Digital health issues for the SUS: "mobile health" and the algorithmic automation of medical knowledge-power

Questões da saúde digital para o SUS: a "saúde móvel" e a automação algorítmica do saber-poder da medicina

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Abstract

The current pandemic has accelerated digital health transformation. One of its faces refers to the progressive use of mobile applications dedicated to care, disease prevention, and health promotion – e.g., mHealth. However, many gaps in the knowledge and questions about digital health to support its use and implementation persist in the scope of Public Health. With that in mind, this study aims to contribute to their assistance, social, political, legal, and ethical characterizations and analyses. The hypothesis we intend to test is that the digital transformation of health care leads, for better or for worse, to the algorithmic automation of the knowledge-power of medicine. To conduct this study, we carried out an extensive literature review and investigated and described mHealth apps based on the critical studies of digital health proposed by Deborah Lupton.
Keywords: Digital Health; Mobile Health; Artificial Intelligence; Medicalization.

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Resumo

A pandemia de covid-19 acelerou a chamada transformação digital da saúde. Uma de suas faces pode ser vista no uso progressivo de aplicativos móveis dedicados à prevenção de doenças e à promoção à saúde (mSaúde). Todavia, ainda há muitas lacunas de conhecimento e problematizações sobre saúde digital para subsidiar seu uso e implementação no âmbito da saúde coletiva. Este ensaio pretende se somar às caracterizações e análises das consequências assistenciais, sociais, políticas, legais e éticas da saúde digital. A hipótese a ser defendida é que a transformação digital da saúde acarreta a automação algorítmica do saber-poder da medicina. Para desenvolver este ensaio, foram realizadas extensa revisão bibliográfica, investigação e descrição de aplicativos de mSaúde, a partir de estudos críticos sobre saúde digital propostos por Deborah Lupton.

Palavras-chave: Saúde Digital; Saúde Móvel; Inteligência Artificial; Medicalização.

Introduction

Until March 2019, digital health was in its infancy (WHO, [2019?], p. 4). During the COVID-19 pandemic, however, saying that it has expanded rapidly is perhaps not an exaggeration. Lockdown measures aimed at curbing the spread of SARS-CoV-2 have propelled human experiences–such as work, teaching-learning, socializing, entertainment, consumption, etc.–into online life.

This also occurred with health care practices, in which in-person services is one of the social activities with the highest contamination risk. Considering the transmission risks and the high costs of implementing biosafety standards, the World Health Organization (WHO) suggested that 24-hour call centers be created. Furthermore, the G20, in April 2020, convened a task force to analyze and explore digital health interventions as an emergency response to COVID-19 (WHO, 2020).

The COVID-19 has greatly exposed the strategic character of digital technologies to maintain much of the daily health activities in times of health crisis. In this scenario, numerous national states and private companies have developed surveillance, tracking, screening, monitoring, promotion, treatment, and rehabilitation policies in the face of the accelerated digital transformation in health. Such a change references to a wide range of technologies: telemedicine, wearable devices and biosensors, *big data*, artificial intelligence (AI), etc. Today, more than two years after the beginning of the pandemic, digital health has been used decisively many times in multidisciplinary health efforts to reduce the spread of the virus and mitigate its impacts (Zeng; Bernardo; Havins, 2020).

In the Brazilian context of the pandemic, for example, all telehealth modalities (telemedicine, teleconsulting, telediagnosis, teleconsultation, etc.) have played an unprecedented and, not infrequently, majority role at public or private outpatient levels (Daumas et al., 2020). Thus, the Ministry of Health (Brasil, 2020) has regulated actions of remote interaction, pre-clinical care, care support, medical consultations, treatment monitoring, and diagnosis–that is, a range of

distance care—as legal practices of procedures of the Brazilian National Health System (SUS).

Among all these technologies, note the wide diffusion of mobile internet applications (app) dedicated, above all, to the scope of health care and promotion, disease prevention, and health monitoring—called mHealth or "mobile health." With the apps, for example, dedicated to COVID-19 it has been possible to track and guide the population on the forms of contagion and on the channels of care. Additionally, in individual clinical care, monitoring and guiding suspected cases regarding isolation and recognition of warning signs is possible, aiming to reduce the number of people in emergency rooms and public and private hospitals, as well as reinforcing social distancing measures (Daumas et al., 2020).

