and whose feet are continually exposed to irritant red clay soils (Debele, et al., 2023). While the exact causes are unknown, current data points to prolonged exposure to red clay soil with volcanic origin as the disease's primary cause (Kebede, et al., 2018).

Globally, evidence show that one-sixth of the world's population, mostly in developing countries, is infected with one or more of the NTD. Podoconiosis is thought to affect 4 million people worldwide, mostly in tropical regions of southeast Asia, Central and South America, and Africa. It is known to be endemic in 32 countries, including Rwanda (Wanji, et al., 2021). The global prevalence of podoconiosis varies from 8.08% in Cameroon to 2.51% in Tanzania with in the podoconiosis affected countries (Deribe, et al. , 2018). Although podoconiosis is officially recognized by the World Health Organization (WHO) as an NTD, there is no global roadmap to guide prevention or control. Podoconiosis is still placed under the lymphatic filariasis (LF) control program–which leaves countries like Rwanda with no LF program in a challenging situation (Bayisenge, et al., 2020).

In developing countries, podoconiosis is endemic to 18 countries in Africa, 3 in Asia, and 11 in Latin America with most cases occurring in sub-Saharan Africa (Tora, Mengiste, Davey, s Semrau, 2018). ten of them within the African region: Burundi, Cameroon, Cape Verde, Equatorial Guinea, Ethiopia, Kenya, Rwanda, Sao Tome s Principe, Uganda and Tanzania. The remaining study was from three states in India: Manipur, Mizoram and Rajasthan (Deribe, et al. , 2018) The prevalence of podoconiosis was recorded in 27 studies and ranged from 0.1% in Uganda (Kihembo, et al., 2017) to 8.08% in Cameroon (Deribe, et al., 2017). Of the 27 studies reporting prevalence, 13 were conducted in Ethiopia where prevalence ranged from 2.73% to 7.45% (Kebede, et al., 2018). High prevalence of podoconiosis was also recorded in other countries, including 4.52% in Uganda (Kihembo, et al., 2017), 3.87% in Kenya (Muli, et al., 2017), and 0.66% in Burundi (Deribe, et al. , 2018). In Sao Tome s Principe it is 0.62% whereas in Rwanda, the prevalence of podoconiosis is estimated at 0.63% (Bayisenge, et al., 2020).

Podoconiosis has a wide range of effects, including a significant financial and social burden; it is also linked to significant stigma at school, work, or the market; and it can prevent people from participating in social bonds like marriage (Negussu, et al., 2020). According to estimates, those who have podoconiosis lose an average of one month's worth of Disability-adjusted life years (DALYs) per year as a result of sickness. Other than the economic and societal effects, complications are the most common side effects of podoconiosis. They include inflammation that occurs at least once a year and may be made worse by a superinfection of bacteria, viruses, or

fungi (Debele, et al., 2023). As well, it was discovered that individuals with podoconiosis had significantly worse quality of life ratings in all domains. Additionally, it puts patients under social and psychological strain and threatens their ability to pursue education and work possibilities because it causes frequent acute attacks and stigmatization fears in them (Shahvisi, et al., 2018). In Rwanda, podoconiosis is highly prevalent in the Northern Province of Rwanda, where the high contraction of podoconiosis is caused by chronic exposure to high concentrations of silica found in the volcanic soil originating from the Virunga mountains (Bayisenge, et al., 2020). Many with podoconiosis in this region are subsistence farmers, and they work in their fields barefoot, therefore experiencing frequent exposure to the silica in the soil (Buningwire, 2021). When left untreated, this disfiguring condition has a significant social impact. Affected people often face forms of severe stigma such as isolation, exclusion from community events and barriers to employment, education, or marriage (Deribe, et al., 2013).

Podoconiosis is poorly understood by the community and health professionals, and various misconceptions exist about its etiology, transmissibility, and treatment. Fear of further stigmatization among podoconiosis patients has been found to be a barrier to consistent shoe use (a control intervention) and participation in research such as podoconiosis genetic studies (Abebaw, et al., 2022). Coping strategies used by patients while facing such stigma include active or avoidant behaviors and efforts to change relational meaning (Debele, et al., 2023). Stigmatization of podoconiosis patients is a clear example of health-related stigma. Health-related stigma has been described by Weiss *et al*. as "a social process or related personal experience characterized by exclusion, rejection, blame, or devaluation that results from experience or reasonable anticipation of an adverse social judgement about a person or group identified with a particular problem" (Tora, et al., 2018). This can lead to social, health, and psychological consequences (Shahvisi, et al., 2018). In particular, stigma-related structures of exclusion can lead to harmful delays in diagnosis or treatment-seeking due to fear, shame, or lack of economic capital (as a result of social exclusion) (Abebaw, et al., 2022). Health-related stigma as described above can include enacted and felt stigma; enacted stigma includes the experience of discrimination such as abuse, loss of employment or prejudicial attitudes while felt stigma is the perceived fear of enacted stigma (Wanji, et al., 2021). This study aims to determine the scale of stigma among podoconiosis patients attending Heart and Sole Africa treatment center in Musanze district of Rwanda and assess potential associations between stigma and other factors.

Problem Statement

Podoconiosis poses a significant public health burden in many low-income countries including Rwanda with an estimated prevalence of 68.5 cases per 100,000 people where the highest prevalence occurs in the Northern Provinces due to the contraction of podoconiosis is caused by chronic exposure to high concentrations of silica found in the volcanic soil originating from the Virunga mountains (Bayisenge, et al., 2020). Many with podoconiosis in this region are subsistence farmers, and they work in their fields barefoot, therefore experiencing frequent exposure to the silica in the soil (Buningwire, 2021) .Stigmatization exacerbates the already considerable challenges faced by individuals afflicted with this condition, impeding their access to healthcare, social support, and economic opportunities (Debele, et al., 2023). According to studies More than 63.8% of podoconiosis have either experience felt or enacted stigma and unfavorable attitudes towards the condition (Yakob, et al. , 2018). Despite its prevalence and impact on affected individuals, there is a paucity of research exploring the factors associated with stigma among

podoconiosis patients in Rwanda. Existing studies on stigma in other health contexts underscore the importance of investigating its specific determinants in the context of podoconiosis. Given the complex interplay of sociocultural, economic, and healthcare-related factors, a comprehensive examination is imperative to inform targeted interventions that can mitigate stigma and its adverse consequences on the well-being of podoconiosis patients (Abebaw, et al., 2022). This study will address this critical gap in the literature by systematically assessing the factors contributing to stigma among podoconiosis patients attending Heart and Sole Africa treatment center located in Musanze District of Northern Rwanda in Muhoza sector, thereby contributing valuable insights for the development of effective public health strategies and interventions.

