

**2021 Annual global report on public  
health intelligence activities as part of the  
WHO Health Emergencies Programme**

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## Foreword



Early detection and rapid response to public health threats is essential to save lives and safeguard communities' wellbeing. It is one of the World Health Organization's (WHO) most important activities.

WHO first formally established a mechanism for detecting, verifying and information sharing of infectious disease outbreaks as part of global disease surveillance in 1997. With the implementation of the International Health Regulations (2005) (IHR) this expanded to all public health threats (all-hazards approach).

Today WHO has dedicated teams at Headquarters and in regional offices that conduct public health intelligence activities 24 hours per day, every day of the year, in close collaboration with WHO country offices, national governments and partners.

This report is the first global report on public health activities which describes the public health events detected, assessed and reported from 2002-2021, with a focus on the year 2021. It builds on excellent previous bi- and tri-regional reports by the WHO Region of the Americas, the WHO European Region and the WHO African Region.

The report underlines the breadth and depth of work that WHO undertakes as part of the routine public health intelligence activities. Over 7500 events were recorded globally between 2002 and 2021. Moreover, in 2021 alone, 41 rapid risk assessments, 103 event publications and 127 announcements for State Parties (through NFPs), and 38 Disease Outbreak News posts were produced and disseminated to assess risk and ensure timely information sharing.

This report underscores three key trends in public health intelligence. First, even though the majority of public health events were of infectious nature, a substantial number were of animal/zoonotic aetiology or caused by natural disasters. As climate change becomes more pronounced, the impact on public health events will grow. This makes a One Health approach a priority for public health intelligence activities.

Second, the importance of the IHR framework and engagement between WHO and State Parties is highlighted. Collaboration for event detection, verification, risk assessment and information sharing is essential to initiate rapid response and mitigate the impact of public health events.

Third, an increase of public health events globally as well as the occurrence of large-scale public health events, such as the COVID-19 pandemic, the 2013-16 Ebola outbreak in West Africa and the 2015-2016 Zika virus disease outbreak in Latin America, was observed. Even though public health intelligence activities continued unabated there was a direct impact on routine activities as resources were diverted to respond to these outbreaks. This emphasises the need for sufficient resources to maintain routine activities while simultaneously also responding to considerable public health threats.

Public health intelligence is an essential part of the global public health response. In the coming years, climate change and other hazards will further increase public health events globally. To ensure a timely and robust health response a strong public health intelligence infrastructure is key. Together, we can make that possible.

**Dr. Ibrahima Socé Fall**

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This global public health intelligence report builds on previous reports produced by the WHO Regional Office for the Americas, the WHO Regional Office for Europe and the WHO Regional Office for Africa, which were led by the WHO Regional Office for the Americas.

This report is a collective work by all Public Health Intelligence Teams in the WHO regional offices and in the Department of Alert and Response Coordination (ex-HIM), Emergency Response, WHO Health Emergencies Programme. A core team produced the initial draft and coordinated the response and feedback to the report, they included; Neil J. Saad, Esther Hamblion, Adedoyin Awofisayo-Okuyelu, Blanche Greene-Cramer, Dubravka Selenic Minet, Katrina Roper with data extraction, cleaning and analyses done by Neil J. Saad, Savina Ognianova and Xi Li.

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## Abbreviations

AFR	WHO African Region
AMR	WHO Region of the Americas
COVID-19	Coronavirus Disease 2019
DONs	Disease Outbreak News
ECDC	European Centre for Disease Prevention and Control
EIS	Event Information Site for International Health Regulations National Focal Points
EIOS	Epidemic Intelligence from Open Sources
EMR	WHO Eastern Mediterranean Region
EMS	Event Management System
EUR	WHO European Region
FAO	Food and Agriculture Organization
GLEWS+	Joint FAO–OIE–WHO Global Early Warning System
IHR	International Health Regulations (2005)
NFPs	National International Health Regulations Focal Points
OIE	World Organisation for Animal Health
PHEIC	Public Health Emergency of International Concern
RRA	Rapid Risk Assessment
SEAR	WHO South-East Asia Region
WHO	World Health Organization
WPR	WHO Western Pacific Region

## Executive summary

Since 1997, the World Health Organization (WHO) has established a mechanism for outbreak detection, verification, and information sharing as part of global disease surveillance. With the entry into force of the International Health Regulations (2005) (IHR) in June 2007, WHO and States Parties committed to detect, verify, assess and report events that may pose a threat to global health security. Through the IHR channels, WHO and States Parties maintain surveillance, reporting, and response capacities at country, regional, and global levels not only for infectious diseases and other categories of potential health related threats (all-hazards approach). Timely communication of potential public health threats enables rapid implementation of response measures and mitigate risk.

This report describes public health events detected, assessed, and reported from 2002 to 2021, primarily focussing on the year 2021. The data on public health events that occurred in member states were recorded by WHO in its Event Management System (EMS), a password-protected web-based tool accessible to professional personnel at WHO Country, Regional, and Headquarter Office levels.

Between 2002 and 2021, a total of 7 572 events were recorded globally in EMS. Only a small proportion (5%) were unverifiable or had no designation, emphasizing the effectiveness of the IHR framework for surveillance and reporting of public health events globally. Of the events requiring verification by IHR National Focal Points, during 2021, 48% of responses to verification requests across WHO Regions were received within 24 hours.

In 2021 alone, among 335 substantiated events recorded in EMS, the majority (63%) were of infectious origin. Other events, such as those related to food safety, natural disasters, chemical, hazards, and sequelae of civil conflicts, also contributed to the burden of international public health events.

WHO conducted and disseminated 41 rapid risk assessments in 2021, of which six were related to COVID-19. In addition, 103 publications on the Event Information Site (EIS) for National IHR Focal Points (disseminated to State Parties via their National Focal Points), on various hazards, and 127 announcements were published on EIS, the latter mainly relating to additional health measures in response to COVID-19. In addition, 38 Disease Outbreak News were disseminated to the general public via WHO webpages. Finally, situation reports on specific events were published including 52 COVID-19 Weekly Epidemiological Updates and numerous region-specific updates.

