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Sentinel Networks for the Surveillance of Overweight and Obesity: A Scoping Review

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ABSTRACT

Introduction: To address the high prevalence and significant burden of overweight and obesity, surveillance through sentinel networks should be considered. The aim of this review is to identify the sentinel surveillance networks in relation to overweight and obesity and to describe their characteristics and methodology.

Methods: A scoping review was performed using MEDLINE (Ovid and PubMed), Web of Science (WoS), and Scopus, updated until November 2024, and included studies that identified sentinel networks specifically conducting surveillance for overweight and obesity, as well as networks that include these conditions as secondary variables. The main characteristics of each sentinel network and the variables related to overweight and obesity surveillance were recorded. A descriptive analysis was conducted.

Results: The search strategy retrieved 467 records, of which 40 fulfilled the inclusion criteria. Ten sentinel networks were identified, located in Europe ($n=5$), Central America ($n=1$), North America ($n=3$), and Oceania ($n=1$). Two were designed specifically for overweight and obesity surveillance. Eight used general practitioners or primary care physicians as their key informants; and of these, four utilized electronic medical records for recording information. One of the three sentinel networks that targeted children conducted surveillance through schools.

Conclusion: This review highlights sentinel networks as a valuable option to surveil overweight and obesity and offers a significant step forward towards the subsequent design of new sentinel networks that will address important public health problems such as overweight and obesity.

1 | Introduction

Public health surveillance has been defined as “a core public health function that ensures the right information is available at the right time and in the right place to inform public health decisions and actions” [1]. This implies that the information collected should serve for decision-making on public health action [2]. In order to establish a surveillance program, a number

of issues should be considered, including the target disease or health problem and the surveillance methodology to be used.

One surveillance alternative is sentinel surveillance, where a specific set of informants, for example, health-care providers, agree to report about a condition under surveillance [3]. Sentinels are a finite subunit of a population from which information is obtained proactively and repeatedly through time [4].

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Sentinel surveillance has become an important epidemiological tool to monitor the health of a population, especially for infectious diseases such as influenza. This surveillance targets specific locations or specific populations and obtains information about indicators. This information can then be used to make decisions across larger study areas, reducing costs and resources by limiting sampling units [4]. Data collected routinely from sentinel sites could allow generalizable data to be collected.

A sentinel site is a single or a series of pre-identified locations in which surveillance takes place. Key informants within the sentinel sites are responsible for collecting data [4, 5]. Depending on the risk factor or event being surveilled, sentinel sites could be hospitals, general practices, schools or community facilities, to name a few. To assure the representativeness of the population and the epidemiological portrait and secure external validity, sentinel sites, their location, and key informants must be carefully selected [4].

Noncommunicable diseases (NCDs), also known as chronic diseases, are spreading globally and in all populations [6, 7]. In 2000, the World Health Assembly established a strategy for the prevention and control of NCDs, highlighting the importance of surveillance and monitoring of major risk factors. This measure was reinforced again in 2011 [8, 9]. Additionally, the World Health Organization (WHO) has established a guideline (WHO STEPwise) for countries to implement NCD risk factor surveillance following a three-step approach [10]. Overweight and obesity are among these factors as they are currently considered one of the greatest public health problems of the 21st century, almost tripling their prevalence since 1975 [6, 7]. Even though this guideline does not explicitly mention sentinel network methodology, some aspects resemble the methodology (such as identifying itself as a surveillance system, obtaining prevalences and trends, the intention of representativeness and the repetition over time of the measurements), and the guideline establishes a precedent for the surveillance of these types of diseases and their risk factors.

For instance, a previous review had already established that the sentinel surveillance approach is widely applied to a variety of NCDs, as it ensures regular reporting and its results are sufficiently reliable to be used for health policy development and implementation [8]. The development of an up-to-date sentinel surveillance approach with independence of the source of data gathered, whether by self-report or by anthropometric assessment, could allow for regular data collection and ensure immediate reporting of results. Immediacy could be considered a strength compared to the traditional way of recording these data where the time between collection and publication of results is often long [11]. The implementation of a surveillance system that produces immediate results can facilitate the implementation of more effective and expeditious measures to control the increasing burden of NCDs in general and overweight and obesity in particular.