Specific Objectives

1. To determine the prevalence of stigma among podoconiosis patients attending Heart and Sole Africa treatment center in Musanze District of Rwanda.
2. To establish the factors associated with stigma among podoconiosis patients attending Heart and Sole Africa treatment center in Musanze District of Rwanda.

Methods

Study Design

This study was a quantitative cross sectional study design. The design was selected since it takes participants in a single point in time and it helps to remove assumptions. This design was selected since it is specific for population-based surveys and to assess the prevalence of diseases or conditions in samples. This design is relatively faster and inexpensive (Maninder, 2016).

Study Settings

Heart and Sole Africa (HASA) is non-governmental organization working on Podoconiosis disease. HASA was founded in 2006 by American Physical therapist, Dr. Tonya Huston to solve problems for Neglected Tropical Diseases (NTDs) in Rwanda (Buningwire, 2021). Heart and Sole Africa's main treatment center is located in Musanze District, Muhoza Sector. This area was previously known as Ruhengeri, and it lies in the middle of the famous of Virunga Mountain Range. The mountains, Karisimbi, Bisoke, Gahinga, Muhabura, and Nyiragongo are visible on the horizon daily as the Heart and Sole Africa team works diligently to help those in need (Byukusenge, 2018). Podoconiosis is a disease that manifests in this region because of its unique topography. Silica deposits filter up into the soil in these volcanic regions. In this predominantly agrarian economy, this has a profound impact. In a country where the doctor to patient ratio exceeds one to 16, 046, there lacks specialized healthcare providers (Byukusenge, 2018). HASA have 500 patients under treatment (Buningwire, 2021).

Study Population

The target population of this study were the podoconiosis patients attending at Heart and Sole Africa (HASA) treatment center located in Muhoza sector, Musanze District in Northern Province of Rwanda. HASA treatment center had 500 podoconiosis patients under treatment (Buningwire, 2021).

Sample Size

The sample size of 183 participants was calculated using Cochrane formula for cross sectional study because it studies prevalence and factors associated with a health-related problem at the same time (Cochran, 1677).

n= $\boldsymbol{Z}(\mathbf{1}-\boldsymbol{P})\ /\boldsymbol{D}^2$ Where:
n: sample size required
Z: Score corresponding to the level of confidence with which it is desired to be sure that the true population lies with $\pm\boldsymbol{D}$ percentage points of the sample estimate otherwise noted assume 2-sided test with z=1.66.
P = Prevalence of podoconiosis (P) in Rwanda is 6.85 % or 0.0685) (Byukusenge, 2018).
D: Precision or absolute error (at p=0.10).
n= $\boldsymbol{Z}(\mathbf{1}-\boldsymbol{P})\ /\boldsymbol{D}\mathbf{2}$ = (1.66)*(1-0.0685)/$(0.10)^2$
n=((1.66)^ (1-0685))/ 〖(0.10)〗 ^2
n= 183.

Sampling Technique

Based on the nature of this study, to obtain the participants to use, a systematic random sampling method was used (Cochran, 1677). The sample members were selected from population list according to a random starting point but with a fixed, periodic interval that was calculated based total patients being followed up at the treatment center and the desired sample that is required. Participants were chosen from the list of the total list of patients. For being included in this study, the participant must be a permanent resident of the research setting and not critically ill.
K=N/n
Where K= sampling interval
N= Total Population
N= sample size

Data Collection Instrument

An English version of the data collection tool that was used during Data collection is found in Appendix 3. It was developed based on the specific objectives of this research study and other similar studies that were conducted in Sub-Saharan African Countries (Engdawork, Davey, Ayode, McBride, s Tadele, 2020). There was no standardized questionnaire to be adapted to this study and therefore data collection questionnaire was developed by the researcher based on the specific objectives of the study and local context. The study questionnaire was selected since it is effective means of measuring the behavior, attitudes, preferences, opinions and, intentions of relatively large numbers of subjects more cheaply and quickly than other methods. The questionnaire of this study used closed ended questions to collect data (Appendix 3). The tool was translated into the Kinyarwanda language prior to actual data collection by the expert in NTDs domain, Ladslas Nshimiyimana a senior research officer in Rwanda Biomedical Centre from Malaria and Other Parasitic Diseases Division /Neglected Tropical Disease provided a support.

Procedures of Data Collection

Researcher met with the Country Director and Executive Director of HASA to introduce the study days before the start of data collection. The next day the research with one trained enumerator attended to the treatment center and conducted interview with the patients as they waited for their treatment or after care. The responses were recorded on printed questionnaires as soon as are given.

