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# e-Health Technical Committee NewsLetter

**March, 2019**

On behalf of the e-Health Technical Committee (TC) of the IEEE Communications Society (ComSoc), we wish all our members a very instructive reading of this letter.

The contribution from this edition is coming from *School of Electronics Engineering VIT University, India* report on the Transdisciplinary Perspective of m-health system for the Diabetes monitoring.

***We also welcome all our members to share their research activities and field experiences through this open newsletter and to open up new opportunities for discussions and collaborations.***

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## TRANSDISCIPLINARY PERSPECTIVE OF M-HEALTH SYSTEM FOR THE DIABETES MONITORING

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### 1. Introduction

Diabetic mellitus is a global epidemic and it is a chronic disease that occurs when the human body couldn't produce the required insulin or when the pancreas couldn't release enough insulin. It is one of the priority non communicable diseases (NCD) under target for consideration in higher levels. Diabetes has the risk of slowly damaging the organs prematurely if it persists for long term irrespective of the type. Common long-term complications include stroke, kidney failure, nerve damage, heart attack and vision loss. This chronic disease is characterised by shoot up of blood glucose level. There are two categories of diabetes- Type 1 and Type 2. Type 1 is the resultant of lacking insulin secretion and necessitates daily administration of required insulin. The major origin of this type is not identified and it is highly preventable with current knowledge. Signs include excessive excretion of urine

(polyuria), thirst (polydipsia), constant hunger, weight loss, vision changes, and fatigue. These symptoms may occur suddenly. Type 2 diabetes (formerly called non-insulin-dependent, or adult-onset) results from the body's ineffective use of insulin. Type 2 diabetes comprises the majority of people with diabetes around the world, and is largely the result of excess body weight and physical inactivity. Today, more than 1.7 billion adults worldwide are overweight, and 312 million of them are obese. In addition, at least 155 million children worldwide are overweight or obese [1].

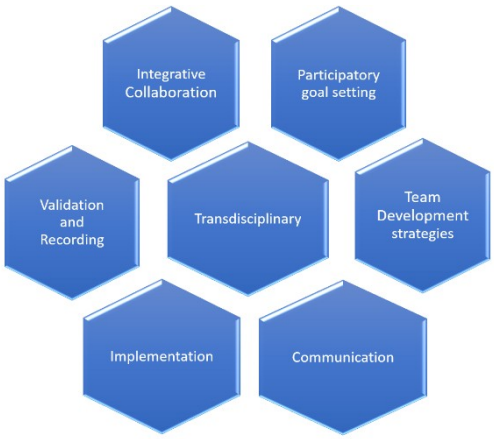


Fig 1.*Overall Transdisciplinary conceptual framework*

The required framework to explain the diabetic discipline can address the sole function that influences this chronic disease. Recent solution is towards the transdisciplinary approach that connects the bridge between the health and economic growth embedding with large social network in the context of lifestyle, operating in various levels, including the family, individual, the communities and the countries which they live. Transdisciplinary is a challenging barrier and there is lack of resources in data to support. But there is always a potential window significant in introducing collaborative research among various disciplines. The overall transdiciplinary conceptual framework is shown in fig.1. These strategies embrace the complexity through a novel conceptual based framework that integrates divergence of discipline speciality theories, mathematical models, measures and analytical study in the current diabetic research. Integrative approach is a highly contributed solution towards deep understanding of the chronic disease and self- management system. This article provides an outline of multilevel, multimethod transverse study to open the door towards the challenge of transdisciplinary research on diabetic community.

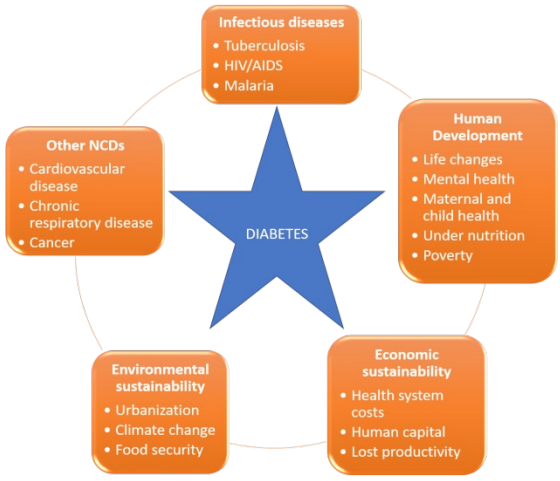


Fig2. *Factors influencing Noncommunicable diseases (NCD)*

The factors in which the noncommunicable diseases are

categorized are shown in fig.2. Diabetes is a poverty issue: 80% of all people with diabetes live in lower and middle income countries. India has over 50 million people with diabetes. In some low-income countries, children with diabetes have a life expectancy of less than a year.

## 2. M-health system for diabetes management based on Internet of things

Internet of Things (IoT) is an emerging new concept which consists of automated devices interconnected to cloud for monitoring data of interest. IoT is providing lots of applications in healthcare ranging from remote health monitoring and connecting smart devices. IoT based system can provide help for healthcare professionals to effectively monitor the patient and provide treatment in emergency situations [2]. Diabetic management is a major task as factors like activity level, stress, dietary, medication and other illness leads to potentially varying fluctuations in blood sugar level. Telemedicine is another speciality for remote healthcare. Home-based monitoring for elderly and bed ridden patients is possible using IoT based treatment.

Basic IoT framework consists of mainly three layers: sensing layer, network layer and application layer. The sensing layer is the physical layer, which consists of different sensors for acquiring the information from the environment. Multiple sensors can be connected to IoT architectures which can provide complete health monitoring of patients. An advanced IoT architecture will have two layers in place of network layer, processing and transport layers.