However, the WHO warns about the lack of "technical documentation and standards for accurate incorporation, resulting in digital implementations inconsistent with recommended data and health practices" (WHO, 2022). Consequently, as Gadelha points out, the analyses on the current digital transformation and its developments demand "the approximation of different fields of knowledge, involving, in particular, political economy and the field of public and collective health, as well as various areas of the social, human, exact, and biomedical sciences" (2021, p. 30, our translation). There is also a "knowledge gap on the use of digital health strategies" due to the "lack of evidence on how such strategies can influence health outcomes, the efficiency of the health system, and the cost-effectiveness of service delivery" (Zeng; Bernardo; Havins, 2020, our translation).

This essay is inserted in this scenario still lacking in systematic information and analysis, especially in the field of public health. Seeking to contribute to this debate, theoretical and methodological contributions considered crucial for developing research will be presented, as well as interventions that have as their object the problem of digital health in Brazil, from a critical perspective regarding the different ethical,

political, and social aspects that circumscribe the use and "management" of this service. We believe, in this sense, that an important number of discussions and concerns about aspects central to the debate are accumulated, such as privacy violations, the so-called governance and security of databases, inequality in accessibility and usability, etc. We consider that other issues should also be analyzed.

In this context, supported by the sociotechnical approach[1] of critical digital health studies (Lupton, 2018), this study intends to add another problematizing axis to the existing ones. Under the support of a non-systematic bibliographic review that deals with digital health, especially mHealth, this article initially presents a brief overview of digital health, in particular its socio-technical arrangement called mHealth, with emphasis on apps. In a second moment, the so-called "datafication" will be exhibited in summary, focusing on the uses of mHealth in the health-disease process. Next, the essay will constitute its central problematization, whose guiding hypothesis is that digital health can update—expanding and increasing—the medicalization process from the automated techniques of pattern recognition, recommendation, and decision making, proper to machine learning. This hypothesis can be defined as the algorithmic automation of the knowledge-power of medicine. The essay closes with some questions considered pertinent and urgent for those who act in defense of a popular, strong, and sovereign SUS.

The production of this text in the form of an essay is emphasized, since this genre consists of a critical interpretation closer to an intellectual experiment than to definitive answers to the verified hypotheses. Therefore, it aims to present the concrete contradictions in which the issues in question are entangled, to contribute to the debate and improve the ongoing analyses. Also note that the intention is not to resist the advances of the digital transformation, but to qualify them from the principles of health reform, such as universality, integrality, equity, and popular participation. Thus, this essay presents itself as a contribution to problematize some issues inscribed

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1 From this perspective, technologies are constructs socially produced from disputes between groups and agents that guide their technical choices based on distinct ethical, political, and cultural contributions. Thus, an app should be understood as a result of interactions and stabilizations carried out within relations of power and conflict (Lupton, 2018).

in the digital transformation that can subtract or push to the second place the collective efforts to guarantee and expand, with equity, public services, and the right to health.

From eHealth to digital health: identifying mHealth

Centered on the innovations of digital information and communication technologies (DICT), the so-called digital transformation marks a process of change in the way that the various professionals, especially physicians, "collect, share, and analyze health information for better clinical decision-making and health care delivery" (Zeng; Bernardo; Havins, 2020, our translation).
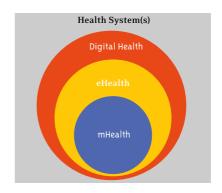
Just as the diversity of definitions and uses that exist for concepts such as telemedicine, telehealth, and other "teles"–which emerged in the 1990s–both the abbreviation "e" for electronic and the term "digital" used today are polysemic; as of 2005 they had 51 definitions (Oh et al., 2005). What is certain, however, is that today they designate the growing uses of digital information and communication technologies (DICT) in supporting health and care-related activities, since there are no more information and communication technologies (ICT) without the digital support of the internet.

At the beginning of the twenty-first century, with the extensive use of computers and the internet, the term eHealth emerged. If in 2005 the WHO (WHO, 2011) created the first "Global Observatory for eHealth," in which it declared that eHealth was a priority on the global agenda, in 2016, the same institution ratified it as "an integral part of providing improvements in health" (WHO, 2016, p. 5-7, our translation). The WHO emphasized its role in achieving what the entity advocates as universal health coverage and, therefore, directed national health systems to consider the contribution of DICTs as an essential and central service in promoting access to health, and no longer just as a complement.

