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Primary care-based health surveillance actions in response to the COVID-19 pandemic: contributions to the debate

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Abstract *We conducted an integrated literature review aimed at reflecting on the challenges related to primary care-based health surveillance actions in response to the COVID-19 pandemic in selected countries. The study included countries with different PHC models that adopted surveillance as an approach to control the transmission of COVID-19. We performed a search in October 2020 for relevant literature and norms and guidelines related to the organization of primary health care (PHC) in response to the pandemic on official government websites and the databases Web of Science and Science Direct. The integrated health surveillance actions demonstrated that efforts were more focused on risks, with some countries adopting innovative and effective measures to respond to COVID-19, considering emerging needs within PHC. However, in addition to ethical controversies and operational difficulties, access to technology was a challenge in actions developed by some countries due to social inequalities.*

Key words *Coronavirus infection, Public health surveillance, Primary health care, Health policy*

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Introduction

Since the World Health Organization (WHO) declared the COVID-19 outbreak a pandemic on 11 March 2020, serious concerns have been raised about the effects of the coronavirus (SARS-CoV-2) on global health, society and the economy, particularly among vulnerable populations in low and middle-income countries with fragile health systems[1,2].

As with previous outbreaks and pandemics, the control of the COVID-19 pandemic depends on the early detection of cases and contacts, followed by isolation measures and quarantine to interrupt community transmission and mitigate the health impacts of the coronavirus[3].

Globally, countries have adopted a variety of strategies to tackle and control the COVID-19 pandemic – such as community-based testing, contact tracing, isolation and other social and public health measures – which are crucial to slowing down transmission and reducing mortality[4]. Within this context, a robust health surveillance system is essential to control spread and guide the ongoing implementation of prevention measures.

A critical element of public health systems, health surveillance includes the collection, analysis, interpretation and systematic and continuous dissemination of data that is essential to the planning and implementation of interventions[5]. Other authors suggest that health surveillance is essential for providing information and guiding both individual diagnosis and treatment (clinical approach) and interventions targeting specific population groups addressing the social determinants of health[6,7]. Health surveillance is mediated by the traditional generation of surveillance data or by the interpretation of data from surveillance systems, adapted and used by the various levels of the health system to meet the needs and cultural and population dynamics of each country[5].

Considered the main point of entry of the health system, primary health care (PHC) is the foundation for direct surveillance with a timely response and outbreak management. With the intensification of the pandemic, the initial failure to detect and trace contacts and the consequent safe relaxation of social isolation, coordination between public health surveillance and PHC has become critical to guaranteeing technical, operational and logistical support and providing the necessary resources to develop and implement a new modus operandi, facilitating greater public participation and optimizing the use of the social facilities necessary for the effective containment of the spread of COVID-19[8].

A variety of approaches used in different disease outbreaks support the integration of health surveillance at the primary care level with wider responses at regional level[9]. These approaches involve the use of data aggregation systems, data dashboards and digital epidemiological surveillance. These data sources are increasingly being integrated into the formal surveillance landscape and play a role in COVID-19 surveillance[10,11]. Such monitoring initiatives are part of a set of actions designed to address the social determinants of health and health risks in a given population and region, ensuring the comprehensiveness of health care, which includes both individual and collective approaches[12-14].

In view of the above, this article aims to identify and reflect upon the experiences and limitations of health surveillance actions integrated with primary care developed in response to COVID-19 in the health systems of selected countries.

Methodology

We conducted an integrative literature review to compile experiences related to primary care-based health surveillance in response to COVID-19 in a selection of countries affected by the pandemic.

Given the countless challenges of undertaking comparative studies in the field of health policy, the risk of semantic confusion, superficiality, mistaken descriptions, caricatures, rhetorical distortion and unwarranted inferences is great[15].

Despite the similarities and differences between the actions developed by different countries, the objective of this study was not to compare the different approaches adopted and replicate them in Brazil, but rather to develop a synthesis of international experiences of integrated surveillance actions in the response to COVID-19. In this respect, we depart from the assumption that a critical comparative analysis of the responses adopted by different health systems requires a more in-depth understanding of the context in which they were produced[16].

