PROPOSAL ON SUSTAINABLE HAND HYGIENE IN LOW AND MIDDLE INCOME COUNTRIES.

This project was initially drafted to improve the viability of Infection Control measures which would eventually lead to lower rates of infection that is a factor in Antimicrobial Stewardship.

However, we have applied it for management of Novel COVID 19 and it is proving very helpful for our country.

ABOUT TEAM MEMBERS

Nalukwago Mercy, was a bachelor of pharmacy finalist at Makerere University. I undertook a course unit on anti- microbial stewardship as well as organized a compounding event at Makerere University where students made cost-effective hand sanitizer. This compounding event won a grant from the International Pharmaceutical Students' Federation (IPSF).

I have since served as chairperson 8th IPSF African Pharmaceutical symposium and currently serving under the FIP YPG in Projects subcommittee- Proffesional Development Team.

Kanyange Angel Moureen, a bachelor of science in nursing finalist at Makerere University. As an intern in the One health Institute in June 2018 under the One Health Of Eastern And Central Africa (OHCEA), I led a group of students in making a low-cost incinerator for Namanyonyi Health Centre in Mbale district, Uganda as one of the innovations to reduce anti-microbial resistance. In addition, I undertook a course on infection prevention and anti- microbial resistance and stewardship while at the institute.

Ahimbisibwe Joan Kwesigabo, a bachelor of science in medicine and surgery finalist at Kilimanjaro Christian Medical University College, Moshi, Tanzania. During the period of 5th February- April 13th 2018, I undertook a short course on principles and practices of infectious diseases with focus on anti-microbial resistance and anti- microbial stewardship. Furthermore, I wrote a research paper in her university on knowledge on anti-microbial resistance and prescription practices among clinicians in Moshi, Tanzania.

Ebbarnezh Lennox Kesington, a bachelor's degree in biomedical laboratory technology finalist at Makerere University currently volunteering with Infectious Disease Uganda under the Global Health Security Project (GHSF) and actively participating in anti-microbial resistance workshops around the country. During this volunteering period, I have been involved in data collection of and analysis during the first national IPC assessment that was carried out in Uganda. I have also been involved in the preparation, refinement of the intergrated AMR surveillance network framework, protocols and data collection tool documents for the Uganda Animal Sector.

BACKGROUND

Due to the current pandemic, applying correct Infection Prevention Control (IPC) principles has become so important that our lives have started to depend on it.

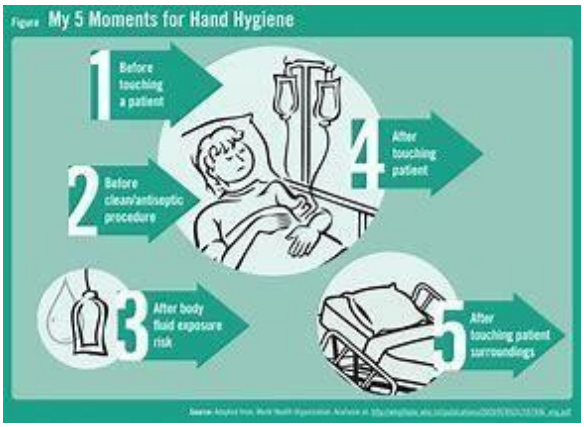
Our team has a keen interest however, on Infection Prevention Control (IPC) practices. This is because IPC plays a vital role in preventing the spread of COVID 19.

According to WHO, there are approximately 1.4million cases of Hospital Acquired Infections (HAI) at any given time worldwide; with a double to twenty fold risk in developing countries. As of today, we are clocking a count of millions of lives lost to one of these.

Our intervention is focused on hand hygiene as a tool for IPC. This is because hand hygiene is has proved the best way to stop infection considering 80% of infections are spread through hands (BC- Centre for Disease Control). Hand hygiene is therefore key in prevention of hospital acquired infections which more likely to be caused by drug resistant pathogens.

