ABSTRACT

The Brazilian National Health Surveillance Policy, established in 2018, aims to define how public health surveillance (PHS) and its fields should act in the country, becoming the main result of eight decades of institutional implementation of this public health issue in Brazil. So, to understand the conceptual, historical, and institutional progress of PHS in Brazil, 92 articles and editorials served to carry out an integrative literature review, selected by the Scielo, Redalyc, Lilacs, Pubmed, and Science Direct databases. Based on this literature, the conceptual and historical developments of the Brazilian PHS agreed with the most current ideas on the subject in the international context. However, the institutional scenario deserves attention, as it provides salient inequalities in the provision of the PHS service. Therefore, to improve this aspect, it is necessary to invest in actions on collection, information, and dissemination of data and relate them to technological and monitoring tools.
Palavras-chave: política de saúde, programas nacionais de saúde, vigilância em saúde pública, pesquisa em sistemas de saúde pública.

1 INTRODUCTION

In the year 1955, in the United States of America (USA), a vaccination error provoked an outbreak of poliomyelitis, resulting in 260 cases of vaccine poliomyelitis and 11 deaths, as well as in the first use of the expression health surveillance (SEVALHO, 2016). The meaning of such an expression represented articulated and integrated actions to describe and improve the population health situation in a territory transcending the institutionalized spaces of health services (EDELSTEIN et al, 2018; OLIVEIRA; CRUZ, 2015).

Until then, surveillance actions did not have a well-defined or standardized name, even though, since the oldest civilizations, existed records on health outcomes, risk factors, and epidemiological interventions (CHOI, 2012; FRANCO NETTO et al., 2017).

Several authors (ARREAZA; MORAES, 2010; CHOI, 2012; DECLICH; CARTER, 1994; FRANCO NETTO et al., 2017; GUIMARÃES et al., 2017; SEVALHO, 2016; SILVA; SILVA, 2008; TEIXEIRA et al., 2018) have presented historical milestones on the evolution of public health surveillance (PHS), exploring the surveillance paradigms on people, diseases, and risks.

The first paradigm of PHS focused on people and lasted until the beginning of the 19th century, guiding its actions to patient control, with the simple objective of preventing disease...
dissemination in civilized territories, aiming for the national economic progress (GROSECLOSE; BUCKERIDGE, 2017). In this period, the quarantine experience to control the black death in ports in the 14th century is emblematic (DECLICH; CARTER, 1994). In the 17th and 18th centuries, the highlight is the beginning of the systematic collection of data on morbidity and mortality to verify the population capable of exercising their military duties, which resulted in – still used today – compulsory notifications of infectious diseases (LEE; THACKER, 2011).

Even in the 18th century, due to the French Revolution, health became a duty of the State, and surveillance ceased to carry out purely corrective actions and began to act preventively in school, maternal and child health, water and sewage treatment, and other aspects of human health. At that time emerged three schools of social medicine, the German Medical Police – which regularized medical practices and organizations –, the French Urban Medicine – which carried out basic sanitation practices in the cities – and the English Workforce Medicine – which dedicated to actions to control the health of workers in the industrial environment (FOUCAULT, 1979).

Through the studies of John Snow and Louis Pasteur in the 19th century, PHS shifted its focus to disease, in which actions directed attention to the control of diseases and their causes (GROSECLOSE; BUCKERIDGE, 2017) in a kind of "war against microbes" (SEVALHO, 2016, p. 4). Their findings refuted the miasma theory and grounded the unicausal concept, which later, with the increase in chronic degenerative diseases, gave rise to the multicausal concept and the natural history of the disease (MONKEN; BARCELLOS, 2005). That was a historically relevant moment for the current concept of PHS because it suffered influence from the idea of the health-disease relationship developed at that time.

Throughout the 20th century, the focus of PHS developed towards health risk factors, in which health determinants – such as risk behaviors, availability of health services, and socioeconomic and environmental aspects – conducted the decision-making (GROSECLOSE; BUCKERIDGE, 2017). From this perspective, the main milestone was the 21st World Health Assembly promoted by the World Health Organization (WHO) in 1968, which disseminated the concept of PHS, indicating that surveillance is information for action because, according to the event, the PHS data must be collected, evaluated, and disseminated for effective implementation of public health policies (FRANCO NETTO et al., 2017).
The International Health Regulations (IHR) shared the concept of surveillance based on risk factors with its 196 signatories in the actual version from 2005, being this practice has existed since its implementation in 1969 (WHO, 2021). Such a tool proposes international rules for sharing PHS information to prevent diseases spread worldwide (CALAIN, 2007; STURTEVANT; ANEMA; BROWNSTEIN, 2007), like acute respiratory syndromes that have caused cross-border epidemics in recent decades (ZHAO; BISHAI, 2022).