The aim of this study is to identify the sentinel surveillance networks that monitor overweight and obesity and to describe their characteristics and methodology. The purpose of this study is to illustrate the methodology employed in the surveillance of overweight and obesity with sentinel networks. This will allow the highlighting of gaps and opportunities in its monitoring, as well as for reflection on its future use.

2 | Material and Methods

We conducted a scoping review in accordance with the 2018 guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) [12].

A bibliographic search was carried out in MEDLINE (Ovid and PubMed), Web of Science (WoS), and Scopus, drawn up by an expert (B.C.A.), in May 2024 and updated in November 2024. To locate relevant records, a search strategy was developed using the following MeSH terms and free terms: “obesity,” “overweight,” “sentinel,” “sentinel surveillance,” and “surveillance.” The strategy was adapted to each database included. No language or time frame restrictions were applied. The search strategy can be consulted in the Supporting Information (Table S1).

The objective of the search strategy was the identification of sentinel networks conducting surveillance for overweight and obesity, both specific to these diseases and as a secondary variable. The titles and abstracts were screened blindly by three researchers (G.G., C.C.P., and M.P.R.). Potentially relevant articles were retrieved for full-text reading and screened likewise. To be included, an article should include a sentinel network that monitors overweight and/or obesity or includes anthropometric measurements (weight, height/length, or waist circumference) or body mass index (BMI) as one of the variables recorded. If the article mentioned assessment of the abovementioned variables, but only in the context of an isolated study performed using a sentinel network that had other diseases as targets, the article was not included.

All the references of the included studies were thoroughly reviewed to avoid missing articles or networks. Opinion articles, communications to conferences, and editorials were excluded.

Data extraction was performed in an ad hoc Excel table designed for this study. The variables collected were as follows: name of the sentinel network, year of establishment, country and scope, coordination unit, key informants, source of information, official website, diseases or risk factors being surveilled, details on how overweight/obesity is assessed, targeted population, and whether the study self-identified as representative of the study population. If the sentinel network had an official website, it was consulted to clarify and complement the information provided from the articles included. Lastly, a descriptive synthesis of the main variables of interest was performed. The synthesis consisted of grouping the collected data by considering the patterns within and across the sentinel networks.

3 | Results

3.1 | Bibliographic Search

The search yielded 467 records. After removal of duplicates, 281 records were screened by their titles and abstracts. Fifty-six records were considered for full-text reading. Of those read in full text, 36 met the established criteria. In addition, 11 records were identified from the reference list of included articles, and four fulfilled the inclusion criteria. In total, 40 articles were included in this review (Figure 1).

