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# DIGITAL VACCINE AS IMMUNITY PASSPORT

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**ABSTRACT**

A different type of vaccine, called a "digital vaccine", might offer a solution to the problem of creating sustained behavioural change. These are not typical vaccinations in the sense of promoting biological immunity to a pathogen, but they have this name because they create resistance to disease through a different mechanism. Digital vaccines are a subtype of digital therapeutics, which use neurocognitive training to promote positive human behaviour using technologies like smartphone apps.

**KEYWORDS**: Digital vaccine, immunity to a pathogen, digital therapeutics, smartphone apps.

**OVERVIEW:** With multiple pharmaceutical companies reporting preliminary results from their COVID-19 vaccine trials and two candidates awaiting imminent FDA approval, there is a lot of recent discussion in the media about vaccines. After almost a year of suffering and over 250,000 known deaths from this virus in the United States alone, the promise of a vaccine in the near future can feel like a light at the end of what has been a long, dark tunnel. Vaccines have historically lessened the burden of diseases like measles and polio, and there is hope that they will bring an end to the current pandemic.[1]

New vaccines to prevent COVID-19 are promising, and feature a number of brand new technologies that might make them more effective and easier to manufacture. However, even if these vaccine candidates are as effective as we hope they are, it will be several months before enough of the population is vaccinated that we can safely return to some semblance of normal life. Until then, the safety of our communities and the stability of our healthcare systems rely on each one of us making healthy choices about hygiene, mask-wearing, and social distancing. Based on how low adherence to public health guidelines has been in the first nine months of the pandemic, that is going to take significant work.
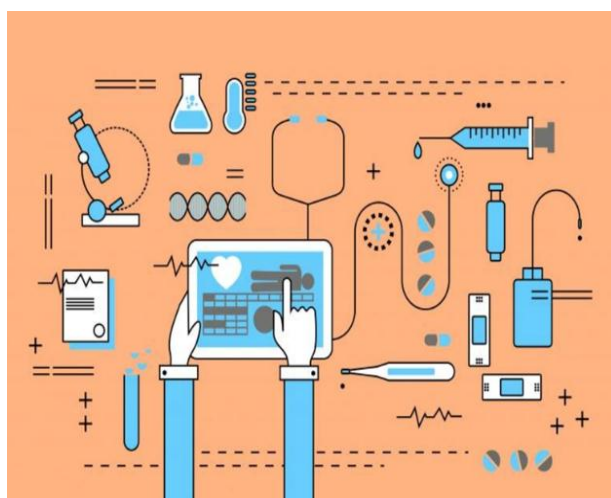


**Figure-1: Digital vaccine.**

**What are Digital Vaccines?** Digital Vaccines are a subcategory of digital therapeutics, which are evidence-based prevention approaches that use digital technologies (applications delivered via smart-phones, tablets, etc.) for nudging positive human behaviour via neurocognitive training. They are gamified, digital interventions that draw from principles of neuroscience, psychology, Artificial Intelligence, persuasive computing and behavioural economics to provide safe and low risk mechanisms for dynamic neuro- behavioural physiological modulation.

A Digital Vaccine candidate for chronic diseases, Fooya!, has been developed by Friends Learn, Inc., deployed and evaluated via pilot clinical trials in a variety of clinical, consumer, and school-based usage settings. Based on a decade of completed and ongoing research with Baylor College of Medicine, Johns Hopkins University Bloomberg School of Public Health, Carnegie Mellon University, and Stanford School of Medicine, a body promising evidence indicates that neuro-behavioural-physiological modulation through the use of Machine-Learning and Deep-Learning-enabled personalized gamified experiences may induce behaviour changes and habits to reduce disease risk. Fooya! is a medical mobile application which has adopted the design principles of Digital Vaccines via a gamified learning platform that uses neuroscience, artificial intelligence and virtual reality to improve dietary choices, physical activity and health literacy amongst children. It has unique, immersive, and motivational features that encourage active-video game playing, and thereby, induce desired behavioural changes in the pediatric population. We propose to re-purpose this platform towards containment of infectious diseases, such as COVID-19, through our knowledge and expertise related to dynamic neuro – behavioural - physiological modulation.[2]

