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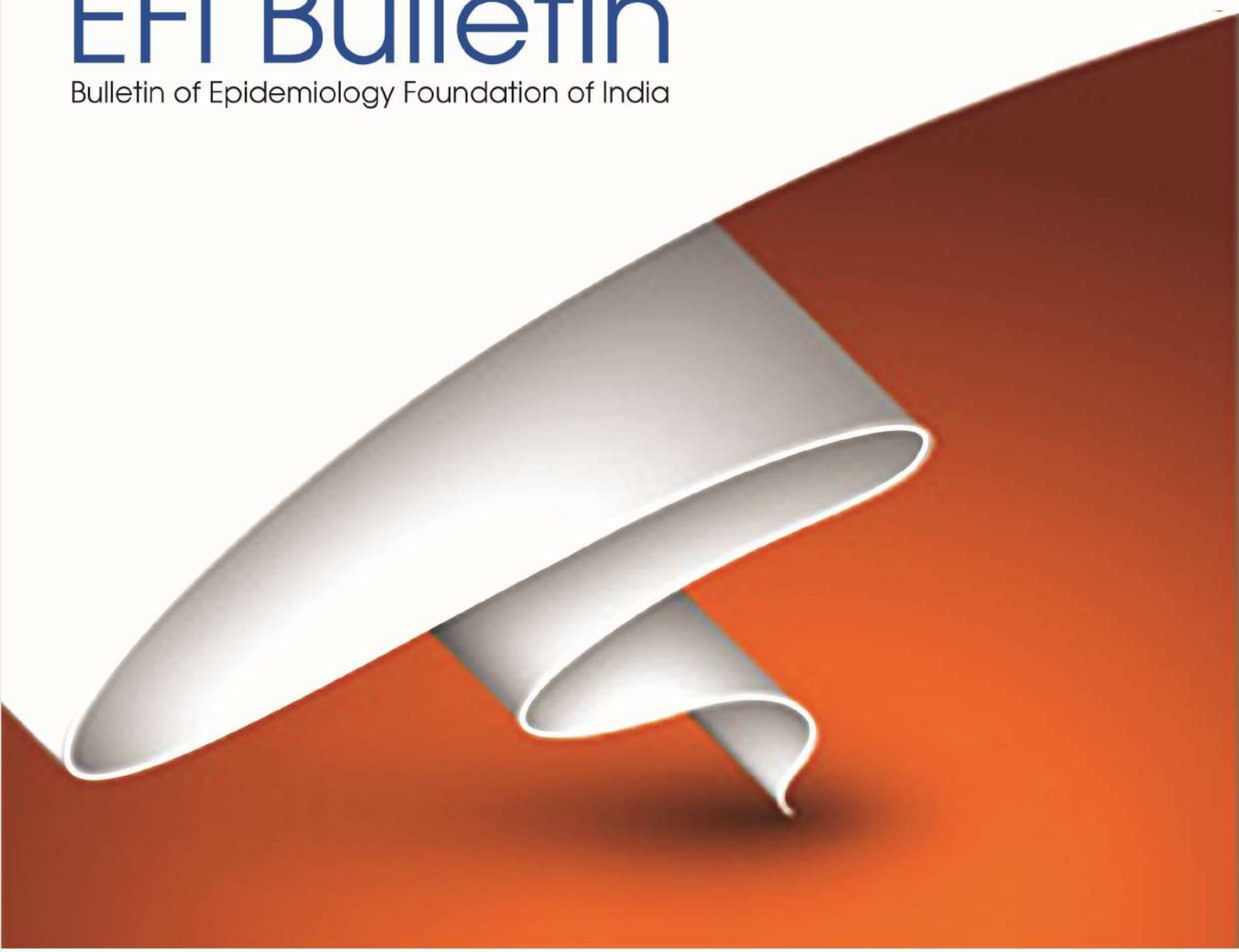
Bulletin of Epidemiology Foundation of India



Epidemiology Foundation of India

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EFI Bulletin

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In this issue

President's Corner

Dear Esteemed EFI Members

I am writing this column with concern about a compulsory national rice fortification program that is being contemplated in India, as a solution to what is perceived to be a 'stagnant and high level' of anaemia.

Prime Minister announcement in his Independence Day address in 2021 that fortified rice would be distributed under the various government schemes--including the public distribution system (PDS) and the mid-day meal scheme (MDM)--by 2024 addresses a vital concern. He emphasised that malnutrition is a hurdle in the development of women and children and food fortification is the answer. But it remains a controversial issue, with many unanswered questions

In an ambitious attempt to combat chronic anaemia and under-nutrition, the Union food ministry is planning to distribute fortified rice through the Integrated Child Development Scheme (ICDS) and the MMS from 2021-22 with a special focus on 112 'aspirational' districts.

The Union government, which now believes this is the panacea for malnutrition, has ironed out the issues in the supply chain in consultation with the NITI Aayog, the Food Safety and Standards Authority of India (FSSAI), and non-governmental stake holders including the Tata Trust, World Food Programme, PATH and Nutrition International.

Rice fortification is complex, as it starts with the development of a rice 'kernel' or grain, that is composed of rice flour paste, along with the required micronutrients and binders. The rice paste is extruded into a grain that matches the shape of the rice it is intended to fortify. The fortified kernel is mixed with the rice and ideally should be indistinguishable from the grain it is fortifying.

Fortifying rice involves grinding broken rice into powder, mixing it with nutrients, and then shaping it into rice-like kernels using an extrusion process. These fortified kernels are then mixed with normal rice in a 1:100 ratio and distributed for consumption. But the current national capacity of 15,000 tonnes of rice kernels a year is far from adequate. To cover the PDS, anganwadis and MDS in at least the 112 aspirational districts, the annual capacity has to be around 130,000 tonnes. To cover the PDS across the country, at least 350,000 tonnes of fortified kernels would be needed. The Food Corporation of India has been asked to invest in equipping rice mills with the blending machines needed to mix the kernels into normal rice.

There are several points of concern which needs consideration to rice fortification specifically:

Rice fortification requires specific 'matching' kernels to be made for each rice cultivar that is distributed in PDS, MDM and ICDS from year to year and state to state.

Given the many types of rice in the Indian system, will it be possible or feasible to have equally different kernels to suit each type, which is eaten in different districts or states?

If compulsory fortification is to be done, it might become expedient to restrict the types of rice in public health programs to (say) a short grain common rice cultivar.

Will this in turn reduce the diversity of rice that is grown and made available in India? Will local rice varieties disappear? The promotion of polished rice is an example.

Biodiversity conservation is a new approach to addressing sustainability in a rapidly changing world, and a recent research paper from Assam on the conservation and utilization of indigenous rice varieties shows that there is a "huge market for these indigenous rice varieties".

Will this move of rice fortification reduce the choice of consumers of rice: rice and its cooking and sensory characteristics are very important in the Indian kitchen and for the Indian palate.

The autonomy of farmers, in choosing what rice they should grow, and of consumers, in choosing what rice they should eat is important for our national identity.