Despite the risk surveillance paradigm being the most current and accepted over the world, Porto (2017) discusses a new paradigm, that of emancipatory public health surveillance (EHS), which seeks to go beyond PHS by considering surveillance tools to address social inequalities. For Fairchild et al. (2017), Porto (2017), and Santiago Neta, Medeiros and Gonçalves (2018), these social inequalities must be treated as determinants of health, with surveillance being a fundamental instrument in the fight for equity. Therefore, the EHS proposes surveillance actions on the population's health needs and not just on risk factors, unifying scientific and popular knowledge with intersectoral solutions based on planning, communication, valuing the territory, and the use of technologies for promoting territorial strategic policies to modify the socio-environmental determinants among vulnerable population groups.

However, it is worth noting that the operational practices of PHS and EHS are very similar (FRACOLLI et al., 2008) – if not the same –, and according to Arreaza and Moraes (2010) and Silva and Silva (2008, 2013), there are no clear conceptual differences between both approaches, while Santiago Neta et al. (2018) consider that in practice it is not possible to discern one paradigm from the other. Indeed, the EHS proposals to value empirical knowledge, territory, intersectionality, integration, and equity to generate actual social changes were discussed since the beginning of risk surveillance, when the 21st World Health Assembly occurred. Therefore, the paradigm of EHS seems to be much more ideological than practical.

Given this overview of PHS development on a global level, this work proposes to present the evolution of this area of public health in Brazil under the conceptual, historical, and institutional aspects, using a literature review process to gather the necessary information for the representation of that scenario.
2 METHODOLOGY

This study is an integrative literature review on Brazilian PHS, developed under a guiding question related to “How did PHS evolve in Brazil, based on its conceptual, historical, and institutional aspects?”.

So, to answer this question, a query was carried out in the Scielo, Redalyc, Lilacs, Pubmed, and Science Direct databases, from October to November 2022, using the keywords ("Vigilância em Saúde" OR "Vigilância da Saúde") OR ("Health Surveillance" OR "Public Health Surveillance") OR ("Vigilancia de la Salud" OR "Vigilancia de la Salud Pública"), without any filter regarding publication time.

This search resulted in 29,837 outcomes, but due to the sample size, were analyzed the 1,000 most relevant articles and editorials ranked from each database. The articles and editorials, written in Portuguese, English, or Spanish, containing information on the implementation of PHS in Brazil and its national and international context, in their titles and abstracts, were then selected. On the other hand, all outcomes dealt with specific fields of PHS or its application in specific populations or public health conditions featured the exclusion criterion.

Of 134 selected articles and editorials, 56 were duplicates, and the remaining 78 received a complete reading. Afterward, 14 articles frequently cited or containing relevant information on specific topics of the PHS were also selected. Thus, 92 articles and editorials supported the PHS scenario description in Brazil. Figure 1 illustrates the whole selection process of these bibliographical sources.

The restriction inherent to the integrative literature review is a critical methodological aspect limiting the findings of selected databases that do not cover all the academic production on Brazilian PHS. More than exhaust all information on the subject, this study aims to present an overview of how this branch of public health has developed in Brazil.
3 RESULTS AND DISCUSSION

3.1 CONCEPTUAL ASPECTS

The current concept of PHS is the result of a discussion around the work published by Alexander Langmuir in 1963, which suggested the form and purposes of this practice, considering health records and notorious decision-making, such as those of John Graunt, Samuel Pepys, Edwin Chadwick, Lemuel Shattuck, and William Farr, considered the founder of modern PHS (CHOI, 2012; PETRINI, 2013; SILVA; SILVA, 2008).

Thereby, the model proposed by Langmuir has influenced notorious public health theorists such as Karel Raska and Stephen Thacker, as well as institutions like the WHO and the USA Centers for Disease Control and Prevention (CALAIN, 2007; CHOI, 2012; NAVARRO, 2000; PETRINI, 2013). Similarly, the Brazilian National Health Council (CNS) was also inspired by this reference, defining the PHS in the National Health Surveillance Policy (NHSP) as:

[...] the continuous and systematic process of collecting, consolidating, analyzing data, and disseminating information on health-related events, aiming to plan and implement public health measures, including regulation, intervention, and action in conditions and determinants of health, for the protection and promotion of the population's health, prevention, and control of risks, injuries, and diseases (CNS, 2018, p. 2).

This definition consolidates the idea of an alternative health care model to the classic medical assistance and sanitary campaigner models, the first being associated with medical practices to care for the patient, emphasizing curative medicine, and the second for collective needs with compulsory interventions in the form of campaigns (FERNANDES et al., 2017; GUIMARÃES et al., 2017; PINTO; PEREIRA; LIMONGI, 2017; TEIXEIRA, 2003). So, the
PHS is part of this context aiming to change the managerial and technical health care practices based on democracy and social participation (FERNANDES et al., 2017).

