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The COVID-19 pandemic and contact tracing technologies, between upholding the right to health and personal data protection

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Abstract. – Countries responded to the COVID-19 pandemic with various levels of restrictions and lockdown in an effort to save lives and prevent the saturation and collapse of national health systems. Unfortunately, the blockades have entailed hefty socioeconomic costs. In order to contrast the spread of the virus, states have used contact tracing technology, in the form of mobile phone applications designed to track close contacts of those infected with COVID-19. Recent research has shown the effectiveness of this solution, particularly when used in conjunction with manual tracking. Nonetheless, the contact tracing app raises concerns due to the potential privacy implications. The authors have delved into the European legislation that protects privacy through the principles of proportionality and minimization, arguing that in order to quickly resolve the pandemic caused by COVID-19, one cannot blindly trust the exclusive help of technology. Instead, we need the involvement of health personnel, scientists, and no less importantly, the citizenry's sense of solidarity and the duty to abide by the rules of social distancing, the use of protective devices and hygiene rules to protect public health.

Key Words:
COVID-19, Digital healthcare technology, Healthcare policies, European legislation, Necessity criteria, Proportionality and minimization, Privacy, False-negative, FIse-positive.

Introduction

According to official reports, the disease caused by SARS-CoV-2 infection (officially denominated COVID-19) has infected 101.053.721 people, causing 2.176.159 fatalities as of 29th January 2021[1] and, one year later, continues to heavily affect the lives of the citizens worldwide[2,3]. Most tragically, overwhelmed hospitals and insufficient health care resources, in Northern Italian regions in particular, have led health care operators to face ethically challenging decisions in terms of allocating intensive care access[4]. Forcing the use of individual protection devices (respiratory masks and face coverings) has not proven entirely successful in countering the spread of the coronavirus, and neither have diagnostic (testing swabs) and therapeutic measures (including artificial respirators), social distancing, stay-at-home orders and the shutdown of economic, productive and educational activities[5,6]. In addition, the choice to put daily activities on hold for long periods of time is not economically and socially sustainable, because it would mean to hamstring and impoverish national economies[7], nor should it be overlooked that the stay-at-home mandates can cause or exacerbate family conflicts, depression, panic attacks[8], murders and suicides[9]. In addition, studies[10-12] have shown that individuals with addiction and substance use issues[10,11] are at a higher risk of contracting COVID-19 and experiencing a severe disease course[12]. Hence, in order to prevent the spread of the virus, European and non-European governments have resorted to digital solutions in many different settings and sectors, as well as in society as a whole. For example, public education officials have developed strategies for distance teaching from primary school to university, by transitioning from classroom lectures to virtual lectures or web-based courses[13,14], while public and private offices, whenever possible, have encouraged or mandated smart working[15]. To contain the rates of infection, digital technology has developed and put in place "contact tracing" apps, i.e., the tracking of infected people (even if asymptomatic), of the people they meet and the places they attend. Such digital tools help to identify those who may be at risk of being infected, due to having interacted with a COVID patient in the last two weeks[16]. The

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Table I. App functions and targets.

App functions	Main focus
1. Informational Function	**1.** Aimed at the general public
2. Contact tracing and alerts	**2.** Individual at risk of infection
3. Quarantine surveillance/monitoring function	**3.** Confirmed infected individuals

main functions of tracing apps and their focus are summarized in Table I. They therefore enable health authorities to isolate any other infected in the shortest possible time and to implement all necessary preventive, diagnostic and therapeutic measures[13,17,18]. The main advantages which such technological tools yield are briefly outlined in Table II.

The World Health Organization (WHO)[19] has stipulated that tracing of all contacts of positive subjects must be carried out from two days before the onset of symptoms, and that tests must be performed on all contacts of patients who test positive, regardless of whether they have symptoms. The WHO policy can be summarized in the following indication: "Find, isolate, test and treat every case and trace every contact"[20,21]. As with all tracking technologies, there are fears that even in this case it may encourage hackers to undertake cyberattacks or others to organize scams against users of the app. Geopolitical risks should not be overlooked either, given how the data collected could be manipulated for political, military, health or commercial purposes; even the system itself could be used to spread false alarms in the population or messages meant to fuel panic[22].