According WHO recommendations, the fortification of rice with iron is recommended as a public health strategy to improve the iron status of populations, in settings where rice is a staple food.

What is the solution to the 'high and stagnant' level of anaemia?

The solution is a better diversity of foods on the Indian plate, and a move away from a heavily cereal based diet. The latter speaks against rice fortification, rather than for it.

We need to ensure that diets have adequate amounts of fruits and vegetables to absorb the existing iron better.

If we are to increase the density of iron in our diets, this should be done through natural methods, rather than unnecessary chemical fortification. The DBT is already considering programs to identify high iron rice cultivars and to understand this trait for breeding experiments.

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Umesh Kapil

From the Editor

Encouraging participation by the scholars of eminence in public health with their valuable write-ups for the Bulletin is a morale booster to the editorial team. I therefore invite the galaxy of EFI members to actively participate and contribute articles of their areas of specialty to help broaden the scope of the contents of the Bulletin. Furthermore, we would like to repeat our earlier requests to the members to come out of their hesitations in sharing with us the news and updates on the academic events, webinars, mini-conferences, seminars and workshops already organized (with a couple of photographs and a brief abstract) and/or are to be organized by them in near future at local or regional levels. This feature is considered to be an essential integral part of the bulletin and therefore it has dedicated space ear-marked for the purpose to encourage awareness amongst the fellow members. Also, per the advice of our President valuable suggestions and comments by the members are invited to be incorporated and published.

The recent mega event of interest IPHACON2021 just concluded in September and hopefully EFICON2021 to be held in October-end, even though both being conducted on virtual or hybrid mode, would ever be remembered by all public health enthusiasts and epidemiologists. It is not only the volume of a wide-spectrum contents and larger participation rather the quality and also the opportunity created to facilitate higher levels of discussions must be appreciated. We seek help and guidance in looking forward to publish a lot of interesting stuff derived from the proceedings of these conferences and a series of pre-conference workshops for continuance of academics and research involved in those interesting theme areas.

This issue has opened-up the awaited section on ‘Health and Nutrition’ and also an added section on ‘Commentary’ besides the regular ones on CME, CD and NCD. At this initial stage our structure of the Bulletin is quite flexible and vibrant. We propose to have a dedicated column for members’ news, wherein significant academic and research achievements made by the members during the past quarter would be considered to be published and highlighted.

Newer ideas for improvements are always welcomed. Somehow, we are still working for a proactive editorial board to be placed just completing certain formalities soon in a couple of months.

Ajit Sahai

EFI Governing Body

Aims of EFI

To identify and promote areas of cooperation and understanding among researchers and like-minded organizations, individuals, scientific networks and other Governmental and Non-Governmental, National & International agencies which are contributing towards realizing the objectives of the Foundation.

Benefit of becoming a member of EFI

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EDITORIAL

The COVID-19 Pandemic as reminder of the power of vaccines

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The power and potential of vaccines is incomparable. For example, if a person is diagnosed with diabetes or hypertension, he or she may have to take medications and follow a healthy lifestyle, every single day for many months and, in some cases, for life long. In contrast, with a full course of a vaccine- usually one to three shots- the person could be protected for a few years, possibly for the rest of the life.

Yet, the benefits of licensed and available vaccines do not reach all children and adults. In some cases, people are simply not aware of the available vaccines or they do not know which diseases can be prevented from vaccines. In other cases, the value of vaccines is not fully appreciated. And then, at times, people have some misinformation, myths or unverified information, which makes them hesitant to get vaccinated. The vaccines in a sense have become the victims of their own success, as some vaccine preventable diseases have nearly disappeared due to their widespread and sustained use. As an example, the Expanded Immunization Program (EPI) in India had started in 1978 and since then, many of the diseases which were widely prevalent at that time, have been minimized and poliomyelitis has completely been eliminated. In fact, over the last few years, India has added many new vaccines in its national immunization program and various initiatives have been taken to improve supply, cold chain capacity and delivery. The national vaccination programs are amongst the best performing government health programs and nearly 85% to 90% of vaccination are delivered through the government health services.

There is inherent acceptance of the importance of vaccines (however, that sometimes does not translate into increased coverage). Soon after the start of the pandemic, the threat perception of the SARS CoV-2 -the virus which causes the COVID-19, was high, and people had started enquiring about and waiting for the COVID-19 vaccines. The researchers and vaccine scientists did not disappoint. The vaccine was given authorization in less than a year after first reported case and in less than 21 months, nearly 2 dozen vaccines, world over, have been given emergency use authorization (EUA) for the public use.

The COVID-19 vaccination in India

In the first week of January 2021, India also gave EUA to two vaccines, including an indigenously developed vaccine. On 16 January 2021, India started the COVID-19 vaccination drive, initially for the healthcare staff and front-line workers. However, a few days into the COVID-19 vaccination drive, the 'vaccine hesitancy' emerged as a challenge and eligible individuals were not coming forward to receive the vaccine. This partly originated in controversies around EUA of the vaccines in India, one of which was authorized without phase III clinical trial data and partly also due to reduction in the number of new COVID-19 cases and reduced risk perception.

Understandably and as it should be, the COVID-19 vaccination in India is voluntary and people can make decisions whether or not to get a vaccine. However, the initial vaccine hesitancy disappeared at the start of April 2021, with emergence of ferocious second wave and changed risk perception amongst the individuals.

In the following period, the demand increased while vaccine supply remained largely unchanged. However, by the fourth week of Sept 2021, two-third of the eligible adult population had received at least one shot of COVID-19 vaccine. One shot of COVID-19 vaccine in the Indian situation- which has experienced a high rate of infection during the second wave of COVID-19 pandemic - is more robust enough protection than two shots of vaccines in settings which have not had a severe pandemic. With all this, it is likely that India is in a very good situation. However, there is a possibility that starting mid Oct 2021, there would be a proportion of eligible adult population- though small but still significant, which may not be forthcoming to get vaccinated.

To tackle this vaccine hesitancy, there is need to take pre-cautionary and pre-emptive measures. Specially, effective communication is key to large scale public health programs and will be key for COVID-19 vaccination as well. It is time now, that in spite of the program going well, the transparent & timely communication with engagement of trustworthy sources (vaccine experts) and influencers (i.e., celebrities) can help in fighting the vaccine hesitancy. The government has already developed a COVID-19 vaccine communication strategy. However, the success would be dependent upon effective implementation. The social sciences research on people's perception of disease risk and concern about safety of the vaccine should be used to regularly update the communication strategy. The strategy should be implemented with the engagement of and in partnership with non-governmental organizations, independent subject experts, medical colleges, civil society and faith-based organizations as well as community members. This can help in fighting 'misinformation' and ensure high coverage.

The availability of 'vaccine doses in a vial' is not enough. To prevent disease, vaccine doses need to reach the arm of every eligible member of the population. All stakeholders need to do everything to make that happen. That's how India will win this fight against the virus and the pandemic.

