Factors Associated with Superficial Mycoses in Patients Visiting Alupe Clinic and its Environs in Busia Western Kenya

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Summary

BACKGROUND:

Globally, *Superficial fungal* infections are common problems in patients infected human immunodeficiency virus (HIV).The most common, predisposition being unknown HIV status and low socio-economic factors.

OBJECTIVE:

The aim of this study was to identify factors associated with *Superficial mycoses* in patients attending Alupe Outpatient Clinic and its environs. After ethical approval, was obtained from ethical review committee, KEMRI.

METHODS:

A cross-sectional study was conducted in 371 patients from two health facilities in Busia County Kenya. Data was collected using semi structured questionnaire after patients had consented. Quantitative data was analyzed using Statistical Package for Social Sciences (*SPSS*) version 20.

RESULTS:

Of 371 respondents; 42.86% (159) were males and 57.14% (212) were females. The mean age for both sexes was 30.8 years with std. dev of 20.0046 and a range of [1,89].The HIV status for respondents were; negative 49.33%, positive 6.20%, unknown status 44.47% respectively.

Conclusion:

The factors associated with superficial *mycoses* in patients visiting Alupe Outpatient Clinic and its environs were statistically significant and were majorly associated with; age, gender, HIV status, occupation, site of infection and County. Further research is needed to establish why there is high prevalence of superficial *mycoses* among; Farmers, business, pupils, students, teachers and those who are unemployed. HIV/AIDS testing and awareness as a predisposition should be prioritized in future studies.

Key words: Superficial *mycosis*, Human Immunodeficiency *Virus*, Busia

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Introduction:

Fungi being ubiquitous are found in water, soil, air, in animal and human tissues with some being pathogenic in humans causing superficial mycoses (1).

Fungal infections can complicate HIV progression in advanced stages due to decreased immune function (2). Superficial *mycose*s are common opportunistic infection in patients with human *immunodeficiency virus* (HIV) (3) which include *Tinea pityriasis* and fungal keratitis.

These can be detected in the skin scales, nails and hair microscopically (4).

The geographic location, cultural background, and population migration patterns significantly affect the characteristics and prevalence of SFIs in particular regions. A significant variation in the pattern of mycotic infection in different countries is clearly evident from studies performed in Algeria, South Africa, Mexico, Italy, Japan, USA ,Canada, Brazil, India and Australia(5-13).

This *heterogeneity* in the prevalence of SFIs in different parts of the world has been attributed to factors such as climate ***(humidity, temperature***), lifestyle (e.g., visiting public swimming pools), involvement in outdoor activities, and the prevalence of underlying diseases (e.g., diabetes rate of 25% in the Saudi population) high incidence of immunocompromised patients as a result of human immunodeficiency virus (HIV) in some African countries.

Another factor is the reluctance of patients to seek treatment because of the minor nature of the disease, or because of embarrassment, unless the condition becomes sufficiently serious to affect the quality of life. Worldwide the most prevalent superficial mycoses in HIV are keratitis, tinea and pityriasis(14).

Kenya is a developing East African country with a high rate of *tuberculosis* (TB) and moderate HIV infection burden. These two diseases are immunosuppressive a predisposition to opportunistic *fungal* infections. Sub-Saharan Africa being the epicenter of HIV/AIDS burden, the most common fungal infections are respiratory, eye, dermatological, and *cryptococcal meningitis* (15).

Data on mycoses in Kenya revealed a high prevalence rate (9-10%) in school children aged13-17 years (16, 17).

A study conducted in Tanzania shows that fungal keratitis accounts for 75% of eye infections and is more common in HIV positive with a higher prevalence noted in females [19]. It also showed that *Fusarium solani* was the commonest cause of fungal *keratitis* in HIV positive patients (18). Similar studies have not been done in Western Kenya.

Tinea infections of the skin and scalp represent a relatively common problem especially in the tropical and subtropical regions of the world where the warm and humid climates provide a favorable environment for the causative organisms (19).

Fungi are important causes of serious and life threatening opportunistic infections in the immune suppressed adults and children (20).

Fungal infections can be Superficial localized to the skin, the hair, and the nails. An example is "ringworm" or 'tinea', an infection of the skin caused by a *dermatophyte* (21).