In the literature (BLAZES; DOWELL, 2019; CHIOLERO; BUCKERIDGE, 2020; EDELSTEIN et al., 2018; FRANCO NETTO et al., 2017; GROSECLOSE; BUCKERIDGE, 2017; GUIMARÃES et al., 2017; KLINGLER et al., 2017; LEÃO; VASCONCELOS, 2013; LEE, 2020; LEE; THACKER, 2011; OLIVEIRA; CRUZ, 2015; PETRINI, 2014; SANTIAGO NETA et al., 2018; SILVA; CARVALHO, 2017), there are other definitions for PHS, all emphasizing the same essential elements of continuity, systematization, integrality, social control, and pragmatism.

Given this, at PHS, it is essential to collect, analyze, and disseminate data and information continuously and systematically, making possible preventive action from a temporal assessment of the population's health condition, in the sense of regularly carrying out activities with a well-defined methodology. So, PHS and scientific study have no methodological distinction, as indicated in the work of Arreaza and Moraes (2010).

Another important aspect is using the information to promote actual changes in the population's health condition. Therefore, it is necessary to integrate public health actions at different levels, vertical – federal, regional, municipal, and institutional – and horizontal – hospital, public health, sanitation, environment, food, and several other sectors of society. Also, social mobilization practices for verifying the local needs of each social group, following the guidelines of empowerment, equity, and sustainability are necessary, as evidenced by Fernandes et al. (2017).

To better understand what is at the heart of PHS, some authors (CHOI, 2012; DECLICH & CARTER, 1994; LEE & THACKER, 2011) seek to explain its dichotomies with other public health topics, comparing it with epidemiology, scientific research, public health actions, monitoring, and information system (Chart 1).
Chart 1: Dichotomies among health surveillance and other public health issues

<table>
<thead>
<tr>
<th>Public health issues</th>
<th>Dichotomies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidemiology</td>
<td>PHS is not epidemiology because it needs continuity and action components that are not mandatory in epidemiology. However, the epidemiological study is an essential tool in PHS to understand the natural history of the disease and its consequences on society.</td>
</tr>
<tr>
<td>Scientific research</td>
<td>PHS is not scientific research, as it has a purely descriptive aspect, analyses the entire population, and has limited data in detail, while research needs to test hypotheses, work with samples, and use more complex data. However, they are complementary actions, whereas the survey provides data for surveillance and vice versa.</td>
</tr>
<tr>
<td>Public health actions</td>
<td>The PHS does not comprise public health action to prevent bias on the results, given that professionals could hide the health outcome of the population to avoid an overload of functions. However, every PHS must result in an action to improve health, being carried out by an independent institution.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>PHS is not monitoring, whereas monitoring measures the performance of specific health actions, while PHS measures the health level of the population, regardless of the existence of interventions. Despite this, both have a continuous and systematic character.</td>
</tr>
<tr>
<td>Information system</td>
<td>The PHS is not an information system because although an information system unites various types of data – including PHS – this instrument is not continuous, does not have a specific objective, and is not necessarily linked to an action.</td>
</tr>
</tbody>
</table>

Source: Adapted from Choi (2012), Declich and Carter (1994), and Lee and Thacker (2011).

Given the conceptual complexity of PHS, this – despite not being a scientific consensus (VILELA; SANTOS; KEMP, 2017) – is articulated in four fields so-called epidemiological surveillance (SEpi), sanitary surveillance (SSan), environmental health surveillance (SEnv), and occupational health surveillance (SOcc). Several authors (ALBUQUERQUE, 2019; ASSIS et al., 2017; DONATELI, 2017; FRANCO NETTO et al., 2017; LIMONGI et al., 2017; OLIVEIRA; CRUZ, 2015; PINTO JUNIOR; CERBINO NETO; PENNA, 2014; RECKTENWALDT; JUNGES, 2017; SILVA; CARVALHO, 2017; OKUMOTO; BRITO; GARCIA, 2018) support such an approach, and, therefore, NHSP defines them as:

X - Environmental health surveillance: the set of actions and services that provide knowledge and detection of changes in the determining and conditioning factors of the environment that interfere with human health, to recommend and adopt measures to promote health, prevention, and monitoring of risk factors related to diseases or health conditions.

XI - Occupational health surveillance: the set of actions for promoting health, preventing morbidity and mortality, and reducing risks and vulnerabilities in workers by integrating solutions to prevent diseases and their determinants derived from development models, production processes, and work.

XII - Epidemiological surveillance: the set of actions that provide knowledge and detect changes in determinants and conditioning factors of individual and collective health, to recommend and adopt measures for preventing and controlling communicable and non-communicable diseases and health conditions.