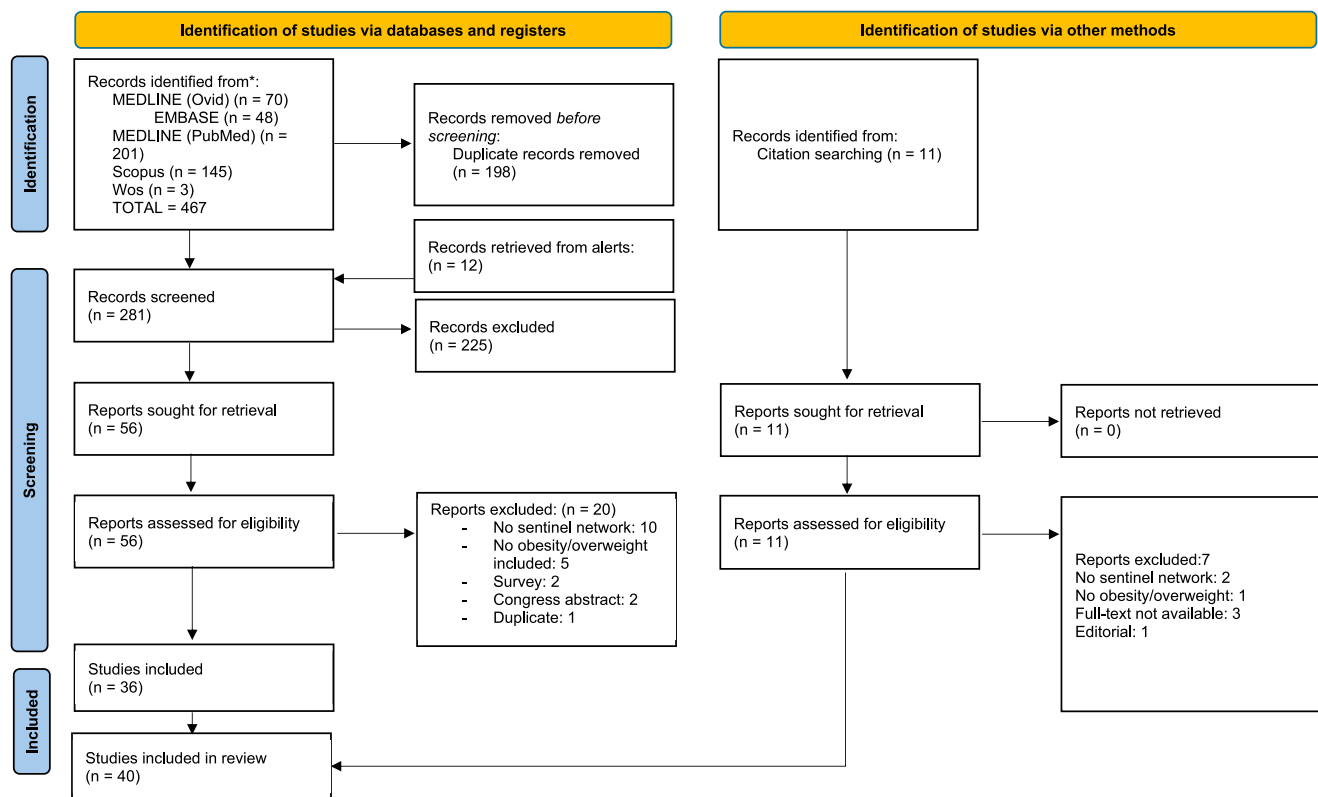


FIGURE 1 | Flow diagram of studies included.

3.2 | Characteristics of Included Studies

Included studies reported on 10 sentinel networks. The number of articles associated with each sentinel network was wide: there were three networks with one article published associated with them, while another network, the Canadian Primary Care Sentinel Surveillance System, had 19 articles related to it (Table S2).

3.3 | General Characteristics of the Sentinel Networks

The sentinel networks were located in Europe, America (Central and North America), and Oceania. The European sentinel networks were based in Spain ($n=2$), Belgium ($n=1$), England ($n=1$), and Hungary ($n=1$). The remaining networks were located in Australia ($n=1$), Canada ($n=1$), Cuba ($n=1$), and the United States ($n=2$) (Table 1). The first sentinel network to be established was the Royal College of General Practitioners Research and Surveillance Centre (RCGP RSC) Sentinel Network from the United Kingdom, which began in 1957. The newest was the Canadian Primary Care Sentinel Network, initiated in 2008. Five of the sentinel networks are known to be still active (two from Spain [13, 14] and one each from England [15], Canada [16], and Australia [17]). However, it should be mentioned that the Spanish sentinel networks no longer monitor overweight and obesity [13, 14].

Four of the sentinel networks have an official website, which could be consulted for more complete information. All of the eight networks that provide information about their coordination

unit were coordinated by public organisms. Half of the sentinel networks were national while the remaining were regional or statewide. Independent of their scope, seven sentinel networks declared they achieve representativeness of the population being surveilled (sentinels from the United Kingdom, Hungary, Belgium, Castile and Leon in Spain, Utah in the United States, Australia, and Canada). The main characteristics of the sentinel networks are presented in Table 1.

Among the 10 sentinel networks identified, only two were exclusively set up for the surveillance of overweight and obesity (Table 2). Regarding the remaining eight sentinel networks, five of them included overweight and obesity (or assessment of BMI without a categorization) as one of the different events targeted for surveillance. In the case of the three remaining sentinel networks, the assessment of overweight and obesity was indirect. The Hungarian sentinel network included their assessment through the surveillance of metabolic syndrome, where one of the criteria for considering this last disease was the presence of abdominal obesity measuring waist circumference. The Belgian sentinel network included overweight and obesity in the assessment of diabetes mellitus [18]. Finally, the UK sentinel network recorded BMI in their database but did not perform overweight or obesity surveillance per se.

3.4 | Sentinel Sites and Population

The number of sentinel sites varied; while the Children's Sentinel Nutrition Assessment Program from the United States included six sentinel sites [19], the sentinel network from the United Kingdom included 1700 general practices as sentinel sites. Nine

TABLE 1 | Main characteristics of the sentinel networks.

