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Role of Scabies Detection Methods in Diagnosis of Scabies in Patients Attending Mbarara Regional Referral Hospital Skin Clinic in Western Uganda

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Abstract:

- ***Introduction:***

Scabies, a skin infestation caused by the Sarcoptes scabiei mite, remains a significant global health burden, affecting approximately 200 million people worldwide. The disease presents with both typical and atypical clinical variants, complicating its diagnosis. Various diagnostic tools, including dermoscopy, burrow ink test (BIT), and microscopy, have been employed to detect scabies, yet their effectiveness, especially in populations with Skin of Colour, remains underexplored.

- ***Objective:***

This study aimed to determine the role of microscopy on skin scrapings, BIT and dermoscopy as screening tests in the diagnosis of scabies infestation in patients seen at Mbarara Regional Referral Hospital Skin Clinic in Western Uganda.

- ***Study Methods:***

The study utilized a hospital-based cross-sectional descriptive design at Mbarara Regional Referral Hospital (MRRH) Skin Clinic from December 2024 to February 2025. A total of 540 participants were enrolled consecutively. Data collection involved clinical examination, structured questionnaires, and diagnostic tests performed by principal investigator and trained research assistants under supervision of a certified dermatologist. Findings were analyzed using Stata version 17. Ethical approval was obtained, and participants provided informed consent, with confidentiality maintained.

- ***Results:***

A total of 540 participants were enrolled with majority being females (60%)and aged between 0 to 9 years (24.3%). Microscopy on skin scrapings demonstrated the highest sensitivity (52.94%), while dermoscopy and the burrow ink test had lower sensitivity (23.53%), though all methods had a specificity of 100%.

Keywords: *Scabies, Diagnostic Accuracy, Microscopy, Dermoscopy, Burrow Ink Test, Skin Infestation, Parasitic Disease.*

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I. INTRODUCTION

The Sarcoptes scabiei mite is the infectious agent that causes scabies, a skin infestation(1). The papular rash, severe itching, and tiny burrow marks on the skin are the hallmarks of the illness(2). Scabies is estimated to afflict 200 millions of people worldwide, greatly increasing the strain on the world's health(3).

Scabies infestation can present with both typical and atypical clinical variants, including bullous, crusted, hidden, incognito, nail, nodular, and scalp forms that can mimic other skin conditions making scabies diagnosis difficult (4).

In 2020, the International Alliance for the Control of Scabies (IACS) established a standardized diagnostic criterion to improve the accuracy and consistency of scabies diagnosis. These criteria categorize diagnosis into "Confirmed," "Clinical," and "Suspected" scabies based on clinical signs, dermoscopic findings, and laboratory confirmation, providing a structured approach for healthcare professionals worldwide(5).

Various diagnostic tools have been used to aid the diagnosis of scabies ranging from invasive biopsy to non-invasive methods including dermoscopy, microscopy and burrow ink test (BIT).

Dermoscopy as a non-invasive tool has been shown to be valuable in the diagnosis of scabies, particularly in specific circumstances such as incognito scabies, previous steroid treatment, and in infants or the elderly patients with dermoscopic features including triangular sign, jetliner with contrail among others (6, 7). The effectiveness of this modality in patients with skin of colour has been an area of limited research.

The BIT has been used as a diagnostic tool for scabies, with studies showing its effectiveness in identifying the characteristic S-shaped burrow and the presence of the scabies mite(8-10).

Microscopy on skin scrapings has also been used in the diagnosis of scabies and it involves examination of the prepared sample under a microscope to identify the mite, eggs or fecal matter.

Given the wide range of detection methods for scabies infestation, there is a need to study and document their effectiveness in diagnosis of scabies infestation in patients with skin of colour.

- *Problem Statement*

Scabies infestation is one of the conditions seen at the dermatology outpatient clinic at Mbarara Regional Referral Hospital in the western part of Uganda, with an average of 15 patients diagnosed with scabies per month, according to anecdotal data from the HMIS OPD 002: outpatient registers.

Non-invasive scabies detection methods including dermoscopy, microscopy on skin scrapings and burrow ink test can be used in the diagnosis of scabies infestation however the role of these screening tests is not well described especially in patients with skin of colour. Thus inadequate knowledge on the use of this technique in populations of skin of color results in lack of establishment of effectiveness in diagnosis that can help physicians distinguish and diagnose these several variants.

This study seeks to determine the role of microscopy, burrow ink test and dermoscopy as alternative screening test in the diagnosis of scabies infestation.

