Synopsis Submitted to

The IIHMR University, Jaipur

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By Dr. Akshat Patel Roll: 1454 Stream: Health Management

Organization: Godrej Memorial Hospital, Mumbai

Under the Supervision and Guidance of Varsha Tanu Mam

Introduction:

Over the last 2 decades, whole genome sequencing (WGS) has emerged from the research realm and is increasingly applied to facilitate infection prevention efforts in healthcare facilities. The ability to process whole genomes quickly and inexpensively is due to high throughput or "next generation" sequencing methods in which DNA sequences are fragmented, sequenced in pieces simultaneously, and then reconstructed in the correct order using areas of overlap to inform orientation. The resulting sequence can then be compared against other sample sequences or a reference sequence. The number of base pair differences (single nucleotide variants or SNVs) between 2 samples in coding regions of the genome can be used to assess relatedness. Depending on the organism, the differences can also inform how long ago the isolates may have diverged from the evolutionary predecessor, allowing for the construction of detailed phylogenic trees.

Whole genome sequencing data continue to challenge long-standing dogma around the transmission of pathogens in the hospital. For the first time, we are able to appreciate the complexity of transmission dynamics, unique to each pathogen, which prior to WGS were largely invisible. Some instances of healthcare-associated transmission are shown to be unrelated, while other transmission events previously missed are now identified. Still, uncertainty in the interpretation of data exists, and epidemiologic data remain integral to understanding the webs of transmission that exist in healthcare settings as well as in the larger community. Some of the questions raised are more philosophical in nature, for example, how much transmission necessitates intensive infection prevention responses and resources? In an era of zero infection targets, some may argue that even one instance of spread is unacceptable, while others may argue that in the setting of predominantly non-healthcare-associated transmission, resources should be focused elsewhere in the absence of an outbreak.

As WGS is increasingly available to IP programs, we open the door to a new era of patient safety, in which threats could theoretically be identified and eliminated prior to causing widespread infections in vulnerable patients. Further experience in the best ways to apply these methods to infection prevention is an area of intense interest and investigation.

Research Question

RQ1: How **useful is** current **technology** in diagnosing and predicting diseases through

Health screening?

RQ 2: What are the long-term health outcomes for patients who participate in technology-based preventive health check-up programs like the Health Genometer Plan?

Objective:

The main objective of this study is to evaluate the efficiency, accuracy and impact of disease detection and prediction technologies through preventive diagnostics, with a particular focus on Health Genomics programs. The purpose of this study is to explore the benefits, challenges, and ethical considerations associated with the integration of preventive health technologies. By assessing patient perceptions, financial impact and long-term health impact, this study aims to better understand how the use of medical technology can improve early disease detection, improve patient outcomes and create a more efficient and effective healthcare system.

Hypothesis:

This study will employ a qualitative research design, utilizing secondary data to explore the effectiveness, challenges, and implications of leveraging technology in preventive health check-ups, specifically focusing on the Health Genometer Plan. The research will involve an in-depth analysis of existing literature, reports, case studies, and other relevant documents to gain insights into the use of technology in disease diagnosis and prediction.

Review of Literature:

1. Whole genome sequencing in support of wellness and health maintenance

This pilot study of eight individuals from the CHDW proposes two approaches for combining and conditioning clinical and genetic profiles, which could facilitate longitudinal evaluation of wellness-focused medical care based on comprehensive self-knowledge of medical risks. The study shows an excess of concordance between genetic prediction and observed sub-clinical disease. Further, we illustrate how a more holistic combination of genetic and clinical data can be achieved by visualizing risk in subclasses of disease. The visualization of concordance and discordance in the genetic and clinical profiles might help develop personalized health action plans in consultation with a health partner. We acknowledge that the data presented here falls short of the gold standards of evidence of inference that are typically required in genetic analysis of causation but argue that the objective of ‘personalized genomics’ is not necessarily to predict disease with any certainty, but rather to provide another line of evidence that physicians and other medical practitioners can consider in their interactions with patients.
Ultimately, the utility of the approach described here will require prospective evaluation in a cohort of healthy adults followed longitudinally for decades. As the volume of personalized information increases, the issue of who will be responsible for interpreting and explaining the assessments to individuals becomes more acute and suggests the need for training of a new class of genomic healthcare professional and development of novel ways to present the information.

2. Disease Diagnosis in Smart Healthcare: Innovation, Technologies and Applications:

This review has provided an up-to-date literature on emerging machine learning algorithms, optimization algorithms and applications in smart healthcare. Important challenges, including privacy, pilot studies and real project and communication between data analytics and medical staffs, have been discussed. These challenges are essential for the breakthrough of smart healthcare; otherwise, the wide adoption of machine learning and optimization algorithms in real deployment is difficult to succeed. To conclude, it is believed that human beings will enjoy more and more smart healthcare applications in the coming decades. It is worth ensuring the health services are financially viable and environmentally sustainable to safeguard the future health of our patients and the health services availability in the future.

3. Exploring the impact and utility of genomic sequencing in established CKD:

Genetics is expanding the field of nephrology to enable better diagnostics and treatments. Applications of clinical genomics for CKD have proven diagnostic efficacy and a growing body of evidence for impact and utility. Understanding genomics including differences in sequencing approaches across different phenotypes of GKD is imperative to improve understanding and integration into clinical care. Nephrologists face several challenges in integrating genomics into clinical practice and require further education and support to improve patient outcomes. Further, genetics has the potential through clinical research to inform future nephrology clinical practice in polygenic dis- ease and pharmacogenomics, with the goal to improve patient outcomes. Developing clear research priorities in con- junction with key stakeholders is imperative to move the field forwards and enable iterative utility and impact focused implementation.

Study Design - Qualitative study design will be employed in tertiary care hospital in Mumbai.

Study Population: Local Population of Vikhroli East, Mumbai and nearby areas.

Duration Of study– The study will be conducted for 3 Months

Sample Size - The estimated sample size is: 140

Data collection Procedure – Secondary data is collected from the genometer plan in the hospital.

Data Analysis Plan – This data analysed by excel to determine outcomes of the technology in genome sequencing through heath check-up.

Ethical Consideration – The Study will be adhered to ethical principles of research including informed consent, confidentiality, and anonymity.

Implications of Research –

We are born with our DNA; hence we carry lifelong risks and that offers us an opportunity to be

"Proactive rather than Reactive". Moreso our DNA is not deterministic and lifestyle changes can modify the risk; it thus becomes imperative to identify the genetic risk and offer personalized management and treatment plans.

For this, Health Genometer Smart Plan has been developed that provides 360-degree views of the high-risk conditions to which the individual is predisposed by analysing present & future health risks through a pathological test as well as a genomic test. The plan assesses the risk for each disease/trait using population allele frequencies over various populations with thresholds optimized to the Indian population.

Health Genometer Smart Plan provides a 'Personalized Health Guide' that addresses medical conditions risks (actionable secondary findings as per American College of Medical Genetics), pathological risks, and genetic predispositions along with the metabolic and fitness genetic profile of the individual making this highly tailored to the consumer.

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