The fate of all of us is interlinked

One of the key learnings in this ongoing pandemic is vaccine inequities. While many rich countries across the world have administered two shots to the majority of their adult population and in some cases, 12-17 years as well. However, in other countries, especially low and middle-income countries, there are not enough doses available for even 10% of the total population. In Spite of the recognition that no one is safe till everyone is safe and as long as the virus is circulating in any part of the world, it could mean emergence of new variants of concerns and risk of new waves of infections. The countries need to work in solidarity.

Many high-income countries have secured the COVID-19 vaccines more than enough to vaccinate three to five-fold of their population. A few countries are showing eagerness for third and fourth shots for their population. Clearly, these countries appear to be missing the learning that no country is safe till every country is safe. Then, the race to administer booster doses and continued prioritization of domestic needs, while many more in low-income countries are waiting for their first shots, is telling on our times and indicates the combined moral failure of the global community.

Some of the challenges were recognized well in advance. The COVAX initiative led by the World Health Organization (WHO) and others was set up to make vaccines available for low- and middle-income countries. However, it is struggling because many countries do not wish to share the vaccines and are adamant to vaccinate their population, repeatedly. The

efforts of the WHO and other international partners have produced only partial success in ensuring vaccine equity. The authorisation of around two dozen COVID-19 vaccines worldwide is an unprecedented achievement, yet the inequity in their global distribution highlights serious failures in global cooperation.

Vaccinating the world against pandemic require planning

Though many challenges were unforeseen, a lack of timely planning and execution, both at global as well as multilateral levels, has complicated the situation. In March 2021, a meeting of the Quadrilateral Security Dialogue rightly identified the need for collaboration between Australia, the United States, Japan and India to ensure increased access to COVID-19 vaccines. But their intended timeline was as late as the last quarter of 2022 — it was only after the Delta variant began rapidly spreading those targets were shifted to the last quarter of 2021.

In June 2021, the G-7 countries pledged to donate 1 billion doses to the COVAX. This is only a fraction of the 11 billion doses the world needs to ensure vaccine equity - a good start, but the global community needs to move beyond symbolism.

In October 2020, South Africa and India floated a proposal for temporary intellectual property waivers for COVID-19 vaccines in the World Trade Organization (WTO). This led to renewed discourse on compulsory and voluntary licensing, receiving a boost after the United States agreed to consider a related proposal. While such measures could pave the way for future collaboration, they will have few immediate benefits. Other mechanisms such as the WHO's COVID-19 Technology Access Pool (C-TAP) have received no takers.

While there have always been discussions about the need for global solidarity to fight pandemics, the world has once again faltered in coming together to tackle COVID-19. Vaccine-manufacturing countries continue to prioritise shots for their citizens before sharing them globally, and India's struggle with COVID-19 vaccination has severely impacted the worldwide availability of vaccines. In the second part of September 2021, the Indian government announced the plan to export the surplus COVID-19 vaccines and supply them to the COVAX as well. This is a right step by the Indian government and we can hope that this will accelerate the process to tackle vaccine inequities.

What can we learn from this pandemic?

There is enough evidence that active collaboration and strong partnerships are crucial — hopefully the global community will soon take note. However, at the core of all this, it is important and we should hope that COVID-19 pandemic would remind each of us of the power of vaccines. It is hoped that this pandemic will result in increased research and development on vaccines against many pathogens, especially those which affect people in low and middle-income countries. It is also hoped that following this pandemic, a system would be created to ensure higher coverage with vaccines recommended for children as well as increase uptake of recommended vaccines for adult age groups. It is an opportunity to convert the challenge of pandemic into an opportunity to highlight the potential and future role of the preventive and cost-effective public health intervention- the vaccines.

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CME

A call for preparedness of epidemiologists for Industry 4.0

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With exponential changes occurring in the field of information technology (IT), it is vital that all spheres of our society are future ready. However, the health sector is usually slow in adopting IT. It has been documented that within a decade, the quaternary industrial revolution will drastically change the way we live and behave. Artificial Intelligence (AI), machine learning (ML), big data science, virtual reality, Internet of Things, GIS/GPS, robotics, cloud computing etc. are spearheading this revolution by improving our understanding of various phenomena and opportunities for intervention, well beyond our past capacities. In medical field also, these technologies utilize available voluminous data to discern patterns and derive inferences to predict future health related outcomes to facilitate decision-making.

With the increasing complexity of data and analytical demands, epidemiology has also undergone considerable changes recently, adapting it to changing public health (PH) scenario. Hence, there is a need to prepare, educate and train the next generation epidemiologists to tackle the PH issues of the 21st century.

As we are all aware, epidemiology is all about collection, sharing and collation of data, its analysis, integration, interpretation and application. As medical information gets digitized, AI helps to convert it into actionable data, making epidemiological predictions manageable and efficient. It requires large quantities of anonymized patient data, not easy to obtain. AI seeks to improve the data computational power of epidemiologists by offering new ways of unraveling and addressing determinants of health.

More the information, the more insights one can gain from this information and can make predictions for future events. Big data healthcare market is poised to grow at an exponential rate. Data is the key. Devices like smartphones with mobile apps can constantly monitor health indicators. These are being increasingly used to collect medical data for integration with telemedicine / telehealth via the medical Internet of Things (mIoT). Thus, in today's digital age, immense volumes of data and new analytical tools are available at our fingertips. It enables epidemiologists to tackle problems, which was impossible to resolve by methods used earlier. The new technology facilitates them to better understand the history and progression of disease as well as their genetic, clinical, environmental and socioeconomic determinants. It generates algorithms to predict the risks, incidence and prevalence of a disease in populations and their treatments, i.e., predictive analytics.

As a major leap forward, AI & ML are becoming increasingly important tools for data-driven predictions, prevention, surveillance, and rapid-response efforts to avert the outbreaks of infectious diseases. AI use in epidemiology can help identify the epicenters of pandemics. Epidemiologists are already beginning to see some of the benefits of the new technology. AI algorithms are being used is to help public health officials fine-tune their prevention and public awareness efforts by indicating the best way to deploy their resources. It will transform healthcare, reducing operational costs, reducing inefficiencies, and saving lives through automation of routine administrative tasks.

Some advances have already been made in this field in the western countries. Harnessing the potential of AI to predict outbreaks is not getting the requisite attention of the epidemiologists in India. They are rather slow to adapt to this new domain. At the most, only some patchy efforts are visible.

NASA uses the climate data such as temperature, average monthly rainfall, etc. and predicts the occurrence of infectious disease outbreaks like influenza or malaria in the US. Many startups use AI, ML, artificial neural networking and statistical learning for outbreak prediction, e.g., Ebola in West Africa, in 2014, Zika in Florida 6 months ahead of official confirmation in 2016, and undiagnosed pneumonia in Wuhan on December 31, weeks before pandemic declaration.

Bayesian network has been used tool to predict vector density using the longitudinal data in Kurnool, Andhra Pradesh, India, from 2001 to 2006 as a part of epidemiological surveillance, for devising effective control measures against Japanese encephalitis. In Malaysia also, a startup, AIME (Artificial Intelligence in Medical Epidemiology) Healthcare used AI to track potential dengue fever outbreaks. Suen et al tested their algorithm using real-world data on tuberculosis prevention efforts in India and gonorrhea prevention in the US. The model accommodated human behavioral patterns related to disease transmission. Similar results were seen in other disease like HIV.