- *Objective:*

To assess the diagnostic accuracy and efficiency of microscopy on skin scrapings, burrow ink test, and dermoscopy as screening methods for scabies infestation at the Mbarara Regional Referral Hospital Skin Clinic in Western Uganda.

II. METHODOLOGY

- *Study Design:*

This was a hospital-based cross-sectional study conducted to evaluate the role of different scabies detection methods, including microscopy, the burrow ink test (BIT), and dermoscopy, in the diagnosis of scabies at Mbarara Regional Referral Hospital (MRRH) Skin Clinic. The study was conducted from December 2024 to February 2025.

- *Study Setting:*

The study was conducted at the MRRH Skin Clinic, located in southwestern Uganda. MRRH serves as a tertiary referral center and a teaching hospital for Mbarara University of Science and Technology (MUST), providing specialized dermatological care to patients from Mbarara and surrounding districts. The clinic operates Monday to Friday, attending to approximately 400 patients per month.

- *Study Population:*

The study included all patients attending the MRRH Skin Clinic during the study period who met the eligibility criteria.

- *Inclusion Criteria:*

Patients attending the MRRH Skin Clinic during the study period who provided informed consent and/or assent.

- *Exclusion Criteria:*

Patients with concurrent dermatological conditions that could interfere with scabies diagnosis (e.g., atopic dermatitis). Patients already on treatment for scabies and unaccompanied minors.

- *Sample Size Determination:*

The sample size was determined using the OpenEpi software, based on an estimated scabies prevalence of 14.5% from previous studies in similar settings. Using a 99.99% confidence interval, a minimum sample size of 512 participants was required. However, a total of 540 participants were enrolled.

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➢ *Sampling Method:*

Participants were enrolled consecutively during the study period. Each participant was assigned a unique identification number for data collection and analysis.

➢ *Data Collection Procedure:*

Patients were clinically assessed by a certified dermatologist and invited to participate in the study. Those who consented were screened for scabies using three diagnostic methods: BIT, dermoscopy, and microscopy on skin scrapings. The findings were recorded in a structured questionnaire.

➢ *Diagnostic Methods*

- **Burrow Ink Test (BIT):** Ink was applied to suspected burrows, allowed to penetrate, and then wiped off to highlight burrow paths. Results were recorded as positive (burrows visible) or negative (no burrows visible).
- **Dermoscopy**: A handheld dermoscope was used to examine characteristic scabies features such as burrows and mite-related lesions.
- **Microscopy**: Skin scrapings were collected, prepared with mineral oil, and examined under a microscope for the presence of mites, eggs, or fecal pellets.
- **Quality Control**: All diagnostic results were reviewed by a certified dermatologist following the 2020 International Alliance for the Control of Scabies (IACS) consensus criteria. Research assistants were trained before data collection, and data was cross-checked for completeness. The microscope was calibrated regularly.
- **Data Management and Analysis**: Collected data was entered into Google Forms, cleaned in Microsoft Excel, and analyzed using Stata version 17. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were computed for BIT, dermoscopy, and microscopy using the IACS criteria as the reference standard.

III. RESULTS

Table 1 Socio-Demographic Characteristics of Study Participants (n=540)

Variable	**Frequency (%)**
Age in years: Median(IQR)	20.87(13.54)
0-9	**131(24.3)**
10-19	130(24.1)
20-29	104(19.3)
30-39	70(13.0)
40-49	43(8.0)
50-59	20(3.7)
60-69	23(4.3)
70-79	10(1.9)
80-89	8(1.5)
90-100	1(0.2)
Gender	
Female	**324(60)**
Male	216(40)
Scabies infestation	
Present	**34(6.3)**
Absent	506(93.7)

A total of 540 participants were enrolled 34 of which had scabies infestation. Majority of the participants were females and between 0 to 9 years with a median of 20.87 years and interquartile range of 13.53 years.