The study includes experiences from South Africa, Argentina, Australia, China, South Korea, Cuba, the United States, France, Italy, India, Singapore and the United Kingdom. Despite having different PHC models, the selected countries adopted an active surveillance approach (inten-

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sive and extensive) to control the transmission of COVID-19. Surveillance is directed at both asymptomatic and symptomatic people with the support of PHC professionals and the community and referral flow coordinated with other emergency and hospital services. Except for the United States, whose care and public health surveillance models are fragmented and differ from state to state, meaning that the federal government has a low regulatory and coordination capacity (Chart 1).

The integration of PHC with other levels of care is an essential feature of a wider-reaching PHC approach, the concept adopted here. In addition to integration within the health system, intersectoral coordination is another crucial element of effective PHC.

We performed a search of the Web of Science and Science Direct databases for publications on the COVID-19 response in PHC, using a combination of the following descriptors: *Health Primary Care AND Public Health Surveillance AND Coronavirus Infections*. The data were collected in October 2020.

Articles written in Portuguese, English and Spanish were read in the original language. Those written in Chinese and French were translated using Google Translate. After the search, selection and reading of the full-text version of the articles, the publications were synthesized as follows: author and year of publication, country of origin, title and health surveillance actions (Chart 2).

Health surveillance actions

Public health emergencies have a major impact on local populations and health surveillance systems. The adoption of multiple surveillance mechanisms helps ensure broader coverage, since every lost case can lead to chains of transmission that may be difficult to contain afterwards.

Countries vary widely in their capacity to prevent, detect and respond to outbreaks and in relation to the capacity for government response and degree of local autonomy and responsibility for health surveillance. Generally speaking, the actions consist of active and passive public health surveillance, with some variations, or a mixture of the two approaches, depending on the possible technological arrangements within the organization of practices[16,17].

With regard to surveillance approaches, active surveillance consists of regular monitoring to obtain information on population health status and behavioral risk factors. It is performed by health professionals with or without the participation of the community and with the support of Information Technologies and Health Care *and communications channels*[18]. Passive surveillance is a system in which health authorities examine reports provided by hospitals, clinics, public health facilities and other sources, stories, rumors and other data on health events using strategies based on sentinel health centers, aggregation methods or digital surveillance and through contact tracing[19,20] and passive monitoring of social media data to measure disease activity (Figure 1).

In China, the initial epicenter of the pandemic, active surveillance measures were implemented. With the support of local committees, PHC doctors played an active role in health education, the mobilization of residents and volunteers, and monitoring confirmed cases (daily monitoring of health status and psychological support for individuals in quarantine)[21]. Passive surveillance approaches were also used, using digital surveillance to provide online prescriptions, instant messaging and electronic dashboards to disseminate information and maintain contact with specialist outpatient centers[22].

Networks led by PHC doctors made a significant contribution to data collection and epidemiological research, through health screening committees, contact tracing and investigation of infection sources, as well as the use of social media apps to generate a combination of aggregated health data and personal risk of infection classification[23-25]. Other actions included surveillance of people who had been in contact with wildlife and behavioral risk factors (certain eating habits, such as eating bats)[26].

Singapore prioritized passive surveillance through the implementation of an enhanced surveillance system and contact tracing, identifying and reporting the location of people in quarantine using a global positioning system (GPS). This information was linked to the results of serological testing, permitting the creation a map of the chain of transmission and sharing of information on infectious diseases from previous experiences of respiratory outbreaks between epidemiology services[27].

In South Korea, all PHC services carry out active screening in households and passive screening by telescreening[28]. People who tested positive were referred to health centers for face-to-face appointments, testing and diagnosis. Confirmed, probable and suspected cases were then monitored on a daily basis through the application of individual risk assessments by PHC doctors to

Chart 1. General characteristics of the health systems and organization of PHC in the selected countries.