There are 5 moments of hand hygiene

- Before touching a patient
- Before aseptic procedures
- After body fluid exposure/risk
- After touching a patient
- After touching patient surroundings.



The project focuses on strengthening the culture of hand hygiene through education of a focus group of vulnerable members of the hospital community; specifically the trainees. This is because during the National IPC assessment that students were among the major categories that were prone to improper hand hygiene convention.

Another major cause of non-compliance to the 5 moments of hand hygiene is inadequate resources like disinfectants required in low resource settings. This is because national supplies often run out in the first month of acquiring them, theft and improper management. All these result in a non-sustainable IPC model.

Our team is interested in promoting local preparation of the hand sanitizers using available and affordable materials among the communities. These are set to supplement quarterly supplies from the government in-order to promote sustainability.

This involves training the focal members of the already existing IPC teams on how to prepare the hand sanitizers. This was demonstrated on the national hand hygiene day; however it was never implemented. Furthermore, the raw materials like alcohol used were not locally available in most rural communities. These raw ingredients are 96% alcohol (prepared from sorghum), 3% hydrogen peroxide, 98% glycerol and distilled water. This would reduce the cost of acquiring commercially already constituted sanitizer by about six times (WHO 2010).

Crude alcohol is a timeless delicacy in African communities and has taken on a variety of indigenous names according to the region i.e, *kwete, marwa,* e.t.c. Traditional breweries are popular social and economic cradles in most communities. With such a strong history, the medical field could take advantage of this.

Sorghum is our focal plant due its versatility. It can be grown as a grain, forage or sweet crop and considered one of the top five cereal crops in the world. It is also drought tolerant and environmentally friendly. Due to its wide uses and adaptation, “sorghum is one of the really indispensable crops” required for the survival of humankind (From Jack Harlan, 1971).

It also yields a greater percentage of alcohol n fermentation compared to other cereals; (Ezeonu Chukwuma Stephen, Nwokwu Chukwumaobim Daniel U., Kadiri Bashir. Comparative
Physico-chemical Analysis of Locally Brewed Beer (*Burukutu*) from Corn, Millet and Sorghum.
American Journal of Science and Technology. Vol. 4, No. 3, 2017, pp. 43-48.)

SORGHUM

PROCESS OF MANUFACTURE OF ALCOHOL FROM SOGHURM

Ezeonu Chukwuma Stephen *et al.*: Comparative Physico-chemical Analysis of Locally Brewed Beer (*Burukutu*) from Corn, Millet and Sorghum