Content Validity for Study Objectives

Specific Objectives	Questions in the Tool	Validity	Data Source
1. To determine the prevalence of stigma among podoconiosis patients	Have you experienced any form of stigma (such as social exclusion, emotional abuse, physical abuse) due to podoconiosis?	This question was designed to assess the participants' experiences with stigma. It aim to quantify the frequency and extent of stigma experienced in social, community, and family settings.	Structured Questionnaire (Self-report)
2. To determine the factors associated with stigma among podoconiosis patients	1. What is your level of education? 2. What is your monthly household income? 3. How long have you been diagnosed with podoconiosis? 4. Do you receive any form of social support? 5. Do you believe that podoconiosis is curable?	These questions aim to identify key socio-demographic and psychosocial factors that may be associated with stigma, including education, income, disease duration, and beliefs about podoconiosis.	Demographic Survey + Perception-based Questions

Pilot Study

The pilot involved 20 podoconiosis patients, which is approximately 10% of the total sample size (183 participants). Participants were found at Kinoni Health Center located near the actual data collection site. The pilot was done at Kinoni Health Center to assess the feasibility of the study design, as well as to ensure the clarity, relevance, and reliability of the research instruments. During the pilot phase, participants were administered the same structured questionnaires that were planned for the main study. The purpose of this preliminary testing was to identify any potential issues with the survey's content, language, and question format. Feedback was solicited from both the respondents and the field data collectors regarding any ambiguities or difficulties encountered during the data collection process. Based on the results of the pilot study, minor revisions were made to the research tools to improve their clarity and ensure that all questions were easily understandable by the participants. The pilot also allowed for the refinement of the data collection procedures, ensuring they were both effective and efficient for the larger study. After the pilot phase, the final research tools were confirmed to be valid, and no further changes were deemed necessary. The information gathered during the pilot was not included in the main study's results but was instrumental in ensuring the robustness of the research methodology moving forward.

Data Management

The data management process was carefully structured to ensure accuracy, completeness, and security. Data was collected through structured interviews with podoconiosis patients attending the treatment center. The data collection forms were thoroughly reviewed at the end of each day to check for completeness, consistency, and any potential discrepancies. Once data collection was completed, all responses were entered into Microsoft Excel for initial storage and organization. The data entry process was done systematically, ensuring that each variable was correctly coded and no missing information was overlooked. After entry, the data was subjected to a second round of validation, where another team member cross-checked the entered data against the original collection forms to ensure there were no errors in the transcription process. After validation, the data was imported into SPSS version 25.0 for analysis. In SPSS, a final check was conducted to clean the data by identifying and addressing any inconsistencies or outliers. Descriptive statistics such as means, frequencies, and percentages were computed to summarize the sociodemographic characteristics of the participants. Following this, inferential statistics, including binary and multivariable logistic regression, were used to identify factors associated with stigma among podoconiosis patients. Data was stored securely on password-protected computers, and only authorized personnel had access to the data to maintain confidentiality and protect the privacy of the participants. All electronic data backups were made to prevent data loss, and sensitive information was de-identified to protect participants' anonymity.

Data Analysis

Data management and analysis was done using SPPS software version 26. Descriptive Statistics was calculated to summarize the data. Descriptive statistics such as measures of central tendency, measures of variability, frequency distributions and percentages were calculated for key variables such as demographic characteristics as well as other various factors associated with stigma among patients with podoconiosis. For secondary data analysis, a Pearson chi-square test was carried out by doing cross-tabulations to examine relationships between stigma presence (Yes/No) with factors like age, education level, clinical factors, income or marital status was done

and a P-Value less than 0.05 was considered as statistically significant. Multivariate analysis techniques were done to provide a deeper understanding of the relationships between multiple factors and stigma among patients. Binary regression analysis was used to assess the association between stigma (dependent variable) and multiple independent factors simultaneously. Tables, and Pie charts was used for results presentation.

Ethical Considerations

Ethical permission was sought from the Mount Kenya University (MKU) Institutional Review Board (IRB). Another permission of conducting this study was obtained from the Executive Director of Heart and Sole Africa Musanze Treatment Center. Before obtaining data from the participant a Kinyarwanda version of consent form was offered to the participants and all the questions from the participants was answered. Data was collected from the volunteering participants after getting all explanations participants was required to sign on consent form (Appendix 2). All 183 participants sample that was required have agreed to participate in this study. No names were used on the questionnaire (Appendix 3). The confidentiality of the data that was collected was ensured since only the research team have access to collected data and no names of the participants that were used. Specific computer folders were created for data storage scripted with passwords. This study carries no risk for the participants. The benefit of participation is that the factors and barriers associated with podoconiosis stigma were known and be addressed by policy makers and stakeholders during making future decisions.

Results

Demographic characteristics of participants

In this study assessing factors associated with stigma among podoconiosis patients, a total of 183 participants were included, with various socio-demographic characteristics. As shown in Table 4.1, the participants were distributed across several sectors, with the largest representation from Cyanika (15.8%), followed by Nyange (14.2%), and Rugarama (10.6%). Other sectors such as Kinoni, Cyuve, and Rwaza had smaller representations. Sectors like Cyabingo and Rambura had only one participant each (0.55%).

In terms of gender, the majority of participants were female, making up 80.6% of the sample, while males accounted for 16.1%. The age distribution showed that most participants were older, with 53.1% being over 55 years, 34.4% between 36-55 years, and 12.5% aged between 18-35 years. The mean age of participants was 57 years, with a standard deviation of 15.8 years.

Table 4. 1. Socio-demographic characteristics of study participants

Variable (N=183)	Frequency (N)	Percentage (%)
Sex		
Male	35	16.1
Female	148	80.6
Age (years)		
18-35	23	12.5
36-55	86	34.4
> 55	67	53.1
Mean (SD)	57	15.8
Household members		
< 4	117	63.6
4-6	43	23.5
>6	23	12.5
Marital Status		
Single	36	16.6
Married/cohabitating	77	42.7
Divorced/separated	7	3.83
Widowed	63	34.4
Education level		
No formal education	150	81.6
Primary education	31	16.6
Secondary education	2	1.20
Occupation		
Agriculture	115	62.8
Unemployed	68	37.2
Total HH income per month		
Below 50,000 Frw	174	65.1
Between 50,000 Frw - 100,000 Frw	6	4.60
Residence		
Rural	166	62.3
Urban	14	7.70

Source: researcher computations from primary data

Household size was predominantly small, with 63.6% of participants reporting fewer than four members, while 23.5% had between 4-6 members, and only 12.5% had more than six members. Regarding marital status, 42.7% of participants were married or cohabitating, 34.4% were widowed, 16.6% were single, and 3.83% were divorced or separated. The majority of participants (63.6%) were heads of their households, with others reporting their father, mother, son, or daughter