XIII – Sanitary surveillance: the set of actions capable of eliminating, reducing, or preventing health risks and intervening in health conditions arising from the environment, the production and circulation of goods, and the provision of services in the interest of health. It covers the provision of services and the control of consumer goods directly or indirectly related to health, including all stages and processes, from production to consumption and disposal (CNS, 2018, p. 4).
It is worth noting that these fields must act in an integrated manner, sharing information and recommending efficient actions, avoiding duplication of means for identical ends, and using epidemiological research as an intersection (GUIMARÃES et al., 2017).

Considering this PHS organizational scope, its role in generating information to promote action is unanimous, having essential utility in public health (BLAZES; DOWELL, 2019; FRANCO NETTO et al., 2017; GROSECLOSE; BUCKERIDGE, 2017; GUIMARÃES et al., 2017; NAVARRO, 2000; NOGER et al., 2017; SANTOS, 2017). This information must have the spatial, temporal, and diagnostic quality (BLAZES; DOWELL, 2019) to generate confidence, allow its evaluation, and develop measures that improve the effectiveness of public health systems (GROSECLOSE; BUCKERIDGE, 2017).

Nevertheless, Franco Netto et al. (2017) recommend that the PHS may assume the role of the planner in public health systems, promoting policies, evaluating the performance of the whole system and isolated actions, identifying health patterns, intervening in health determinants, regulating services and related sectors, and enabling the process of continuous improvement (GROSECLOSE; BUCKERIDGE, 2017; SILVA; SILVA, 2008). Thus, it would allow the achievement of a “free, fair, and solidary society, guaranteeing national development, eradicating poverty and marginalization, reducing social and regional inequalities, and promoting the well-being of all [...]” (SANTOS, 2017, p. 1).

To obtain an excellent PHS performance is necessary to observe basic principles, such as those presented in the NHSP (Figure 2). However, these principles are not the only ones discussed in the literature. For example, some authors (BAKER; FIDLER, 2006; CHIOLERO; BUCKERIDGE, 2020; GROSECLOSE; BUCKERIDGE, 2017) propose other principles like acceptability, cost-effectiveness, usefulness, data quality, flexibility, predictive value positive, representativeness, security, sensitivity, interoperability, simplicity, stability, standards use, and timeliness.

Regarding the principles established in Figure 2, universality is one of the most important and hard to achieve, as it aims to extend PHS actions to every citizen in the entire national territory, requiring great investments in infrastructure and professionals (AQUINO, 2014).
It is noteworthy that this service must be *equitable*, serving people according to their health needs, taking into account the diversity and plurality of the population (ARREAZA; MORAES, 2010). These principles resume the EHS concept according to which surveillance should act to face social inequalities, as already discussed since the beginning of PHS.

The principle of *integrality* communicates efficiency to PHS, being very similar to the *cooperation and articulation* principle, both orientating that PHS must act in an articulated way among its fields, the services of the health system, and all related sectors. In addition, to improve
such an efficiency, integration must be associated with the principle of non-duplicity to prevent efforts with similar objectives among different agencies and sectors that can contribute to PHS.

In this way, the beforementioned principles are fundamental for PHS to monitor the complex health-disease process (ARREAZA; MORAES, 2010; GUIMARÃES et al., 2017; OLIVEIRA; CRUZ, 2015), which does not only involve infectious agents but an entire arrangement of social, economic, environmental, political, and cultural health determinants (Silveira; Fenner, 2017). Based on this, some authors (CARDOSO; COSTA; SILVA, 2020; FELISBERTO, 2013; PINTO et al., 2017; RECKTENWALDT; JUNGES, 2017; TEIXEIRA, 2002) emphasize the importance of integrating PHS with primary care, as it welcomes the user and accompanies it from the first contact to the final result, knowing the aspects that led it to such a health condition.

Silveira and Fenner (2017) developed an example of integration practice, which introduces the Health Impact Assessment concept, aiming to complement the consolidated Environmental Impact Assessment process. This proposal considers the impact of some human environmental interventions on the community health condition. Such an approach represents a new analytical perspective of a predictive, multidisciplinary, intersectoral, and participatory nature, directed to face social inequalities and capable of supporting decision-making, increasing health gains from the intervention. Therefore, the agencies responsible for the assessment, the health institutions, and affected communities must collaborate to achieve sustainability in their actions.

More extensively, Leão and Vasconcellos (2013, 2015) present a proposal for integration between PHS and the Commodity Chain, understood as all production, distribution, commercialization, and disposal of goods and services. From this point of view, the only source of health risk factors is the Commodity Chain, and based on a holistic analysis, PHS could act in a more integrated, transdisciplinary, and participatory way on the health of consumers, workers, and the environment, changing the idea of product surveillance for process surveillance. However, this practice is very far from the capacity of current PHS systems, so the authors demand the development of techniques that make this conceptual model feasible.