Table 2 Shows Specificity, Sensitivity, Positive Predictive value and Negative Predictive value of Dermoscopy, Microscopy on Skin Scrapings and Burrow Ink Test

Test	**Percentage**	**95% CI**
Dermoscopy		
Sensitivity	23.53%	19.95%,27.11%
Specificity	100.00%	100.00%,100.00%
Positive predictive value	100.00%	100.00%,100.00%
Negative predictive value	95.11%	93.29%,96.93%
Microscopy on skin scrapings		
Sensitivity	52.94%	48.73%,57.15%
Specificity	100.00%	100.00%,100.00%
Positive predictive value	100.00%	100.00%,100.00%
Negative predictive value	96.93%	95.48%,98.39%
Burrow ink test (BIT)		
Sensitivity	23.53%	19.95%,27.11%

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Specificity	100.00%	100.00%,100.00%
Positive predictive value	100.00%	100.00%,100.00%
Negative predictive value	95.11%	93.29%,96.93%

All the tests had a specificity of 100%(CI 100.00%,100.00%) and a positive predictive value of 100%(CI 100.00%,100.00%). Microscopy had the highest sensitivity of 52.94%(CI 48.73%,57.15%) and negative predictive value 96.93%(95.48%,98.39%). Dermoscopy and burrow ink test had the same sensitivity of 23.53%(CI 19.95%,27.11%) and negative predictive values of 95.11%(CI 93.29%,96.93%).

Fig 1 Scabies Mite Seen Under Light Microscope at x100 Magnification

Fig 2 Scabies Egg as Seen Under Microscope at x400 Magnification

Fig 3 Scabies Burrows and Mite on Genital Skin Seen Under a Dermo Scope.

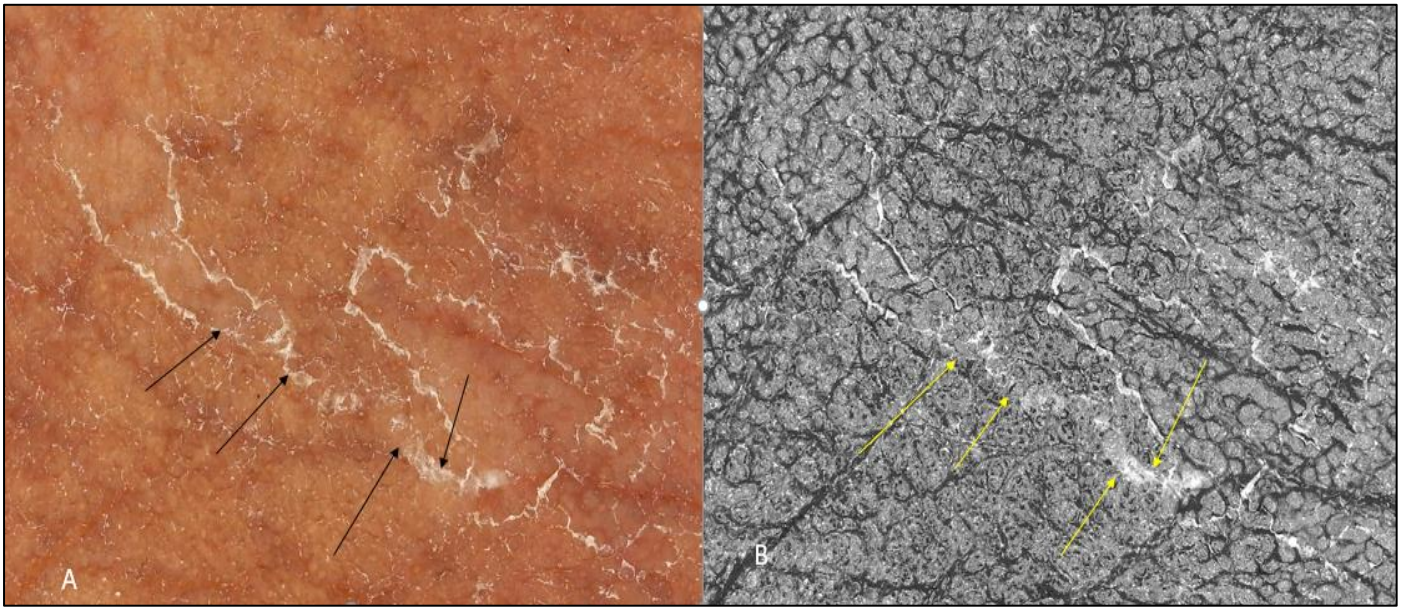

Fig 4 Dermo Copy shows a Burrow(A) which is Enhanced by UV Camera mode (B)