Various skin conditions are associated with HIV infection epidemiologic studies have shown that almost all persons with HIV infection will have skin disorders at some point during the progression of their disease (22).

Fungal *dermatophytoses* are common in HIV-infected patients. In one survey, for example, the prevalence of d*ermatophytosis* was higher in a group of HIV-infected patients (37%) than in a paired population of HIV-negative homosexual males (32%).

These investigators noted that the superficial infections were more common in both groups of homosexual males than in the general population (23).

Tinea versicolor (ie, pityriasis versicolor) is a common superficial fungal infection. Patients with this disorder often present with *hypopigmented, hyperpigmented,* or erythematous macules on the trunk and proximal upper extremities. Unlike other disorders utilizing the term tinea (eg, tinea pedis, *tinea capitis),* tinea *versicolor* is not a *dermatophyte* infection (24).

Superficial fungal infections are chronic and recurring conditions. Tinea capitis is a scalp infection, primarily affecting prepubescent children. Ringworm infections, such as *tinea corporis* and *tinea cruris,* involve the glabrous skin.

Tinea nigra is a rare mycotic infection that may be related to travel abroad. *Piedra,* black or white, is limited to the hair shaft without involvement of the adjacent skin. *Pityriasis (tinea) versicolor* and *seborrheic dermatitis* are *dermatoses* associated with yeasts of the *genus Malassezi*a that affect the lipid-rich areas of the body (25)

In a survey carried out in 1988 and 1989 in Karonga district, northern Malawi, 4915/61735 (8.0%) people examined were found to have extensive *pityariasis versicolor* (PV). An additional 6085 people (9.9%) were diagnosed as having mild disease.

The highest prevalence rates of extensive and mild PV were found among subjects aged 15-24 years. In these age group between 20% and 25% of people had extensive PV. Rates were generally higher among males than among females and rarely found in pre-pubertal subjects (26)

Tinea pedis is a *fungal* infection of the feet (athletes' foot), the most common skin *fungal* infections that affect 70% or more of the adult population worldwide. *Tinea capitis* is a scalp infection with *Trichophyton tonsurans* and *T. violaceum* or *Microsporum canis*, primarily affecting prepubescent *children*. *Ringworm infections (Tinea corporis and Tinea cruris*) are expanding ring lesions, not caused by worms but fungi infection of the skin.

Tinea corporis is usually a scaly plaque with a red ring border and central clearing; this is caused by *Trichophyton rubrum, Trichophyton tonsurans, Trichophyton mentagrophytes* and *Microsporum canis.* The *fungus* can be transmitted from other humans, cats and dogs. *Trichophyton rubrum* may first infect the feet and spread to other parts of the body through *autonoculation* (27).

Evidence shows that *fungal* infections are often hidden killers causing a substantial morbidity and mortality in susceptible individuals. However, their impact is not widely acknowledged or appreciated as compared to other diseases.

A great disparity of access to fungal diagnostic and treatment services in resource-constrained countries is apparent particularly in sub-Saharan Africa. Moreover, despite efficient diagnostic tests and safe effective drugs, research on fungal infections in comparison to other *pathogens* is somewhat neglected (28).

When a fungal infection is suspected, diagnosis should be confirmed by microscopy and culture of skin scales, plucked broken hairs or nail clippings (29).

The choice of an anti-fungal agent is dependent on the site involved, the extent of clinical infection, the age and general health of the patient and concomitant drug therapy (30).

Superficial infections of the skin and nails may be managed either topically or systemically. Topical formulations are effective against localized infections but have limitations. They do not penetrate hair follicles, thick keratin, or the nail plate effectively and patients may find inconvenient which may affect compliance (31, 32).

The aim objective of this study was to identify factors associated with superficial mycoses in patients attending Alupe Outpatient Clinic and its environs.

Study Design:

The study was conducted on individuals who visited the out -patient department (OPD), with complains or presenting with superficial mycoses infection.

Individuals, who were clinically diagnosed with superficial fungal infection and accepted to consent, and referred to the Mycology department in Microbiology Department for laboratory investigation.

During the period of study, a total number of 371 patients consented for the study:

Study Site:

The study was carried out in Alupe, at the Centre for Infectious and Parasitic Diseases Control Research (**CIPDCR**) which is one of the centers of the **Kenya Medical Research Institute (KEMRI).**

The Centre is in Busia County in the former Western Province, which is the gateway to Kenya from the neighboring Uganda, with two border crossing points at Busia and Malaba towns.