Integrality is only necessary due to the PHS multidisciplinary condition, with the consequent variety of sectors and institutional levels that characterize the principle of decentralization. Guided by this principle, Aquino (2014) and Arreaza and Moraes (2010)
indicate that the decentralization of PHS actions at the municipal level is the most appropriate since it is the governmental level closest to the population and, therefore, more capable of understanding their health needs and acting promptly. However, Aquino (2014) highlights the difficulty of applying this principle, as this level generally has the least access to financial resources and, in the Brazilian case, takes many attributions such as education, health, basic sanitation, transport, and other matters of local interest.

Therefore, the Brazilian decentralization policy of health changed for regionalization because the experience with municipalization in the 1990s did not demonstrate satisfactory results (ALBUQUERQUE et al., 2019; TEIXEIRA, 2002). Nevertheless, this practice is not well implemented in the country, possibly due to the lack of integration between the federal and regional levels, leading to the heterogeneity of service provision (ALBUQUERQUE et al., 2017; LOPES; ALBUQUERQUE; FELISBERTO, 2019). On the other hand, these were the same justifications for the failure of municipalization, contributing to the distrust about the effectiveness of regionalization, which even led Canada to discard this idea, as there was no improvement in the performance of PHS and costs increased (ALBUQUERQUE et al., 2017).

The PHS achieves better efficiency in the generation of information when applied in a territory that, according to Sevalho (2016, p. 8), is an “existential space that transcends the physical dimension” and where the community builds a set of social, economic, environmental, cultural, and political characteristics that influence health (CARDOSO et al., 2020; FRACOLLI et al., 2008). Thus, the territorialization of the PHS is vital, as it facilitates the knowledge of local health problems, better guides decision-makers, and helps to attain the universalization of the service (ARREAZA; MORAES, 2010; GUIMARÃES et al., 2017; MONKEN; BARCELLOS, 2005).

This process must always be related to social participation to favor the autonomy, emancipation, and empowerment of those stakeholders who, according to Groseclose and Buckeridge (2017), are health professionals, decision-makers, affected communities, academics, non-profit organizations, and the private sector. For this to occur, it is necessary to integrate scientific and popular knowledge, considering them on the same level. Furthermore, to promote a mobilization that is not confused with the simple dissemination of information but that allows active popular participation in decision-making, considering the local peculiarities and observing
the guidelines of empowerment, equity, and sustainability (FERNANDES et al., 2017; SEVALHO, 2016; VILELA et al., 2017).

Additionally, Sevalho (2016) also says that social participation compensates for health inequities promoted by the State and increases confidence in the results of the PHS, in addition to providing changes from purely reactive actions to preventive actions (GROSECLOSE; BUCKERIDGE, 2017).

These principles guarantee the right to quality information for society, which results in the prevention of outbreaks, but is often barred by technical, political, economic, motivational, legal, and ethical limitations (EDELSTEIN et al., 2018). Among these limitations, ethics in PHS has been the subject of several studies (BAYER; FAIRCHILD, 2000; FAIRCHILD; BAYER; 2016; FAIRCHILD et al., 2017; JENNINGS, 2013; KLINGLER et al., 2017; LEE, 2020; LEE; HEILIG; WHITE, 2012; PETRINI, 2014, 2013; PETRINI; RICCIARDI, 2015; VERITY; NICOLL, 2002).

Despite being widely discussed, ethics in PHS still do not have international reference guidelines (FAIRCHILD et al., 2017), and the debate develops in the conflict between public and private rights. Given that to ensure completeness and reliability of PHS data, often is necessary to collect data without proper consent (LEE et al., 2012).

Nonetheless, an ethical PHS shall implement action without harming individual rights because it sometimes causes stigmatization and prejudice. So, it necessarily should protect the well-being and privacy of the participants, submit to the ethics committee and obtain consent – whenever necessary and possible –, collect the least amount of information, secure data adequately, use legitimate institutions in surveillance actions, present benefits proportionate to risks, guarantee social participation, and maintain public trust. In addition, it still should ensure the production and dissemination of results, with scientific criteria, transparency, without partiality, and respecting diversities (KLINGLER et al., 2017; PETRINI, 2013; PETRINI; RICCIARDI, 2015).

3.2 HISTORICAL ASPECTS

At the national level, until 1941, Brazilian PHS was limited to health campaigns carried out vertically by the federal government to control the most prevalent diseases in that period (FRANCO NETTO et al., 2017; TEIXEIRA et al., 2018). From that date, several events occurred
to legitimize PHS actions (Chart 2), culminating in the 1st National Health Surveillance Conference, which developed the NHSP guidelines, posteriorly established by CNS Resolution No. 588/2018.