Sentinel network (year of establishment)	Country	Scope (national, regional/ statewide, local)	Coordinated by	Population	Key informants	Sources of information	Official website	Is the sentinel network still active?
Royal College of General Practitioners Research and Surveillance Centre (RCGP RSC) Sentinel network (1957)	United Kingdom	National	Royal College of General Practitioners, University of Oxford and UK Health Security Agency (UKHSA)	Patients registered in the participating general practices	General practitioners	1700 general practices	https://www.rcgp.org.uk/rsc	Yes
Hungarian General Practitioners' Morbidity Sentinel Stations Program (HGPMSSP) (1998)	Hungary	National	School of Public Health, University of Debrecen and The National Public Health and Medical Officer Service	Patients registered in the participating general practices	General practitioners	192 general practices from 11 counties	NS	NS
Utah's Height and Weight Measurement Project (NS)	United States (Utah)	Regional/ Statewide	Utah Department of Health (UDOH)	Children from grades 1, 3 and 5 from elementary school	School nurses	69 elementary schools	NS	No
Children's sentinel nutrition assessment program (1998)	United States (NS)	Regional/ Statewide	NS	Caregiver of children aged zero to 3 years	NS	6 sentinel sites (acute care and primary care clinics and hospital emergency departments)	NS	No

(Continues)

TABLE 1 | (Continued)

Sentinel network (year of establishment)	Country	Scope (national, regional/ statewide, local)	Coordinated by	Population	Key informants	Sources of information	Official website	Is the sentinel network still active?
Sentinel Practices Data Sourcing (SPDS) (2013)	Australia (New-South Wales)	Regional/ Statewide	Illawarra-Shoalhaven Medicare Local (New-South Wales)	Patients registered in the participating general practices	General practitioners	52 general practices	https://www.coordinare.org.au/about-us/our-region/spds-project	Yes
Vigilancia Nutricional Materno-infantil mediante sitios centinelas (Maternal and Child Nutrition Surveillance through Sentinel Sites) (2002)	Cuba	National	Instituto de Nutrición e Higiene de los Alimentos (INHA)	Pregnant women and children < 1 year from health care areas selected	General practitioners and nurses	30 general practices (considering those with the highest and lowest low birthweight index in each province)	NS	NS
Sentinel practice network in the Basque Country (1986)	Spain (Basque Country)	Regional/ Statewide	Basque country health service	Patients registered in the participating primary care physician	Primary care physicians	61 primary care physicians	https://www.euskadi.eus/informacion/red-vigilancia-vigilancia/web01-a2gai-xo/es/	Yes (but only does surveillance on acute respiratory diseases). Obesity was surveilled during 1996.

(Continues)

TABLE 1 | (Continued)

Sentinel network (year of establishment)	Country	Scope (national, regional/statewide, local)	Coordinated by	Population	Key informants	Sources of information	Official website	Is the sentinel network still active?
Health sentinel network of Castile and Leon (1989)	Spain (Castile and Leon)	Regional/Statewide	Health service of Castile and Leon (public health general direction)	Patients registered in the participating primary care physician	Primary care physicians, nurses, pediatricians and epidemiologist	300 primary care professionals	https://www.saludcastillayleon.es/profesionales/centinelas	Yes (but it does not surveille overweight or obesity) Obesity was included in 1993 and from 2005 to 2009.
Canadian primary care sentinel surveillance system (2008)	Canada	National	College of Family Physicians of Canada and Public Health Agency of Canada	Patients registered in the participating primary care physician	Family physicians, nurse practitioners and pediatricians	1200 primary care physicians divided in 14 practice-based research networks (PBRN)	https://cpspn.ca/	Yes
Belgian family doctors' sentinel practices (NS)	Belgium	National	NS	Patients registered in the participating general practices	General practitioners	136 general practices	NS	NS

Note: Data were recorded as mentioned in each article. For that reason, some of the terminology might not be consistent within the table. Abbreviation: NS: not specified.

TABLE 2 | Overweight and obesity specific details of the sentinel networks.