The county spans 1,695 sq km borders Uganda to the north, North-east and West, Lake Victoria to south west, Siaya to the South and South-east and Kakamega and Bungoma to the East.

The coordinates of Busia, Kenya are: 00°27'48.0"N, 34°06'19.0"E (Latitude: 0.463333; Longitude: 34. 105278). Busia, Kenya sits at an average elevation of 1,227 metres (4,026 ft), above sea level.

Data Collection Method:

A semi structured questionnaire was designed to collect data on socio-demographic; Region, sex, age, county, occupation, HIV status, laboratory results, culture results, site ,clinical diagnosis ,skin scrape done, types of specimen and clinical signs of *fungal* infections.

Collection Of Skin Scrapping:

The affected areas were cleaned with 70% alcohol, allowed to dry before sampling. This minimizes contamination and is an aid to microscopy if greasy ointments or powders have been applied.

The sterile scalpel blade was used for scraping and this was done at the active edge of the lesion and the skin scrapes were collected in a white envelope, and then transferred this into a sterile slide. These scrapings were done to obtain skin scales, crusts, hair pieces and finger nails as follows;

Skin Samples:

Using a sterile scalpel blade the scraping were done at the active edge of the lesion and collected the skin scrapes into a participant's code labeled white envelope, and then transferred this into a sterile slide.

Nail Samples:

The *Subungual debris* in addition to nail clippings, discolored, *dystrophic* or brittle parts of the nail, were sampled as far back as possible from the *distal* part of the nail.

Hair Samples:

We plucked hairs from the affected area with forceps and scraped the scalp with a scalpel. The sample included hair roots, the contents of plugged *follicles* and skin scales

Mycological Analysis Of Specimens:

This was performed by mounting each specimen on a slide in a drop of 20% potassium hydroxide (KOH) solution and leaving it for 30 minutes for the digestion of *keratin* to occur then observed under X40 microscope. Specimens showed *hyphae* or yeasts were considered positive.

The positive samples (KOH positive) were further analyzed by culture method.

Culture:

The skin scrapings were seeded onto *Sabouraud's dextrose agar* medium with *chloramphenicol* (**Oxoid, U.K.)**, and incubated at 30^0C for two weeks.

Sabouraud's dextrose agar medium is a selective medium primarily used for the isolation of *dermatophytes,* other *fungi* and yeasts.

Antibiotic chloramphenicol was added as selective agent to inhibit bacterial overgrowth of competing *microorganisms* while permitting the successful isolation of *fungi* and yeasts.

The colonial characteristics color of the specimen, texture, topography, and growth-rate, aerial and submerged type of *hyphae* was recorded. Slide culture was prepared and examined for Microscopic characteristics *morphology* by staining with *Lacto-Phenol* Cotton Blue.

We used Lacto-phenol cotton blue staining technique to distinguish the three *anamorphic genera* by their *morphological* characteristic of *micro conidia* and *macro conidia*

Data Analysis:

Data were analyzed using ***SPSS version 20.***The results were then presented in descriptive statistics using frequency tables, bar charts, graphs and percentages as shown in the result section.

Results:

The study was conducted on individuals who visited the out -patient department (OPD) in Alupe with complain or presenting with superficial *mycoses.* Individuals, who were clinically diagnosed with superficial *fungal* infection and accepted to consent, a total number of 371 patients consented for the study.

A semi structured questionnaire was designed to collect data on socio-demographic; Region, sex, age, county, occupational, HIV status, laboratory result, culture results, site, clinical diagnosis ,skin scrape done, types of specimen and clinical signs of *fungal* infections

Table 1:0 Social demographic characteristics of study participants with superficial mycoses variables and percent