Country	Type of health system	PHC model	Organization of PHC teams	Primary care response to the COVID-19 pandemic
South Africa	Mixed public and private coverage.	System based on community health centers; teams composed of one nursing professional and 4 to 6 community health workers. The family physician is multifaceted, playing an essential role in the point of entry to the health services and in quality management, continuous professional development, and the application of health and treatment guidelines and protocols.	The work of health teams is centered on home visits and the active search for patients, adopting a generalist approach and emphasizing care focusing on common diseases. The importance of community participation is recognized; the community has the right to plan and implement its own health programs and services.	28,000 community health professionals allocated to perform active home-to-home screening in high-risk communities and home visits.
Argentina	Mix of three large subsystems: 1. universal and free public system; 2. Social security with public investment and worker contributions; 3. Private system involving corporate services and pre-paid medical services.	In general, primary health care is provided by health centers under the management of municipal and provincial governments and is the preferred point of entry and filter for specialist care.	Model centered on specialties	Implementation of the Tele-Covid service with coverage provided exclusively by the public system and provision of video appointments. Tele-Covid used to screen suspected and confirmed cases of COVID-19 in order to prevent circulation and to share knowledge and care experiences and coordinate actions developed by PHC, emergency, hospital and laboratory services. Use of a Strategic Testing Device for Coronavirus in the Field of Argentina (DETeCTAr).
Australia	Mixed public (Medicare universal health care scheme) and private coverage.	PHC is the point of entry to the health system and is provided at home level or in community settings through general practices, private services, community health, the local government and non- governmental services. Medicare Locals and Local Hospital Networks work as local consumers and providers, developing integrated plans and services coordinated at local level.	Interprofessional teams.	Most vulnerable people receive medical care and primary care counseling, generally provided by Medicare GP teams. Online training for health professionals. Counseling and support for the public in relation to social distancing. Substantial investment in support for mental health for all Australians. Elderly care, services for disabled people and hospital services. Teleappointments, screening, electronic prescriptions, telemonitoring.

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determine the severity of the disease and the necessary parameters for quarantine and isolation. PHC appointments were integrated with health surveillance and provided an estimation of the local and national epidemiological situation of COVID-19[29].

Chart 1. General characteristics of the health systems and organization of PHC in the selected countries.

Country	Type of health system	PHC model	Organization of PHC teams	Primary care response to the COVID-19 pandemic
China	Mixed public and private coverage.	All citizens have the right to receive basic care services provided by the local government.	Mainly community physicians and health professionals in rural clinics, general practices in rural areas and urban community hospitals, and medical professionals in secondary and tertiary hospitals.	GPs actively involved in diagnosis and treatment, health education, active and passive surveillance, monitoring and counseling/appointments. GPs work together with local neighborhoods, committees and community police in joint defense, counseling, screening and monitoring. WeChat health screening networks for contact tracing and investigating sources of infections.
South Korea	Mixed public and private coverage.	Doctors treat patients in private practices.	Combination of tasks undertaken by a team of nursing professionals and social workers.	Mass diagnosis as part of a policy to test as many people as possible and use of technology for case screening.
US	Does not have a universal care system. Private health insurance and public health coverage.	Primary health care in the US is delivered by three specialties: family medicine, general internal medicine and general pediatrics.	Doctors, whose main role is to coordinate patient care, as well as nurses and physician assistants.	Poor organization of PHC services. Attempt to organize Medicare and Medicaid. Isolation of contacts and confirmed cases after laboratory confirmation. Urgent and emergency services paid by service users on an as-needed basis. Support available from other local and state government agencies and partner organizations. Difficulties in implementing telemedicine.
France	Universal.	General practitioners work in private practice or health centers.	Most outpatient care is delivered by nurses at home, especially in the case of elderly and disabled patients. Professionals include paramedics, dentists, pharmacists, physiotherapists and midwives, outpatient specialists, pediatricians, gynecologists, ophthalmologists and psychiatrists.	Two-level functional hierarchization of healthcare facilities. Expansion of telemedicine. City outpatient services and other health facilities continue to operate normally.
Italy	Universal.	GP model and some interprofessional outpatient care teams.	Care coordinated predominately by GPs and, in some regions, interprofessional collaboration to improve accessibility, equity and continuity of care.	Decentralization of health care services for potentially affected populations. Recruitment of health professionals for most affected regions (Lombardy). Establishment of solid public-private partnerships. Teleappointments. Electronic prescriptions interlinked to pharmacies.

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Chart 1. General characteristics of the health systems and organization of PHC in the selected countries.

