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Electronic vaccination certificates: avoiding a repeat of the contact-tracing 'format wars'

To the Editor—With the successful development, approval and rollout of numerous vaccines intended to provide acquired immunity against COVID-19, the focus of attention is now shifting to the immunization of populations. As restrictions on international travel, hotels, restaurants, public events and other aspects of social life are expected to be relaxed in the coming months, the relevance of tamper-proof, privacy-preserving and validated vaccination certificates is proliferating. Immigration authorities, airlines and other organizations worldwide need to be able to robustly and efficiently ascertain a given person's vaccination status.

Addressing this need, efforts have been made to develop electronic vaccination certificates (EVCs)[1]. The purpose of EVCs is to replace traditional vaccination record cards or booklets—which are vulnerable to forgery, alteration and loss—with an electronic substitute that overcomes those limitations[2]. Hence, EVCs unite two functions: they constitute a digital record of vaccination data, and they also serve as validated proof to any entity required to verify these data (e.g., airline check-in staff or immigration authorities)[3]. As a major caveat, we wish to point out that there are ethical issues surrounding EVCs that should be resolved before a rollout of this technology. Specifically, there are valid concerns that the civil rights and freedoms of non-vaccinated persons, as well as of vulnerable populations unable to adopt EVCs, could be violated[4,5]. Additionally, as with many other data-driven health technologies, there are concerns about privacy and data protection.

From a technological perspective, the dominant design of an EVC is a smartphone app that connects to a centralized database[1]. Healthcare providers enter a person's vaccination status into the database. On the basis of that record, the app generates a token or QR ('quick response') code signifying the vaccination status, which can then be verified by authorized parties. In some countries, proposed EVCs leverage existing government vaccine-record-digitization advances, whereas in others, the databases are established by private actors[6]. Until vaccination becomes widely available for major population groups, EVCs may also include a facility for storing validated PCR and/or antigen test results. Currently, a plethora of actors—including governments, consortia and firms—are engaged in the development of EVC solutions. Major actors include the World Health Organization and the International Air Transport Organization[7,8]. The field has been characterized thus far by considerable heterogeneity (Table 1), and the various EVCs are generally not mutually compatible.

Table 1 | Overview of major EVCs under development

Solution name	Key actor(s)	Origin	Actor type
AOKPass	International Chamber of Commerce	Global	Consortium
Co-WIN	Ministry of Health and Family Welfare	India	Government
CommonPass	Commons Project; various airlines	Global	Consortium
Covid Care Programme	BLOK BioScience	UK	Firm
COVID-19 Credentials Initiative	Various universities, firms and startups	Global	Consortium
Digital Health Pass	IBM	USA	Firm
Ink Digital Health Platform	Ink Aviation; Tento Health	Spain	Firm
SafeVac	Federal Institute for Vaccines and Biomedicines	Germany	Government
SMART Health Cards	Microsoft	USA	Firm
Smart Vaccination Certificate	World Health Organization	Global	Government
Travel Pass Initiative	International Air Transport Organization	Global	Consortium
Trusted Travel	African Union	Africa	Government
Vacmobile	Vacmobile Corporation	USA	Firm
Vacuna	IO Propagator	Germany	Firm
VeriGO TrueSeal	Veridos	Germany	Firm
V-Health Passport	VST Enterprises	UK	Firm

Compiled on the basis of information publicly available as of 3 February 2021.

In early 2020, there was an analogous situation with contact-tracing apps. Initially, profoundly diverse solutions were developed, ranging from QR codes and GPS tracking to Bluetooth-based solutions. In large parts of the world, Bluetooth-based apps emerged as the dominant design, but this initially resulted in a plethora of mutually incompatible solutions. This hampered the epidemiological utility of these apps[9], as contact-tracing apps are an example of a network good—i.e., their utility increases with each additional user. Furthermore, from the beginning, there was also a special requirement for cross-border use, such as in the European Union, where decision-makers aimed to keep internal borders open. Various stakeholders, such as governments, consortia and individual firms, developed their own contact-tracing apps but failed to coordinate a common standard. These 'format wars', which went on for months, delayed the widespread adoption and rollout of contact-tracing apps. Ultimately, the solution propagated by technology companies Apple and Google prevailed. Through their control of the market for mobile operating systems, these firms had the power to push a solution by virtue of excluding alternatives from their respective platforms.