By 2026, the total global AI share in the epidemiology market is likely to cross USD $9.7 billion. In other countries, private players have entered this domain, in a big way. For India, it remains to be seen, if the control of the government will be the exclusive mainstay, or some outsourcing will be there, inviting private AI & ML vendors, with attendant security issues.

Meaningful prediction of infectious diseases based on human behavior is challenging. The issue assumes more complications when scientists try AI and ML based inferences to predict outbreaks among animals, whose surveillance for reservoir tracking has gained more importance in the recent past.

Some of the applications of AI in epidemiology are electronic health data (EHR) based predictions and analysis of social media activities. 'Weaponization of social media' has emerged as a serious issue these days. This is important because conflicting information, viewpoints, and interpretation are quite common. Misinformation and disinformation about various health care related issues has been widely shared, by people with vested interests and hidden agendas, on social media, e.g., anti-vaccine campaigns (Covid / measles), shortage of oxygen cylinders/ ventilators/ medicines This information warfare has a potential to foment chaos worldwide. Hence, good communication skills with single chain of command will improve the credibility and success of strategies suggested by the epidemiologists.

However, there are many limitations in use of AI and ML in the futuristic epidemiology, e.g., data use related privacy and cost concerns. There is also a need to address language and technical barriers that can make it difficult for epidemiologists to read and assess ML studies. Apart from this, there may be problems in the need to have increased access for the public health professionals to high-speed Internet. A routine scenario in India about the pathetic situation regarding basic amenities (no electricity) may nullify any potential advantage of having an AI-enabled scanning machine.

Also, it has been said that the display of undue zeal to promote AI and ML in futuristic epidemiology, shifts the focus away from the basic social problems troubling the masses, e.g.,

non-availability of doctors in remote areas, thus hindering any sustainable solution. It is necessary to understand that AI application is closely dependent on the sociopolitical contexts in which they are deployed. Still, with high hopes of extracting new and actionable knowledge that can improve the present status of healthcare services, researchers are plunging into biomedical big data despite the infrastructure challenges.

Quality of data is very vital here. If an ML algorithm is based on biased data, it may be yield GIGO syndrome (Garbage In Garbage Out) rather than resolving the issue. Preferably, validation of such data and models should be done before using the same.

It goes without saying that any AI & ML fetish should not rob the public health experts of the traditional / classical epidemiology wisdom, which is becoming a scarce commodity ever since advent of computers and sophisticated yet tedious statistical packages. However, we must also appreciate that AI & ML alone cannot cure what ails / restricts epidemiology. We also need to realize that AI can't replace, in any way, the importance of direct medical testing, surveillance, or any primary data-based decisions.

All said and done, epidemiologists need to play a central role to be the hub of multidisciplinary teams in understanding, analyzing, and interpreting health related 'big data'. There is a need to develop new computational modeling methods to combat any devastating crisis like a potential pandemic. And if they do not wake up and act fast, the day is not far when lateral entry of IT engineers in to epidemiology domain will sideline them. In fact, health care arena is all full of such forays of software whiz kids. Sufficient evidence is there of the same in laboratory diagnostics, tele-consultation, predictive analytics etc. wherein, many startups have made fortunes during Covid-19 Crisis!

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Communicable Diseases

A rapid review of digital health technology for combating Covid-19 pandemic with a focus on strengthening primary health care

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Background

Primary Health Care (PHC) represents the key mechanism towards attaining comprehensive and universal health care services that are people centered, focussed on health promotion, disease prevention, and rehabilitation with their equitable distribution [1]. PHC is well-established as the most cost-effective means of enhancing the people's physical, mental, and social well-being, particularly, in the health systems of lower-middle income countries (LMICs) [2].

The Covid-19 pandemic caused the disruption of the PHC system in LMICs in an unprecedented manner with the crisis resulting from limited existing public health infrastructure with inadequate capacity to maintain Covid-19 related infection prevention and control measures [3-5]. Practically non-existent means of airborne infection prevention in majority of PHC facilities with limited ventilation and queue management systems providing for social distancing and limited hand hygiene measures has undermined the safe delivery of health services [3]. Furthermore, the suboptimal functioning of outpatient health departments in primary care facilities have undermined the medical adherence, screening for early diagnosis of disease and complication with consequent worsening of health outcomes in patients with non-communicable diseases like Diabetes Mellitus, hypertension, and heart disease [6].

In this backdrop, the expansion of mHealth based digital applications and telemedicine services have been considered as potentially effective ways of strengthening PHC during the Covid-19 pandemic, particularly in context of the LMICs [7,8]. Moreover, in the long-term, the potential role of digital technology in bridging gaps in healthcare accessibility by maintaining the continuum of care is warranted [9].

This rapid review was therefore conducted to synthesize the feasibility, operational, and implementation research evidence towards integration of mHealth with primary health care in the context of LMICs especially India.

Methodology

This analysis was conducted by adhering to the principles of rapid review to identify publications and policy documents related to the application of digital health technology that were relevant to strengthening of primary health care, health policy, and health systems [10].

Results

The application of digital technology enabling the delivery of primary care services through virtual consultation, specialist referral, prescription, monitoring of adherence and health outcomes from investigation reports has been undergoing considerable expansion in high-income countries. In the aftermath of the Covid-19 pandemic, the landscape of PHC has been transformed by the rapid acceleration of digitization of health services for: (i) virtual video consultation as the primary mode of consultation to restrict physical contact and curtail the risk of SARS-CoV-2 infection transmission between providers and patients

(Australia/United Kingdom/USA/Canada/etc.), electronic prescription services, Covid-19 remote triage through consultation and digital (applications) self-assessment tools, and setting up of guidelines for the provision of low-risk, non-Covid clinical care [11, 12]. The Centre for Disease Control, USA recommended the adoption of telemedicine facilities for prevention of risk of Covid-19 transmission in health facilities [13]. In China, emergency teleconsultation services were used for surveillance, contact tracing and reduction in incidence of Covid-19 [14].

Consequently, digital technologies have been extensively harnessed to combat the Covid-19 pandemic globally worldwide but more efficiently and effectively in higher income countries. Digital technologies have been utilized for public health activities including epidemiological surveillance, case identification, contact tracing and preventing disease transmission in communities, health communication, and clinical care through teleconferencing [9, 11].

Digital technology situation analysis in India

India is recognized as a global hub of information technology industry. As per the telecom regulatory authority of India, it also had a mobile phone subscriber base of >1200 million connections, and internet user base of >743 million in 2019. Nearly 25% of Indian mobile phone users are current smartphone users.