Traditional vs. Technological Tracing

In the event of an epidemic, it is essential to identify those who have had close contact with infected individuals over the past two weeks. Manual tracing was entrusted to health personnel; each operation takes about 12 hours and requires three units of specialized personnel[23].

Table II. App utilization and its benefits.

App main advantages
a) Identify potentially infected individuals before symptoms onset;
b) Piece together the chain of infections in order to break it;
c) Stave off the formation of new infection transmission chains.

Ferretti et al[24] have shown that most unmonitored infections occur in the period in which those infected do not know it yet, and therefore, do not take any precautions. The same study has also shown that the disease is asymptomatic up to 55% of transmissions with a very short generation period (3-5 days). This means that the traditional tracking of the transmission chain of the infection, based on diagnostic test results, is not fast enough to stem the spread of COVID-19 and does not ensure the interruption of epidemic reproduction. In fact, it is quite difficult for infected patients to remember all previous contacts, both because many of them occurred accidentally (on the street, on public transportation, at restaurants and whatnot) and due to the fact that many people encountered by the subject are total strangers[24].

Instead, the use of technology in the field of contact tracing allows for a much more efficient means of "proximity tracking", because operators can intervene more quickly in the prevention action. Since about 44% of secondary cases of infection occur during the presymptomatic phase of primary cases, scientists have concluded that a tracking app would play a key role if combined with social distancing and isolation. This app should inform the users if a person whom they have come into contact with is diagnosed with COVID-19 within the previous 2-3 days, and induce self-isolation[25]. A further advantage is constituted by the fact that since the app uses phone data, it can solve the problem posed by the difficulty of remembering all the movements over the past 14 days or the lack of direct knowledge as to the contacts' identities. It should be kept in mind that the contact tracing app alone is not enough to limit infections, because it will not protect those who do not own a smartphone or who, for various reasons, has not installed the app[26]. Hence, apps need to be relied on in addition to diagnostic testing and interventions of healthcare professionals[27].

False Positives and False Negatives

False positives and false negatives can be detected with automated collection. Instances of false positives take place when people, despite having

adhered to legally required social distancing measures, receive the alert and could decide, out of caution, to enforce unnecessary and unjustified self-confinement. It could also happen that if a subject receives an excessive number of alerts he or she could "get used to it" and eventually decide to ignore an alert, even if determined by a high risk situation. In addition, there are situations that would enter the app's radar without there being an actual risk. In fact, an app cannot detect a wall or a barrier, it does not distinguish if a given space is closed or open, it is obviously unaware of whether other people are wearing personal protective equipment. Furthermore, apps cannot know if the subject encountered by the device holder only for a moment, within the legal distance and within bluetooth range had their mask on or not. These are all potential cases of false positives, and therefore the system could consider that a "contact" has taken place and start an alert over that, with all the ensuing consequences[28]. In fact, citizens who receive alerts are forced to enter into a period of self-isolation until the test comes back negative. The system has substantial repercussions on the people's psychological and emotional health, but also a significant social impact because following the alerts, many people could turn to the health authorities or even unnecessarily inflate the emergency numbers. Hence, it might well lead to an excessive number of requests for further information that public health facilities may not be able to handle effectively and in a timely fashion, due to shortages of means and personnel. Only medical supervision has the capability to tackle the issue of false positive notifications. Article 22 of the General Data Protection Regulation also recommends the correction of inaccurate notifications of positivity ("subsequent manual contact tracing for the purpose of doubt removal"). Just as important can be the issue of false negatives, i.e., cases in which a contact with an infected individual has not been traced. This may depend not only on the fact that either one of the two subjects who come into contact has not activated the app, but also on the fact that the contact is "mediated" (e.g., an infected individual touches a surface and moves away, after a few seconds someone else touches the same surface, potentially getting infected), or simply due to the ineffectiveness of the app.