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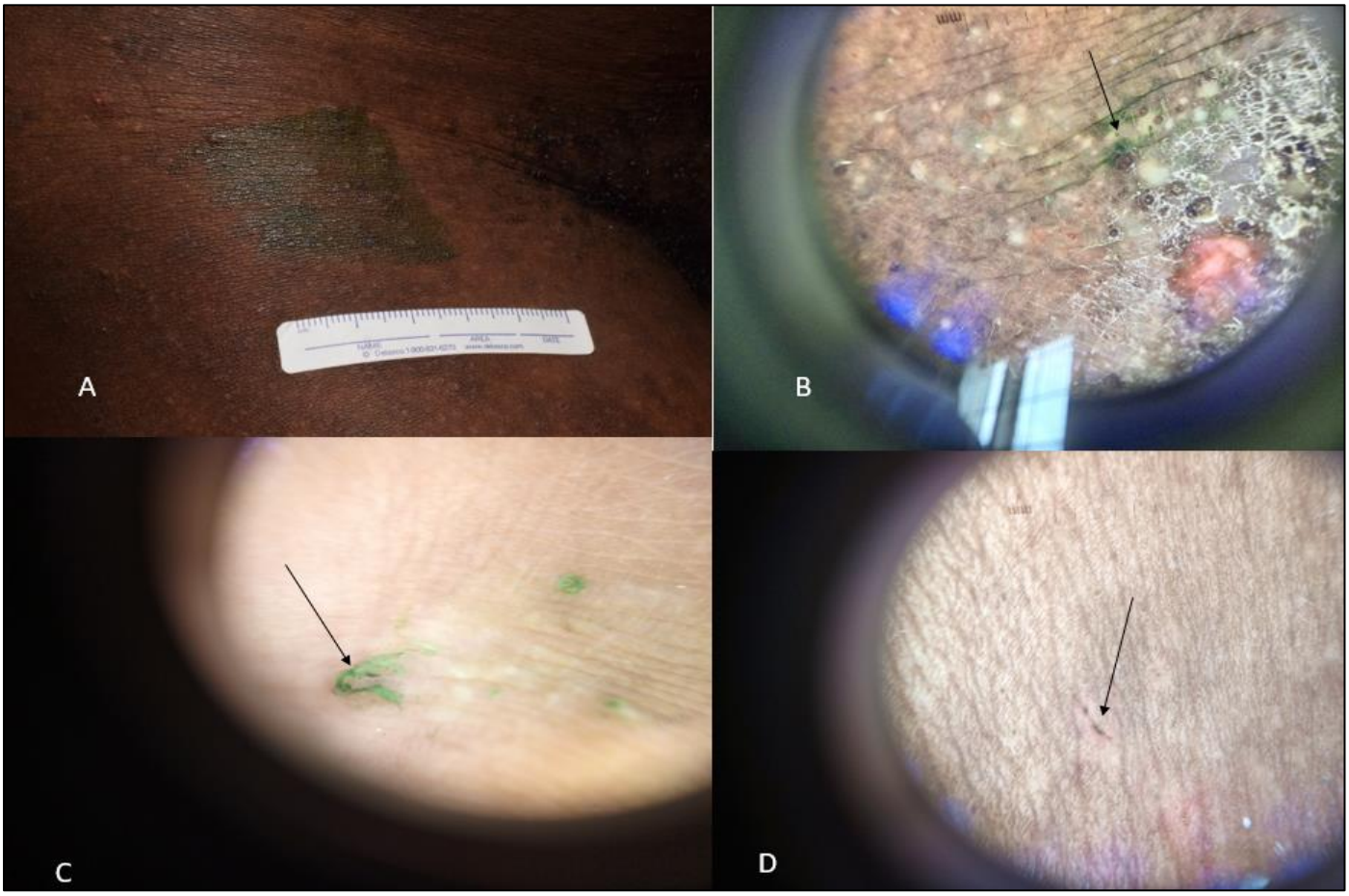

Fig 5 Shows the Burrow Ink Test. A Shows Ink Applied to the Suspected Area. B, C, and D Show Ink Retained in the Burrows (Black Arrows).

IV. DISCUSSION

➢ *Microscopy on Skin Scrapings*

In our study, microscopy on skin scrapings demonstrated a sensitivity of 52.94% and a specificity of 100%. This suggests that while microscopy is highly accurate in confirming positive cases, its ability to detect all true positives remains moderate in our settings.

Comparing our findings with studies from other countries reveals significant variations in sensitivity but with consistent specificity.

Studies done by Dupuy et al and Cinotti et al in France, microscopy achieved a much higher sensitivity of 90% and 92% respectively(11, 12). Higher sensitivity in France may be attributed to advanced sampling techniques, optimized skin scraping preparation, and skilled microscopists who accurately identify parasites. Variations in disease presentation, particularly differences in lesion morphology in skin of colour, can impact sample collection and parasite visibility, affecting sensitivity. Additionally, enhanced laboratory equipment and staining techniques in these settings may further improve detection rates.