Pre-covid technologies

In India, prior to the Covid-19 pandemic, digital technology comprising of mHealth and eHealth applications have shown early promise in their feasibility and implementation for improving accessibility, available and affordable supplementary health services to the general population irrespective of geography or social status. These include the success of mCessation, a free of cost, government sponsored text-message (SMS) based intervention to promote tobacco cessation which has been adopted by >1.6 million tobacco users with reported quit rates of ~15% [15]. mDiabetes is a similar text-message intervention to promote healthy lifestyle and self-care towards prevention of the onset of DM and its associated complications. 99-DOTS is a mobile phone based intervention for monitoring medication adherence in Tuberculosis patients which is being piloted under the National TB Elimination Programme [16]. Vaccine supply chains in India have been augmented and strengthened through design and implementation of the electronic vaccine intelligence network (eVIN) [17]. Telemedicine and telehealth services have however been restricted with only some isolated pilot projects underway [8].

Digital technology for Covid-19 management

The Indian government has focussed on enhancing telemedicine services during the pandemic. The revised guidelines for practice of telemedicine in India suggest greater liberalization of policy towards the promotion of telemedicine with clarity on fees and reimbursements, upholding patient privacy, confidentiality, and delivery of services [18]. The government of India has it-self deployed a flagship telemedicine service, eSanjeevani to provide online OPD services which will also be available at all Health and Wellness Centers under the Ayushman Bharat (National Health Protection) scheme (https://esanjeevaniopd.in/About). Helplines for information on Covid-19 and counselling for mental health care were also available and extensively utilized in the country.

Aarogya Setu (bridge to health) application whose development was sponsored by the government of India for contact-tracing of Covid-19 suspects and alert those at risk

became the most downloaded mobile phone application in India. Early evidence indicated that the app data helped in identification of hotspots and the test positivity rate in identified contacts was significantly higher compared to the district and state level estimates [19]. The app was also used to provide useful health information and later upgraded to issue details related to location of Covid-19 vaccination sites, vacant vaccination slots, and the generation of vaccination certificates.

Various app based e-learning modules have been designed and tested for training of frontline health workers towards training them for the provision of information to support Covid appropriate behavior, utilization of IEC materials, and home based surveillance of suspected or diagnosed Covid-19 patients in their communities [20].

Limitations of digital health technology in enhancing public primary health care

The Covid-19 pandemic has highlighted several challenges in integrating digital health technology with primary healthcare. First, the intention to use mHealth applications can be variable, as observed in surveys in developed countries and their adoption can be hindered by several factors [21]. For instance, contact tracing applications worldwide had limited success because of the hesitancy in adopting these apps and distrust and apprehension over the collection of perceived personal data [22]. Another obstacle primarily in the developing countries is the digital divide with majority of the people still lacking access to smartphones which have capabilities to run special applications [23]. A correlation of lower baseline health literacy with lower digital literacy also critically impairs the self-efficacy of individuals to engage and utilize digital health technology [24].

Future questions

The Covid-19 pandemic has accelerated the development and proliferate of multiple digital health technologies which can be potentially harnessed for achieving universal health coverage and bridging healthcare gaps at higher cost-effectiveness. The National Digital Health blueprint in India, in continuation of India's recent-most national health policy conceptualizes the creation of digital personal health records and a national health registry [24]. Efforts towards strengthening health information systems also need a renewed focus. Moreover, there is need to assess the efficacy of digital health technologies and their cost-effectiveness with a further thrust towards innovation while ensuring universal digital access.

Conclusion

Digital health technologies during the Covid-19 pandemic were primarily focussed on continuum of care through telemedicine and telehealth services. However, the extent of adequacy of these services in maintaining continuum of care and treatment satisfaction from the perspective of both clients and practitioners during the pandemic have not been critically explored either. The experiences of primary care practitioners in the deployment of telemedicine and other digital health technologies during the pandemic need rigorous data collation and analysis to understand the challenges in further improvement of these ever-evolving resources for benefiting humankind.

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Many COVID-19 vaccines and none for HIV: will the future of viral vaccines change?

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The first smallpox vaccine was officially introduced in 1798 by Edward Jenner (1). From community point of view, vaccination programmes across the world have covered 14 different infectious diseases, namely – smallpox, diphtheria, tetanus, yellow fever, pertussis, Haemophilus influenzae type b, poliomyelitis, measles, mumps, rubella, typhoid, rabies, rotavirus diarrhoea, and hepatitis B. Some of them achieved complete success i.e. eradication of the concerned disease e.g. small pox, while others achieved elimination of the disease in certain parts of the world like Rubella and congenital rubella syndrome in Americas (1).

History is rich with stories of vaccine success, but, there have been cases of vaccine defeats too. One such example is Human Immunodeficiency Virus (HIV) infection causing Acquired Immunodeficiency Deficiency Syndrome (HIV/AIDS). Failure to develop a successful vaccine for HIV despite its discovery in 1980 is a contraposition to Severe Acute Respiratory Syndrome Corona Virus (SARS-CoV-2), discovered in December 2019.

The unprecedented speed and zeal to develop a vaccine against SARS CoV-2 across globe with political will, huge funding and united efforts has been a silver lining of this gruesome pandemic(2). COVID-19 is a respiratory viral illness and the present pandemic has spread to involve almost all the countries across globe in very short span of time. Therefore, it became a global emergency and every effort was directed towards combating it. Technology advancement and concentrated efforts added to its success(3).

Moreover, the success of vaccine in acute febrile illness that spreads through respiratory tract has already been proven like in Influenza and measles(4). HIV infection is chronic with an extremely long phase of latency, hence there was always a debate in-between development of preventive vaccine or a therapeutic vaccine which can prevent AIDS. This also delayed the process of vaccine development.

Moreover, the political will to develop HIV vaccine was also shadowed with prejudice and discomfort around the mode of its transmission as it is primarily a sexually transmitted disease (5,6).

Unlike SARS Cov-2 where the complete viral genome was available within few months (3) and many culture systems were available, a good disease model and culture system for HIV/AIDS was lacking(1). Clinical trials for COVID -19 vaccines were also very fast to produce results while HIV due to the absence of spontaneous recovery from infection, latency of the virus via integration into host genome, its persistence in memory T-cells led to long and expensive human clinical trials without much clinical benefit(1). Vaccine efficacy studies were easier to be done for COVID-19 vaccines due to the neutralizing nature of the antibody response developed following vaccination/exposure to the virus. This was slightly difficult to do in HIV/AIDS as the infection itself primarily involves the immune system of the body and the virus successfully evades neutralizing antibodies and other immune responses through its adaptability. Long standing infection with high rate of replication and mutation causes genetic diversity inside the same host, therefore making vaccine against so many variants is difficult.

Apart from viral factors the availability of antiviral therapy resulting in 48% reduction of deaths due to HIV/AIDS also hampered the efforts towards vaccine development due to vested interests of the pharmaceutical companies, this was not the case in COVID-19 where there is no effective antiviral therapy so vaccination is the only recourse(6). COVID -19 vaccine development also explored several new techniques of vaccine formation like m-RNA based approaches (7), these upcoming platforms can be helpful for other viral infections as well in future.

To conclude, current pandemic has pushed the world towards an era of vaccine development and integration of various technological resources for scientific advancement, a silver lining of COVID-19 gruesome pandemic.