Variables		Frequency	Percent
Sex	Male	159	42.86
	Female	212	57.14
Region	Western	302	81.4
	Nyanza	49	13.21
	Others	20	5.39
Age	Smallest	1	0.81
	Largest	89	0.27
Occupation	Farmers	109	29.38
	Pupils	77	20.75
	Student	68	18.33
	Business	48	12.94
	Teacher	20	5.39
	Unemployed	12	3.23
	Others	37	9.97
County	Busia	258	69.54
	Siaya	30	8.09
	Bungoma	22	5.93
	Kakamega	18	4.85
	Others	43	11.59
Clinical diagnosis	Tinea infections	109	29.38
	Eczema	70	18.87
	Others	192	51.75
Clinical signs of superficial fungal infection	Skin rash	195	52.56
	Skin lesions	37	9.97
	Others	139	37.47
Skin scrape done	Yes	282	76.01
	No	89	23.99
HIV status	Positive	23	6.20
	Negative	183	49.33
	Unknown	165	44.47
Laboratory results KOH	Positive	219	59.03
	Negative	152	40.97
Culture results	NGO	92	24.80
	Bacterial	39	10.51
	Trichophytonverrucosum	32	8.63
	Others	208	56.06
Site	Leg	63	16.98
	Hand	52	14.02
	Others	256	69

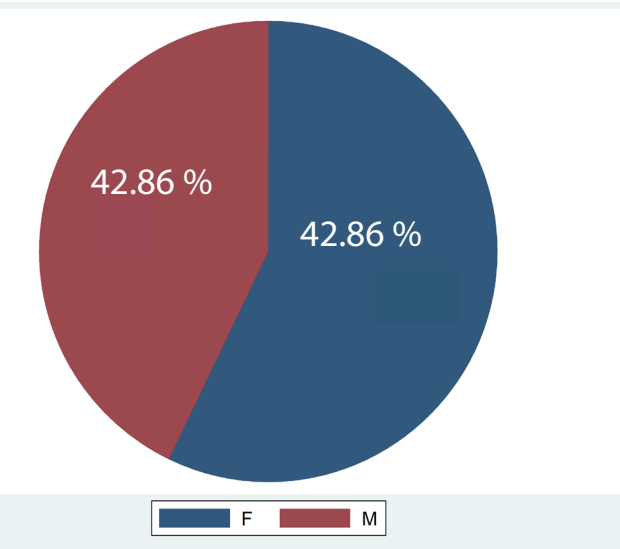


Figure 1:0 *Pie Chart Showing Percentage In Gender*

In this study, 371 respondents were recruited (159) 42.86% were males and (212) 57.14 % were females. The mean ages for both sexes were 30.8 with std. dev. of 20.0046 and a range of [1, 89]

The highest prevalence rates of extensive *Superficial mycoses* were found among participants aged 5-14 years and females were more affected compared to males unlike the other studies which was done in northern Malawi where the highest prevalence rates of *fungal* infection were found among subjects aged 15-24 years and rates were generally higher among males than among females.

Table 2.0: *Common fungal isolates obtained from culture*

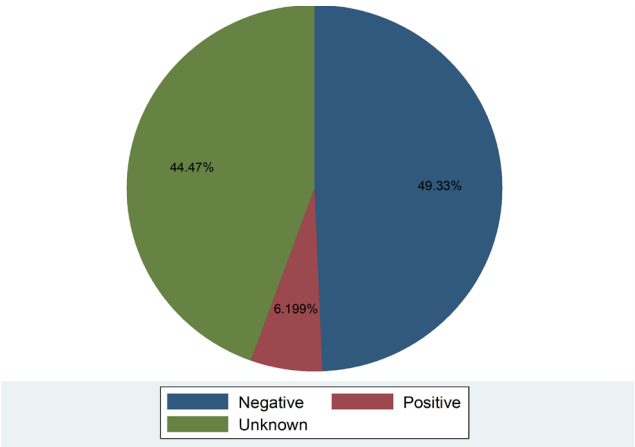
CULTURE RESULT	FREQUENCY	PERCENT
Alternaria alternata	13	3.50
Aspergillus fumigatus	11	2.96
Aspergillus niger	22	5.93
Bacterial	39	10.51
NGO	92	24.8
Trichophyton interdigitale	15	4.04
Trichophyton verrucosum	32	8.63
Yeast	10	2.70

Figure 1.1: *The pie chart below, shows the HIV Status of the participants*

The HIV status factor was determined by the analysis in which 206 (55.53%) of the participants who knew their HIV status with 6.2% being positive and 49.3 % negative.