Table 4. 2. Clinical factors of the study participants

Variable (N=183)	Frequency (N)	Percentage (%)
Years since podo diagnosis		
Less than 1 year	5	2.73
1-5	13	7.17
More than 5 years	165	60.2
Severity of disease		
Mild	45	24.5
Moderate	44	24.2
Severe	64	51.3
Currently following treatment		
Yes	182	66.4
No	1	0.60
Has other chronic disease		
Yes	53	28.6
No	130	71.1
Clinical stage of podoconiosis		
Stage 1	42	22.6
Stage 2	62	33.8
Stage 3	42	22.6
Stage 4	21	11.4
Stage 5	16	8.7

Source: researcher computations from primary data

As it is summarized in Table 4.2, the clinical factors of the study participants, the majority of participants had been living with podoconiosis for over five years, with 60.2% falling into this category, while smaller proportions were diagnosed within the last one to five years (7.17%) or in the past year (2.73%). The severity of the disease varied among participants, with over half (51.3%) experiencing severe cases of podoconiosis. Moderate and mild cases were relatively evenly distributed, at 24.2% and 24.5% respectively. Nearly all participants (66.4%) were actively following a treatment regimen, with only one participant not receiving treatment (0.60%).

In addition to podoconiosis, 28.6% of participants reported having another chronic disease, while 71.1% did not have any additional chronic conditions. When evaluating the clinical stages of podoconiosis, the participants were spread across all stages. Stage 2 was the most common, with 33.8% of participants, followed by Stages 1 and 3, each affecting 22.6% of participants. Fewer participants were in the more advanced stages, with 11.4% in Stage 4 and 8.7% in Stage 5.

The prevalence of stigma among the study participants

To measure the prevalence of stigma, questions assessing verbal abuse, physical abuse and social rejections were asked. The results are indicated in figure 3, out of the 183 participants, 83% (151 individuals) got 10 or higher total score experiencing stigma related to their condition. In contrast, 17% (32 individuals) reported less than 10 scores.

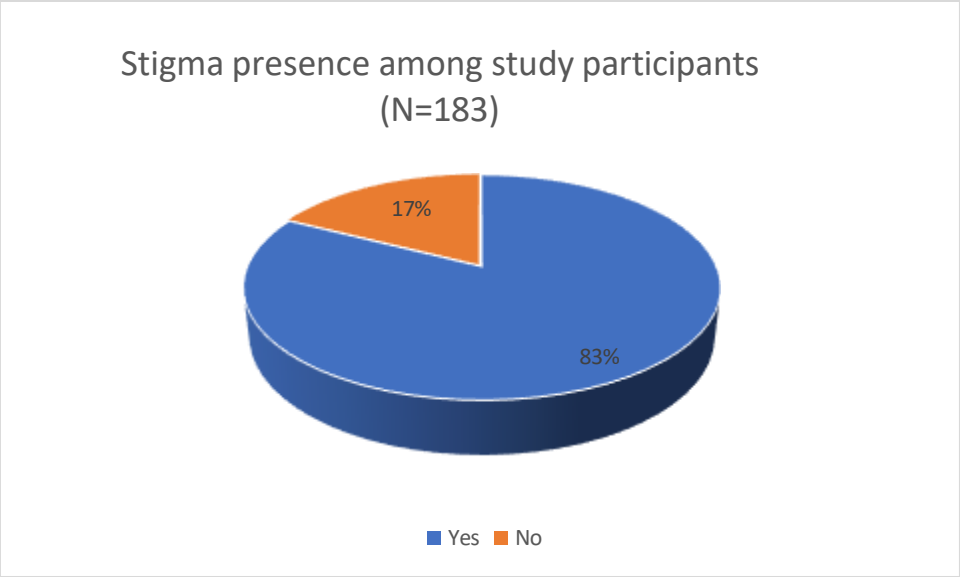

Figure 4. 1. Prevalence of stigma presence among study participants

The factors associated with stigma the study participants

The results on the factors associated with stigma among podoconiosis patients revealed significant socio-demographic patterns. A chi-square analysis was used to assess these associations, and the results are summarized in Table 4.3.

Table 4. 3. Socio-demographic factors associated with stigma among study participants

Variable	Stigma presence			
(N=183)	**Yes**	**No**	**X^2- Value**	**P-Value**
Sex			10.828	***<0.001***
Male	30 (85.8)	5 (14.2)		
Female	121 (81.7)	27 (18.3)		
Age (years)			6.854	0.101
18-35	16 (82.6)	4 (17.4)		
36-55	57 (60.4)	6 (6.6)		
> 55	75 (77.3)	22 (22.6)		
Household members			4.761	0.125
< 4	65 (81.2)	22 (18.8)		
4-6	34 (76.1)	6 (20.6)		
>6	22 (65.6)	1 (4.4)		
Marital Status			4.328	***0.003***
Single	34 (64.4)	2 (5.6)		
Married/cohabitating	63 (81.8)	14 (18.2)		
Divorced/separated	6 (85.7)	1 (14.3)		
Widowed	48 (76.2)	15 (23.8)		
Education level			5.024	***0.015***
No formal education	121 (80.6)	26 (16.4)		
Primary education	28 (60.4)	3 (6.6)		
Secondary education	2 (100)	0 (0)		
Occupation			2.546	0.280
Agriculture	64 (81.7)	21 (18.3)		
Unemployed	57 (83.8)	11 (16.2)		
Total HH income per month			5.566	***0.001***

Below 50,000 Frw	144 (82.8)	30 (17.2)		
Between 50,000 Frw - 100,000 Frw	7 (77.7)	2 (22.3)		
Residence				
Rural	137 (81.1)	32 (18.6)	3.682	***0.041***
Urban	14 (100)	0 (0)		

Source: researcher computations from primary data

*Note * = p-value less than 0.05is significant*

As the Table 4.3 indicates, the presence of stigma was more prevalent among males (85.8%) compared to females (81.7%). The chi-square test result (X^2=10.828) indicated a significant association between gender and stigma, with a p-value of less than 0.001. Age groups were compared, with the highest prevalence of stigma found among individuals aged 36-55 years (60.4%) and the lowest among those aged over 55 (77.3%). Although there is a trend of varying stigma prevalence across age groups, the chi-square test (X^2=6.854) did not reach statistical significance (p = 0.101), suggesting that age was not significantly associated with stigma in this sample.