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Non-Communicable Diseases

Centre for Implementation Sciences & Research in NCDs: A key initiative of World NCD Federation

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Noncommunicable diseases (NCDs) and their risk factors are one of the major global challenges of the 21st century. Collectively, NCDs are responsible for almost 70% of all deaths worldwide and three quarters of which occur in low and middle-income countries (LMICs). (1) Four major behavioural risk factors – tobacco use, physical inactivity, the harmful use of alcohol and unhealthy diets – are the primary drivers of the rise of NCDs. Reducing these risk factors is the key focus of the Global Action Plan for the Prevention and Control of Noncommunicable Diseases.(2)

World NCD Federation (WNF) a Professional Association has been working for Global Health Agenda for Universal Health care for Non-communicable (NCDs) diseases since 2015. It aims to work towards health care which is accessible and acceptable to all and at a cost, the developed and developing countries can afford to maintain and sustain population wide and individual clinical NCD interventions.(3)

Despite the availability of many resources, the current level of implementation of best buy interventions remains significantly low.(4) The nine global voluntary targets for NCDs or SDG 3 will not be achieved if the current pace continues.(5) There is a need to scale up and improve uptake of affordable and efficient NCD interventions.(6, 7) There are challenges in implementing NCD programmes, however research that is grounded in local settings and context can overcome the barriers and accelerate the implementation of the programmes.

Implementation research which is defined as the scientific study of the processes used to implement policies and interventions, and the study of contextual factors that affect these processes can improve the effect of NCD prevention, early diagnosis, screening, and treatment management programmes.(8) Calls for greater implementation research capacity come in the wake of compelling evidence that implementation strategies are critically important for the dissemination and facilitation of evidence-informed policies and interventions, thereby improving outcomes for both individuals and populations. Implementation science and research is relevant in LMICs as it can help ensure that limited resources are invested in cost-effective interventions.

One of the purposes of implementation research is to support the successful selection of policies and interventions that have been shown to be efficacious.(9) It also helps identify how to implement these policies and interventions in contexts where populations and/or resources may differ from that where they were initially formulated and evaluated, and helps identify which components of a policy or intervention are needed to obtain intended outcomes.

Implementation is a major challenge as many NCD programme are new and there are long delays in translating research into policies and actions. Keeping in view of these gaps, the Centre of Implementation Sciences and Research in NCDs has been initiated which aims to identify the bottlenecks, move ideas and innovations into action to strengthen the existing national NCD programmes. The

research is local, regional, national and international in scope and involves collaborations with stakeholders and knowledge users at each level in key healthcare priority areas. The main goals and activities of the centre include capacity building, consultancy to National and state governments in implementation research, offering guidance and support to potential researchers, and use of a new technology and innovations.

The centre also aims to deliver implementation science and technical support to assist governments and organizations to address challenges in planning, implementing, and scaling up objectives of strengthening the scientific and technical expertise of the health agencies; to promote training and capacity building efforts to improve national research for NCD prevention and control with a special focus on implementation research. Also, for developing, implementing, and evaluating lifestyle and community-based interventions to improve the prevention and control of chronic disease in resource constrained settings and countries. The centre aims to support integration of evidence-based practices in community settings. Currently there are four implementation research projects being undertaken under the centre in India and Africa.

It is intended for researchers, students, policymakers and practitioners around the world who wish to enhance their knowledge in implementation research, especially its application for the prevention and management of non-communicable diseases in low-resource settings. The centre envisions that the results of implementation research and the evidence-based policymaking can help run the robust programmes more effectively to improve public health. The centre will also provide linkage of evidence generated under the Centre for Evidence-based research in NCDs in LMICs for pilot implementation

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Health and Nutrition

Nutritional Epidemiology: New Field of Medical Research

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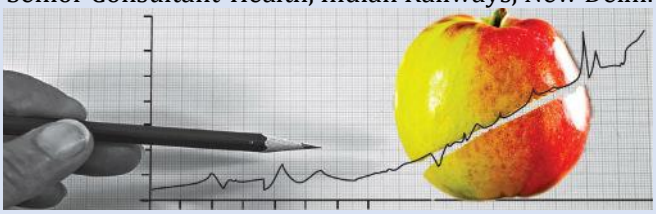

Nutritional epidemiology examines dietary and nutritional factors in relation to disease occurrence at a population level.[1] Nutritional epidemiology is a relatively new field of medical research that studies the relationship between nutrition and health.[2] It is a young discipline in epidemiology that is continuing to grow in relevance to present-day health concerns.[1] Diet and physical activity are difficult to measure accurately, which may partly explain why nutrition has received less attention than other risk factors for disease in epidemiology.[2] Nutritional epidemiology uses knowledge from nutritional science to aid in the understanding of human nutrition and the explanation of basic underlying mechanisms.[3] Nutritional science information is also used in the development of nutritional epidemiological studies and interventions including clinical, case-control and cohort studies.[4] Nutritional epidemiological methods have been developed to study the relationship between diet and disease. Findings from these studies impact public health as they guide the development of dietary recommendations including those tailored specifically for the prevention of certain diseases, conditions, and cancers. It is argued by western researchers[1][5] that nutritional epidemiology should be a core component in the training of all health and social service professions because of its increasing relevance and past successes in improving the health of the public worldwide.[4] However, it is also argued that nutritional epidemiological studies yield unreliable findings as they rely on the role of diet in health and disease, which is known as an exposure that is susceptible to considerable measurement error.[6]

History of nutritional epidemiology

Nutritional epidemiology started as a sub discipline of epidemiology in the 1980s[7] before advancing into a core disciple in epidemiology. It deals with the role nutritional exposures play in the occurrence of impaired health conditions. The assessment of these exposures and the investigation of the association between exposure and outcome form the core of nutritional epidemiology.[7] It is through the understanding of how nutrients and vitamins affect deficiency and disease early in the twentieth century that nutritional epidemiology became better established.[8] Later in the twentieth century it gained further significance when the role of exposure in chronic disease became well understood.[8] Since then, the application of information from nutritional epidemiology has led to significant scientific and social breakthroughs.[9] Epidemiological methods have been used for centuries to study the relationship between diet and disease,[10] yet were not considered definitive. Advancements to the ways in which dietary exposures were measured gave rise to the reliability of data. The inclusion of genetic risk factors in models of causation have made nutritional epidemiology an increasingly interdisciplinary field.[11]

Nutritional epidemiological studies

Nutritional epidemiological studies form the foundation for nutrition-related discoveries.[6] The studies reveal the relationship between nutrition and health, with a focus on aetiology of chronic disease.[6] They provide a comprehensive view of the way in which diet

affects or maintains health and wellbeing in individuals and populations. A prominent controversy lies within the ability to reliably and accurately measure exposures as they are subject to measurement errors and variation.[12] Nutritional epidemiological study designs are required to establish a definitive relationship between diet and disease to be able to develop interventions and policies that will be implemented for the health of the public.[12] There are observational and experimental investigations which have applicable study designs that fall under them including ecological, cross-sectional, cohort, case control, clinical and community trails.