Those who did not know their status were 165 (44.47%).In spite of the decline in HIV prevalence; Busia County has a prevalence of 6.8%. HIV incidence rates variably remain high among Key Populations (KPs) and other vulnerable groups, particularly the businessmen in which out of 48 participants 6 were positive and out of 109 farmers 8 were positive.

Figure 1.1: *HIV Status of the participants*



This table beside shows out of 371 patients 246 (66.31%) had a frequency of more than 10 cases cultured, while 125 (33.69%) had less than 10 cases. 92 (24.8%).

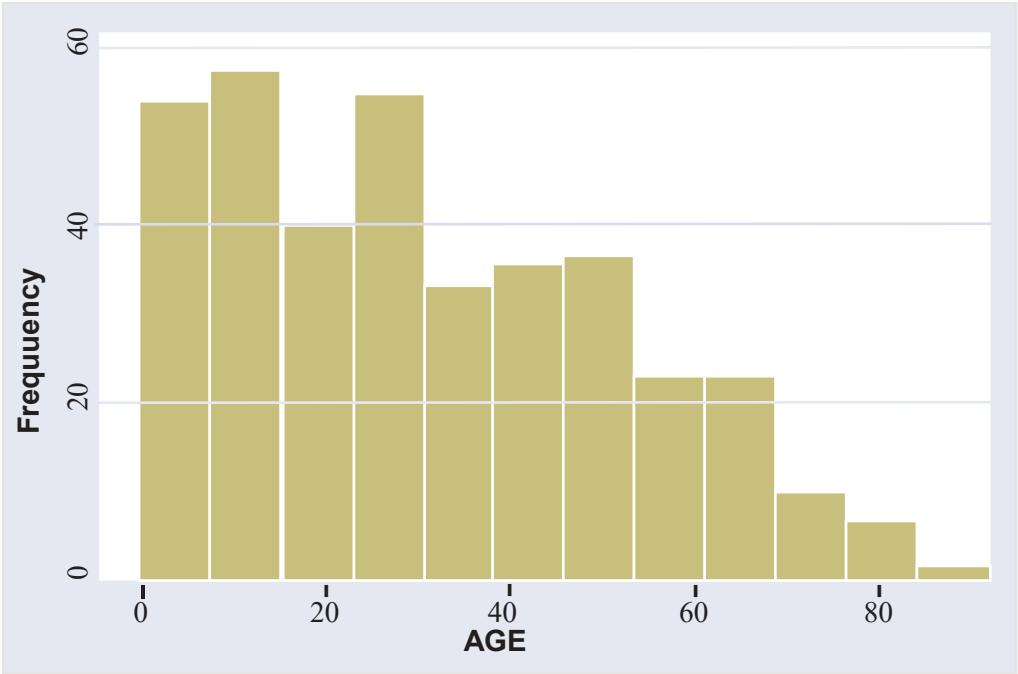
There were NGOs, 39(10.51%) were bacterial, 32(8.63%) were *Trichophyton verrucosum,* 22(5.93%) *Aspergillus* niger, 15 (4.04%) were *Trichophyton* interdigitale, 13(3.50%) Alternaria alternata, 11 (2.96%) *Aspergillus fumigatus* and Yeasts were 10 (2.70%).

High numbers were recorded in NGO (24.8%) as indicated in the table above due to premedication of antifungal drugs

The table below shows frequency of *superficial mycoses* in occupation variable with farmers having the highest frequency of 109(29.38%), pupils 77(20.75%), students 68(18.33%), business 48(12.94%), teachers 20 (5.39%) and unemployed 12(3.23%) respectively.

Table 3.0: *below shows superficial mycoses and it is related occupation variable*

Occupation	Frequency	Percentage %
Accountant	1	0.27
Agricultural Officer	1	0.27
Business People	48	12.94
Casual	2	0.54
Civil Servant	7	1.89
Clerk	1	0.27
Driver	7	1.89
Farmer	109	29.38
Mason	4	1.08
Mechanic	1	0.27
Painter	1	0.27
Pastor	2	0.54
Police	2	0.54
Priest	1	0.27
Pupil	77	20.75
Revenue Officer	1	0.27
Security	1	0.27
Student	68	18.33
Surveyor	1	0.27
Tailor	1	0.27
Teacher	20	5.39
Technician	2	0.54
Unemployed	12	3.23
Secretary	1	0.27
Total	***371***	***100***