Due to the generalization of smartphones and tablets, the miniaturization and cheapening of digital technologies in general, in 2018, the concept of eHealth began to be incorporated into another broader definition, namely: digital health–which had

been introduced in 2000 by Seth Frank to designate the convergence between health care and the internet. This term only gained political contours with the resolution of the 2018 World Health Assembly, in which the use of DICTs in "support of health and health-related fields" came to be defined (WHO, 2019, p. ix, our translation). The result was the allocation of a variety of digital technologies aimed, to some extent, at health, telemedicine, and genomics practices, including the areas of advanced computing (big data, internet of things [IoT], AI, etc.) under its umbrella. With the recent creation of the WHO digital health department in 2019, the first "evidence-based guidelines for digital health" were drafted (WHO, 2019, our translation), establishing the use of the term as a key concept of global health policies.

The field of digital health, in addition to eHealth, comprises geolocated personal mobile computing devices–more precisely health apps named by the WHO as mHealth. It is a subset of eHealth (Figure 1) in which "medical and public health practice is supported by mobile devices such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices" (WHO, 2011, p. 6, our translation). Thus, mobile health or mHealth can be reasonably defined as: the full range of health practices supported by internet-connected mobile devices (intermittently or constantly) to overcome geographical, temporal, and organizational barriers, covering a variety of contexts and uses, such as diagnosis, treatment, clinical decision support, care management, provision of care, therapeutic supports, education, promotion, and prevention.

Figure 1 — mHealth: subset of eHealth

In recent years, according to the WHO (2016), about 83% of Member States have at least one mHealth initiative. Commercial investments are also voluminous: almost US$ 6 billion in financing in 2017 alone (R2G, 2017); the number of mHealth apps marketed in the same year was close to 325,000, with more than 200 added daily, and in 2019, consumer expenses were around US$ 1.5 billion (R2G, 2017). With the global health crisis, as indicated, this scenario has accelerated.

The potential and benefits of using these *apps* have already been highlighted. Its broad scope and flexibility—which can be updated in real time—make it possible to adjust to the health needs of each social context, expanding the possibilities of interaction between patients and health professionals. At the same time, it "supports direct access to health services regardless of time and place and allows to reduce the existing high costs of national health services," also adapting to "chronic and lifestyle-related diseases" given the agile "scalability to deal with the growing number of elderly and patients with chronic diseases that require constant monitoring" (Aceto et al., 2018, p. 128, our translation).

However, the contradictions that cross this context should not be ignored. To follow with some problematizations about the ongoing digital transformation, a brief analysis of the sociotechnical process that has been termed as datafication is necessary.

mHealth: a support for the datafication of the health-disease process

Today almost all processes of social interaction are potentially a source of data, which can be stored, computed, analyzed, and correlated to countless others, such as diagnostic tests, pharmacy records, electronic medical records, and "omic" data—genomic, proteomic, interatomic, metabolomic, among others—to the stream of data coming from web 2.0 (Lupton, 2018). In short, one lives immersed in the so-called "digital ubiquity" (Lupton, 2018).

The ubiquitous presence of these data sources has made some scholars argue that there are two new global phenomena underway. One of them of economic dimension, which can be called "data colonialism" (Couldry; Mejias, 2018). It combines the extractive practices of ancient colonialism with the quantification methods of computing to accumulate individual and population data throughout the world. The other one is of epistemic/cultural dimension, called "dataism" (Van Dijck, 2014). According to some analysts (Silveira, 2020), this phenomenon has been updating the instrumental rationality proper to (neo)positivism with the absolute belief in the objectivity and neutrality of data (digitally extracted) as superior forms of knowledge and intervention in reality.

Note that both processes appear under the support of a socio-technical infrastructure that operates the "datafication" (Van Dijck, 2014). This is the name given to the automation of the extraction-conversion process of users, their bodies, affects, symptoms, practices, relationships, etc. in quantitative modeling and computer languages, which are ultimately reduced to binary pairs "0" and "1." Digital health does not exist without datafication, and with it, everything is liable to become bits.

This has made the most diverse experiences of citizens, patients, and health professionals, in the interaction with insurers, technology companies, public health services, etc., into a large pool of data to be stored, extracted, converted, and incorporated into the "digital health ecosystem" (Hadzic; Chang, 2010), that is, to the set of digital technologies dedicated to health and that, to a greater or lesser degree, are interconnected, interrelated, and interdependent via the internet and/or the web and their operators and owners.