This report highlights the importance of the IHR framework and engagement between WHO and States Parties for all public health hazards, particularly related to event detection, verification, risk assessment, and information sharing. The COVID-19 pandemic has underscored the importance of public health intelligence activities as an essential part of the global public health response. Given

this, there is an urgent need to continue and sustain resources, funding, and IHR compliance and enforcement mechanisms at the global level.

## 1. Introduction

The International Health Regulations (2005) (IHR) is an international legal framework that facilitates global efforts for detection, verification, risk assessment, and dissemination of information on public health events that may threaten public health security.

Under the IHR, 196 States Parties around the world, including all 194 WHO Member States, Liechtenstein and the Holy See, committed to strengthen their national surveillance and response capacities to improve international surveillance and reporting mechanisms of public health events. As part of WHO's accountability and transparency, actions undertaken under the IHR are documented using internal recording procedures and tools. Annex 1 provides an overview of WHO member states by WHO region.

Since 2012, the WHO Regional Office for the Americas and the WHO Regional Office for Europe have prepared yearly joint reports to share with member states. These bi-Regional reports included figures on event detection, the initial source of information, designation and type of hazard. In 2016, the WHO Regional Office for Africa began participating in the joint report creating a tri-Regional report. Following joint discussions in 2021, the three remaining WHO Regional Offices - the WHO Regional Office for the Eastern Mediterranean, the WHO Regional Office for the South-East Asia, and the WHO Regional Office for the Western Pacific - also participated in the annual report, thus creating the first global public health intelligence report.

In the spirit of WHO transparency and accountability, the joint reports were previously disseminated through the secure Event Information Site (EIS)<sup>1</sup> for National IHR Focal Points (NFPs)<sup>2</sup> and the WHO Regional Offices' websites<sup>3, 4, 5</sup> since 2014. The 2021 report will also be distributed to WHO Member States through the EIS platform and be available for wider distribution through the WHO Regional Offices' websites and the WHO headquarters' website

The aim of this report is to provide an overview and analysis of public health events recorded by WHO between 2002 and 2021, and related WHO information products with a particular focus on the events that occurred in 2021, globally and by WHO Region.

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<sup>1</sup> The Event Information Site for the National IHR Focal Points is a website developed by WHO to facilitate secure communications with National IHR Focal Points as part of IHR implementation

<sup>2</sup> The IHR NFP is "the national centre, designated by each State Party which shall be accessible at all times for communications with WHO IHR Contact Points under these Regulations". Information available at:

<https://www.who.int/teams/ihr/national-focal-points>

<sup>3</sup> WHO Regional Office for the Americas: <https://www.paho.org/en/dva-annual-report> ;

<sup>4</sup> WHO Regional Office for Africa: <https://www.afro.who.int/publications>

<sup>5</sup> WHO Regional Office for Europe: <https://www.euro.who.int/en/home>

## 2. Methodology

Events of potential international public health concern are mainly detected through either public health intelligence activities, which includes event-based surveillance activities that is currently mainly conducted using the Epidemic Intelligence from Open Sources (EIOS) system, or through direct reporting by States Parties to WHO using NFP channels (urgent communications under IHR 2005, European Commission’s Early Warning and Response System), other governmental channels (e.g., the Ministry of Health and national government agencies), or partner networks (e.g., other United Nations agencies and the Global Outbreak, Alert and Response Network).

Information for each detected and assessed event presented in this report was documented and recorded in the WHO Event Management System (EMS)<sup>6,7</sup>. EMS is a password-protected web-based tool accessible to professional personnel at the three levels of WHO: country office, regional office and headquarters, subject to completion of relevant training. The criteria for entering information into EMS include any event-related urgent communication under the IHR (e.g., an event notified by a State Party;<sup>8</sup> an unofficial report for which a request for verification is sent to a State Party;<sup>9</sup>), but also any events for which WHO assistance is requested, or that might pose a reputational risk to WHO. EMS is not intended to be an exhaustive database of all public health events occurring worldwide and contains entries of some potential acute public health events that, after verification, were discarded (no international risk expected) or were deemed not to constitute an outbreak.

An initial risk assessment is conducted after a signal is detected and verified as an event or when events are notified to WHO. Assessed events that may pose a risk to international public health are communicated to States Parties through a post on EIS. EIS is a WHO platform used for communication by WHO to NFPs. Assessed events may also undergo a formalised rapid risk assessment (RRA), which is an internal risk assessment that involves all three levels of WHO, and is conducted for events with

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<sup>6</sup> EMS is the central electronic repository for event-related information. National IHR Focal Points and relevant government communications, event details, WHO assessments and decisions are documented and recorded in EMS. EMS does not function as a repository of information on all the outbreaks occurring worldwide. Rather, its objective is to support event management accountability.

<sup>7</sup> Early detection, assessment and response to acute public health events: implementation of early warning and response with a focus on event-based surveillance. <https://www.who.int/publications/i/item/WHO-HSE-GCR-LYO-2014.4>

<sup>8</sup> Pursuant to the IHR (2005), Article 6, Notification: “Each State Party shall assess events occurring within its territory by using the decision instrument in Annex 2. Each State Party shall notify WHO, by the most efficient means of communication available, by way of the National IHR Focal Point [IHR NFP], and within 24 hours of assessment of public health information, of all events which may constitute a public health emergency of international concern within its territory in accordance with the decision instrument, as well as any health measure implemented in response to those events.”

<sup>9</sup> Pursuant to the IHR (2005) Article 10, Verification: “1. WHO shall request, in accordance with Article 9, verification from a State Party of reports from sources other than notification or consultations of events which may constitute a public health emergency of international concern allegedly occurring in the State’s territory. In such cases, WHO shall inform the State Party concerned regarding the reports it is seeking to verify.”

serious public health implications following pre-defined criteria within WHO<sup>10</sup>. The outcome and summary of the RRA may be communicated to the international community through a variety of channels, including: EIS postings, Disease Outbreak News (DONs), websites, external situation reports, bulletins of WHO Headquarters, Regional and Country Offices, and disease-specific networks.