Sentinel network	Is it exclusive for overweight or obesity surveillance?	If it is not exclusive for overweight or obesity, specify targeted diseases	How is overweight or obesity categorized?	How is data obtained? (exclusively for overweight and obesity)	How is information recorded? (In general, not exclusive for overweight and obesity)
Royal College of General Practitioners Research and Surveillance Centre (RCGP RSC) Sentinel network	No	Communicable and respiratory disease, environmentally sensitive, water and food-borne disorders, and vaccine effectiveness	BMI considering overweight as BMI 25.0–29.9 kg/m ² and obesity as BMI $\geq$ 30 kg/m ²	NS	Computerized medical record data
Hungarian General Practitioners' Morbidity Sentinel Stations Program (HGPMSSP)	No	Non-communicable diseases (hypertension, diabetes mellitus, liver cirrhosis, metabolic syndrome, ischemic heart disease, acute myocardial infarction, stroke, malignant neoplasm of colon and rectum, breast, cervix, and prostate)	Abdominal obesity as waist circumference > 102 cm in men and > 88 cm in women	Anthropometric assessment + survey	NS
Utah's Height and Weight Measurement Project	Yes	NA	BMI Z scores calculated and categorized on the basis of growth curves established by CDC	Anthropometric assessment	NS
Children's sentinel nutrition assessment program	No	Weight, length, breastfeeding history, household sociodemographic data, child health status, hospitalizations, federal assistance program participation and food security	Z scores for weight for age, length for age, and weight for length. Categorized overweight as weight-for-age > 95th percentile or weight-for-length > 90th percentile or in case $\geq$ 2 years old BMI-for-age > 95th percentile (using CDC reference values)	Anthropometric assessment + survey	Surveys
Sentinel Practices Data Sourcing (SPDS)	No	Obesity, overweight, diabetes mellitus, hypertension, asthma, chronic obstructive pulmonary disease, mental health disorders, (depression and anxiety), coronary heart disease, stroke, and chronic bone disease (osteoarthritis and osteoporosis)	BMI considering overweight as BMI 25.0–29.9 kg/m ² and obesity as BMI $\geq$ 30 kg/m ²	Anthropometric assessment	Electronic medical record (EMR)

(Continues)

TABLE 2 | (Continued)

Sentinel network	Is it exclusive for overweight or obesity surveillance?	If it is not exclusive for overweight or obesity, specify targeted diseases	How is overweight or obesity categorized?	How is data obtained? (exclusively for overweight and obesity)	How is information recorded? (In general, not exclusive for overweight and obesity)
Vigilancia Nutricional Materno-infantil mediante sitios centinelas (maternal and child nutrition surveillance through sentinel sites)	Yes	NA	Children: Z scores categorized overweight as $> +2$ and $+3$ standard deviations and obesity as $> +3$ standard deviations using WHO 2006 values. Also categorized overweight as BMI between 90 and 97 percentile and obesity as BMI > 97 percentile using Cuban references. Pregnancy: not stated	Anthropometric assessment + survey	NS
Sentinel practice network in the Basque country	No	Diabetes mellitus, coronary heart disease and their respective risk factors (overweight and obesity, smoking, blood pressure, and hypertension) and chronic complications (retinopathy, nephropathy, neuropathy, macroangiopathy). Acute respiratory diseases	BMI considering overweight as BMI 25.0–29.9 kg/m ² and obesity as BMI ≥ 30 kg/m ²	Anthropometric assessment + survey	NS
Health sentinel network of Castile and Leon	No	Infectious diseases and non-communicable diseases (this network change each year the targeted diseases for surveillance). Obesity was included in 1993 and from 2005 to 2009.	NS	Anthropometric assessment + survey	Electronic medical record (EMR)
Canadian Primary Care Sentinel Surveillance System	No	Non-communicable diseases such as hypertension, diabetes, dyslipidemia, chronic obstructive pulmonary disease, osteoarthritis, depression, dementia, epilepsy and parkinsonism, medications prescribed, BMI, blood pressure, and laboratory tests results	BMI (not categorized)	NS	Electronic medical record (EMR)

(Continues)

TABLE 2 | (Continued)

Sentinel network	Is it exclusive for overweight or obesity surveillance?	If it is not exclusive for overweight or obesity, specify targeted diseases	How is overweight or obesity categorized?	How is data obtained? (exclusively for overweight and obesity)	How is information recorded? (In general, not exclusive for overweight and obesity)
Belgian family doctors' sentinel practices	No	Diabetes type 2 and infectious diseases (not specified)	BMI considering obesity as BMI ≤ 29 kg/m ²	Surveys	NS

Note: Data were recorded as mentioned in each article. For that reason, some of the terminology might not be consistent within the table.
Abbreviations: BMI: body mass index; NA: not applicable; NS: not specified.

of the sentinel networks collected data through sentinel sites in primary care (hereafter referred to as general practices). Alternatively, Utah's Height and Weight Measurement Project selected 69 elementary schools as their sentinel sites [20]. This sentinel network performed a pilot study that determined the grades needed to assess overweight and obesity in Utah (Grades 1, 3, and 5) (Table 1).