One of the many possible examples in this scope is the emergence of "digital epidemiology" (Salathé et al., 2012). Data from digital ubiquity have already demonstrated its potential in helping to predict the spread of the cholera epidemic in Haiti in 2010 and during the Ebola crisis in West Africa in 2014-2016. In Brazil, the Ministry of Health has also used the technique with the apps Tinder and Hornet for targeted advertising to users with risk behaviors for sexually transmitted infections (STIs). Prior to the COVID-19 pandemic, the international health regulations (IHR) had already officially welcomed the use of "unofficial sources" for calculations and epidemiological information (Leal-Neto et al., 2016). In fact, more and more an avalanche of data that was not clinically and epidemiologically computed until a

few years ago constitutes today state and/or corporate big data with unprecedented volumes, speeds, and varieties—such as the *Rede Nacional de Dados em Saúde* (RNDS – National Health Data Network).

Within this digital ecosystem mHealth apps appear as artifacts designed to promote granular, constant, and real-time datafication of their users by urging them to upload their experiences within the health-disease process. Thus, a heterogeneous set of scholars and activists have been shedding light on what has become known as the "quantified self" or "self-tracking" (Lupton, 2018).

Following the study by Deborah Lupton (2018), efforts to monitor and quantify bodies and "selves" have been going on for centuries to subsidize the biopolitics of the modern state. Today, however, the sociologist warns: "There is hardly a limit to the ways in which a person's daily activities can be monitored, measured, and quantified" (Lupton, 2012, p. 240, our translation), be it sun exposure, food consumption, alcohol consumption, sexual practices, tobacco control, sleep monitoring, psychological care, menstrual cycle monitoring, the control of anatomophysiological variables, weight control and body mass index, blood glucose level, physical activity fitness, energy expended, body temperature, heart rate, brain activity, etc. In short, currently, all dimensions of the health-disease processes are, potentially, capable of being datafied.

Thus, the self-tracking operated by mHealth can also be understood as a device for datafying the "ways of walking life" (Canguilhem, 2009). Consequently, this avalanche of data became a constitutive part of an automated biopolitics of "pattern recognition," that is, in the algorithmic construction of medical norms; in the same way that, for this to occur, the "medical gaze" has also become an mHealth app that acts as the normalizing biopower.

The algorithmic automation of the knowledge-power of medicine

As the digital transformation of healthcare takes place, a myriad of "smart" techniques and technologies operate. The main one, surely, is machine learning (ML)—for some, the dominant subfield of AI. Without going into the technicalities that constitute it,[2] ML can be roughly defined as the application of statistical models to a large amount and variety of data—big data—with a view to pattern recognition by using software with unprecedented computational capabilities for memory and processing.

Its great novelty is the fact that the "learning algorithms" that operate it do not depend entirely on models and previous rules established by humans; on the contrary, in specific computational layers they "learn" in an automated way with the data that they themselves process, creating for themselves more calibrated rules to present recommendations and make "better" decisions. In short, ML is a software that "learns" without being programmed. Its central scope is, with pattern recognition, to predict future scenarios and, based on these calculations, to make the most "intelligent" decisions in the face of the specific task for which it was created.

Today, examples of applying different types of ML are various, from consulting Google to recommending movies on Netflix or videos on YouTube, as well as mobility services such as Uber. To these MLs inscribed in everyday technologies some have given the name of "actually-existing A.I"—in which apps are also included (Dyer-Witheford et al., 2019).

When observing the accelerated insertion of ML in health and care practices from the perspective of the medicalization process, the question that arises is: what is the repercussion of the digital transformation on the knowledge-power of medicine? The general hypothesis that underlies the considerations of this work is that the "actually-existing A.I" of the health field updates medicalization—expanding and increasing it—from the automation of calculations, predictions, monitoring, and guidance provided by ML.

What is common in the polysemy of the concept "medicalization" is the "transposition of what is originally from the social, moral, and political order to the domains of the medical order and related practices" (Freitas; Amarante, 2015, p. 14, our translation). Considering, therefore, that medicine is a social

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practice that has as its background technologies of power focused on individual biological bodies and population biological processes, the conception of medicalization used here comprises the process in which the knowledge-power of medicine dictates norms of conduct and prescribes behaviors.