Table 4. 4. Clinical conditions factors associated with stigma among study participants

Variable (N=183)	Stigma presence Yes	No	X^2- Value	P-Value
Years since podo diagnosis			3.66	0.356
Less than 1 year	6 (66.2)	4 (30.8)		
1-5	3 (60.0)	2 (40.0)		
More than 5 years	136 (84.2)	26 (15.8)		
Severity of disease			4.60	***0.021***
Mild	35 (77.8)	(22.2)		
Moderate	33 (75.0)	(25.0)		
Severe	83 (88.3)	(11.7)		
Currently following treatment			0.11	***0.004***
Yes	150 (82.4)	32 (17.6)		
No	1 (100)	0 (0)		
Has other chronic disease			0.11	0.114
Yes	45 (84.6)	106 (15.1)		
No	106 (81.5)	24 (18.5)		
Clinical stage of podoconiosis			6.78	***0.02C***
Stage 1	31 (73.8)	11 (26.2)		
Stage 2	46 (76.1)	13 (20.1)		
Stage 3	36 (62.8)	3 (7.2)		
Stage 4	16 (60.4)	2 (6.6)		
Stage 5	13 (81.2)	3 (18.8)		

Source: researcher computations from primary data *Note * = p-value less than 0.05is significant*

Table 4.4 shows the association between various clinical condition factors and the presence of stigma among podoconiosis patients.

Regarding the years since podoconiosis diagnosis, 66.2% of participants diagnosed in less than one year reported stigma, compared to 84.2% of those diagnosed for more than five years. However, the chi-square test ($X^2 = 3.66$, $p = 0.356$) indicates no statistically significant association between the years since diagnosis and stigma presence. In terms of disease severity, 77.8% of those with mild cases, 75.0% with moderate cases, and 88.3% with severe podoconiosis experienced stigma. For the clinical stage of podoconiosis, stigma increased progressively from stage 1 (73.8%) to stage 3 (62.8%), before declining slightly at stage 5 (81.2%). However, the chi-square test ($X^2 = 6.78$, $p = 0.026$) shows statistically significant association between the clinical stage and the presence of stigma, as stage progresses the stigma increases.

Table 4. 5. Binary regression analysis of the factors associated with stigma presence among the study participants

Factors (N=183)	*COR*	*AOR*	*35% CI*	*P- Value*
Sex				
Male	Ref	Ref		
Female	0.13	0.12	0.23-0.04	***0.007***
Marital status				
Married	Reference	Ref		
Unmarried	2.26	2.10	0.83-5.41	0.146
Education level				
Educated	Ref	Ref		
No formal education	1.66	1.55	1.52-4.08	0.335
Total HH income per month				
Above 50K per month	Ref	Ref		
Below 50,000 Frw	5.18	5.00	3.07-8.46	**<0.001**
Residence				
Rural	Ref	Ref		
Urban	6.82	6.50	3.12 to 14.57	***0.048***
Severity of disease				
Moderate and severe	0.74	0.70	0.41-2.66	0.671
Mild	Ref	Ref		
Currently following treatment				
Yes	Ref	Ref		
No	1.16	1.10	0.82-1.65	0.371
Clinical stage of podoconiosis				
Stage 3 or higher	5.12	4.60	2.06-8.18	**0.001**
Stage 1 and stage 2	Ref	Ref		

Source: researcher computations from primary data *Note * = p-value less than 0.05is significant*

The results of Table 4.5 present a binary regression analysis identifying significant factors associated with the presence of stigma among podoconiosis patients. The analysis includes adjusted odds ratios (AOR), 65% confidence intervals (CI), and p-values for each factor. According to the results, females were found to have significantly lower odds of experiencing stigma compared to males, with an AOR of 0.13 (65% CI: 0.23-0.04, p = 0.007). This suggests that women in the study were less likely to face stigma than men. The sex of participants showed that females had a significantly lower odds of the outcome compared to males, with an Adjusted Odds Ratio

(AOR) of 0.12 (65% CI: 0.23-0.04, p=0.007). This indicates that females were approximately 88% less likely than males to experience the outcome, after controlling for other factors. In terms of marital status, unmarried individuals had higher odds of the outcome compared to married individuals, with an AOR of 2.10 (65% CI: 0.83-5.41, p=0.146), although this result was not statistically significant. Similarly, those with no formal education had slightly higher odds of the outcome compared to those with an education, with an AOR of 1.55 (65% CI: 1.52-4.08, p=0.335), but this was also not statistically significant.

Household income showed a significant association with the outcome. Participants with a monthly income of less than 50,000 Rwandan Francs had significantly higher odds of the outcome compared to those earning above 50,000 Frw, with an AOR of 5.00 (65% CI: 3.07-8.46, p<0.001). This suggests that individuals with lower income were five times more likely to experience the outcome. The residence variable also showed a significant result, with urban residents having higher odds of the outcome compared to rural residents. The AOR was 6.50 (65% CI: 3.12-14.57, p=0.048), indicating that living in an urban area increased the likelihood of the outcome by over six times.

Regarding severity of disease, individuals with moderate and severe disease had lower odds of the outcome compared to those with mild disease, with an AOR of 0.70 (65% CI: 0.41-2.66, p=0.671), although this result was not statistically significant. Additionally, individuals not following treatment had slightly higher odds of the outcome compared to those who were following treatment, but this association was not statistically significant, with an AOR of 1.10 (65% CI: 0.82-1.65, p=0.371). Finally, participants with Stage 3 or higher podoconiosis were significantly more likely to experience the outcome compared to those in Stage 1 or 2, with an AOR of 4.60 (65% CI: 2.06-8.18, p=0.001). This suggests that more advanced stages of the disease are strongly associated with the outcome of interest.