For this report, data on public health events were extracted from EMS. Events were included based on the creation date within the system between 1 January 2002 to 31 December 2021. Data on EIS posts were extracted from EIS. Information on EIS posts that were posted between 1 January 2017 and 31 December 2021 was extracted. Data on RRAs was extracted from EMS into a bespoke database for the report, with information extracted for RRAs published between 1 January 2017 and 31 December 2021. Data on DONs was extracted from an internal WHO database, with information extracted for DONs published between 1 January 2017 and 31 December 2021.

Results on event detection, event designation, initial source of event information, type of hazard, diseases or conditions, and information dissemination are presented in tables or figures. Data was presented as averages, medians or aggregate by WHO Region or over time. Tables and figures were created using R (version 4.0.3, R Foundation for Statistical Computing, Vienna, Austria) and RStudio (version 1.3.1093, Boston, MA, USA).

Previous and future reports may show minor differences due to routine updates and cleaning of EMS, EIS and DON data.

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<sup>10</sup> World Health Organization. Guidance on using the “Rapid risk assessment, acute events of potential public health concern” template. Version 2.0.

### 3. Definitions

- *Public health intelligence*, is a core public health function responsible for identifying, collecting, connecting, synthesizing, analysing, assessing, interpreting and generating a wide range of information for actionable insights and disseminating these for informed and effective decision-making to protect and improve the health of the population.
- *Event*, the IHR defines an event as a manifestation of disease or an occurrence that creates a potential for disease (this can include events that are infectious, zoonotic, food safety, chemical, radiological or nuclear in origin and whether transmitted by persons, vectors, animals, goods/food or through the environment.). Due to inherent differences in pathogen presence, epidemiological dynamics, socio-political factors, climatic conditions and other disease drivers of what might constitute an event in one geographical area at a certain time might not be sufficient to meet the threshold for an event in another area at a comparable or different time. Therefore, the categorization of events will vary between WHO Regions. When comparing events between WHO Regions the underlying dynamics that influence the emergence, spread and impact of acute public health events should always be taken into account.

During the risk assessment process within EMS, each entry is designated as:

- *Substantiated*, when the presence of a hazard is confirmed or the number of human cases exceeds normal thresholds;
- *Discarded*, when no international risk is expected;
- *No outbreak*, when the number of human cases or hazard reported is within the normal limits of occurrence;
- *Unverifiable*, when no information is forthcoming from the NFP or responsible national authority to substantiate its occurrence, despite the best efforts to obtain such information.
- *Under verification*, when the entry continues to be undergoing the process of verification.
- *No designation*, when no information regarding the designation is available.

Hazards are categorized into seven categories:

- *Animal or zoonosis*, if there is potential harm to public health from a zoonosis;
- *Chemical*, if there is potential harm to public health from the toxic effects of chemical substances, which are chiefly non-medical, as to source;
- *Disaster*, if there is potential harm to public health from a natural disaster;
- *Food safety*, if there is potential harm to public health from the toxic effects of food (poisoning or injury);
- *Infectious*, if there is potential harm to public health from an infectious disease;

- *Other*, which includes the following hazards:
  - *nutritional deficiency*, if there is potential harm to public health from nutritional deficiencies;
  - *radionuclear*, if there is potential harm to public health from the toxic effects of ionizing radiation;
  - *societal*, if there are violent or hostile events, caused by humans, which have an impact on public health
  - *undetermined*, if there is potential harm to public health from an undetermined hazard.
- *Product*, if there is potential harm to public health from contaminated or faulty therapeutic goods including medicines, blood products, tissues and organs, medical devices, diagnostic tests and devices, etc., including poisonings due to mislabelling of therapeutic good



## 4. Results

### 4.1. Event detection

This Section summarizes the entries recorded in EMS since 2002 over time and by WHO Region. This will include entries that were, after verification, designated as substantiated public health events as well as entries that were discarded (no international risk expected) or deemed no outbreak after verification (more details on event designation are provided in Section 4.2.). Therefore, when referring to events or public health events in this Section it refers to all entries in EMS, regardless of their designation status.