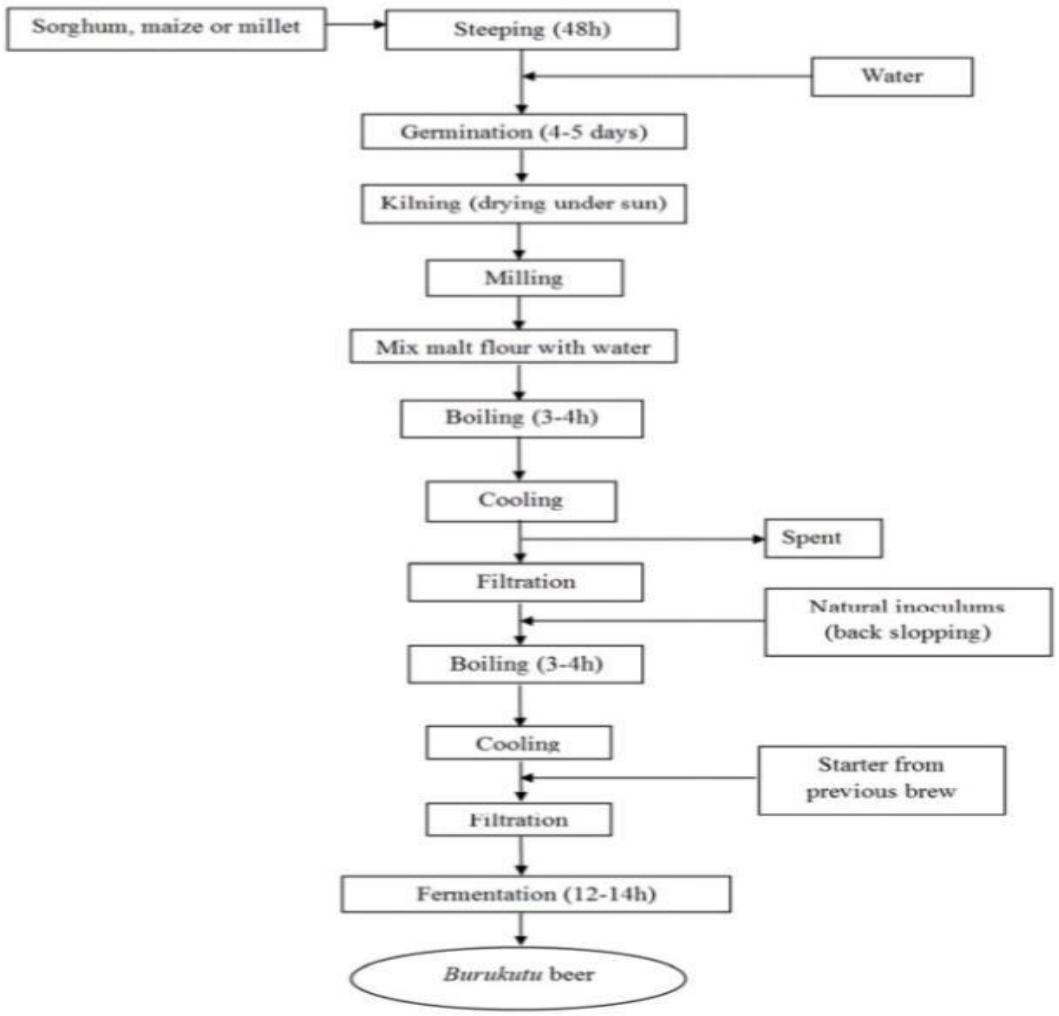


Figure 1. *A process flow chart of Burukutu production.*

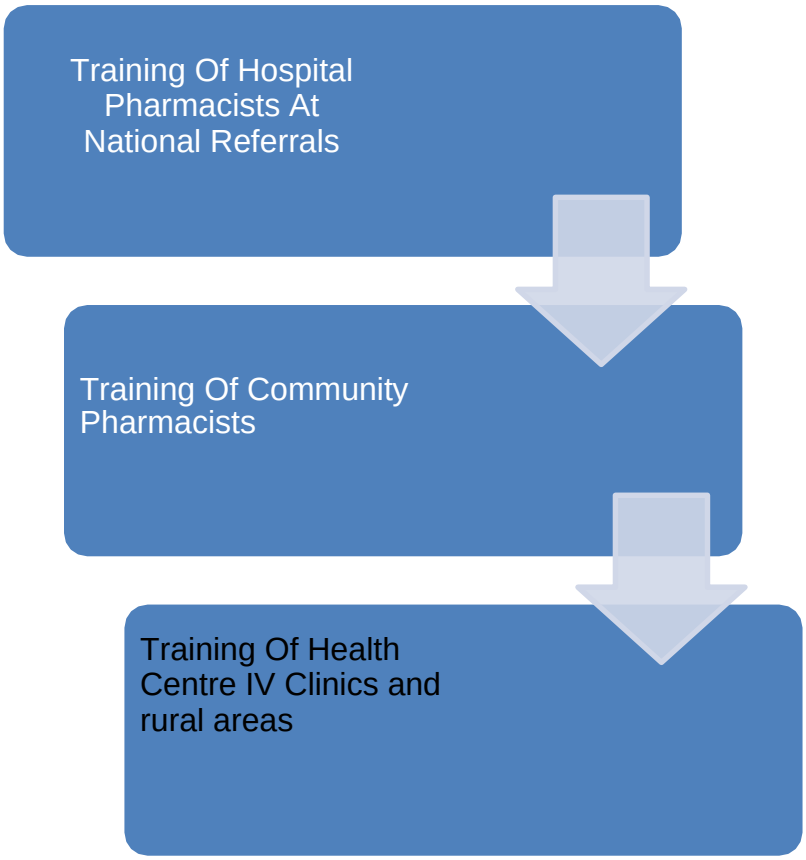
IMPACT OF OUR INNOVATION

We believe our innovation will create more impact as it is easier to impact this behavior among health trainees compared to those already practicing. Trainees minds will be conditioned that good hand hygiene practice rewards greater credit points in their examinations hence adopting the behavior and improving the compliance rates. This solution seeks to reduce the incidence of HAI hence reducing the need for antibiotic treatment.

Value Proposition

Capacity building of the pharmacy auxillary staff e.g pharm techs and nurses through impacting knowledge and skills on how to make hand rub.

IMPLEMENTATION PLAN



Also, to ensure the availability of sanitizer at all times in health facilities to boost our intervention, we intend to equip focal persons at each health center with the knowledge of making their alcohol rub by reconstituting raw ingredients. One of our team members has organised a similar training for pharmacy students in Makerere and the event won the International Pharmaceutical Students' Federation Compounding grant 2017. This shows feasibility and affordability. We have also supported our National Pharmacists Council in implementing this as well as the International Hospital Kampala where I serve as the Acting Deputy Pharmacist.

Our innovative strategy is using alcohol from sorghum or sugarcane as a local source of alcohol.

This solution seeks to reduce the incidence of HAI hence reducing the need for antibiotic treatment.

SPECIAL CONSIDERATION IN ETHANOL PRODUCTION

The presence of unspecified microorganisms from traditional leaven complicates the control of the fermentation process and yields products of variable quality. The use of starter cultures seems to be a good method to reduce organoleptic variations and to reduce the risk of contamination with pathogenic organisms. This approach would also increase the chances of preserving of traditional sorghum