Investigators in experimental studies have the control of assigning exposures, whereas in observational studies exposures are observed only with no intervention.[12] Experimental studies can therefore provide stronger evidence for the effect of exposure on outcome, which would otherwise be considered unethical in an observational study as exposure could be harmful.[6] But Observational studies are simpler to carry out and more cost effective. Observational studies are able to detect rare or unusual findings over long periods of time (diet-related diseases develop over time) which would otherwise burden subjects and be expensive in Experimental studies.[12] In nutritional epidemiology, Experimental studies may be used to draw causal conclusions between dietary exposures and health outcomes,[13] however for some diet-disease relations there are ethical considerations.[12] Nutritional policy and procedure decisions are therefore guided by findings from a combination of sources to ensure accuracy, reliability and validity.[13]

The measure of exposure is dependent on the question and study design.[6] It can be objectively or subjectively measured on individuals or populations in the past or present. In nutritional epidemiological studies this refers to factors such as food including nutrients and non-nutrients and the social environment.[14] The effect of these exposures is measured as outcomes.[12] In nutritional epidemiological the outcome is commonly referred to as the disease state or the anthropometric or physiological state under either continuous or discrete variables. The objective of nutritional epidemiological research is to provide scientific evidence to support an understanding of the role of nutrition on the causes and prevention of ill health.[6] It is important to address the factors that affect food supply, including quality, quantity and balance and the factors that affect food after consumption. The development of a specific, feasible and relevant aim of study and target population is the first step in epidemiological research.[19] The second step is the selection and correct use of a method that measures exposure and outcome followed by extensive analysis. Exposure and outcome of interest are measured to enable reliability of the relationship assessed. Studies that are well designed, have a strong foundation, detailed methodology and are governed by ethical principles will have the derived conclusions used to improve health care. All steps require knowledge of past and current literature.[6]

The different nutritional epidemiological study designs offer advantages and limitations in different circumstances.

Ecological study

An ecological study is an observational study that studies risk-modifying factors on health outcomes of populations based on their geographical and/or temporal ecological state. Ecological studies are useful in studying patterns of disease in large populations however may not accurately reflect true associations between individuals within those large populations.[15] Ecological studies use

geographical information to examine spatial framework of disease and exposure but there is potential for systemic difference in classification language.[12]

Cross-sectional study

A cross-sectional study is an observational-individual study that measures exposure and outcome in the present. In examining the relationship between disease and diet, cross sectional studies provide a snapshot of the frequency of disease in a population at a given point in time.[20] Cross-sectional studies offer advantages such as the ability to measure multiple outcomes and exposures and, in the planning, and allocation of health resources as it assesses the burden of disease in a specified population. The measure of the outcome is however heavily reliant on population responses. Non-response results in responder bias and therefore unreliable results.[12]

Case control study

A case-control study is an observational-individual study that is defined by the outcome (i.e. measures outcomes in the present and past exposure is established). It involves two groups controls and cases (diseased), both which have two treatments; exposed and unexposed.[12] Case-control studies can be used to study diseases that are rare and over long periods of time however are limited to examining one outcome and are also susceptible to the effects of bias if selected control groups are no representative of the population, so give rise to misleading results.[15]

Cohort study

A cohort study is an observational-individual study that measures exposure in the present over long periods of time and the outcome is determined in the future.[15] Cohort studies allow for multiple outcomes to be measure per one exposure.[12] In nutritional epidemiological studies it is advantageous in measuring outcomes that occur after exposure and can measure both incidence and prevalence. Cohort studies are however costly and time consuming.[13] As outcome is determined in the future, any issues pertaining to the collection of information or confounders cannot be resolved back in time.

Clinical and community trails

Clinical and community trails are experimental studies that involve active intervention in either individuals (clinical) or populations (community). Clinical trials often involve test and procedures carried on subjects placed in different treatment groups.[12] Clinical trials allow for the evaluation of new therapies, drugs and procedures. Clinical trials however risk subject to experience side effects and inadvertent harm from the intervention therefore should only be considered when supporting evidence is strong.[15] Community trials involve assigning groups of individuals with and without disease to different interventions. This allows for larger scale findings however does not account for individual variability.[12]

Social impact

The impact nutritional epidemiology had in the past has led to social, physical and economic changes. Nutritional epidemiological findings guide dietary recommendations including the prevention of certain disease and cancers.[1] They play a role in policies on diet and health given the works are published based on grounding evidence.[5] The observational findings allowed for health interventions such as the fortification of foods and limits/bans of certain substances from food.[5] These implemented changes have since enhanced human health and wellbeing by means of prevention and improvement. Research suggest its impact specifically on cancer patients has

been promising.[1] The nutritional support to some provides relief of side effects, improves response to therapy and reduces the risk of cancer reoccurring, all of which enhance the quality of life for cancer patients.[1] Progressive impacts have also been seen on a variety of infectious diseases, chronic disease, and congenital malformations,[5] ultimately elevating the burden on the healthcare system and striving for optimal function.

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Commentary

FOPL: Need of the hour

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Worldwide, 65% of all deaths are attributed to non-communicable diseases (NCDs), and dietary risk factors and physical inactivity collectively accounted for about 10% of disability-adjusted life years lost globally in 2010. The Global Action Plan 2013–2020 of the World Health Organization (WHO) to reduce premature NCD-related mortality by 25% by 2025 was adopted at the 66th World Health Assembly in May 2013.

The majority of the action plan's nine optional global targets are "downstream" markers and risk factors for NCDs. The only nutritional goal is a 30% reduction in the average population's salt intake, with a goal of 5 g of salt per person per day. Other food-related indications include limiting saturated and trans-fatty acids in the food supply, as well as limiting children's exposure to unhealthy food advertising. [1]

Food labelling is defined as "any written, printed, or graphic matter that is contained on the label, accompanies the food, or is exhibited near the food, including that for the aim of promoting its sale or disposal," according to the World Health Organization (WHO).[2]

Food labels, in general, inform consumers about the composition and nature of items in order to minimize misunderstanding and protect consumers from misuse, risk, and abuse. The area of a food label that expressly declares nutrient content is known as nutrition labelling. Nutrition labelling is effective, according to the Codex Alimentarius, when it gives consumers with information about a food to assist them in making healthy eating choices.[2]

The two major stakeholder groups with the greatest ability to influence food environments and population diets are national governments and the global food business. The WHO and others advise governments to take a "systems approach" to initiatives incorporating non-health sectors to achieve supportive and long-term benefits.[1]

Rationale of Front of package labelling (FOPL), lies in the fact that it's right of consumers to know and make informed choices about the foods they consume, especially the packed ones. Packaging has been a time immemorial concept as it serves the purpose of physical protection, barrier protection (maintaining permeation to increase shelf life), agglomeration to improve storage and selling efficiency, information transmission, portion control, branding and marketing of the product concerned[5]. Packaging label primarily being a technology for enclosing or protecting products for distribution, storage, sale, various types of labels exist viz. brand labels, grade labels, descriptive labels etc. Globally nutrition fact labels or the nutrition information panel is prerequisite on most packaged foods displaying type and amount of ingredients and nutrients in the product. Even Ministry of Health and Family Welfare on 2008 had notified Prevention of Food Adulteration Rule by 5th Amendment stating '*packaged food manufacturers need to declare on their product labels nutritional information and a mark from F.P.O /Agmark to enable consumers to make informed choices while purchasing'* unlike a prior voluntary *approach [3].* It's a public health interventions requiring small behavioural

change with potential to bring about vast difference in health outcome as quoted famously “Health of a nation lies in Hands of its people’.