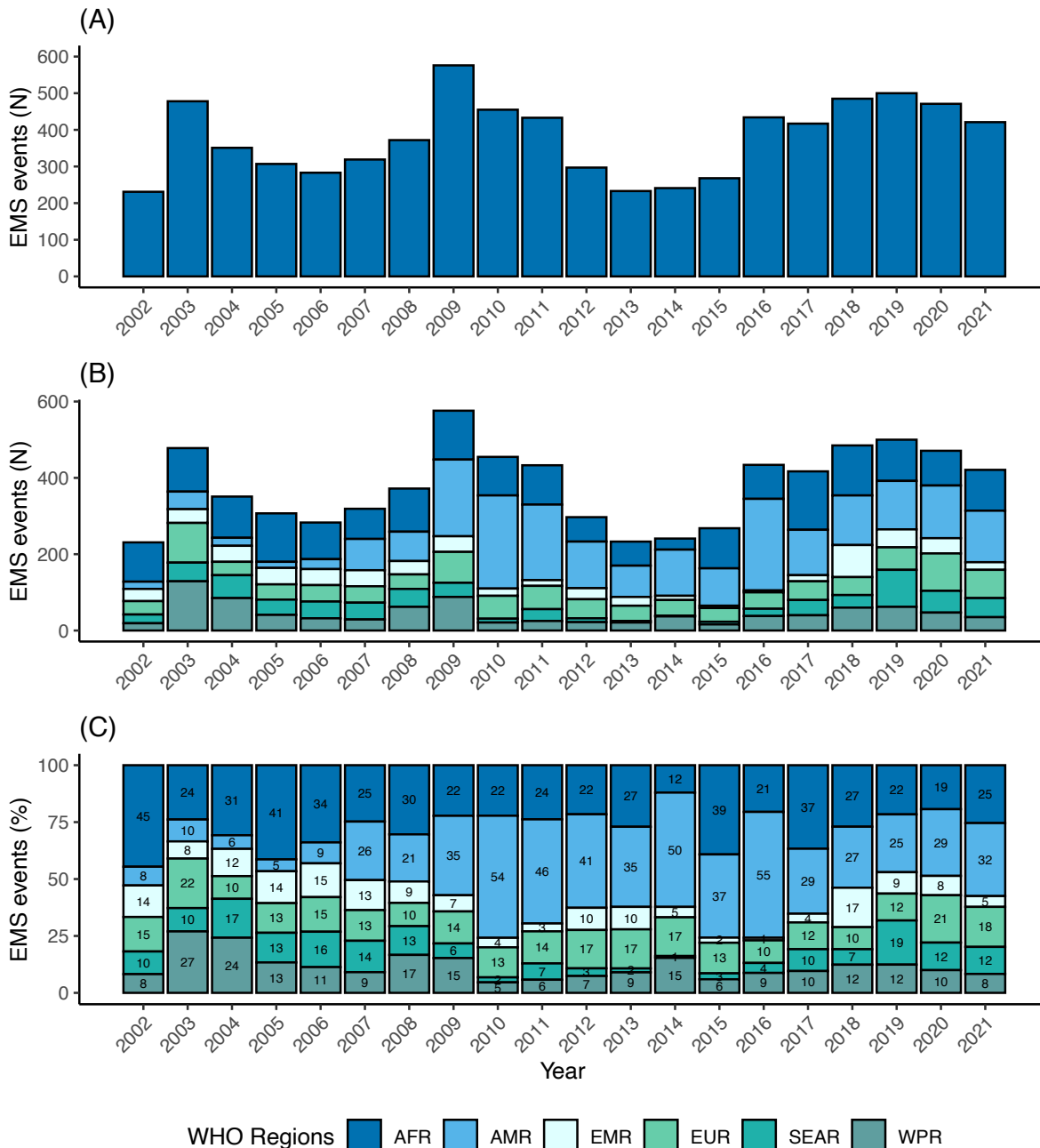
From 2002 to 2021, a total of 7 572 public health events were recorded globally in EMS. The number of events recorded per year has fluctuated within this time period and ranged from 231 to 576. Moreover, the trend over time, globally, displays a cyclical pattern; peaking in 2003, followed by a decrease and then another peak in 2009, followed by another decrease and a further peak in 2019 (**Figure 1A**). Since 2013, there has been an increase in the number of recorded public health events observed globally. However, in 2020 and 2021, a reduction in the number of entries was observed which can be explained by the onset and spread of the COVID-19 pandemic which resulted in a redistribution of resources for response and control efforts.

Over the 20-year reporting period, most of the public health events were reported in the WHO African Region and the WHO Region of the Americas (**Figure 1B**). The WHO African Region has generally reported an average of 100 events per year, except in 2014 (when it reported far less, only 29) and in 2017 (when it had a peak of around 150 events). On the other hand, the WHO Region of the Americas initially reported less than 50 events per year but peaked at around 250 events per year in 2010 and 2016 and has, for the last five years, reported around 130 events per year. The other WHO Regions have remained largely consistent in the average number of public health events reported (approximately <100 events per year), with the occasional peak, and in the last five years have mostly ranged from 25 to 75 events reported per year.

For 14 out of the last 20-year period, the majority (ranging from 51%-76% annually) of reported public health events occurred in the WHO African Region and the WHO Region of the Americas (**Figure 1C**). Moreover, in four of the remaining six years (2005, 2006, 2019 and 2020), 43-49% of reported public health events occurred in those WHO Regions. For each of the remaining WHO Regions, the percentage of reported public health events has been relatively constant in the last five years; ranging between 10-20%.

In 2021, there were a total of 421 public health events detected, recorded in EMS, and monitored by WHO. Of these, 135 (32%) occurred in the WHO Region of the Americas, 107 (25%) occurred in the

WHO African Region, 74 (18%) occurred in the WHO European Region, 50 (12%) occurred in the WHO South-East Asia Region, 35 (8%) occurred in the WHO Western Pacific Region and 20 (5%) occurred in the WHO Eastern Mediterranean Region.



**Figure 1.** Number of events entered in EMS (N=7 572) between 2002-2021 (A) globally by year, (B) by WHO Region and year, (C) proportion of EMS events by WHO Region and year. AFR: WHO African Region, AMR: WHO Region of the Americas, EMR: WHO Eastern Mediterranean Region, EUR: WHO European Region, SEAR: WHO South-East Asia Region, WPR: WHO Western Pacific Region

## 4.2. Event designation

This section summarizes the final designation of entries recorded in EMS since 2002, with a particular focus on substantiated events. Similar to Section 4.1. when referring to events or public health events in this Section it is referring to all entries in EMS, regardless of their final designation status.

### 4.2.1. Event Designation – globally

Between 2002 and 2021, of the 7 572 total events assessed globally in EMS, 5 466 (76%) were designated as substantiated, 1 178 (16%) as no outbreak, 505 (7%) as discarded, 356 (5%) as unverifiable, 23 (<1%) had no designation, and 44 (<1%) as under verification. The overall number and percentage of substantiated events have steadily increased since 2014, reaching 94% in 2020 (**Figure 2A and 2B**).