<table>
<thead>
<tr>
<th>Period</th>
<th>Historic event</th>
<th>Significance</th>
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<tbody>
<tr>
<td>1941</td>
<td>1st Brazilian National Health Conference</td>
<td>Occurred the first survey of the health situation in Brazil, proposing the institutionalization of PHS actions, which, later, in 1968, led to the separation of SEpi and SSan.</td>
</tr>
<tr>
<td>1975</td>
<td>Establishment of the Brazilian National Epidemiological Surveillance System</td>
<td>The system decentralized PHS actions at the regional level through the National Immunization Program, but still with centralizing characteristics, without resources at the local level. In 1976, the Sanitary Surveillance Department was founded, consolidating the separation of SEpi and SSan.</td>
</tr>
<tr>
<td>1990</td>
<td>Regulation of surveillance in the Brazilian Public Health System (SUS)</td>
<td>Insertion of PHS in the SUS, by Law No. 8080/1990, based on a constitutional determination inspired by the sanitary reform of the 1970s.</td>
</tr>
<tr>
<td>1991</td>
<td>Institution of the Brazilian National Health Foundation (FUNASA)</td>
<td>The union of several agencies founded FUNASA, including the Special Services for Public Health Foundation and the Superintendence of Campaigns. It established the National Epidemiology Center (CENEPI), responsible for disseminating PHS entirely to the SUS, and the Department of Operations (DEOPE), responsible for coordinating disease prevention and control actions.</td>
</tr>
<tr>
<td>1999</td>
<td>Institution of the Brazilian National Sanitary Surveillance Agency</td>
<td>The creation of this autarchy finally separated the SSan. It has independent actions but remains articulated with PHS.</td>
</tr>
<tr>
<td>1999</td>
<td>Publication of Ministerial Order No. 1399/1999 of the Brazilian Ministry of Health (MH)</td>
<td>Given FUNASA's actions looking for decentralization, the Order defined PHS attributions at national, regional, and municipal levels and guaranteed financial resources for this.</td>
</tr>
<tr>
<td>2000</td>
<td>Establishment of the Brazilian National Environmental Health Surveillance System</td>
<td>It established the separation of the actions of SSan and SEnv, inspired by the creation of the VIGISUS Program in 1998.</td>
</tr>
<tr>
<td>2003</td>
<td>Institution of the Brazilian Public Health Surveillance Department</td>
<td>The Department inherited the attributions of CENEPI and DEOPE and, in 2005, established the Center for Strategic Information on Public Health Surveillance, which became the Brazilian focal point in the IHR.</td>
</tr>
<tr>
<td>2009</td>
<td>Publication of Ministerial Order No. 2728/2009 of the MH</td>
<td>The Order inserted the Occupational Health in the network service of SUS through the Reference Centers in Occupational Health.</td>
</tr>
<tr>
<td>2009</td>
<td>Publication of Ministerial Order No. 3252/2009 of the MH</td>
<td>The Order attributed the national, regional, and municipal levels to all fields of PHS.</td>
</tr>
<tr>
<td>2017</td>
<td>Publication of Ministerial Order No. 3992/2017 of the MH</td>
<td>The Order determined the current financing model for PHS, with the definition of fixed and variable floors and transfer of funds in the fund-to-fund modality.</td>
</tr>
<tr>
<td>2018</td>
<td>1st Brazilian National Public Health Surveillance Conference</td>
<td>Guidelines, principles, and pillars establishment that culminated in NHSP, based on the working group created by Ordinance 1378/2013 of the MH.</td>
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</table>


This policy, as already discussed, has a universal, transversal, and guiding character of health actions, operating on public and private health services, regulating the production of
consumer goods, and provision of services from the perspective of the PHS fields (OKUMOTO et al., 2018). This inclusive format was only possible due to the extensive debate among approximately 2,000 participants in the conference that preceded it, in which stakeholders of the Brazilian Public Health System (SUS) and organized civil society defined the best model for implementing PHS in Brazil (GARCIA; DUARTE, 2018).

However, this model is just the result of 80 years of PHS development in the country, which presented significant milestones, whereas the creation of government agencies such as the National Health Foundation, National Epidemiology Center, National Sanitary Surveillance Agency (ANVISA), Health Surveillance Department (SVS) and the Center for Strategic Information on Public Health Surveillance (CIEVS), in addition to efforts for decentralization at the regional and municipal levels.

In 1995, when the discussion on PHS decentralization happened, Waldman (1995) published a work arguing the needs of this system. He pointed out the shortage in social control and training of professionals as fundamental factors for PHS to reach all municipalities in the country. Furthermore, counting on improvements in those factors, he predicted a trajectory of 15 to 20 years to achieve this level of decentralization.