**The design and mechanism of Digital Vaccines:** The Digital Vaccine research focuses on assessing mechanisms and interventions that are based on Neuroscience and Neuro-behaviour-physiological modulation, and can offer a novel framework to induce immunological memory, as a way to lower the risk for a number of diseases. The aim of our research team is to explore and validate health interventions for disease prevention through technology, backed by a body of evidence and rigorous science. A Digital Vaccine is a sub-category of digital therapeutics that provides neurocognitive training to the reward and self-control regions of the brain at a neuro systems level, thereby inducing sustained behaviour changes. A recent focus of this ongoing research is to study the impact of our methodologies upon inducing and sustaining Neurobehavior modulation on sustaining personal hygiene. These interlinked mechanisms are being assessed by near-term and longitudinal impact of dose exposure on biomarkers of incidence and indicators of disease risk, such as blood glucose, A1C numbers, Triglycerides, HDL/LDL, length of telomers, insulin consumption, etc.
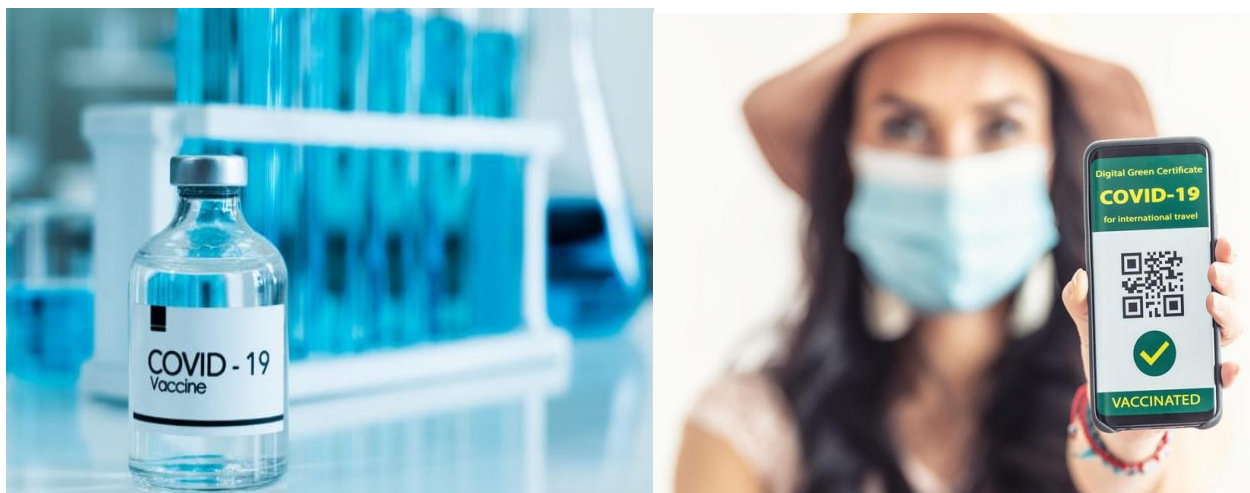


**Figure-2: Digital Vaccine [COVID-19]**

**Digital Vaccine for COVID-19:** Practicing good personal hygiene (hand washing, disinfecting surfaces, social distancing, etc.) is a critical lifestyle behaviour change that could mitigate the spread of infectious diseases. We propose the use of Digital Vaccines to provide neurocognitive training to users so as to nudge them towards adopting health hygiene practices. The Digital Vaccine will be administered via a gamified-mobile application that will be culturally sensitive and customizable. In other words, the gamified application will entail deep levels of personalization and localization that will ensure that the vaccine meets the requirements of each target audience from all geographical, social and cultural realms. For example, for developing a COVID-19 Digital Vaccine that promotes hand-hygiene in Tamil Nadu in India, our research team will seek consultations from experts to understand the sociological, environmental, and regional norms of the area. The team will then adapt and extend the existing game design and interface components for hand hygiene literacy to

include local preferences that may include displaying play-instructions in the regional language, designing game avatars to resemble local appearances, using universally recognized icons in the game interfaces, and so on. Furthermore, such dynamic content configuration embedded through engagement mechanisms proven for neurocognitive training will allow rapid deployment of the Digital Vaccine. This will be enabled by a neural network to learn and adapt based on live and forecasted streams of data. In the case of a rapidly changing virus, we need to approach containment and immunization with agility and precision that exceeds the vectors of infection. Artificial intelligence provides a system of rule based/supervised/unsupervised learning frameworks, also moderated through human intervention that can stay ahead of an epidemic based on data.[3]