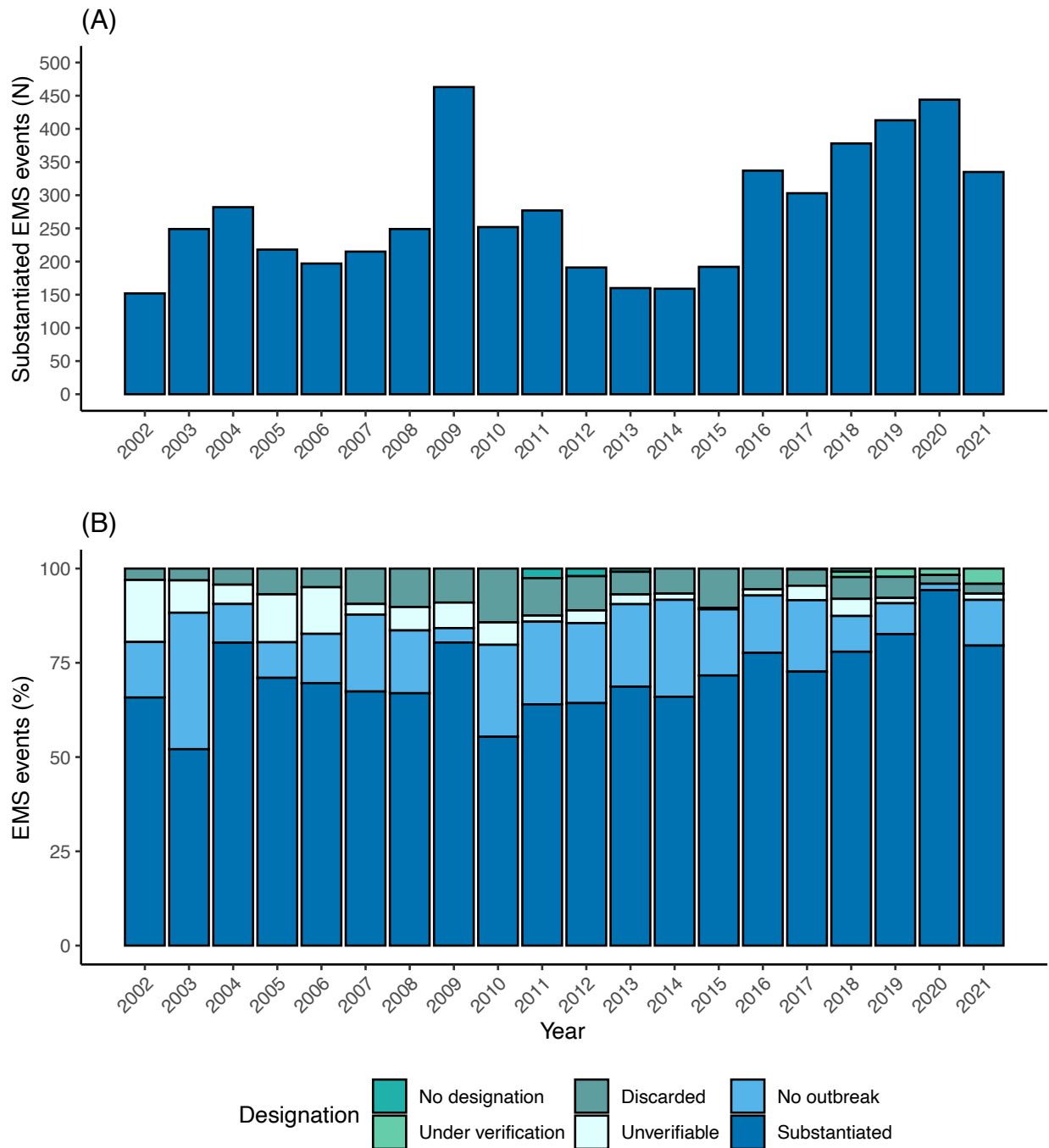
From 2011 to 2018, an average of 1.6% of reported events per year were without designation. However, since 2018, all events have been accorded a designation. In 2021 alone, of the 421 total events assessed globally, 335 (80%) were designated as substantiated, 51 (12%) as no outbreak, 17 (4%) as under verification, 11 (3%) as discarded and seven (1.5%) as unverifiable (**Figure 2B**).

### 4.2.2. Event Designation by WHO Region

Between 2002 and 2021, the majority of the 7 572 events reported globally in EMS occurred in the WHO Region of the Americas (2 242, 30%), which was closely followed by the WHO African Region (2 012, 27%). The WHO European Region reported 1 077 (14%) events whereas 909 (12%), 704 (9%) and 628 (8%) of events reported globally in EMS, occurred, respectively, in the WHO Western Pacific Region, the WHO South-East Asia Region and the WHO Eastern Mediterranean Region.

**Table 1** outlines the designation of events by WHO Region between 2002 and 2021. The highest proportion of substantiated events was found in the WHO African Region (84%), followed by the WHO Western Pacific Region (81%) and both the WHO South-East Asia Region (76%) and WHO Eastern Mediterranean Region (76%). A comparable percentage of substantiated events was found in the WHO European Region (67%) while the percentage was lowest in the WHO Region of the Americas (59%).

With regard to events designated as no outbreak, the largest proportions were found in the WHO Region of the Americas and the WHO European Region (**Table 1**). The percentage of events designated as discarded ranged from 2-12% while those designated as unverifiable ranged from 2-9% across the WHO Regions. Only two WHO Regions reported a small percentage of events without designation; the WHO South East Asia Region (2.7%) and the WHO African Region (0.2%). However, it is important to note that events without designation occurred only during the 2011-2018 period and has not occurred since. When examining the designation of events over time in the last 20 years by WHO Region we observe a different pattern across the Regions (**Figure 3**).