Consumers globally need solutions like Front of Package Labelling (FOPL) to enhance their diets and lower their CVD risk factors. FOPL systems can influence consumer choices by boosting consumers' understanding and application of nutrition information, according to the research community.[4]

Several of these labelling methods have been demonstrated to have an impact on the most nutritionally vulnerable populations, including those with lower levels of education and nutritional expertise. Governments around the world have established or are in the midst of implementing a wide range of FOPL systems. Nutrient-specific warning labels are one example of an established system that alerts customers when products contain excessive levels of nutrients linked to the top risk factors for CVD and other NCDs. For example, the traffic light system, which uses green, amber, and red colours to indicate relatively low, medium, or high levels of critical nutrients in a product; and summary indicators, which use algorithms that include both negative and positive nutrients and ingredients to rate the overall nutritional quality of a product.[3]

The WHO's guiding principles and framework handbook for front-of-pack labelling for promoting healthy diets were created to assist nations in developing, implementing, monitoring, and evaluating a suitable FOPL system. [3]

The Codex Alimentarius Commission (CAC) establishes worldwide food standards that serve as a guideline for all 188 of its member countries' packaging and food safety.

Nutrient declarations, nutrition and health claims, and supplementary nutrition information, which includes FOPL, are the three types of nutrition labelling now recognized by the CAC guidelines.[4]

Nutrient declarations are standardized listings of a food or beverage's nutrient content, commonly seen on the back or side of the packaging. Codex proposed that nutrient labelling on food containers be made mandatory in 2012. However, there are no explicit and mandatory guidelines for FOPL in Codex. Examples of some of the FOPL initiatives which were regarded successful because they improved consumer nutrition education and/or reduced the sale of unhealthy foods are: Chile which enacted some of the toughest obligatory FOPL legislation in 2012, alerting customers whether a product has too much sugar, sodium, saturated fats, or calories. Consumers in Chile are aware of and comprehend the Chilean FOPL, according to evidence from multiple evaluation studies and impact assessments undertaken since the legislation was introduced. They are also using the labels to make food purchasing decision thereby influencing social norms and attitudes toward purchasing healthful foods.[3]

Similarly, a voluntary FOPL system was designed in France and has been in use since 2017. It uses five colours (from green to red) and a grading system from A to E to display a nutritional summary score of products. The total score is calculated by taking into account the number of beneficial nutrients and ingredients (fruits, vegetables and nuts, fibres, and proteins) as well as the product's negative nutritional and caloric concentration (too many calories, saturated fat, sugars, and/or sodium).[3]

Thus, it is evident that often consumers make incorrect product decisions due to a lack of clear, understandable information. Consider how much food is marketed: "low fat" can

conceal high sugar and sodium levels, "low sodium" can mask high calorie levels, "zero trans fats" can mask high saturated fat levels, and so on.To address this deception, governments can push companies to reveal the truth about their products by enforcing more detailed food labelling. [5] A population-wide intervention, such as promoting a healthy diet by providing proper nutrition information on product labels, as well as consumer education to better understand nutrition labels, is critical in helping to overcome the NCD conundrum.[2]

Way forward: Apart from serving basic purpose of safety, protection, sustainability, and usefulness of food products alongside increasing attractiveness of the food packaged the nutrition labels aid consumers in making informed choices. Labelling however mostly being in English it may be difficult for a vernacular literate person to read nutrient labels despite the intent. Moreover, India still is not fully literate hence some symbols for nutrient identification may be thought of. A colour coded triaging of food products in terms of nutrition content like ones for segregating vegetarian foods may be contemplated. Due to online buying methods in the new normal, even apps may display nutrient labelling for food product before the final clicks to buy. Prints like Harmful for diabetics (India fast proceeding to be the diabetic capital of the world) or 'not for kids below 18 years' may be additionally put as in tobacco.

Awareness generation regarding benefits of FOPL needs to be percolated in community for complete adoption and uptake of the program. People need to realize they can prevent health hazards by making choices in the foods they buy and consume by simply reading the food labels before buying. A minor one-minute modification in the process of buying can usher incremental improvement in their health. Peer dissemination of information and incorporating these topics in school curriculum and daily health communications can bring around a sea changes in building a healthy nation. "*Responsible citizens are we- just read begore u buy. Choose to live not die".*

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News and Events

EFICON 2021

Second Annual National Conference of Epidemiology Foundation of India is being organised by Community Medicine and Family Medicine and School of Public Health, All India Institute of Medical Sciences, Jodhpur, Supported by National Medical Commission (NMC) and Department of Biotechnology (DBT)

Theme: Transforming Global Health by Integrating Medical, Social and Behavioral Interventions

Date: 29-30 OCTOBER,2021

Email: eficon2021@gmail.com

Website: https://eficon2021.in/

ISMSCON-2021

39th Annual Conference of Indian Society for Medical Statistics (ISMS) organized by the Department of PSM Rajendra Institute of Medical Sciences (RIMS), Ranchi

Theme: Application of Biostatistical Techniques for Summarising Evidence; Systematic Review and Meta-Analysis

Date: 09th to 11th December 2021. Pre-conference workshop: 8th December 2021

Registration opens: 1st August 2021

Email: ismscon2021@gmail.com

Website: http://rimsranchi.ac.in/ismscon/index.php

IBS(IR)CON-2021

The Department of Statistics, National Institute for Research in Tuberculosis (ICMR-NIRT), Chennai is hosting the XV Biennial Conference of International Biometric Society (Indian Region) from November 16th to 17th 2021; on theme 'Statistical challenges in clinical trials'.

This conference aims to provide opportunity for all members of the society and others including students, teachers and professional statisticians alike to present their research findings, participate and interact during the technical sessions.

The conference will be preceded by a one day workshop on Survival analysis on 15th of November 2021.

The link for NIRT

National Institute for Research in Tuberculosis

http://nirt.res.in/

Accessing the conference brochure

XV Biennial e-Conference of International Biometric Society (Indian Region) (nirt.res.in)

http://nirt.res.in/events/2021/XV_IBS_IR_CON_PAMPLET_2021.pdf

Online registration of the conference

XV International Biometric Society-Indian Region Biennial Conference - 2021 (google.com)

https://docs.google.com/forms/d/e/1FAIpQLSdkc0XZxlygAN3JvKC600p5dmvgRglX_syYxZKRvfS3-yGHgA/viewform

Email: ibsir2021@gmail.com