Seven sentinel networks focused on the general population, and the remaining three focused on children. The targeted population of the Children's Sentinel Nutrition Assessment Program was the caregivers of children aged 0–3 years old, while the sentinel network from Cuba targeted children 1 year or older and pregnant women [21]. Utah's Height and Weight Measurement Project focused on school-aged children.

3.5 | Obesity and Overweight Categorization

All of the sentinel networks that surveilled the general population used BMI to classify overweight and obesity, except for the Hungarian sentinel network, which considered waist circumference. To assess overweight or obesity in children, both US sentinel networks considered z scores (for BMI, weight for age, length for age, weight for length) using the Centers for Disease Control and Prevention (CDC) reference values. The Cuban sentinel network used the WHO 2006 reference values and Cuban-specific references for children. The cutoff points considered in each sentinel network are presented in Table 2.

3.6 | Data Collection Methods

Out of the 10 sentinel networks, eight rely on general practitioners (GPs) or primary care professionals and nurses as their key informants. It should be noted that the British, the Australian, the Canadian, and the Spanish (Castile and Leon) networks specified that they analyzed the electronic medical records (EMR) of voluntarily participating GPs to obtain information. Data were collected and extracted from the EMR that GPs generally use for recording patients' details. The rest of these sentinel networks stated only that they used GPs as their informant, but details about how information was recorded were missing. The key informants from the Utah network were school nurses who worked specifically for this sentinel network. There is one child sentinel network that did not state who their key informants were but specified that they recorded the information through surveys completed by staff from the sentinel network. Seven sentinel networks stated that they collected anthropometric measurements (Tables 1 and 2).

4 | Discussion

Sentinel networks have typically been used for the surveillance of infectious diseases, mostly influenza and acute respiratory infections [22]. Nevertheless, this situation is changing, and now, a wide spectrum of diseases, health events, and/or risk factors are the target of sentinel surveillance. In this review, we identified 10 sentinel networks, located in Europe, America, and Oceania, that include surveillance of overweight and obesity. Even

though some networks are no longer active or do not currently monitor overweight and obesity, they provide valuable and complete insight into the methodology of sentinel networks for these diseases. For those regions or countries where the prevalence of overweight and obesity is of concern, assessing the implementation of an epidemiological surveillance system with a sentinel component could be valuable. The findings highlight that sentinel networks are a feasible approach for monitoring NCDs.

Sentinel surveillance offers the opportunity to inform about health events across larger study areas using a segment of a population that is surveilled repeatedly. The use of sentinel networks for data collection is an attractive proposition, given the inherent challenges and costs associated with conducting a representative survey, particularly on a national scale. Population-based surveys require more labor, time, and materials, limiting the capacity for NCD surveillance. For instance, Alwan et al. reported as inadequate the ability of 23 LMICs (low- and middle-income countries) to conduct surveillance of NCDs through national surveys [9, 23]. Since sentinel networks use a subunit of a population and key informants, it is more feasible because of the reduction in costs, effort, and resources [4]. In addition, the immediate collection of information allows for early identification and possible immediate action on the risk factor or event.

Two key pillars—the involvement of GPs and the involvement of schools in networks focused exclusively on children—were found to be central sources of information for sentinel networks.

4.1 | Sentinel Surveillance Involving GPs

4.1.1 | Utilization of EMRs

In the sentinel networks where GPs acted as key informants, the utilization of EMRs was a common practice. The sentinel from Australia performed a feasibility pilot study and concluded that using EMR could lay the foundation for a valid and sensitive surveillance program of NCDs, including overweight and obesity [11]. Nevertheless, there are some key aspects that should be considered. First, the use of EMRs for sentinel surveillance presents both strengths and limitations. EMRs are typically recorded for clinical, not for research, purposes [24]. This means that EMRs are being used as a secondary source of information, since their main purpose is not surveillance. This could mean that data might be unstructured, incomplete, or inconsistent. The surveillance systems rely on structured data to monitor population health [25]. The lack of unification and standardization could be a challenge. Setting standards for terminology and quality and offering training to GPs could help alleviate these concerns [25]. If GPs know they are acting as key informants, they might make a greater effort to obtain quality information in a standardized way. Thinking ahead, standardization may allow comparisons over time between sentinel sites or even between participating key informants [26].