Country	Type of health system	PHC model	Organization of PHC teams	Primary care response to the COVID-19 pandemic
India	Mixed public and private coverage. Provision is the responsibility of the states, which are often incapable of ensuring coverage in vulnerable and/or remote regions.	Healthcare for the poor is provided by small-scale, largely unregulated and often unlicensed commercial and not-for-profit providers.	Polyclinics have become an alternative to the capitalist system of health care provision, offering accessible services and GP medical residencies. Care provided to vulnerable populations, with special attention given to women and children.	Integrated Disease Surveillance Program using phone location and Bluetooth data. Continuous updates provided by the Ministry of Health and numerous helplines. Difficulties in convincing the population to adopt hygiene and social distancing measures.
United Kingdom	Universal.	GPs are the point of entry to the health system.	The primary care team includes GPs, nurses management/administrative professionals linked to a clinic or a geographically defined population.	Remote screening of patients by health teams, considering suspected cases, risk groups and the wider population. Clinical Commissioning Groups (CCGs). Large-scale emergency training program to recruit community health workers. Expansion of teleappointments and telemonitoring.
Singapore	Government health system based on the "3M framework": Medifund, Medisave and Medishield.	Primary care is the cornerstone of the health system and is provided through government polyclinics and clinics run by private GPs.	Primary care is delivered through a network of polyclinics and clinics run by GPs and supported by Family Medicine Clinics (FMCs), and by Community Health Centers (CHCs), which make up the Primary Care Networks (PCN).	Free appointments and examinations for all citizens during the outbreak. Strict contact tracing system, with criminal charges for breaching measures. Social distancing and payment of fines of up to US $7,000. Popular appointments in public hospitals organized with funding from the Ministry of Health. Information technology-mediated monitoring.

Source: Authors' elaboration.

In the US, health surveillance was developed by Centers for Disease Control and Prevention (CDC) and the Department of Defense Global Emerging Infections Surveillance and Response System (DoD-GEIS). The following systems were used: ILINet, a national surveillance system for influenza-like illnesses, the databases ProMed and Epi-X, and reports derived from the Outbreaks Near Me app. However, while informative, these systems can result in selection bias, excessive interpretation of results due to lack of integration with official surveillance resulting from the fragmentation of the health system and PHC, and variations in decision-making by state health managers[30].

Italy opted for passive surveillance, using integrated COVID-19 surveillance data[31] collected by the *Instituto Superiore di Sanità* (ISS) via an exclusive online platform, electronic questionnaires and daily infographics processed exclusively for the purposes of epidemiological and microbiological surveillance in the context of the COVID-19 pandemic. The data permit the government to monitor the epidemiological situation at national and regional level[31,32].

The interprofessional health teams in Medicare Locals in Australia prioritize contact tracing and vulnerable groups – especially the elderly – and monitoring people with mild respiratory disease symptoms (syndromic surveillance) in the

Chart 2. Types of surveillance actions and data collection methods adopted by the selected countries in their COVID-19 responses.

Países	Type of surveillance								
	Active Involvement of health services and professionals in the identification of diseases or specific conditions			Passive Regular ongoing reporting of diseases and conditions by all health facilities in a given area				Mixed Use of active and passive monitoring techniques	
	Community	Participatory research	Primary care	Information via communication channels	Environmental samples	Monitoring of behavioral risk factors	Digital monitoring	Sentinels	Combination of data collection methods
	Community involvement in the prevention of risks and illness	Use of self-reported data or participatory sites	Group/ household risk screening and counseling	Use of communication channels for public health surveillance	Analysis of substances to monitor health risks	Continuous monitoring of risk factors/ epidemiological data associated with health conditions	Collection of data from sites, applications or digital devices (mobile phones)	Continuous monitoring of data in services across different levels of care	Use of data from different information sources
South Africa	X							X	
Argentina				X					
Australia			X	X					X
China			X				X		X
South Korea	X		X	X			X		X
Cuba	X	X	X						
US		X					X	X	X
France					X			X	X
Italy	X					X			X
India	X	X							
UK		X	X			X			X
Singapore							X		

Source: Authors' elaboration.