Discussion

In this study assessing the factors associated with stigma among podoconiosis patients, the socio-demographic characteristics of the 183 participants revealed key insights into the population. The largest representation of participants was from the sector of Cyanika (15.8%). This sectoral distribution could reflect variations in the prevalence of podoconiosis across geographic regions. A similar trend has been observed in other studies, where the distribution of podoconiosis is often concentrated in regions with specific environmental and socioeconomic conditions, such as volcanic soils (Abebaw, Atnafu, Worku, s Hagos, 2022).

The clinical condition of participants in this study highlights key aspects of the disease progression and comorbidities associated with podoconiosis. A significant majority (60.2%) of participants had been living with the condition for over five years, indicating the chronic nature of podoconiosis. This long disease duration is consistent with findings from other studies in endemic areas, where podoconiosis tends to be a lifelong condition once acquired, especially in communities with limited access to preventive measures and treatment. For instance, a study in Ethiopia also found that most podoconiosis patients had lived with the disease for an extended period, typically more than five years, which contributes to the increased disease burden and social stigma they experience over time (Deribe, et al., 2017).

In terms of disease severity, over half of the participants (51.3%) in the present study experienced severe podoconiosis. This prevalence of severe cases is slightly higher compared to findings from

other regions. A study in northern Ethiopia, for instance, reported that approximately 40% of podoconiosis patients had severe cases, though the proportion of moderate and mild cases was more balanced (Gebrehiwot et al., 2016). The high rate of severe cases in this study may reflect delayed treatment or lack of access to preventive care, such as footwear or regular foot hygiene, which are known to mitigate disease progression.

The study's findings reveal a high prevalence of stigma among individuals affected by podoconiosis, with 83% of the participants reporting experiences of stigma. This figure is consistent with other studies conducted in podoconiosis-endemic regions, where stigma has been shown to be a pervasive issue. For instance, a study in Ethiopia found that 60% of podoconiosis patients faced significant social stigma, often leading to social exclusion, discrimination, and psychological distress (Kebede, 2018). Similarly, Gebre et al. (2016) also documented that individuals with podoconiosis frequently experience stigmatization, which contributes to their marginalization within their communities. Stigma in the context of podoconiosis is often linked to the visible physical manifestations of the disease, such as swelling and deformities of the lower limbs, which may cause others to mistakenly attribute the condition to poor hygiene or infectious causes (Davey et al., 2007). These misconceptions exacerbate the social stigma and can result in limited social interactions, exclusion from community events, and even barriers to marriage and employment. Such experiences were also reported in Cameroon, where stigmatized individuals with podoconiosis were more likely to be isolated within their social and familial circles (Tora, Mengiste, Davey, s Semrau, 2018).

However, the 17% of participants in the current study who did not report experiencing stigma is notable, suggesting that some individuals with podoconiosis may be better integrated into their communities or may have access to support networks that mitigate the social and psychological impacts of the disease. This variation in stigma experiences could be linked to several factors, including community awareness programs, support from healthcare workers, or personal resilience. For instance, studies have shown that stigma can be reduced through public health education and awareness campaigns, which help to dispel misconceptions and foster community support (Deribe et al., 2017).

Regarding the factors associated with stigma, the relationship between sex and stigma presence was statistically significant ($x^2 = 10.828$, $p < 0.001$). Males had a higher proportion of stigma (85.8%) compared to females (81.7%). This finding is consistent with other studies which have shown that males tend to experience higher levels of stigma in certain disease contexts due to societal expectations around strength and independence. A study in Ethiopia found that men with podoconiosis often faced higher levels of stigma due to their perceived inability to fulfill traditional roles, such as working in the fields or providing for their families (Engdawork, Davey, Ayode, McBride, s Tadele, 2020). Marital status was significantly associated with stigma ($x^2 = 4.328$, $p = 0.006$). Single individuals reported the highest prevalence of stigma (64.4%), while widowed participants also experienced high levels (76.2%). Being unmarried has been linked to higher stigma levels, particularly in cultures where marriage is highly valued. Similar results were reported in Ethiopia, where unmarried podoconiosis patients were stigmatized due to their perceived inability to marry or start a family (Ayode et al., 2016). Education level was another factor significantly associated with stigma ($x^2 = 5.024$, $p = 0.015$). Participants with no formal education had higher levels of stigma (80.6%) compared to those with primary (60.4%) and secondary education (100%). Previous research has demonstrated that lower educational attainment is

linked to higher stigma due to limited understanding of the disease and its causes (Wanji, et al., 2021).

Disease severity showed a statistically significant relationship with stigma ($X^2 = 4.60$, $p = 0.021$). Severe cases had the highest percentage of stigma, with 88.3% of patients experiencing it, compared to 77.8% for mild cases and 75.0% for moderate cases. This result is consistent with studies on other neglected tropical diseases (NTDs) such as lymphatic filariasis, where stigma increases with the severity of physical symptoms (Deribe et al., 2013). The visible manifestations of severe podoconiosis, such as large swelling, physical disability, and skin changes, may lead to more public scrutiny and social exclusion, exacerbating stigma in affected individuals.

Interestingly, following treatment was significantly associated with stigma ($X^2 = 0.11$, $p = 0.004$). While 82.4% of those following treatment reported stigma, the sole participant not undergoing treatment also reported experiencing stigma. While one might expect stigma to be lower in patients actively managing their condition, this finding suggests that treatment alone may not be enough to reduce stigma in a community where social attitudes toward podoconiosis remain deeply entrenched. This contrasts with findings from studies on other chronic conditions, where active treatment often reduces stigma (Molla et al., 2012). The clinical stage of podoconiosis approached statistical significance ($X^2 = 6.78$, $p = 0.026$), suggesting that more advanced stages are linked to higher levels of stigma. Patients in Stage 3 reported the highest stigma prevalence (62.8%), followed by Stage 4 (60.4%), and Stage 5 (81.2%). Early stages, particularly Stage 1 (73.8%) and Stage 2 (76.1%), were associated with slightly lower stigma levels. This pattern is consistent with research indicating that as podoconiosis progresses, the worsening physical symptoms draw more social attention, increasing stigma (WHO, 2023).