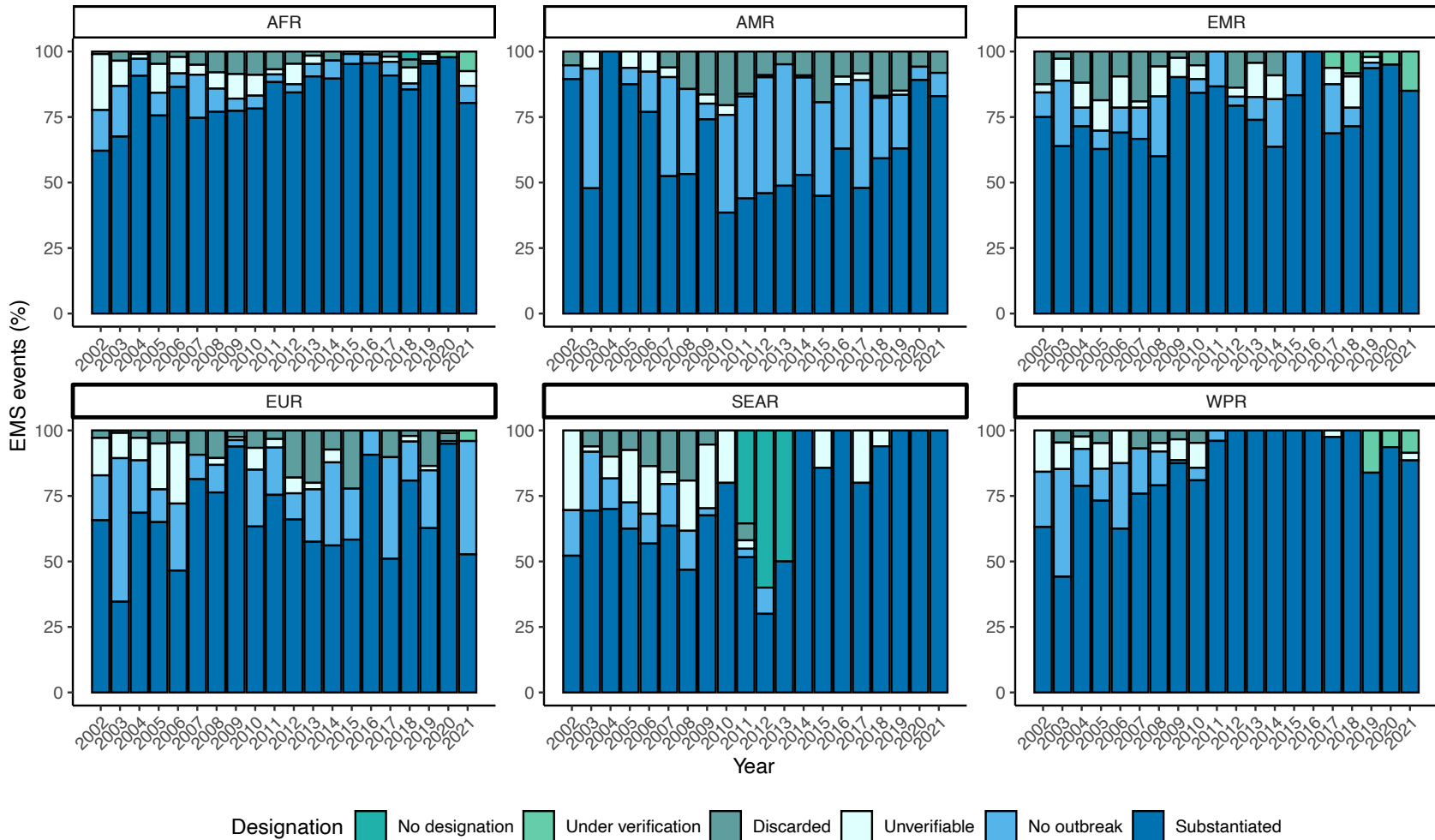


**Figure 2.** (A) Number of substantiated EMS events by year (N=5 466) and (B) Distribution of the different final designations of EMS events by year, 2002-2021.

**Table 1.** Designation of events entered in the WHO event management system (EMS) globally by WHO Region between 2002-2021.

	<b>AFR,</b>	<b>AMR,</b>	<b>EMR,</b>	<b>EUR,</b>	<b>SEAR,</b>	<b>WPR,</b>
<b>Event designation</b>	N = 2 012	N = 2 242	N = 628	N = 1 077	N = 704	N = 909
<b>No designation</b>	4 (0.2%)	0 (0%)	0 (0%)	0 (0%)	19 (2.7%)	0 (0%)
<b>Under verification</b>	10 (0.5%)	0 (0%)	14 (2.2%)	4 (0.4%)	0 (0%)	16 (1.8%)
<b>Discarded</b>	69 (3.4%)	270 (12%)	41 (6.5%)	68 (6.3%)	38 (5.4%)	19 (2.1%)
<b>Unverifiable</b>	114 (5.7%)	42 (1.9%)	44 (7.0%)	52 (4.8%)	63 (8.9%)	41 (4.5%)
<b>No outbreak</b>	131 (6.5%)	618 (28%)	54 (8.6%)	229 (21%)	48 (6.8%)	98 (11%)
<b>Substantiated</b>	1 684 (84%)	1 312 (59%)	475 (76 %)	724 (67%)	536 (76%)	735 (81%)

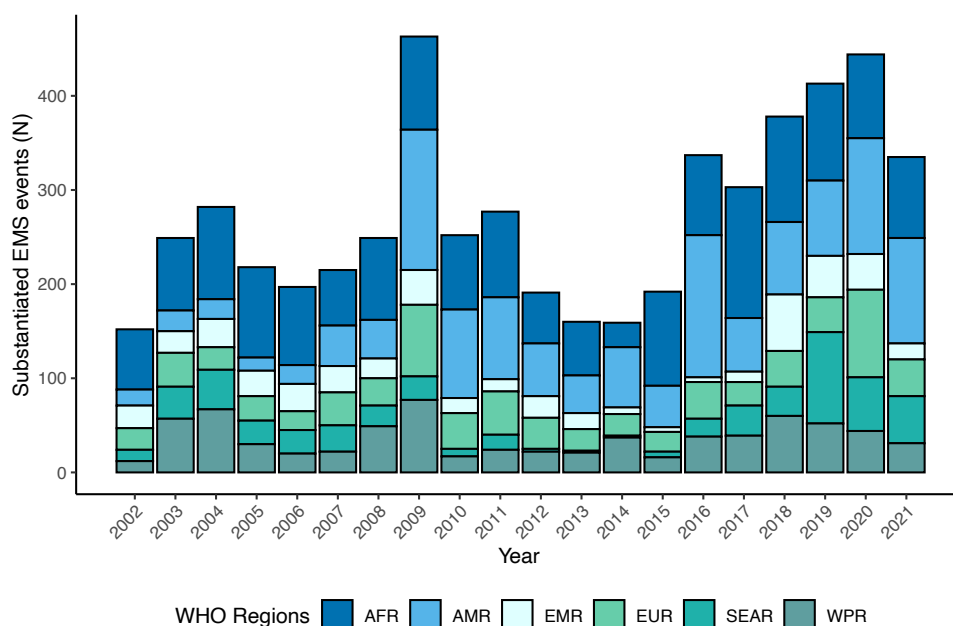
AFR: WHO African Region, AMR: WHO Region of the Americas, EMR: WHO Eastern Mediterranean Region, EUR: WHO European Region, SEAR: WHO South-East Asia Region, WPR: WHO Western Pacific Region.