A study done in Germany generated sensitivity of 46%, which is closer to our findings(13). This discrepancy may be due to differences in study design, as the German study employed a prospective, evaluator-blinded approach.

➢ *Dermo Copy*

The dermoscopy sensitivity of 23.53% and specificity of 100% in our study indicates that while the test is highly reliable in confirming scabies when a positive result is obtained, it misses a significant number of actual cases. This contrasts sharply with studies from France and Germany, where sensitivity was much higher.

For instance, the study by Dupuy et at reported a sensitivity of 91% and specificity of 86%, while Cinotti et al study showed even higher accuracy, with sensitivity of 95% and specificity of 97%(11, 12). These results suggest that dermoscopy was highly effective in detecting scabies in their settings, likely due to differences in factors such as operator expertise, lesion characteristics, skin type and equipment quality. In these mentioned studies, the majority of the populace has Fitzpatrick skin types I, II and III compared to our settings where all participant had Fitzpatrick skin types V and VI making the mite harder to visualize. The stark contrast in sensitivity between our study and those from France suggests that factors such as training in dermoscopic pattern recognition, variations in disease presentation, equipment quality and skin type may play a crucial role. Our specificity of 100% indicates that when scabies was identified, it was correctly diagnosed, but the low sensitivity highlights the

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challenge of detecting all true cases. This suggests that improvements in training and imaging techniques coupled with use of multiple investigation tools for example microscopy on skin scraping and dermoscopy, could enhance diagnostic accuracy for patients with skin of colour(6).

➢ *Burrow Ink Test (BIT)*

The results from our study using the burrow ink test, showed a specificity of 100% and a sensitivity of 23.53%(95%CI:19.95%,27.11%). This suggests that, while the test is excellent at correctly identifying those without scabies (no false positives), it struggles to detect a significant number of actual scabies cases (false negatives). This is in contrast to the study done in France, where the burrow ink test demonstrated a specificity of 100% and a higher sensitivity of 36%(9). In our study the dermoscopy and burrow ink test had same specificity and sensitivity thus can be used interchangeably in patients with skin of colour.

V. CONCLUSION

Microscopy on skin scrapings, dermoscopy, and the burrow ink test (BIT) all have a specificity of 100%. However, microscopy demonstrated the highest sensitivity at 52.94%, compared to dermoscopy and BIT, both of which had a sensitivity of 23.53%.

LIST OF ABBREVIATIONS

- AIDS---------- Acquired Immunodeficiency Syndrome.
- BIT ----------Burrow ink test
- CI ----------Confidence interval
- CPDS---------- Continuous Professional Development Sessions
- FRC ----------Faculty research committee
- HIV---------- Human Immunodeficiency Virus.
- HMIS----------Health Management Information System
- M.U.S.T----------Mbarara University of Science and Technology
- MRRH ----------Mbarara Regional Referral Hospital
- NTD ----------Neglected tropical disease
- PCR ----------Polymerase chain reaction
- REC ---------- Research Ethics Committee
- WHO ---------- World Health Organization

ACKNOWLEDGEMENT

I extend my sincere gratitude to our dedicated dermatology nurses, Sister Josephine and Sister Rose, whose kindness, wisdom, and unwavering support have been a source of comfort and motivation

A special and heartfelt thank you to all the study participants—without your willingness to contribute, this work would not have been possible. Your participation has played a crucial role in advancing knowledge in dermatology, and for that, I am truly grateful.

➢ *Availability of Data and Material*

The dataset and study materials are all available upon request from the editor.

➢ *Funding*

We declare no source of funding for the study.

➢ *Ethics Declaration*

Ethical approval was obtained from the Faculty Research Committee (FRC) and Research Ethics Committee (REC) of MUST. Site clearance was granted by MRRH administration.

All participants provided informed consent, and confidentiality was maintained by assigning unique identifiers. Photographs taken were de-identified to protect patient privacy.

➢ *Consent for Publication*

All participants provided informed consent for publication.

➢ *Conflict of Interests*

All authors declare no conflict of interest.

➢ *Author Contributions*

Dr. Mukalazi Abraham conceptualized the study, developed the methodology, and wrote the manuscript.

Mrs. Esther Awino conducted data analysis and interpretation.