beer, giving it a longer shelf life. The pasteurization of sorghum beer appears most promising for resolving the brewer's perennial principal problem of a shorter shelf life. This operation coupled to the application of plants extracts could be a potential alternative to synthetic preservatives for reasons that they have large spectrum activity against Gram negative bacteria, Gram positive bacteria and fungi which are known to be the main factor of beverages deterioration. (*Christian Tétédé Rodrigue KONFO*1, Nicodème Worou CHABI2*)

APPENDIX

PART A:

1. **BUDGET**

ITEM	**PRICE**
TRAINING	10 USD
SORGHUM/ SUGARCANE	0.5 USD/ KILO
WATER	0.1 USD/ KILO
HYDROGEN PEROXIDE	1 USD/LITRE
GLYCEROL	0.5 USD / LITRE

2. WHO GUIDE TO LOCAL PRODUCTION OF HOSPITAL HAND SANITIZERS.

Materials required (small volume production)

REAGENTS FOR FORMULATION

• Ethanol 96%

• Hydrogen peroxide 3%

• Glycerol 3%

• Sterile distilled or boiled cold water

• 10-litre glass or plastic bottles with screw-threaded stoppers (**1**), or

• 50-litre plastic tanks (preferably in polypropylene or high density

polyethylene, translucent so as to see the liquid level) (**2**), or

• Stainless steel tanks with a capacity of 80–100 litres (for mixing without overflowing) (**3** , **4**)

• Wooden, plastic or metal paddles for mixing (**5**)

• Measuring cylinders and measuring jugs (**6** , **7**)

• Plastic or metal funnel

• 100 ml plastic bottles with leak-proof tops (**8**)

• 500 ml glass or plastic bottles with screw tops (**8**)

• An alcoholometer: the temperature scale is at the bottom and the ethanol concentration (percentage v/v) at the top

Step by step preparation:

1. The alcohol for the formula to be used is poured into the large bottle or tank up to the graduated mark.

2. Hydrogen peroxide is added using the measuring cylinder.

3. Glycerol is added using a measuring cylinder. As glycerol is very viscous and sticks to the wall of the measuring cylinder, it should be rinsed with some sterile distilled or cold boiled water and then emptied into the bottle/tank.