The best solution would be a synergy between manual and technological systems, in order to reach as many potential infected as possible, so that the person who slips through one system can be tracked by the other.

COVID-19 and Data Processing: European Legislation

It cannot be overlooked that the adoption of contact tracing measures jeopardizes personal data protection of the of all parties involved. In fact, it may also be necessary to retrace the contacts of subjects who did not contract the virus or who will only show symptoms later on, or in any case will be found to be positive for COVID-19[29] (and therefore contagious). Therefore, contact tracing apps, if not properly devised and structured, can seize personal data and through them they can give rise to various potentially illegal practices. A heated debate has arisen on the subject between those who want to use technology to track COVID-19 positives in order to stem the spread of the disease and opponents of that approach, who argue that the emergency should not be used as the excuse for carrying out mass health surveillance[30]. In the democratic and liberal West, and in Europe in particular, the fundamental problem is how to strike a balance between two equally important and potentially conflicting rights: the right to personal data protection *vs.* the protection of individual and public health. It should be kept in mind, however, that the balancing cannot derive "neither the absolute prevalence of either one of the values involved over the other, nor the total sacrifice of one of them" (Italian Constitutional Court, ruling 58/2018). European case law has established some underlying fundamental principles based on which a balance can be achieved in a manner consistent with the needs of a democratic society, and inspired by respect for the dignity of the person and inalienable human rights. The challenge will therefore be to isolate the confirmed cases and their contacts while respecting their own fundamental rights and freedoms, which constitute the very foundation of European democracies[31-33].

According to the European Data Protection Board "Data protection rules (such as the GDPR) do not hinder measures taken in the fight against the coronavirus pandemic". Nonetheless, that same body has specified that "even in these exceptional times, the data controller and processor must ensure the protection of the personal data of the data subjects"[34]. The Charter of Fundamental Rights of the European Union (Art. 8, Par. 1) and the Treaty on the Functioning of the European Union (Art. 16, Par. 1) both recognize that personal data protection of every individual constitutes a fundamental right. The General Data Protection Regulation r2016/679, known as

GDPR, while recognizing this right, admits that "is not an absolute right; it must be considered in relation to its function in society and be balanced against other fundamental rights, in accordance with the principle of proportionality" (recital 1)[35]. The GDPR goes on to point out that data are "personal" only when and to the extent to which they allow the identification of a natural person. Therefore, data processing, including clinical data, which cannot in any way identify a natural person does not involve personal data. By virtue of that reasoning, any privacy issue is completely ruled out. In order to comply with this principle, a preferable approach is therefore to track the spread of the virus, and only then notify users, without collecting any personal data. A promising example in this direction was provided by Yasaka et al[36], who described an open-source proof-of-concept app for contact tracking that does not require recording or any disclosure of private data, such as location. Instead, this tool uses an elaborate and effective "checkpoint" system which enables users to create a network of peer-to-peer interactions and determine whether they may have been exposed to infection risks; an infection diagnosis can be entered in the app and the data are then transferred to a central server while preserving anonymity.

Under What Conditions Can Contact Tracing Apps Be Relied On?

When using contact tracing apps, European jurisprudence urges to meet criteria such as necessity, proportionality and minimization[37]. The Personal Data Protection Committee has in fact stressed that, "In principle, location data can only be used by the operator when made anonymous or with the consent of individuals"[38] in order to prevent the subsequent personal re-identification. Data processing must comply with important principles: first of all, it has to be processed lawfully, fairly and in a transparent manner in relation to the data subject ('lawfulness, fairness and transparency') (Art. 5, Par. 1, Letter b), of Regulation 2016/679). Therefore, in keeping with the minimization principle, the data must be "adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed ('data minimization') (art. 5, par. 1, lett. b), of Regulation 2016/679). However, it is also stated that "In case of an emergency situation, it should also be strictly limited to the duration of the emergency at hand"[38] and allows, in the context of an epidemic, both public health authorities and employers to process personal data, even without individual consent. In any case, States must guarantee data security, using "State-of-the-art cryptographic techniques" (EU Commission, COM 2020/C 124/01, par. 3.8), 2) data retention must be limited to what is strictly necessary, distinguishing between infected people and those who are only at risk following risky contact; 3) it must still be guaranteed that, when the pandemic is declared under control at latest, all data shall be dispensed with and the apps deactivated, with the further clarification that the deactivation should not depend on uninstallation on the part of users[39].