Dr. Stephen Kizito Mirembe, Dr. Grace Mulyowa Kitunzi, and Dr. Aloyo Gladys Onguti supervised the study and provided critical revisions to the manuscript.

All authors reviewed and approved the final manuscript.

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APPROVALS

APPENDIX 1: Research Ethics Committee (Rec) Approval

MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY

RESEARCH ETHICS COMMITTEE

E-mail: sec.rec@must.ac.ug

Mbarara University of Science & Technology
P. O. Box 1410, Mbarara
RESEARCH ETHICS COMMITTEE
15 NOV 2025
APPROVED
VALID UNTIL DATE SHOWN ABOVE

19/11/2024

To: ABRAHAM MUKALAZI

MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY
0784944440

Type: Initial Review

Re: MUST-2024-1734: PREVALENCE, CLINICAL VARIANTS AND ROLE OF SCABIES DETECTION METHODS IN DIAGNOSIS OF SCABIES IN PATIENTS ATTENDING MBARARA REGIONAL REFERAL HOSPITAL SKIN CLINIC

I am pleased to inform you that at the **173rd** convened meeting on **03/10/2024**, the MUST Research Ethics Committee meeting voted to approve the above referenced application.
Approval of the research is for the period of **19/11/2024** to **19/11/2025.**

As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the REC for re-review and approval **prior** to the activation of the changes.
3. Reports of unanticipated problems involving risks to participants or any new information which could change the risk benefit: ratio must be submitted to the REC.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Continuing review application must be submitted to the REC **eight weeks** prior to the expiration date of **19/11/2025** in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study.
6. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
7. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following is the list of all documents approved in this application by MUST Research Ethics Committee:

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No.	Document Title	Language	Version Number	Version Date
1	Translated consent	RUNYANKOLE	PDF RUNKYAN KOLE VERSION	2024-11-05
2	Informed Consent forms	ENGLISH	PDF ENGLISH VERSION	2024-11-05
3	Protocol	English	PDF ENGLISH VERSION	2024-11-05
4	Data collection tools	ENGLISH	PDF ENGLISH VERSION	2024-11-05
5	Community Engagement plan	ENGLISH	PDF ENGLISH VERSION	2024-11-05
6	COVID-19 & EBOLA risk management plan	ENGLISH	PDF ENGLISH VERSION	2024-11-05

Yours Sincerely

Dr. Paul Alele
For: MUST Research Ethics Committee

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APPENDIX 2: Hospital administrative clearance letter.

Telegrams
Telephones

Dirs' Office: 048521806
Others : 048520007/21086/20024
Dirs mobile: 0772 415875
In any correspondence on
This subject please quote ref: No.....

THE REPUBLIC OF UGANDA

Ministry of Health
MBARARA REGIONAL REFERRAL HOSPITAL
P.O. Box 40,
Mbarara - Uganda

November 26, 2024

Dr. Mukalazi Abraham
2022/MMed/077/PS
Mbarara University of Science and Technology

Re: Administrative Clearance of Protocol On "Prevalence, Clinical Variants, and Role of Scabies Detection Methods in the Diagnosis of Scabies in Patients Attending Mbarara Regional Referral Hospital".

Mbarara Regional Referral Hospital has received and reviewed your proposal referenced above and hereby grants approval to conduct this study. This clearance covers the proposal and the accompanying documents listed below:

- Approval from MUST Research Ethics Committee (in English only)
- Parental Consent form (in English and Runyankore)
- Photography Consent form (in English and Runyankore)
- Photography Assent form (in English and Runyankore)
- Study data collection tool (in English and Runyankore)
- Certificates of Good Clinical Practices for the Study Team

This approval is subjected to the following conditions:

1. That you will abide by the regulations governing research in the country as set by the Uganda National Council for Science and Technology.
2. That any changes to the protocol and study documents that you may find necessary to make will be reviewed and approved by relevant authorities.
3. That the conduct of your study shall be monitored by the Mbarara Regional Referral Hospital supervisors in the relevant departments/units.
4. That you provide a copy of the final document upon completion of the study, including a summary of the results and any publications to Mbarara Regional Referral Hospital.
5. That you will include Mbarara Regional Referral Hospital in your acknowledgements in all your publications.

My best wishes to you.

MBARARA REGIONAL REFERRAL HOSPITAL 04 DEC 2024 P.O BOX 40 MBARARA

for: **HOSPITAL DIRECTOR**