Since the emergence of epidemiological surveillance in the eighteenth century, the nascent modern state constitutes techniques of data collection, measurement, and calculation with a view to regulating the "mass effects proper to a population" and then predicting the probability of a biological event subtracting the "strength" and "health" of the body-species of the nation—the biopolitics based on the birth of statistics, of epidemiology etc. At the same time, the seventeenth and eighteenth centuries also saw the "birth of the clinic," whose characteristics included new techniques for disciplining individual bodies and conducts—to a large extent, aiming to producing docile and useful subjects for the emerging urban-industrial society—in short, biopower. In both accommodations, population and individual, the knowledge-power of modern medicine became an essential rationalizing vehicle for this, sometimes guiding urban reforms based on hygienism, sometimes normalizing the conduct of the "degenerates" based on racism and misogyny, for example.

In this sense, two central characteristics of ML are fundamental for the digital updating of medicalization: it is a technology of (a) pattern recognition, from which predictions are inferred and from which (b) recommendations and decision-making are built, in an automated way, that is, without the direct mediation of a human being.

First, pattern recognition must be understood as a "cultural construct, not just a technical one" (Pasquinelli; Joler, 2020). Big data relies on an *ad infinitum* data extraction-conversion— the more data extracted, the more calibrated the inferences produced by ML. At the heart of this process is the fact that all pattern recognition is, by definition, a classification and hierarchization. Of course, pattern recognition is assigning a category (label) to a population sample according to already existing cultural convention and political and moral rationality. Consequently, for better or worse, it is a computational way of constructing population *norms*, that is, it is a biopolitical device.

A plausible way to look at the automated construction of these biopolitical norms is to pay attention to studies that have discussed "algorithmic discrimination" (Eubanks, 2018). Without going into the technical reasons that give rise to the production and use of discriminating algorithms around the world, the facts raised by these scholars ratify the reading that ML pattern recognition is the construction of a new taxonomy open to the old social structures of racial, gender, and class discrimination and segregation.

Restricting the examples to the field of health, one can briefly mention two cases of racist "smart" technologies. The first is the case of the algorithms used by Optum to, in theory, fairly and efficiently distribute health resources (Gawronski, 2019). According to the study published in Science, Black patients received the same risk indicator (health score) as white patients, even when presented with more severe conditions. The racial bias of the ML reduced by more than half the number of Black patients identified to receive necessary extra resources and care; the research estimates that 200 million people a year could be affected by similar tools.

Second, we can highlight heart rate trackers, such as Fitbit (from Google) and Apple Watch, among others. As reported in Stat, several consumer complaints "suggest that devices can't get a reading on darker skin" (Hailu, 2019). Moreover, the article adds, these trackers are now widely used as a source of data for clinical trials and academic research, whereas not considering their "biases" such as skin color. For the scholar of the field, Kadija Ferryman: "No matter what [the] technology is, there is evidence that... inserting another tool, no matter how advanced it is, will likely continue on and continue to uphold the existing biases or exacerbate them" (Hailu, 2019).

In the other pole of medicalization, biopower, consider that mHealth apps cannot be understood simply as "passive" technologies, either in the provision of health information, or as tools of distance care or as auxiliaries in a specific therapy. Following Lupton (2018, p. 1-7, our translation), considering that, "in addition to new tools of digital technology," they are also "sociocultural products" capable of "creating new practices and knowledge" and, therefore, constituting new "productive forms of power" is necessary. In the wake of Michel Foucault, the socio-material perspective

of the author considers that, by engaging users in digital self-monitoring/self-tracking of health, the relationships between apps and users produce knowledge about the bodies of the latter in their various characteristics, consequently, establishing new relations of knowledge-power that provide the existence of new practices and subjectivities.

This study, in the wake of Lupton, considers that mHealth is precisely an automated expression of biopolitics-biopower. Since apps act as essential sources of data extraction-conversion—in a granular, uninterrupted, and real-time way—that feed various big data whose ML operates the pattern recognition. At the same time, apps are a new form of the "medical gaze" that directly affects the process of disciplinary normalization of bodies and behaviors—also in an automated way. They are, therefore, the union—structural and structuring—of biopolitics and biopower in the digital transformation of health.