**Figure 3.** Distribution of EMS events in percentage by final designation, WHO Region and year, 2002–2021.  
*AFR: WHO African Region, AMR: WHO Region of the Americas, EMR: WHO Eastern Mediterranean Region, EUR: WHO European Region, SEAR: WHO South-East Asia Region, WPR: WHO Western Pacific Region.*

The proportion of substantiated events increased over the last three to five years, with a high (>80%) median percentage of substantiated events for all WHO Regions except the WHO European Region in the last three years. For the WHO European Region, this was due to a large proportion of public health events which were discarded or designated as no outbreak following consultations and verifications with health authorities (largely due to the requirement that any urgent communication under IHR was logged in EMS). Moreover, there were a few years for which a large proportion of events were without designation, which occurred in the WHO South-East Asia Region (**Figure 3**). However, this has not occurred since 2018 and was aided by a change in data entry requirements in EMS for the field “designation”, which became a mandatory field for data entry.

When examining the absolute number of substantiated events between 2002 and 2021 (N= 5 466) by Region, the majority of substantiated events in a given year occurred either in the WHO African Region or the WHO Region of the Americas. (**Figure 4**).



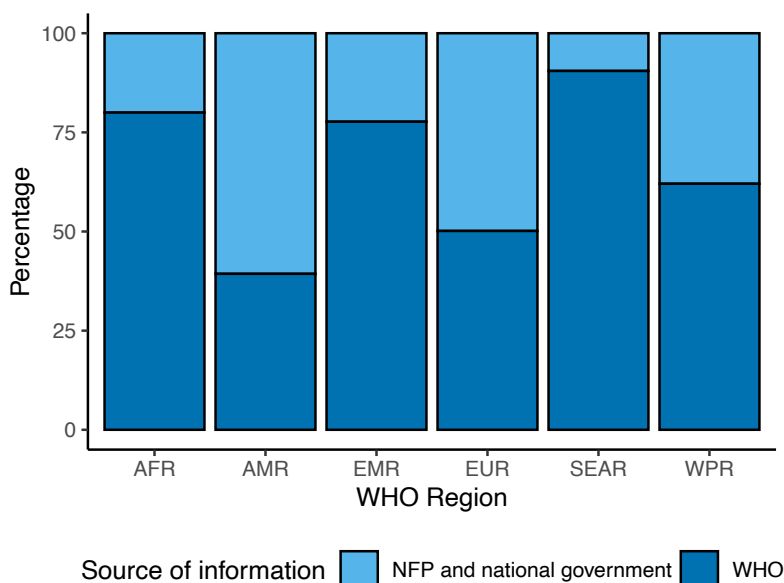
**Figure 4.** Number of substantiated EMS events (N= 5 466) by WHO Region and year, 2002–2021. *AFR: WHO African Region, AMR: WHO Region of the Americas, EMR: WHO Eastern Mediterranean Region, EUR: WHO European Region, SEAR: WHO South-East Asia Region, WPR: WHO Western Pacific Region.*

### 4.3. Initial source of event information

This section summarizes the initial source of information for events designated as substantiated in EMS since 2002. Certain considerations should be taken into account when interpreting the following data: a) the International Health Regulations (2005) entered into force in 2007, after which NFPs were designated by States Parties as a channel of communication with WHO, and b) variations exist

in event reporting and recording procedures between each of the WHO Regions that impact the data collected on initial source of event information.

Between 2002 and 2021, 50%-60% of substantiated public health events were categorised as directly reported by NFPs and national governments in the WHO Region of the Americas and the WHO European Region. However, for the other WHO Regions, except for the WHO Western Pacific Region (38% directly reported by NFPs and national governments), it was only 20% or less of substantiated events that were directly reported by NFPs and national governments (**Figure 5**).