Mandate vs. Voluntary Use?

European case law still has not clarified whether the use of contact tracing app should be on a voluntary basis or mandatory. A solution that would involve a free choice is certainly preferable. In fact, many fear that states will use the current emergency to introduce forms of mass population control inspired by models in force in other jurisdictions[40]. This concern risks putting people off and discouraging them from using the apps, although contact tracing strategies can only be successful if citizens embrace them with conviction and spontaneously. Braithwaite et al[41] suggest that a high degree of acceptance by the population of such app-based systems is necessary to obtain effective contact traceability (ranging from 56% to 95%), usually in conjunction with other control measures. Hence, automated contact tracking could potentially reduce transmission, but only if enough people are willing to give it a chance.

Furthermore, the compulsory approach would inevitably clash with the principle of the proportionality of the use of information, since the restriction on people's freedom would be certain, whereas the benefits thereof merely possible[42]. Furthermore, compulsory app use would bind on citizens not to leave the house without a smartphone, or for those with outmoded devices, buy a new device capable of running the required app. In addition, the EDPB Guidelines[43] clarify that large-scale monitoring of location or contacts between people represents a serious intrusion on the private sphere of individuals, which can only be justified and legitimized on the basis of the voluntary adoption by the user for a specific purpose[44].

A Further Noteworthy Aspect: Interoperability Among States

Although the General data protection regulation had advised member states to seek and implement a common strategy, and had established guidelines for the development of contact tracing apps[32], European countries in the initial stages of the epidemic have independently crafted and put in place different technologies. It was not until a year after the pandemic outbreak that national decision makers in Italy, Germany and Ireland decide to join up their software-based tools into the Gateway system, which enables users who go abroad to send or receive reports in case of contagion or contacts with infected people, as it already happens at the national levels, without the need to install a new app[45].

Another problem involves the storage of the collected data: the choice is between a centralized system, in which all data are stored in a single central server, and a decentralized one, in which the data stay on the individual devices and are transmitted in the event that a person who has been using the app should test positive for the disease, which makes it necessary to set in motion the alert process. The decentralized system, applied by Germany, Italy, Switzerland, Austria, Belgium, seems more in line with the minimization principle: by following such a model, it is in fact feasible to alert those who have had a risky contact with an infected person, while at the same time store as little data as possible in servers. States must indicate the purposes of the app with utmost clarity; the data must be managed by government bodies, namely health authorities (EU Commission, COM 2020/C 124/01, par. 3.1). In fact, if a private company were to handle these kinds of data, "nothing could ensure that data from tracking activities could not be illicitly sold to tech giants such as Google, which are always hungry for data in order to feed their business[46]". The European Commission and the EDPB agree that contact data must be stored on each individual device and that, in keeping with the minimization principle, proximity data must be generated and processed only if a real risk of infection exists (based on proximity and contact duration) (EU Commission, Communication 2020/ C 124 1/01, par.3.4.).

Why Relying on Bluetooth Technology?