Thus, we can say that pattern recognition is to automated biopolitics as recommendations and decision-making are to automated biopower. One of the central devices of biopower is the "medical gaze" to define what is normal and what is pathological. Traditionally, the knowledge-power of medicine looks at the "case" and infers a diagnosis, as well as prescribes a conduct and/or a therapeutic project, during the encounter between physician and patient in the clinical/outpatient space. In this encounter, therefore, the deviation, the abnormal, is defined. In other words, from the perspective of medicine modernity operates the disciplinary normalization of bodies and behaviors. When looking at mHealth, as philosopher Marjolein Lanzing rightly pointed out, self-tracking operates "'less to enlighten users with information than to prod them to change', thus controlling, changing and improving users' behaviour based on the insights derived from the data" (Lanzing, 2016, p. 10).

In other words, what, in theory, should be a technology of "empowerment" of the patients (Lupton, 2018) and, consequently, a means of strengthening their autonomy by providing more information about themselves, should also be seen as the increasingly granular and constant incidence of the "medical gaze" in the patient's life. The users of the apps, calling back to Lupton (2018), position themselves to preserve and promote their own health, including accessing relevant information, monitoring their own health, and taking responsibility for managing their medical conditions, but, in parallel to this, relationships are also constituted in which the apps offer recommendations capable of exerting a decisive influence on the decision making of the users themselves, both on their care practices and on their care and health promotion regimes.

For Nete Schwennesen (2019), observing even an "affective bond" generated by the trust that the user has in the technology and in its ability to act as a substitute for the health professional is possible. Patient-users believe that following what is asked by the app provides the most "correct" path to their health. The doctor-patient relationship, therefore, ceases to be constituted only by human beings and starts to happen also under the mediation of a "robot," hence the algorithmic automation. In the end, in addition to managing user data, with self-correcting techniques from information collected/extracted in real time, artificial intelligences transform health apps into "algorithmic authorities" capable of acting as biopower devices in health care and care practices, whether to affirm self-care practices directed to the quality of life of the population, or to normalize the different forms of life.

The mHealth apps aimed at mental health, which have spread in the quarantine and social distancing contexts required by the COVID-19 pandemic, show this exemplarily. These apps can include treatment components such as cognitive therapy, behavioral activation, psychoeducation, or symptom monitoring. The case of apps for suicide prevention can be seen as paradigmatic in this field, given the sensitive task—ultimately behavioral—that the applications propose. One of them is Better Stop Suicide, created by a team of psychologists and digital health experts to help the user "press your own stop button" (Better App Company, 2023). To do this, they said, the app "uses world-leading psychological techniques and technologies to stop people from committing suicide," including "better sleep audio," "emotional needs check," indicators of "simple, helpful tasks to make you feel better," etc. (Better App Company, 2023). In the end, based on the extraction of data from all the activities performed by the user in their daily lives—their digital journey—and on "self-guided

digital interventions, designed to be used without professional guidance" (Torok et al., 2020, p. 25), suicide prevention apps such as Better already demonstrate results.

In Brazil, on the #TodosporTodos platform, created by the Federal Government to organize solidarity actions in the face of the pandemic, some mental health apps are publicized as important tools, such as *Guided Meditation for Well-Being in Quarantine* and Vitalk. The latter, note, is a tool developed for the digital management of mental health and has already "impacted more than 2 million people in 2020" (Valenti, 2021, our translation). According to its institutional media, Vitalk "offers virtual conversations that track your health and show you how to achieve your best in every moment of life" (Vitalk, 2022, our translation). With the app, "you will learn techniques to take care of your emotional and deal with anxiety, stress, burnout, depression, self-esteem, mood, sleep, and focus"; also "you will have assessments of your mood, teachings on emotional health and practical tips such as meditation techniques, gratitude, breathing, and relaxation" (Vitalk, 2022). All of this, with user interaction being "Viki," "an intelligent chatbot that talks about health when you need it" (Vitalk, 2022). By the end of 2021 the company already had more than "220,000 lives served and major clients such as Vale, Johnson & Johnson, Grupo Soma, and Grupo GSK, among others – there are more than 60" (Valenti, 2021). And, until the information for finalizing this essay, Vitalk, in April 2022, was acquired by the *Gympass* group and is now *Wellz*, expanding its action with Gympass mental health platform. As João Barbosa, co-founder of Gympass, said in an interview with Exame magazine, "With Vitalk, we bring an experience that we did not have before, which is the combination of artificial intelligence with a human journey via chatbots and digital knowledge, complementing our strong professional base" (Valenti, 2022).