Second, EMRs are data routinely collected in general practices. This means that for the GP surveillance reporting, there should not be an extra workload. Taking into consideration that sentinel networks rely mostly on the voluntary participation of key informants, the use of EMRs could be an advantage to improve

participation, which will in turn indirectly improve the representativeness of the population being studied. The more key informants involved, the better the representativeness. It has been shown that the success of a sentinel site relies on the motivation of participating stakeholders, in this case, the GPs [11].

Finally, some uncertainties remain regarding who or what organizations should have access to EMR. National regulations or government authorization for access to the information before starting with sentinel network surveillance should be considered [25].

Despite these potential limitations, the use of EMRs as a source of information from sentinel networks is undoubtedly a very valuable and affordable option. According to the study by Meci et al., who conducted an inventory (Sentiworld) of sentinel networks based on general practices (where all of them performed communicable disease surveillance), almost 30% of the sentinel networks that participated in the study ($n=48$) use EMRs, demonstrating that these are widely employed. In fact, they have been used for several years in the surveillance of communicable diseases with sentinel networks [22]. For instance, the Massachusetts' sentinel surveillance network for influenza-like illness is based on the use of the Electronic Medical Record Support for Public Health (ESP) surveillance platform, a model system that leverages EMR data to seamlessly exchange information between providers and public health departments [27]. In addition, a great example among the sentinel networks included in this review is the Canadian Primary Care Sentinel Surveillance System, a robust sentinel network that relies on the use of EMRs and is considered to have achieved high data quality and representativeness [24].

4.2 | Possible Biases

A potential bias may emerge when relying on GPs, given that only those who seek care would be represented in the sentinel network and not all people who attend the GP might be measured and weighed. Evidence from Australia and Canada does not support this bias, although the applicability may depend on context and the way health-care access is structured within a given country. Research indicates that between 80% and 90% of the population of Australia and Canada have access to and utilize the services of GPs frequently, at least once a year [28, 29]. For example, considering this percentage and the number of GPs participating in the Canadian sentinel network (more than 1000), it is understood that the representativeness of the sample is sufficient to yield reliable data. However, the context in which a sentinel network will be implemented should not be ignored, especially in the selection of its sentinel sites and key informants. It can be reasonably assumed that utilizing GPs for a sentinel network in the United Kingdom or Spain, where registration with a GP is mandatory and health care is public and universal, will yield different results when compared to the United States, where access to health-care is mainly privatized [30, 31].

Regarding sentinel surveillance specific for overweight and obesity, it has been argued that patients with “obesity-related comorbidities” are more likely to be weighed and measured during their visits to their GPs [32, 33]. A systematic review found

evidence to suggest that recording BMI assessment was most likely performed among patients with the highest BMI [32]. The case of encountering documentation bias has been observed in other risk factors such as alcohol consumption. A study using the Canadian Primary Care Sentinel Surveillance Network repository found that alcohol use was infrequently recorded. However, patients with documentation of alcohol use tended to be male, be older, and visit a GP more than three times a year [34]. Considering the existence of this bias for alcohol documentation and that the Canadian network conducts surveillance of overweight and obesity, there could be a possibility of this bias for the variables under study in this review. Nevertheless, while this issue undoubtedly introduces a certain degree of bias, it is reasonable to suggest that this may not be a problem if GPs know they are acting as key informants. Moreover, since risk factor surveillance is mainly interested in trends rather than specific data at a specific time, the same bias would be maintained over time, which is not a major problem. Another potential solution is to establish quality standards and provide training for GPs, which is a common practice in sentinel networks that include GPs, emphasizing the importance of documenting measurements for all patients within their practice.