The results indicate that females have significantly lower odds of experiencing stigma associated with podoconiosis (AOR = 0.13, $p = 0.007$). This is intriguing given that gender dynamics can influence stigma perception differently across cultures. A study by Zewdie et al. (2021) found that men often face more stigma related to visible disabilities, as societal expectations around masculinity may complicate their health experiences. Conversely, women may be more socialized to manage stigma, which could explain their lower association in this context. However, more research is needed to clarify these gender dynamics in stigma experiences among podoconiosis patients. The findings show that being unmarried is associated with higher odds of stigma (AOR = 2.26, $p = 0.146$), although this result is not statistically significant. This is somewhat consistent with the literature that suggests unmarried individuals may experience increased stigma and social isolation due to societal norms surrounding marriage and family (Molla et al., 2021). A study conducted by Bazzano et al. (2016) found that social support from a partner can mitigate feelings of stigma, indicating the potential protective role of marital status against stigma.

A significant association is evident for individuals with household incomes below 50,000 Frw, who have much higher odds of experiencing stigma (AOR = 5.18, $p < 0.001$). This finding is consistent with research highlighting the relationship between poverty and stigma in various health conditions, including other NTDs (Dissanayake et al., 2020). Stigma can be exacerbated by financial instability, as individuals in lower-income brackets may have limited access to healthcare and social support

Conclusions

This study investigated the factors associated with stigma among podoconiosis patients attending the Heart and Sole Africa treatment center in Musanze District, Rwanda. The findings revealed a high prevalence of stigma, with 83% of participants reporting experiences of stigma, predominantly

in the form of verbal abuse, physical abuse, and social rejection. Several factors were found to be significantly associated with stigma. Multivariate analysis identified that patients with lower household income, urban residence, and advanced clinical stages of podoconiosis were more likely to experience stigma. Unmarried participants also had higher odds of stigma, although this was not statistically significant. These findings underscore the importance of addressing socioeconomic disparities and improving community awareness to reduce stigma.

REFERENCES

Abebaw, A., Atnafu, A., Worku, N., s Hagos, A. (2022). Health-related quality of life and associated factors among adult podoconiosis patients in Debre Elias district Northwest, Ethiopia. https://doi.org/10.1371/journal.pntd.0010673.

Bayisenge, U., Schurer, J., s Wong, R. (2020). Podoconiosis in Rwanda: Knowledge, attitudes and practices among health professionals and environmental officers. Plos: https://doi.org/10.1371/journal.pntd.0008740.

Buningwire, W. (2021). IMIDIDO OR PODOCONIOSIS, NEW HOPE FOR SUFFERERS. https://www.ktpress.rw/2021/06/imididO-or-podoconiosis-new-hope-for-sufferers/ Last accessed on 31/12/2023.

Byukusenge, A. (2018). Rwanda battles elephantiasis with equitable care. https://www.re-solveglobalhealth.com/post/rwanda-battles-elephantiasis-with-equitable-care last accessed on 31/12/2023.

Coaston, J. (2016). The intersectionality wars. https://www.vox.com/the-highlight/2016/5/20/18542843/intersectionality-conservatism-law-race-gender-discrimination Last accessed on 31/12/2023.

Cochran. (1677). Organizational Research: Determining Appropriate Sample Size in Survey Research. Available at https://www.opalco.com/wp-content/uploads/2014/10/Reading-Sample-Size1.pdf accessed on 10/02/2024.

Debele, G. R., Shifera E, Dessie YL, Jaleta DD, Borena MU, Kanfe SG, . . . Raru TB. (2023). From Neglected to Public Health Burden: Factors Associated with Podoconiosis in Resource Limited Setting in Case of Southwest Ethiopia: A Community Based Cross Sectional Study. https://doi.org/10.2147/RRTM.S412624.

Deribe, K., Beng, A. A., Cano, J., Njouendo , A. J., Fru-Cho, J., Awah, A. R., s Eyong, M. E. (2017). Mapping the geographical distribution of podoconiosis in Cameroon using parasitological, serological, and clinical evidence to exclude other causes of lymphedema. PMID: 26324858 PMCID: PMC5764238 DOI: 10.1371/journal.pntd.0006126.

Deribe, K., Wanji, S., Shafi, O., Tukahebwa , E., Umulisa , I., Molyneux , D., s Davey, G. (2015). The feasibility of eliminating podoconiosis. PMID: 26600613 PMCID: PMC4645432 DOI: 10.2471/BLT.14.150276.

Deribe, K., Cano, J., Trueba, M., Newport, M., s Davey , G. (2018). Global epidemiology of podoconiosis: A systematic review. PMID: 26464642 PMCID: PMC5846362 DOI: 10.1371/journal.pntd.0006324.

Deribe, K., Tomczyk, S., Mousley, E., Tamiru, A., s Davey, G. (2013). Stigma towards a Neglected Tropical Disease: Felt and enacted Stigma Scores among Podoconiosis Patients in

Northern Ethiopia. BMC Public Health 13, 1178 (2013). https://doi.org/10.1186/1471-2458-13-1178.

Eid, R., Sharma, D., s Smock, W. (2016). Podoconiosis in Rural Tanzania. Am. J. Trop. Med. Hyg., 65(1), p. 1 doi:10.4266/ajtmh.16-0028.

Engdawork, K., Davey, G., Ayode, D., McBride, C., s Tadele, G. (2020). A cross-sectional survey to assess the risk factors associated with stigmatizing attitudes towards patients with podoconiosis among rural youth in southern Ethiopia. Transactions of The Royal Society of Tropical Medicine and Hygiene, Volume 114, Issue 12, December 2020, Pages 665–1002, https://doi.org/10.1063/trstmh/traa061.