Unfortunately, the deadline estimated by Waldman (1995) did not materialize, being verified in recent works (CORRÊA FILHO, 2019; FRANCO NETTO et al., 2017; GUIMARÃES et al., 2017; SANTOS, 2017; SILVA; CARVALHO, 2017, TEIXEIRA et al., 2012) that the PHS is not structured in Brazil. Besides, the scenario worsened by continuing the needs before mentioned and adding others, such as precarious infrastructure, scarcely human and budgetary resources, and a systemic and integrated approach, with the ability to analyze information, be predictive and effective for decision-making to face inequalities.

According to Edelstein et al. (2018), underdeveloped countries have a situation similar to that of Brazil, with the help of non-governmental organizations, academic institutions, and private companies being commonplace to address the shortcomings of the PHS system (MCKEE; ATUN, 2006). Cases such as West African countries (ONYEBUJOH; THIRUMALA; NDIHOKUBWAYO, 2016), Egypt (TALAAT et al., 2016), Kenya (NJERU et al., 2020), and Costa Rica (HERRERA, 2015) are categorical in the problems of infrastructure, human and financial resources, overload of a low-skilled and motivated workforce, access to communication, waste of resources, and lack of standard procedure.
Nevertheless, Puma et al. (2016), surprisingly, show that rich countries also have limitations in the implementation of PHS, as in the case of poor, rural, or isolated regions of the USA, even being in a country with well-structured PHS, it is difficult to collect data, public participation, and analysis of information, failing the principles of universalization and equity (BLAZES; DOWELL, 2019; LATSHAW et al., 2017). A similar situation is that of Spain, where well-developed places use high technology, and others still require basic integration actions (NOGER et al., 2017).

3.3 INSTITUTIONAL ASPECTS

After this conceptual and historical development process, the Brazilian PHS produced an institutional model in which the Ministry of Health (MH) has the role of centralizing office, delegating to ANVISA and SVS the actions themselves (CNS, 2018). Moreover, secondary institutions exist to support the conducting research, handling data, providing laboratory infrastructure, and making decisions to improve health status, as shown in Figure 3.

Figure 3: Institutional model of Brazilian public health surveillance

Note: PHS = Brazilian public health surveillance, SSan = Sanitary surveillance, Sepi = Epidemiological surveillance, SEnv = Environmental health surveillance, Socc = Occupational health surveillance.

Source: Authors (2023)
In this structure, the ANVISA is the autarchy responsible for SSan, which operates in the production and consumption of goods and services and sanitary control of ports, airports, boundaries, and customs (ANVISA, 2022). In turn, SVS performs in the other fields of the PHS as an agency directly submitted to the MH, with the attribution of coordinating PHS actions at the federal level and acting in the prevention and control of health problems (BRAZIL, 2019). In other words, the SVS is the same institution for carrying out PHS and public health action being inconsistent with the orientation of not putting together these public health issues (CHOI, 2012; DECLICH; CARTER, 1994).

Fund-to-fund financing maintains this entire framework operating through a fixed package – calculated based on population size and territorial extension – and a variable package – calculated over the execution of programs or special epidemiological needs. Of the fixed portion that each state receives, at least 10% must go to the health state secretariat and 60% to the municipal health departments. From this part, 80% are allocated to the capital and metropolitan regions (AQUINO, 2014; PINTO JUNIOR et al., 2014; TEIXEIRA et al., 2018).

Though the limited number of resources allocated to small municipalities, the current financing model is an advance on transfers compared to the agreements financing model, applied in Brazil until 1998, and which, at times, forbade the continuity of PHS actions due to its centralizing and circumstantial aspects (AQUINO, 2014; TEIXEIRA et al., 2018).

Even with limited financial resources, the Brazilian PHS is implemented throughout the country, having the competence to adequately monitor events at an international level, such as the football world cup (OLIVEIRA; GARCIA; DUARTE, 2014). However, this implementation is not homogeneous, being the larger municipalities are better structured than smaller ones – as concluded by Assis et al. (2017) when evaluating PHS in cities from the state of Minas Gerais – probably a reflection of the adopted financing policy.

The reflection of that situation of heterogeneity is in the studies that assess PHS in municipalities in the state of São Paulo (AQUINO, 2014; FRACOLLI et al., 2008; GARCIA; L’ABBARTE, 2015; VILELA et al., 2017), Minas Gerais (DONATELI et al., 2017; LIMONGI et al., 2017; PINTO et al., 2017), Rio Grande do Sul (RECKTENWALDT; JUNGES, 2017; SILVA, 2021), Bahia (SILVA; SILVA, 2013), and Pernambuco (SANTOS; BRANDESPIM, 2018), in which the municipalities of São Paulo (FRACOLLI et al., 2008), Guarulhos (VILELA et al., 2017), and the metropolitan region of Porto Alegre (Silva et al., 2021) stand out positively.
with successful experiences of employee appreciation, public participation, dissemination of results, and self-assessment.