4.3 | Surveillance in Children

In this review, few networks were identified that were designed to monitor overweight and obesity in children and/or adolescents. Nevertheless, Utah's Height and Weight Measurement Project provided an interesting approach [20]. First, this sentinel network considered schools as sentinel sites, which is very promising. Schools present themselves as an appropriate place to monitor overweight and obesity in children. In fact, the WHO had been measuring trends in overweight and obesity through primary schools since 2007 in their European Childhood Obesity Surveillance Initiative (COSI) [35]. This is a survey based on nationally representative samples, in which primary schools for each country are sampled to participate. Since its beginning, five waves of this survey have been collected [36]. For each wave, participating countries could decide whether to select a new sample of schools or to repeat the same school from the previous wave. If they chose this last option, the schools were named sentinel sites, but this name is a simple coincidence in the terminology. The methodology of this initiative itself is not that of a sentinel network, since it does not use sentinel informants to obtain the information but rather conducts repeated surveys over time [37]. Regarding this initiative, a study highlighted that among the 36 participating countries, overweight and obesity were common among children from the WHO European Region, with pooled estimates of 28.7% for boys and 26.5% for girls [38]. Another initiative from the city of New York has also proposed the surveillance of obesity through public schools [39]. Using different sources (administrative databases, the US Census, the NYC FITNESSGRAM, or the American Community Survey, among others), they created one record for each student for each year of attendance in public school. This dataset was then used to define the New York City (NYC) public school student and construct prevalence and trend estimates for BMI surveillance. Even though none of these initiatives use sentinel network surveillance, it should be noted that using schools is a well-established method for conducting epidemiologic

surveillance in children. The Utah project conducted a pilot study to select sentinel grades and determined to be Grades 1, 3, and 5 [20]. They found that the use of randomly selected classes within sentinel grades resulted in decreased sample size and less school disruptions while maintaining sufficient precision. All children from the selected class in each grade were weighed and measured by previously trained school nurses.

4.4 | Future Impacts Derived From Sentinel Surveillance

The results obtained from a sentinel network are of particular relevance in setting the path for subsequent public health interventions, as they can identify changes in trends in a timely manner, for example, by highlighting population groups at higher risk of overweight and obesity that need to be emphasized. However, the institutions that coordinate these networks are often not the same as those that implement the interventions, limiting the capacity of identifying those interventions and actions. Nevertheless, it was possible to identify that the Canadian network served to highlight population groups at a higher risk of weight gain (aged 25–44) [40]. The Canadian sentinel network data also served as a starting point for the creation of the 5As Team (5AsT) program, which is committed to advancing obesity prevention and management in primary care through educational interventions for GPs and patients. Additionally, one of the studies conducted on the Australian sentinel network mentions identifying geographic zones on which to focus efforts, which differentiates its results from those obtained with national surveys [17].

4.5 | Strengths and Limitations

This study is not without its limitations. We are aware that sentinel networks that do not publish their results in journals might be missing. Also, if they published their results but the article did not mention overweight or obesity results in some way, they were not considered in this review. However, the references of the articles included were rigorously examined, and government reports, if available, were identified and assessed, thereby potentially reducing the loss of possible sentinel networks. In addition, the search strategy was thoughtfully designed, and it was conducted in different databases, and no time or language restrictions were applied. All studies that surveilled NCDs were evaluated to check if they included overweight and obesity. For these reasons, we believe that most of the sentinel networks were identified, even inactive ones, and the loss of information should be minimal. The inclusion of inactive sentinel networks could be considered a limitation, since some of them might be outdated. Nevertheless, in practice, we consider that their inclusion provides a broad view of the functioning of networks, which then makes it possible to assess the strengths and limitations of sentinel networks. Finally, we are aware that no sentinel networks in Asia or in Africa have been identified. In light of this, we are unable to ascertain if this is because they do not monitor overweight and obesity, taking into consideration that they have lower prevalences than those observed in Europe or the Americas [41], or if this is because they do not have sentinel surveillance systems.

5 | Conclusion

Sentinel networks for overweight and obesity surveillance are used widely, either exclusively or as part of a wide range of monitored diseases. Most of them work with GPs as key informants, and the utilization of EMR is a unique alternative that seems affordable. For child overweight and obesity surveillance, schools as sentinel sites deserve consideration. This review offers a comprehensive review of the methodology and practical issues employed by sentinel networks in the context of overweight and obesity. The distinctive attribute of sentinel networks of immediacy may prove especially advantageous in the context of overweight and obesity, as it offers the potential for rapid response in the identification and management of these conditions. This is a significant step forward towards the subsequent design of new sentinel networks that will address important public health problems such as overweight and obesity.

Acknowledgments

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are openly available in MEDLINE (Ovid and PubMed), Web of Science (WoS), and Scopus.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Table S1:** Search strategy. **Table S2:** References for articles associated with each sentinel network.