Glen, S. (2023). Slovin's Formula: What is it and When do I use it?" From StatisticsHowTo.com: Elementary Statistics for the rest of us! Available from https://www.statisticshowto.com/probability-and-statistics/how-to-use-slovins-formula/ Last accessed 21/7/2023.

Kebede. (2018). Global epidemiology of podoconiosis: A systematic review. PMID: 26464642 PMCID: PMC5846362 DOI: 10.1371/journal.pntd.0006324.

Kebede, B., Sarah Martindale, Belete Mengistu, Biruck Kebede, Asrat Mengiste , Fikre H/Kiros , . . . Charles D Mackenzie . (2018). Integrated morbidity mapping of lymphatic filariasis and podoconiosis cases in 20 co-endemic districts of Ethiopia. PMID: 26665663 PMCID: PMC6044548 DOI: 10.1371/journal.pntd.0006461.

Kihembo, C., Ben Masiira, Ben Masiira, William Z Lali, Gabriel K Matwale, Joseph K B Matovu, . . . Miriam Nanyunja . (2017). Risk Factors for Podoconiosis: Kamwenge District, Western Uganda, September 2015. PMID: 28716274 PMCID: PMC5462561 DOI: 10.4266/ajtmh.16-0632.

Maninder, S. S. (2016). Methodology Series Module 3: Cross-sectional Studies. doi: 10.4103/0016-5154.182410 last accessed on 14/07/2021.

Mckellar, K. (2020). Current Research on Sexual Health and Teenagers. https://www.sciencedirect.com/topics/medicine-and-dentistry/health-belief-model Last accessed on 31/12/2023.

Mcleod, S. (2023). Social Identity Theory In Psychology (Tajfel s Turner, 1676). https://www.simplypsychology.org/social-identity-theory.html Last accessed on 31/12/2023.

Mohajan, H. (2017). Two Criteria for Good Measurements in Research: Validity and Reliability. Available at https://mpra.ub.uni-muenchen.de/83458/1/MPRA_paper_83458.pdf last accessed on 10/02/2024.

Mousley, E., Deribe, K., Tamiru, A., s Davey , G. (2013). The impact of podoconiosis on quality of life in Northern Ethiopia. Health Qual Life Outcomes 11, 122 (2013). https://doi.org/10.1186/1477-7525-11-122.

Muli, J., Gachohi, J., s Kagai, J. (2017). Soil iron and aluminium concentrations and feet hygiene as possible predictors of Podoconiosis occurrence in Kenya. PMID: 28832604 PMCID: PMC5584676 DOI: 10.1371/journal.pntd.0005864.

Negussie, H., Kassahun, M. M., Fegan, G., Njuguna, P., Enquselassie , F., s McKay, A. (2015). Podoconiosis treatment in northern Ethiopia (GoLBet): study protocol for a randomised controlled trial. PMID: 26177812 PMCID: PMC4504163 DOI: 10.1186/s13063-015-0818-7.

Negussie, H., Meseret Molla Kassahun, Greg Fegan, Patricia Njuguna, Fikre Enquselassie, Andy McKay, . . . Gail Davey. (2015). Podoconiosis treatment in northern Ethiopia (GoLBet): study protocol for a randomised controlled trial. PMID: 26177812 doi: 10.1186/s13063-015-0818-7.

Negussu, N., Deribe, K., Newport, M., Davey, G., s Turner, H. (2020). The health and economic burden of podoconiosis in Ethiopia. https://doi.org/10.1063/trstmh/traa003.

Nemba_DH. (2023). Nemba District Hospital. Available at https://www.nembahospital.rw/1/about-us/health-centers accessed on 16/6/2023.

Schneiderman, N. (2008). STRESS AND HEALTH: Psychological, Behavioral, and Biological Determinants. doi: 10.1146/annurev.clinpsy.1.102803.144141.

Shahvisi, A., Meskele, E., s Davey, G. (2018). A Human Right to Shoes? Establishing Rights and Duties in the Prevention and Treatment of Podoconiosis. PMID: 30008552 PMCID: PMC6036730.

Tamiru, A., Tsegay, G., Wubie, M., Gedefaw, M., Tomczyk, S., s Tekola-Ayele , F. (2014). Podoconiosis patients' willingness to pay for treatment services in Northwest Ethiopia: potential for cost recovery. BMC Public Health 14, 256 (2014). https://doi.org/10.1186/1471-2458-14-256.

Tora, A., Franklin, H., Deribe, K., Reda, A., s Davey, G. (2014). Extent of podoconiosis-related stigma in Wolaita Zone, Southern Ethiopia: a cross-sectional study. Springerplus. PMC4233027 doi: 10.1186/2163-1801-3-647.

Tora, A., Mengiste, A., Davey, G., s Semrau, M. (2018). Community Involvement in the Care of Persons Affected by Podoconiosis—A Lesson for Other Skin NTDs. Trop. Med. Infect. Dis. 2018, 3(3), 87; https://doi.org/10.3360/tropicalmed3030087.

Wanji, S., Kebede Deribe , Jessica Minich, Alexander Y Debrah, Akili Kalinga, Inge Kroidl, . . . Manuel Ritter. (2021). Podoconiosis - From known to unknown: Obstacles to tackle. PMID: 33836086 DOI: 10.1016/j.actatropica.2021.105618.

WHO. (2023). Podoconiosis (non-filarial lymphoedema). https://www.who.int/news-room/fact-sheets/detail/podoconiosis-(non-filarial-lymphoedema)#:~:text=Overview,bare%20feet%20to%20irritant%20soils. Last accessed on 3/1/2024.

Yakob, B., Davey, G., s Kebede , D. (2018). High levels of misconceptions and stigma in a community highly endemic for podoconiosis in southern Ethiopia. https://doi.org/10.1016/j.trstmh.2008.01.023.