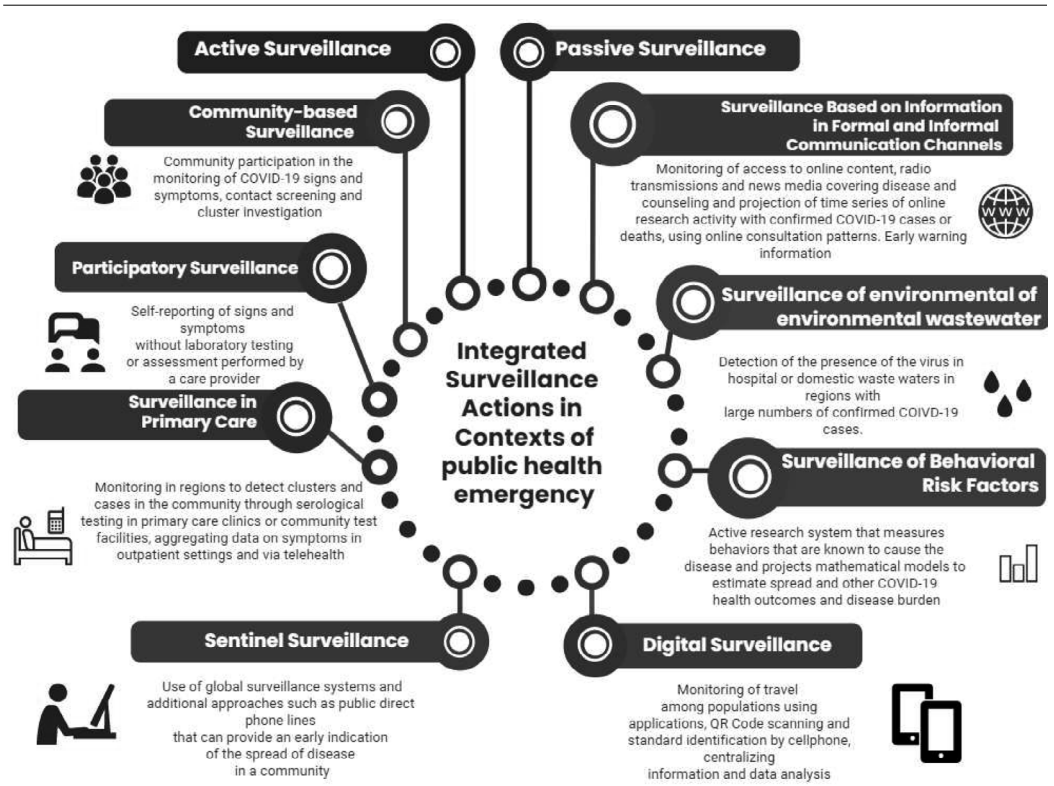

Figure 1. Integrated surveillance actions in the context of a public health emergency.

Source: Authors' elaboration.

community[35]. At national level, data is provided by the internet-based FluTracking syndromic surveillance system, the Australian Sentinel Practices Research Network (ASPREN), Victoria Sentinel Practice Influenza Network (VicSPIN), general practice (GP) sentinel surveillance systems, and the Commonwealth GP Respiratory Clinics[34]. Surveillance includes the aboriginal population and Torres Strait islanders[35].

South Africa chose active community-based surveillance to promote early detection and rapid confirmation through contact tracing, setting up quarantine centers and care support under the Integrated Disease Surveillance and Response framework (IDSR), which provides a framework for syndromic surveillance and entry point for identifying, characterizing and responding to community transmission of COVID-19[36]. In addition, the Africa Health Research Institute (AHRI) implemented demographic surveillance systems for community surveillance in rural areas. These systems are a vital tool in the COVID-19 response in remote areas, permitting screening of symptoms in household members[37-38].

With limited resources and a not so robust health system, India uses a participatory surveillance system called *Aarogya Setu* ("bridge to health" in Sanskrit) to prevent spread and control the pandemic[39]. This system complements the India Integrated Disease Surveillance Program using Bluetooth and telephone data to identify the proximity of infected people, comparing databases of confirmed cases to classify individual risk status (low, medium and high)[40]. Individuals are advised of the measures that should be taken based on risk assessments and test counselling and informed the location of the nearest test center. The application also has a chatbot, which provides constant updates from the Ministry of Health and state help line numbers[40,41].

In France, the use of a sentinel network by PHC doctors was supported by the installation of java-coded applications on health center com-

puters. The app allows the reporting of cases, implementation of surveillance protocols and questionnaires and case description in areas with poor internet access, since the computers are linked to a central server in national surveillance centers[43].

In the United Kingdom, the National Health Service and Public Health England implement a community-based surveillance system integrated with various national syndromic surveillance systems coordinated by the Real-Time Syndromic Surveillance Team (ReSST). The Oxford Royal College of General Practitioners (RCGP) Research and Surveillance Centre (RSC) provides weekly surveillance data reports[11]. The web-based syndromic surveillance system uses daily search query frequency statistics obtained from the Google Health Trends API focusing on queries about COVID-19 symptoms and monitoring models[43] based on previously established Influenza internet search algorithms (FluSurvey) currently included in Public Health England's weekly COVID-19 reports[44,45]. This allows for the analysis of anonymous health data from various sources and facilitates the search for trends that indicate above normal disease levels. Bulletins are published to keep public health professionals up to date, aggregating symptom data in outpatient settings[44,45].