Another example of note is the acceleration in 2021 of the Prudential Vitality physical and mental wellness program. Launched by insurer Prudential do Brasil in conjunction with Wellness Services, it is based on a digital ecosystem that operates in the user interface via the app and "rewards healthy habits and adoption

of regular care and physical activity, from weekly goals achieved over time" (Herrera, 2021). In practice, the app encourages its users to change their behavior, with periodic goals, which, according to the platform, are healthier. The change in behavior, when carried out, is rewarded with a voucher modality that grants discounts "to buy your smartwatch, in the food delivery, in the transport app, gyms, music streaming and life insurance cashback, among other benefits" (Herrera, 2021). Perhaps it is not an exaggeration to say that Vitality's algorithmic (medical-sanitary) authority focuses on the lives of its users to reward them with consumptions on other platforms of the digital ecosystem, integrating and further perfecting the so-called surveillance capitalism.

With digital health, therefore, we can no longer–definitively–understand that the "decision-making" about the normal is carried out only in the encounter, punctually and institutionally located between health professionals and patients. If from the beginning modern medicine was "social," it invested its knowledge-power over the "social body," medicalizing it. Currently, imbedded–intensively and extensively–in the social fabric, digital health radicalizes the modern medical project: the medicine gaze becomes a continuous and de-territorialized device, consecrating a knowledge-power diagram in open spaces and no longer only in disciplinary closures such as the clinic and the hospital (Deleuze, 2006).

Therefore, the (techno)political level in the medicalization process changes. Datafication, for better or worse, enables the transformation of "all" dimensions of the health-disease process into digital data, whether social and cultural characteristics, or affective and symptomatic. Thus, what is datafied can be incorporated into medical calculations for pattern recognition, recommendations, and decision-making considered more effective for a way of life classified as normal (and healthy). All the data extracted by/within the digital ecosystem becomes potential raw materials for ML, that is, for automated pattern recognition (the automated construction of population **norms**) and for automated recommendations and decision-making (the automated normalization of the "medical gaze"). This fold between biopolitics automation and biopower automation is suggested in the name of

algorithmic automation of the knowledge-power of medicine.

Final considerations

The COVID-19 pandemic has made explicit the numerous inequalities that cross the Brazilian and the global reality and evidenced the importance of a unified and public health system characterized by a robust integration of all its levels of care, in addition to the need for global coordination to face the disease. Parallel to this, however, it became the first pandemic fully covered by digital technologies—albeit unevenly and in a combined manner. In the end, the socio-sanitary, political, cultural, and economic convalescence of Brazil and the world caused by SARS-CoV-2 will occupy years of analysis and debate. As Hegel would say: the morning ignores what the night holds, since Minerva's owl only begins its flight with the irruption of twilight (Hegel, 2010, p. 44).

Therefore, this essay intended to present some problematizations that take up collective health issues about the medicalization process, more particularly to what was called **algorithmic automation of the knowledge-power of medicine**. This article can help build a debate agenda in which SUS advocates need to commit themselves to respond in a public and democratic way to the digital transformation of health—more specifically, to the emergence of a constellation of mHealth apps.

When being a citizen and being online became almost synonymous, life in the contemporary *polis* required special reflective attention, since the population can be used by the very tools it uses—without knowledge nor consent. Only in this way that building a broad common debate that addresses digital health for the effective defense of the SUS and for its improvement as a universal, equitable, and popular public service is possible.

Otherwise, people will be thoughtlessly confronted by questions such as: are these technologies neutral and objective? What are the views of the health-disease process that underlie their algorithms? What should be their designs to be consistent with SUS principles and guidelines? How are the cultural meanings of the health-disease process and the social determination

of health incorporated into the calculations of these algorithmic authorities? Who are the professionals who effectively develop such apps and their digital ecosystems? What is the participation of health professionals and communities in the development of these tools? What are the power relations between the agents involved in the digital transformation of health? What are the pros and cons of algorithmic automation of healthcare professionals' work? What are the effective influences that such technologies can exert on users and patients? These and many other questions should be present in a broad agenda of popular debate on the digital transformation of the SUS.

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