Both the European Commission and the EDPB had to make a choice between GPS (Global Positioning System) or geolocation, or the use of proximity data (Bluetooth), and both have opted for Bluetooth (and in particular Bluetooth Low Energy - BLE, i.e., low consumption) because - unlike GPS - it does not allow to identify user position, but only the proximity between devices. In fact, for contact tracing, neither the location data nor the time or place of the contact are necessary, while it could be useful to keep track of the day, both to have a clear picture of the person's clinical background at the time of possible contagion, and for the subsequent follow-up. Bluetooth, in fact, uses short range radio waves, enabling communication between devices within a few meters' radius. Let's imagine for instance two people meeting on the street and talking for a few minutes. If they have activated their tracking apps, their devices will be exchanging codes. These codes are numbers generated randomly every 15 minutes, and do not identify the device itself, thus do not identify a given individual. If after a few days either one of those individuals involved in the contact should test positive for the coronavirus, the healthcare staff can conduct a questionnaire or an interview, or ask him or her to share the random numbers that the subject's device has stored in the last days. In this case, these numbers are uploaded - anonymously - into a central server, which all other users' apps can access in order to make sure that they don't have exactly the same code. If a user's app finds the same code in the healthcare database, that user will be receiving an alert informing them that they have been in contact with an infected person, and that they will have to take precautions. Bluetooth technology guarantees that both the infected and the other participant in the contact will stay anonymous: serial numbers are in no way attributable to the identifiers of the two, and the contact locations are never saved or stored. Neither the healthcare professionals nor Apple or Google will ever be able to identify the user. A major flaw with this system is that there are many factors that can affect Bluetooth interactions. This makes the calculation of the contact distance extremely complicated[47,48]. For example, a human body can muffle the signal, so if the smartphone is in the back pocket, a person who comes towards another will perceive, through the device, that person's smartphone at a distance greater than the actual one. To solve or at least mitigate those issues, it would therefore be necessary to carry out tests on all types of smartphones to check how they manage the Bluetooth signal.

Bottom Line: Can Contact Tracing Really Help us get back to Normal?

Harnessing the potential of contact tracing technologies is certainly useful and it is the World Health Organization itself that advocates for it. In fact, both economic and health considerations make it absolutely urgent to put in place all measures that can contribute to and foster the process of returning to normality as quickly as possible. Nevertheless, contact tracing technology must be used very responsibly and in conformity with the fundamental rights and freedoms of all citizens. As stressed in the guidelines of the European Data Protection Committee, we must beware of "tech solutionism". Contact tracing is valuable in terms of countering the spread of COVID-19, but must be embraced and implemented while taking other aspects into account. Firstly, the health aspect, because app use must be supported by health facilities charged with monitoring quarantined patients, testing in a timely fashion, and promptly entering updated information in the various data-collecting networks. It is apparent that contact tracing applications cannot fully replace manual contact tracing, because only qualified healthcare personnel can assess the likelihood of any close contact leading to a viral transmission incident. For instance, if an encounter with an adequately protected person occurs, an infection would be less likely. The technological aspect should not be overlooked, since it is not limited to just contact tracing, but relies on the effectiveness of telemedicine strategies and tools to interact with infected patients, to create effective avenues for health resources to be allocated where they are really needed (thus preventing waste). Such an approach also includes automated unmanned cleaners in order to help health professionals disinfect the premises safely[49,50]. The social aspect is also essential, in terms of managing relations and interactions between public authorities and the people, but also of getting through to everyone the importance of following social distancing rules, the use of protection devices and sound hygiene practices meant to protect their health and that of others; if in fact people fail to act guided by a broad sense of community and responsibility, even the best tools and rules are doomed to fail. Besides, the use of complex technologies does not guarantee the equality of access to such tools for all people. In fact, an uncontrolled digitalization of health services and policies risks cutting off some classes of people from the benefits of these technologies, further worsening dangerous forms of technological divides, much to the detriment of those traditionally considered more vulnerable.

Conclusions

To sum up, we believe that we must not blindly trust in the exclusive help of technology to quickly resolve the COVID-19 pandemic[51]. Apps can undoubtedly constitute a valuable tool that can work alongside healthcare professionals engaged in contact tracing, but must be integrated into wide-ranging general prevention plans. In addition to its inability to be relied on as an exclusive solution, at least in the short term, the technology of contact tracing apps may run afoul of fundamental rights such as privacy, which are just as important as the right to health. From that perspective, it is imperative that contact tracing apps use the least intrusive techniques possible, so as to ensure the necessary protection of privacy, even in the extraordinarily challenging times of the COVID-19 pandemic, while securing the highest possible degree of cooperation from the people.

Conflict of Interest
The Authors declare that they have no conflict of interests.

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