Argentina's Ministry of Health implemented a contact tracing plan called *Detectar* in areas in which an increase in the number of cases has been detected or estimated. Launched in May after a sharp rise in the number of cases among lower-income families in densely populated neighborhoods in Greater Buenos Aires, the plan was subsequently expanded to the rest of the country[46-48].

In Cuba, the country's previous experience with the dengue and Zika epidemics proved to be an advantage. The country already had a national diagnosis and surveillance network, supported by Provincial Hygiene, Epidemiology and Microbiology Centers, a *national network of WHO-compliant diagnostic laboratories and* a national reference center lab for infectious diseases at Havana's Pedro Kourí Tropical Medicine Institute de Havana[49,50]. Before the appearance of the first case, the Ministry of Health had trained its health professionals in disease management and community-based surveillance[49,50].

Following protocols, PHC teams conduct continuous community health assessments (public health and epidemiological situation) and individual and family health assessments to detect respiratory symptoms. Daily screening of suspected and confirmed cases was performed in every neighborhood with the participation of approximately 28,000 volunteer medical students[49,50]. Home visits were used to broaden the monitoring of high-risk people and confirmed cases in home isolation, conducting physical examinations and comprehensive assessments with emphasis on vulnerable groups[50,51].

A little-used method of surveillance was the detection of SARS-CoV-2 in longitudinal samples of metropolitan waste water collected during the early stages of the pandemic in countries like Spain and France, enabling the detection of viral RNA, which is related to the increase in number of declared cases[43]. The routine analysis of waste water is a sensitive and cost-effective COVID-19 surveillance technique, resulting in a significant improvement in preparedness in the event of future or reoccurring viral outbreaks [53].

Challenges, limitations and final considerations

Public health surveillance is essential for understanding the epidemiology of diseases and provides a solid foundation for the implementation of control measures. The majority of countries included in this study adopted different approaches to public health surveillance, ranging from the systematic recording of common medical conditions using administrative data systems, vital statistics and annual health surveys. However, the scope of public health surveillance actions may be limited, even in countries with universal health systems, due to the poor quality of surveillance and public health response, for example as a result of the decentralization of actions to districts or provinces, which can lead to a loss of locally collected data[53].

Despite having systems considered to be effective for detecting major public health problems, the countries that adopted sentinel systems, such as France, the United Kingdom and US (with private PHC), showed a low level of sensitivity to rare events such as the early emergence of a new disease. This is because these infections can emerge in any part of the population and require large-scale monitoring integrated across all levels of care.

Another interpretive challenges observed in this article is the comparison of ways of life and territorial occupation in different countries and their respective care models. Even with robust surveillance systems, hospital-centric care mod-

els in high-income countries may be less effective for vulnerable groups living in densely populated areas, especially when social distancing is not maintained. Hospital-centric systems tend to be less effective for vulnerable populations in lower and middle-income countries, regardless of the type of surveillance and/or degree of integration with PHC.

In contrast, PHC models strongly oriented towards the community tend to achieve more effective surveillance outcomes as they promote actions drawing upon cultural competence implemented in social spaces by interprofessional teams, often including community workers. In this regard, the integration of surveillance and PHC catalyzes the performance of the entire health system, minimizing the adverse effects of the pandemic, even in areas with limited social protection.

Over the last two decades, other approaches have been used to address the gap between PHC and health surveillance, such as the use of data from online news sites, news aggregation services, social media and web searches by countries like Australia, South Korea and Singapore, and longitudinal community-based cohorts in India and the United Kingdom[54]. Digital surveillance uses technologies to support active and passive epidemiological intelligence using digital platforms to aggregate datasets that enable the identification of cases and groups of infections, rapid tracing of contacts, monitoring of travel patterns during lockdowns and public health messaging to wide audiences[55,56].

It is important to highlight that the widespread use of digital surveillance raises some concerns, including the violation of privacy both during and after the outbreak, as not all digital interventions were consensual or explicitly mentioned the consent option for the use of data for specific ends and a given period of time[57].