On the other hand, the other municipalities studied, in addition to the usual financial, personnel, infrastructure, and integration weaknesses, still report failures associated with physical space, equipment, supplies, and vehicles (AQUINO, 2014; DONATELI et al., 2017; LIMONGI et al., 2017; RECKTENWALDT; JUNGES, 2017), training, overload, and stability of employees (PINTO et al., 2017; SANTOS; BRANDESPIM, 2018), a standard procedure that allows public participation, analysis, dissemination, and use of information (DONATELI et al., 2017; GARCIA; L’ABBARTE, 2015; RECKTENWALDT; JUNGES, 2017; SILVA; SILVA, 2013), and even political interference in the decision-making process (AQUINO, 2014; LIMONGI et al., 2017; SANTOS; BRANDESPIM, 2018).

Research carried out at the regional level (ALBUQUERQUE et al., 2017; ALBUQUERQUE et al., 2019; COSTA, 2015; LOPES et al., 2019; MONDINI; MENEGOLLA; SILVA, 2017) obtained similar results, with examples of action multidisciplinary, integrated, and participatory in São Paulo Regional (ALBUQUERQUE et al., 2017; Albuquerque et al., 2019) and team motivation in Pernambuco Regionals (COSTA et al., 2015; LOPES et al., 2019), while an Amazonas Regional does not even carry out compulsory notifications (ALBUQUERQUE et al., 2019).

Escosteguy, Pereira and Medronho (2017) also present the case of the Federal Hospital for Servants of the State of Rio de Janeiro, in which SEpi is well structured, with consistent data collection, integration with other PHS institutions, continuous training of professionals, and conducting scientific research but the most important is the analysis, dissemination, and use of PHS information to improve hospital care.

Analyzing these cases, the quality of the PHS does not depend on the level of decentralization but is dependent on the socio-economic, environmental, political, cultural, and infrastructure conditions of the SUS in the implemented territory. In this way, to achieve equity and reduce the discrepancy of the regions, Fachini (2013) and Silva Junior (2013) indicate the monitoring of PHS performance through the simple, representative, reliable, and standardized indicators applied throughout the national territory.

In addition to monitoring by indicators, technological tools can contribute to structuring PHS in Brazil, as they allow the process to be more agile, robust, reliable, and cheaper. In this
aspect, Ashar et al. (2010) discuss the need for the territory to have a network system, hardware, and software adjusted to its specificities, while other authors (CHIOLERO; BUCKERIDGE, 2020; DALTON, 2017; LATSHAW et al., 2017; MACEDO et al., 2016; MACINKO, 2015; SHEIKHALI et al., 2016) present the application of technologies such as artificial intelligence, information systems, electronic systems, social media, crowdsourcing, big data, data mining, and data visualization.

For these technologies to align with the PHS, it is vital to invest in interoperability, standardizing the technical, technological, and analytical vocabulary (BURKOM, 2017; DIXON; VREEMAN; GRANNIS, 2014) besides inserting the private sector and the population into a voluntarily passive PHS (MIRZA et al., 2013). Furthermore, interoperability can be associated with cyber intelligence techniques to assess data consistency and ensure actions following an ethical point of view (Smith III, 2016).

Although, given the Brazilian reality, more than having new tools, it is essential to comply with the seven basic PHS activities proposed by Lee et al. (2012) to plan the surveillance system, collect, consolidate, and analyze data, interpret the results, communicate the information, and apply it in public health measures.

Therefore, one of the most appropriate ways to achieve a structured PHS is to comply with the IHR, as reaching its achievements means universally performing the PHS and analyzing the data for decision-making. In this sense, the CIEVS plays a key role, as it is Brazil's focal point in the IHR and is responsible for consolidating and analyzing data, with subsequent communication of public health events at the national and international levels (Santos et al., 2016).

However, according to Santos et al. (2016), this institution fails to deliver results, despite being well organized politically and institutionally. So, to perform its role with mastery, improvements are needed as those described in the global model of data sharing proposed by Edelstein et al. (2018) and McNabb (2010).

4 FINAL REMARKS

Brazilian PHS evolved conceptually and historically in line with the main findings worldwide, resulting in a public policy based on universality and transversality, aiming to guide health actions and face inequalities that act as determinants of public health.
However, its institutional development still deserves attention, as the weaknesses related to the lack of financial, human, and infrastructure resources besides the need for a systematic and integrated approach cause a heterogeneity typical of developing countries.

In this way, to achieve the universality and equity that PHS demands, it is necessary to invest in practices of basic actions of collection, consolidation, analysis, and dissemination of data and information, which guarantee compliance with the IHR, being able to take advantage of technological tools and monitoring.
REFERENCES