One important aspect which is to be considered while designing IoT based systems is the communication protocol. An IoT based system requires unique networks and protocols for dealing with the interconnected devices that have limited power and is to be wirelessly transmitted over a wide range. Basically, in IoT there will be a WPAN (Wireless Personal Area Network) for interconnecting the IoT devices. Apart from Wi-Fi or cellular networks, this type of architecture use protocols such as Bluetooth Low Energy (BLE), Zigbee or 6LowPAN. All these protocols fall under IEEE standard 802.15.4 Zigbee provide better efficiency than Bluetooth in conditions where large numbers of devices have to be connected and managed in a WPAN. A new technology called 6LowPAN9 is widely used in IoT designing nowadays as this allows individual devices to directly communicate with the internet. 6LowPAN stands for IPv6 for Low Power Personal Area Network. This allows individual devices to have IPv6 addresses for communication [3].

## 3. Future Research directions

In the past several decades many research efforts have been made towards the prevention, treatment and curing of diabetes. Even though interdisciplinary approach in diabetes monitoring and curing can outperform existing systems there are several obstacles that halt its successful implementation. The following

are some future research directions that can address these issues.

### *(i) Patient centered approach*

The significance of patient centered approach [11] in diabetes monitoring lies in the fact that the clinical outcome is highly influenced by the individual behaviour of each patient. Patient centered approach includes personalized predictive modelling, interactive and co-decision making among patient and health care professionals. Even though patient centered care has great potential in diabetes management in terms of health outcome and expenditure, there are barriers that affect its successful implementation in practice. This includes absence of a generally approved framework or management system, lack of expertise and regulation. Moreover, the requirement for a professional team of clinicians and educators make the system comparatively less feasible in terms of economy.

### *(ii) Advanced data analytics and modelling approaches*

As the onset and progress of diabetes depends on multiple factors like different biomarkers, care should be taken to select a suitable multilevel and multiscale modelling approach. Depending on the degree of association of each factor, two types of data analysis methods can be considered namely undirected and directed networks. Undirected networks can model variables with significant correlation whereas directed network deals with casual relations. One example for undirected network is weighted correlation network that works based on pairwise correlation between variables and thereby determines the significance of each link. In directed networks, the direction of link indicates the casual relationship between variables. The examples for directed networks are Bayesian network and ARM based network. The Bayesian network works on the basis of Bayes rule in which the event of existence of a feature depends on that of other.

In recent years, the deep learning has gained significant attention in many fields. It is a powerful method to discover patterns in multi scale data for both types of unsupervised and supervised study. Deep learning techniques can be used to analyse the clinical data and bio molecular properties and thereby identify novel biomarkers.

### *(iii) Unobtrusive and Seamless sensing*

The key objectives for the development of a reliable system for diabetes managing include reduced cost, improved reliability and accuracy. Even though considerable research has been done in developing a non-invasive technique to monitor the glucose level, considerable improvements in terms of precision, stability, robustness and fast response are required. Dietary monitoring by means of wearable body sensors has been recently investigated.

The physiological parameters like glucose, blood pressure, pulse, cardia

rhythm and lifestyle parameters like dietary and physical exercise should be continuously monitored in order to detect any abnormalities beforehand. The advent of Internet of Things which can provide global connectivity among sensors and embedded devices can significantly contribute in achieving a seamless and unobtrusive sensing.

## References

[1] Alberti, K.G.M.M. and Zimmet, P.F., 1998. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus. Provisional report of a WHO consultation. Diabetic medicine, 15(7), pp.539-553.

[2] Zarkogianni, K., Litsa, E., Mitsis, K., Wu, P.Y., Kaddi, C.D., Cheng, C.W., Wang, M.D. and Nikita, K.S., 2015. A review of emerging technologies for the management of diabetes mellitus. IEEE Transactions on Biomedical Engineering, 62(12), pp.2735-2749.

[3] Gope, P. and Hwang, T., 2016. BSN-Care: A secure IoT-based modern healthcare system using body sensor network. IEEE Sensors Journal, 16(5), pp.1368-1376.

## Funding opportunity:

**Global Maternal and Neonatal Health 2019 - outlines**

**Closing date: 24 Apr 2019 16:00 GMT+1**
The Global Maternal and Neonatal Health funding call is a joint initiative between the Medical Research Council (MRC; part of UK Research & Innovation, partly funded by the Global Challenges Research Fund (GCRF)), and the National Institute for Health Research (NIHR). The purpose of the call is to address the burden of maternal and neonatal mortality and morbidity in low and middle income countries (LMICs), by funding high-quality proposals across the spectrum of basic to applied research.

Further details can be found via this link https://mrc.ukri.org/funding/browse/global-maternal-and-neonatal-health/global-maternal-and-neonatal-health-2019-outlines/#Summary

## Call for Papers:


The 2019 IEEE Global Communications Conference (GLOBECOM) will be held in Waikoloa on the beautiful Big Island, Hawaii, USA, from 9 -13 December 2019. Themed “Revolutionizing Communications,” this flagship conference of the IEEE Communications Society will feature a comprehensive high-quality technical program including 13 symposia and a variety of tutorials and workshops. IEEE GLOBECOM 2019 will also include an attractive Industry program aimed at practitioners, with keynotes and panels from prominent research, industry and government leaders, business and industry panels, and vendor exhibits.

Paper Submission:

15 April 2019 (23:59), Acceptance Notification 15 July 2019, Camera-Ready 16 August 2019

Technical Panel Proposals 14 June 2019

Full details of submission procedures are available at https://globecom2019.ieee-globecom.org