2.0 Figure *for age distribution for superficial mycoses*

The study shows study participants 54 years and below 83.6% (310) were more affected by *superficial mycoses* compared to those who were above 55 years16.4% (61) with a mean of 30.98 and a median age of 28.00._

Table 4.0 Age grouping in relation to frequency for superficial mycoses

Age group	Frequency	Percent %
0-4	21	5.66
5-14	81	21.83
15-24	56	15.09
25-34	66	17.79
35-44	47	12.67
45-54	39	10.51
55-64	38	10.24
65-74	15	4.04
75-84	7	1.89
85-94	1	0.27

Table 4:1 Shows the Site of fungal infection in participants with superficial mycoses

In this study *superficial mycoses* were noted in the following sites 86 (23.18%) leg, 46 (12.40%) neck, 52 (14.02%) hand, 21(5.66%) face, 49(13.21%) scalp and the rest were recorded in other sites 117 (31.54%) of the body.

Table 4:1 Site of fungal infection in participants with superficial mycoses

Site of infection	Frequency	Percentage %
Face	21	5.66
Hand	52	14.02
Leg	86	23.18
Neck	46	12.40
Scalp	49	13.21
Others	117	31.54

Discussion

It was observed in this study that social-demographic factors like region, county, occupation, age, sex, and HIV status, contributed the extent of *Superficial mycoses* infection. The study revealed that the distribution of *superficial mycoses* differ between geographical region. Of the total participants, Busia

county had the highest rate 69.54% followed by Siaya county with 8.09% with Mombasa, Nairobi and Kericho counties registering the lowest 0.27% .These findings are similar to what was reported by other studies in other countries (5-12, 33-36)

Fungal elements were detected **microscopically** in females (34.5%) compared to males 24.51% and females represented 57.14% of the general population compared to males 42.85%.

The highest prevalence rates of extensive *superficial mycoses* were found among participants aged 5-14 years and females were more affected compared to males unlike the other studies which were done in northern Malawi where the highest prevalence rates of fungal infection were found among subjects aged 15-24 years and rates were generally higher among males than among females (26).

The relationship between occupation and HIV status factors was clearly noted in this study. Businessmen had the highest rate of HIV infection 12.5% followed by farmers, 7.3% among the total number of businessmen and farmers respectively.

Pupils (2.59%) and students (2.94%) had almost similar percent. Similar studies have shown that *Superficial mycoses* are important causes of serious and life threatening opportunistic infections in the immunosuppressed, including children (15, 20).

Diagnosis of s*uperficial mycoses* was fairly straight forward and we ensured that correct diagnosis, skin scrapings were collected for *potassium hydroxide* preparations and cultures.

In this study *Tinea species* recorded high prevalence 29.92% with *Eczema* 18.87%. *Tinea capitis* is a scalp infection and *Tinea corporis* involved the glabrous and these had registered a prevalence of 12.67% and 6.47% respectively.

It emerges from the study that the *genus Trichophyton* is the most common variant isolation from culture. *Trichophyton* were 31.81% , NGO 24.80%, bacteria 10.51% and species *Alternaria alternata* 3.5% were isolated and this have not been reported by other studies while others were 29.38.% (21, 24, 25).

In our study we noted that *superficial mycoses* involved its outer most covering including *appendages;* Face, hand, leg, neck and scalp. The *causative fungi* colonize only cornfield layer of *epidermis* or *supra-follicular* portions of hair and do not penetrate into deeper *anatomical* sites .

The *superficial mycoses* is the most common causes of skin infections in many patients visiting Alupe clinic in Busia western Kenya. This is supported with studies done in other areas (37, 38).

Conclusion:

The study confirmed that *superficial mycoses* are common infections in patients visiting Alupe Clinic and its environs with demographic factors playing a significant role. It was noted that *superficial mycoses* has no *predilection*, for neither gender nor HIV status.

However, high prevalence was noted among farmers, pupils, students, business people and teachers respectively. The commonly affected site was exposed parts such as face, foot, hand, leg, neck and scalp.

There is need to strengthen clinical *mycology* capabilities for correct and timely diagnosis of *fungal* infections and *epidemiological* understanding of demographic and occupational risk factors for *fungal* infections.

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