The Digital Vaccine for infectious diseases will be developed by FriendsLearn (https://friendslearn.com/), a decade old life science research company based in India and with an R&D office in San Francisco that has pioneered commercially deployed Digital Vaccines in the past. Through this unique consortium of academic partners and a proven technology pioneer that can move with the agility of a startup, we propose to design, develop and evaluate, via human clinical trials, our Digital Vaccine candidate to prevent and mitigate the spread of COVID-19. The key outcomes of the trial will be tracking incidence of COVID19, time factors as well as transmission rates, and uptake of health-hygiene practices.

**The Digital COVID-19 Vaccine Record (DCVR) portal:** Digital Vaccine Record or DVR: COVID-19 Digital Vaccine Record (DVR) is an electronic vaccination record drawn from the data stored in the District of Columbia's immunization information system (DOCIIS) and is an official record issued by the District of Columbia. The DVR includes a QR code that (when scanned by a SMART Health Card reader) will display the same information as paper CDC vaccine card: name, date of birth, vaccination dates and vaccine manufacturer.[4]

We may use our CDC card as proof of vaccination in addition to other possible options such as a digital or physical proof of vaccination from our provider/pharmacy or other jurisdictions.

**Proof of vaccination:** There are 5 ways you can show your COVID-19 proof of vaccination in Victoria:
• COVID-19 digital certificate via the Service Victoria app
• COVID-19 digital certificate saved to a smartphone wallet
• Printed copy of COVID-19 digital certificate
• Printed copy of immunisation history statement
• Eligible proof of vaccination exemption.

**Proof of vaccination if you don't have a smartphone:** If you don't have access to a smartphone, you can print your COVID-19 digital certificate or immunisation history statement from myGov. If you don't have access to a printer, you can ask your GP, pharmacy, or community centre where you received your vaccination to print your COVID-19 digital certificate or immunisation history statement for you. Alternatively, call Services Australia on 1800 653 809 and ask them to send your immunisation history statement to you. It can take up to 14 days to arrive in the post. If you are an international worker in Victoria and are up to date with your vaccination status with an approved or recognised vaccine, you can use an Australian International COVID-19 Vaccination certificate, a paper or digital certificate issued by an overseas government authority or an accredited overseas government vaccination provider that shows:
• Your name as it appears in your passport
• Your date of birth or passport number
• The vaccine brand name
• Date of each dose, or the date on which a full course of immunisation was completed.

Your certificate must be written in English or accompanied by a certified translation.
Visit Services Australia for information on how to add your vaccination record to the Australian Immunisation Register.

**Troubleshooting:** If you have received your vaccination at a Victorian vaccination centre and:
• Your immunisation history has not been updated on MyGov after 10 days of receiving your vaccination; or
• Your details are incorrect.

Then you can submit your request through the Missing or incorrect immunisation history in MyGov form.
If you have received your vaccination at a doctor's clinic, pharmacy, or community health service and:
• Your immunisation history has not been updated on MyGov after 10 days of receiving your vaccination; or
• Your details are incorrect.

You will need to contact your vaccination provider directly.[5]

Indian biomedical tech entrepreneur Bhargav Sri Prakash has been awarded the first patent globally by the US patent office for a 'digital vaccine', a platform that prevents real world health issues through the metaverse. Digital vaccines use applications via smart-phones, tablets, and other similar devices for nudging positive human behaviour through neurocognitive training.

**CONCLUSION**

Digital vaccines are envisioned as evidence-based prevention approaches that are delivered via smart

phones and tablets for nudging positive behaviour. They are gamified, digital interventions that draw on principles of neuroscience, psychology, Artificial Intelligence (AI) and behavioural economics to provide safe and low risk mechanisms for influencing significant behaviour change. The goal is to provide fun, immersive and motivational features within a mobile app to encourage non-addictive, interactive, game-playing experiences and induce desired changes in behaviours. This idea of digital health technologies is supported by the U.S. Food and Drug Administration. Sri Prakash, founder of the life sciences startup FriendsLearn, recently received the patent for the 'systems and methods for digital vaccine' that he developed as part of Carnegie Mellon University's digital vaccine project.

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