Workshop on Biosensors: Measuring glucose and the clinical impact of accuracy.

Date: 10 – 11 December 2022

Venue: l'Université Cheikh Anta Diop de Dakar (*UCAD*) II

Facilitator:

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Purpose of the workshop

To equip participants with a basic knowledge of biosensors and the use of the glucose test-strip as an exemplar that is widely used. The participants will learn how a glucose biosensor works and will examine the data collected from glucose test-strips and calculate accuracy and precision using statistical data analysis. Based on the outcomes, we will consider what the clinical impact on the treatment might be on the patient, if the measurement isn't perfectly accurate or precise. The expectation is that upon returning to their home institutions, the participants will understand the principles of biosensors and be equipped to understand that the accuracy of a medical diagnostic can impact treatment given to a patient. The participants are also expected to be able to make a network within the AMRS which should lead to sustainable collaboration.

Outline

Introduction to Biosensors:

A biosensor is ***a self-contained integrated analytical device (a diagnostic), which is capable of providing specific quantitative or semi-quantitative analytical information using a biological recognition element (biochemical receptor) which is retained in direct spatial contact with an transduction element.*** A most important component of a Biosensor is the *biological recognition elementt* that is used to:

(i) recognize the analyte
(ii) generate a signal that can be measured, directly or through a labeling or mediation system

Biosensors have mainly been developed for medical diagnosis and management of health and were especially highlighted in the Covid 19 pandemic with the lateral flow assays. However, the first biosensor which used amperometric electrochemistry measured glucose. The history of amperometric biosensors is linked with that of blood glucose monitoring.

The Glucose Biosensor:

Blood glucose monitoring plays a crucial role in the management of diabetes. Glucose biosensors provide real-time information on the changes in glucose concentration. The glucose biosensor technology helps individuals maintain normal blood glucose levels. The rising prevalence of diabetes worldwide, technological advancements in self-monitoring of blood glucose, and growing awareness about point on care (POC) testing are the key factors boosting demand for glucose monitoring biosensors. The increasing number of people suffering from diabetes among the urban population is boosting the demand for glucose monitoring biosensors.

Amperometric glucose biosensors have been divided into **three generations**. The first-generation biosensors were proposed by Clark and Lyons and became called enzyme electrodes. We will discuss the 3 generations of glucose biosensors and look at some examples of these biosensors that are in use today.

Discussion on accuracy and precision and the development of an error grid for glucose determination:

We can see differences between the actual glucose concentration and the measured glucose concentration, so how we can understand the differences, and does it matter? We will look at how the data are affected by accuracy and precision and we will discuss the statistical methods we need to use to give us information for comparing devices and seeing how a device performs and how the data are distributed. We will then learn about Error Grid Analysis (EGAs) and how the development of EGAs for glucose measurement provide guidance on the impact of measurement error on clinical intervention.

Table 1: Time table for the Biosensor workshop

Time	**Activity**
08:00 – 08:15	Introductions and the purpose of the workshop
08:15 – 10:00	Introduction to Biosensors and the Glucose Biosensor
10:30 – 10:30	Break
10:30 – 12:30	Using a Glucose Biosensor
12:30 – 13:30	Lunch
13:30 – 15:30	Analysing data from the Glucose Biosensor and its clinical impact
15:30 – 16:00	Break
16:00 – 17:00	General discussion