One example of the above is the use of smartphone apps by South Korea to report the movement of people with COVID-19, raising fears that this initiative could lead people to avoid testing (or other measures imposed by the government) so as not to suffer a violation of their privacy[25]. One of the weaknesses of contact tracing apps is that a large part of the population need to use them and follow the guidance for them to effectively interrupt community transmission[58]. Practical questions also remain, such as which contacts are considered close enough for transmission and when the exposure time is considered long enough to trigger an alert.

Digital surveillance can therefore generate a sense of being controlled and be seen as an obstacle to autonomy, having negative effects on motivation and well-being[59]. Infrared sensors, including the use of thermal imaging cameras to identify possible cases by detecting fever (for example in airports), may generate a false sense of control over the situation. Another obvious concern is the large number of false positive and false negative results, meaning that monitoring strategies are unlikely to have a substantial effect other than raising awareness[60].

Data dashboards have been used extensively during the pandemic, collecting public health data (including confirmed cases, deaths and number of tests) in real time to keep the public informed and helping policy-makers refine interventions. COVID-19 dashboards[61] normally focus on time series graphs and geographical maps, ranging from regional statistics to case-level coordinate data. Few dashboards include an analysis of contact tracing or community surveillance data[62].

Mathematical models have been widely used to estimate spread and other COVID-19 health outcomes, as well as disease burden. Such models require knowledge of the main transmission parameters, such as the serial interval (SI) and the interval between onset of symptoms in the infecting and infected person in the chain of transmission[63-65], to enable the estimation of the interval between infection of primary and secondary cases and time-varying reproduction numbers (how many secondary cases are caused by a typical primary case during the infectious period) during the course of the pandemic[59,66,67].

The quality and consistency of data remains a concern. The lack of official standards and inconsistencies in government statistics between countries make global comparisons difficult[12], especially in countries with striking regional differences, such as Brazil, France and Canada. In addition, up-to-date and accurate offline government statistics are not always evenly accessible.

In China, current policies and technology systems have marked limitations, preventing the integration of clinical care and PHC and collaboration between PHC and other levels of care (for example, hospitals), and make it difficult to ensure a sufficient number of properly trained and an adequately paid PHC professionals[68].

The literature also shows that surveillance services should not operate in isolation and need to be integrated into existing public health systems. Although innovative digital technologies

and data sharing enhance the effectiveness of control measures, they have a number of limitations in relation to the COVID-19 response. This is because they are vertical interventions based on traditional case reporting, recording and investigation and syndromic surveillance practices, meaning PHC actions – which account for 80% of all mild cases – remain disjointed. In contrast, comprehensive multi-sectoral health surveillance integrated with PHC has shown itself to be effective and capable of ensuring continuous monitoring of the range of health problems affecting the local population, both during and after the pandemic. A surveillance system integrated with PHC contributes to the control of transmission in the community, orienting the implementation of mitigation measures towards the community, taking into account scale, time and duration and promoting strategies tailored to local demands.

In this respect, participatory disease surveillance has also shown itself to be an effective strategy for monitoring communicable diseases, in which citizens are actively involved in self-reporting symptoms or events in order to help public health experts to aggregate and analyze data to inform public health interventions[69]. However, biased results may arise in primary care surveillance systems based on voluntary participation due to the lack of representativeness of the monitored population and uncertainty about population denominators.

The Cuban experience reveals a common element for the *organization and professional integration of* PHC into the surveillance system and broader analysis of health problems, focusing not only on the systematization of general indicators, but aimed at informing the planning and organization of systems and services. This requires a PHC model that seeks to understand local living and working conditions and the forms of organization and operation of local government and non-governmental organizations. In other words, a care model articulated with representative collective decision-making spaces within society and tailored to different realities in order to provide comprehensive and equitable care[51,70,71].

The primary care-based surveillance model should include the following: the articulation of interprofessional team practices, including primary care providers; a health surveillance, health promotion and disease prevention funding system or incentive program; information technology systems to promote the continuous and systematic collection of data and implementation of common plans and protocols; and the capacity to detect and report new and emerging diseases using platforms integrated across local, provincial, national and international health systems.

Finally, the experiences analyzed by this study demonstrate that, although robust surveillance systems are essential tools for detecting and monitoring outbreaks and public health emergencies, strong primary care systems form the foundation for any response to health emergencies.

Collaborations

All the authors contributed substantially to study conception and planning, data collection, analysis and interpretation, and to writing the article, revising it critically for important intellectual content and approving the final version to be published.

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