For EVCs, a major goal has to be to prevent a repetition of such a format war, as this would delay their diffusion and adoption. Instead, the rapid emergence of a universal solution, or ensured compatibility between different solutions, is needed. It is inconceivable that vaccinated people, healthcare professionals and authorities will adopt numerous EVCs simultaneously. Thus, isolated solutions in deliberate opposition to international and regional standardization efforts—such as the French government's deciding not to adopt the Apple–Google contact-tracing solution and thus forfeiting interoperability with apps in other European countries[10]—need to be avoided.

To ensure that EVCs experience a faster and more coordinated rollout than contact-tracing apps did earlier during the pandemic, it would behoove policymakers and practitioners alike to take a critical look back at the standardization processes of these apps and the lessons learned. First, neither companies nor consortia or governments alone were able to set a standard. This highlights the need for coordinated multi-stakeholder collaboration in the development, propagation and adoption of a standardized EVC. However, the present case shows the complexity of actor involvement: the International Air Transport Organization, which ostensibly represents all airlines, is engaged in the development of an industry-wide EVC standard. At the same time, however, a number of leading airlines are involved in the development of an alternative solution. Second, for app-based EVCs, it might prove especially important to include the main technical platform owners, Apple and Google, as their involvement has been shown to enable the rapid rollout and adoption of contact-tracing apps through the inclusion of key functionality in their mobile operating systems. The early involvement of technological actors also ensures that potential technological barriers can be identified and rectified early in the development process to ensure frictionless rollout and operation. Third, government and industry decision-makers need to be aware of the importance of diffusing a universal standard, rather than prioritizing short-term national or commercial interests. Once a common standard is set, the role of national governments and industry is to provide linkages with national health infrastructure and localized user interfaces and to encourage widespread adoption of EVCs.

In conclusion, EVCs seem to be a promising technology for supporting the resumption of activities suspended by COVID-19, once the ethical concerns and implications surrounding them have been sufficiently deliberated. However, for full capture of the utility of this technology in practice, the important issue of setting a universal standard cannot be understated. In the current early stage of development, there is still a chance to homogenize solutions and prevent unnecessary delays due to the competition between and incompatibility of various solutions. ❐

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Competing interests

The authors declare no competing interests.

The battle for COVID-19 vaccines highlights the need for a new global governance mechanism

To the Editor—Although the rapid development of several vaccines against COVID-19 is an unparalleled scientific accomplishment, one made possible through the collaboration of researchers, industry and funding bodies, the absence of a system that secures equitable access to vaccines has uncovered deep fissures in the global governance systems for health, as noted in a recent *Nature Medicine* Editorial[1].

For example, advance purchase agreements for vaccines against COVID-19 have favored affluent countries, allowing them to secure 150–500% of their predicted needs[2], while many citizens of low-and middle-income countries (LMICs) will remain unvaccinated until 2024.

Additionally, the power of patent-holders and pharmaceutical companies to place conditions on the use of vaccines prices out access for LMICs, and bilateral purchasing deals are rarely disclosed.

By affording priority on the basis of economic or political power, today's discourse clearly deviates from previous ethical and public-health principles of maximizing lives or life-years saved, and the sentiment that "people's entitlement to lifesaving resources should not depend on nationality"[3].

The COVID-19 pandemic has tested wealthy nations' commitments to Agenda 2030 (ref. [4]) and to 'leaving no one behind' at the same time that it has revealed democratic deficits, institutional rigidity, weak accountability systems, and inadequate policy space that protects health-governance systems from economic goals[5].

Thus, the as-yet-limited support for the vaccine-sharing and allocation principles of the COVAX initiative[6] may be a sign not only of a moral catastrophe, to quote the director-general of the World Health Organization (WHO), but also of inadequate global accountability mechanisms that exposes the consequences of commercial determinants of health.

The ongoing battle for scarce vaccines against COVID-19 also highlights the lack of legally binding mechanisms that hold market actors accountable for failing to act for the public good, and the absence of global mechanisms for coordinating the pooling and sharing of resources.

In a recent example, high-income countries blocked an effort to enable timely, affordable access to products for