4. The bottle/tank is then topped up to the 10- litre mark with sterile distilled or cold boiled water.

5. The lid or the screw cap is placed on the tank/bottle as soon as possible after preparation, in order to prevent evaporation.

6. The solution is mixed by shaking gently where appropriate or by using a paddle.

7. Immediately divide up the solution into its final containers (e.g. 500 or 100ml plastic bottles), and place the bottles in quarantine for 72 hours before use. This allows time for any spores present in the alcohol or the new/re-used bottles to be destroyed.

Post-production analysis is mandatory if either ethanol or an isopropanol solution is used. Use the alcoholmeter to control the alcohol concentration of the final use solution. The accepted limits should be fixed to ± 5% of the target concentration (75%–85% for ethanol).

Quality control

Pre-production analysis should be made every time an analysis certificate is not available to guarantee the titration of alcohol (i.e. local production). Verify the alcohol concentration with the alcoholmeter and make the necessary adjustments in volume in the preparation of the formulation to obtain the final concentration.

Post-production analysis is mandatory if either ethanol or an isopropanol solution is used. Use the alcoholmeter to control the alcohol concentration of the final use solution. The accepted limits should be fixed to ± 5% of the target concentration (75%–85% for ethanol).

The alcoholmeter shown in this information pamphlet is for use with ethanol; if used to control an isopropanol solution, a 75% solution will show 77% (± 1%) on the scale at 25°C.

General information

Labelling should be in accordance with national guidelines and should include the following**:**

WHO-recommended hand rub formulation

For external use only

Avoid contact with eyes

Keep out of the reach of children

Date of production and batch number

Use: Apply a palmful of alcohol-based handrub and cover all surfaces of the hands. Rub hands until dry

Composition: ethanol or isopropanol, glycerol and hydrogen peroxide

Flammable: keep away from flame and heatProduction and storage facilities:

Production and storage facilities should ideally be air conditioned or cool rooms. No naked flames or smoking should be permitted in these areas.

WHO-recommended handrub formulations should not be produced in quantities exceeding 50-litres locally or in central pharmacies lacking specialized air conditioning and ventilation.

Since undiluted ethanol is highly flammable and may ignite at temperatures as low as 10°C, production facilities should directly dilute it to the above-mentioned concentration. The flashpoints of ethanol 80% (v/v) and of isopropyl alcohol 75% (v/v) are 17.5°C and 19 °C, respectively. National safety guidelines and local legal requirements must be adhered to the storage of ingredients and the final product.

PART B: SUPPLEMENTARY TECHNICAL, SAFETY AND COST INFORMATION:

Part B contains important safety and cost information and incorporates information from the WHO Guidelines on Hand Hygiene in Health Care (2009).

The case for alcohol-based handrubs in health care

At present, alcohol-based handrubs are the only known means for rapidly and effectively inactivating a wide array of potentially harmful microorganisms on hands.

WHO recommends alcohol-based handrubs based on the following factors:
Evidence-based, intrinsic advantages of fast-acting and broad-spectrum microbicidal activity with a minimal risk of generating resistance to antimicrobial agents;
Suitability for use in resource-limited or remote areas with lack of accessibility to sinks or other facilities for hand hygiene (including clean water, towels, etc.);
Capacity to promote improved compliance with hand hygiene by making the process faster, more convenient and immediately accessible at the point of patient care;
Economic benefit by reducing annual costs for hand hygiene, representing approximately 1% of extra-costs generated by health care-associated infection
Minimization of risks from adverse events because of increased safety associated with better acceptability and tolerance than other products.