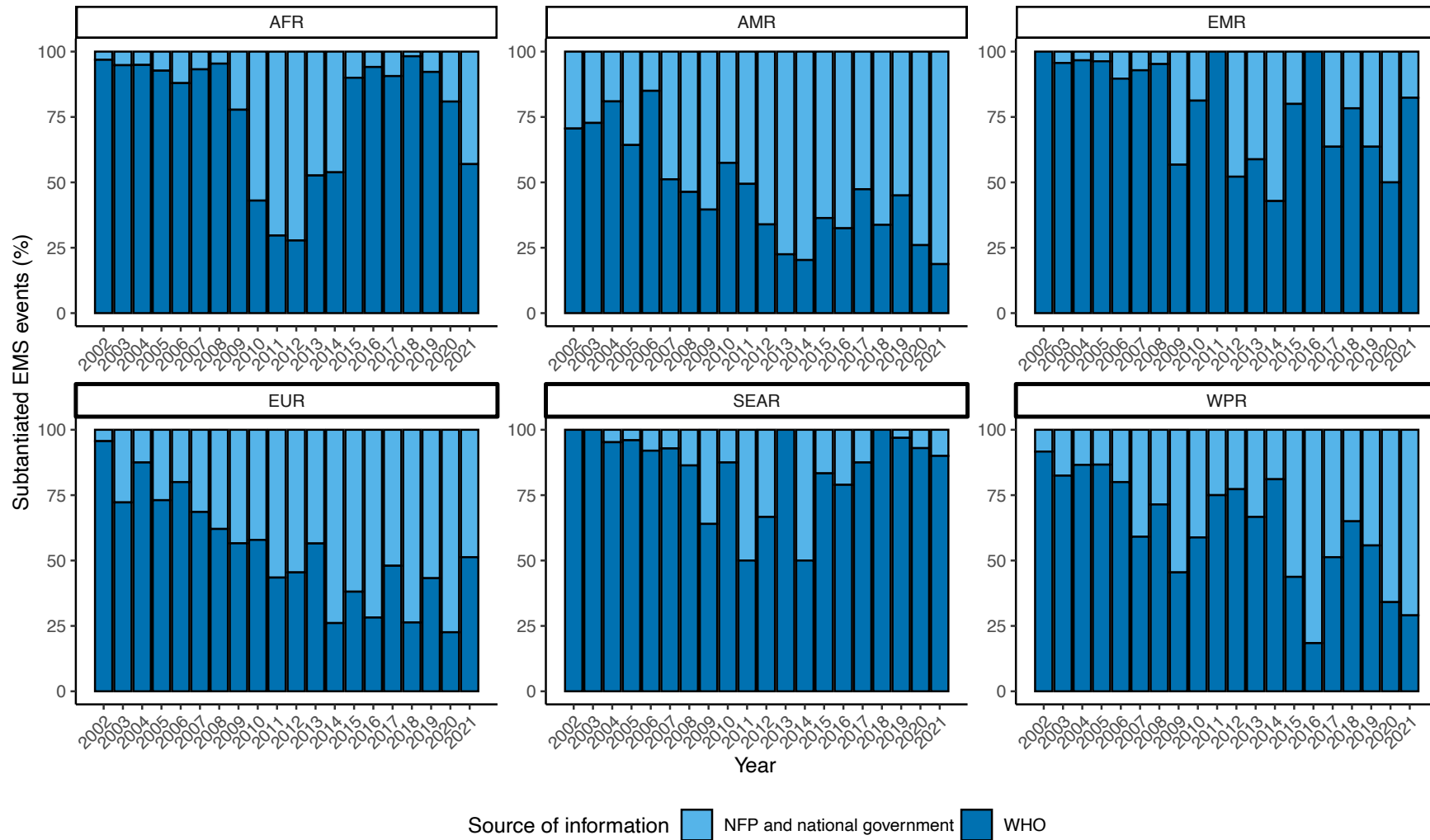


**Figure 5.** Source of information for substantiated events reported globally in EMS by WHO Region, 2002–2021. *NFP: National International Health Regulations Focal Point, AFR: WHO African Region, AMR: WHO Region of the Americas, EMR: WHO Eastern Mediterranean Region, EUR: WHO European Region, SEAR: WHO South-East Asia Region, WPR: WHO Western Pacific Region*

Globally, two-thirds (65%, 3 536/5 466) of substantiated public health events between 2002 and 2021 were initially reported by WHO; either reported by the WHO Country Offices or WHO Regional Offices or detected through routine public health intelligence activities coordinated by the WHO, which includes indicator and event-based surveillance.

When examining the initial source of substantiated events by Region we found a divergence across WHO Regions (**Figure 6**). The proportion of substantiated events with NFPs and national governments as initial source of information increased over time in the WHO Region of the Americas, the WHO European Region and the WHO Western Pacific Region.





**Figure 6.** Distribution of substantiated EMS events (N= 5 466) by initial source of information, year and WHO Region, 2002-2021. *NFP: National International Health Regulations Focal Point, AFR: WHO African Region, AMR: WHO Region of the Americas, EMR: WHO Eastern Mediterranean Region, EUR: WHO European Region, SEAR: WHO South-East Asia Region, WPR: WHO Western Pacific Region .*

On the other hand, in the WHO African Region, the WHO Eastern Mediterranean Region and the WHO South-East Asia Region, an increase was seen in previous years but more recently, in the last five years, the proportion from NFPs and national governments was observed to be less than 33% on average.

In 2021, for three WHO Regions the initial source of information of approximately 50% or more of substantiated public health events was the NFP and national government: the WHO European Region (49%, 19 of 39 events), the WHO Region of the Americas (81%, 91 of 112 events) and the WHO Western Pacific Region (71%, 22 of 31 events). In the other three WHO Regions, the proportion was much lower: the WHO African Region (43%, 37 of 86 events), the WHO Eastern Mediterranean Region (18%, 3 of 17 events) and the WHO South-East Asia Region (10%, 5 of 50 events).

In the WHO Region of the Americas and the WHO Western Pacific Region the proportion of substantiated public health events reported by NFPs and national governments increased in 2021 compared to the median of the proportion for the five previous years (81% and 71% vs a median of 66% and 49%, respectively). For the WHO European Region and the WHO South-East Asia Region, the proportion in 2021 is similar to the previous five-year median (49% compared to 57% median and 10% compared to 9% median, respectively) while in the WHO Eastern Mediterranean Region in 2021 the proportion had decreased (18% vs 36% median in the past five years). Finally, the WHO African Region has increased markedly, up to 43% in 2021, compared to a median of 9% in the past five years.

It is important to note is that the trend in the WHO African Region may reflect changes in event reporting and recording procedures rather than actual changes in NFP reporting. Moreover, the increasing trend in the WHO European Region could be due to regular NFP workshops (one in 2017, one in 2018, and two in 2019), the Joint Assessment and Detection of Events (JADE) simulation exercises in 2018 and 2019 and the increased IHR communication with the IHR NFPs during the COVID-19 pandemic period since 2020.

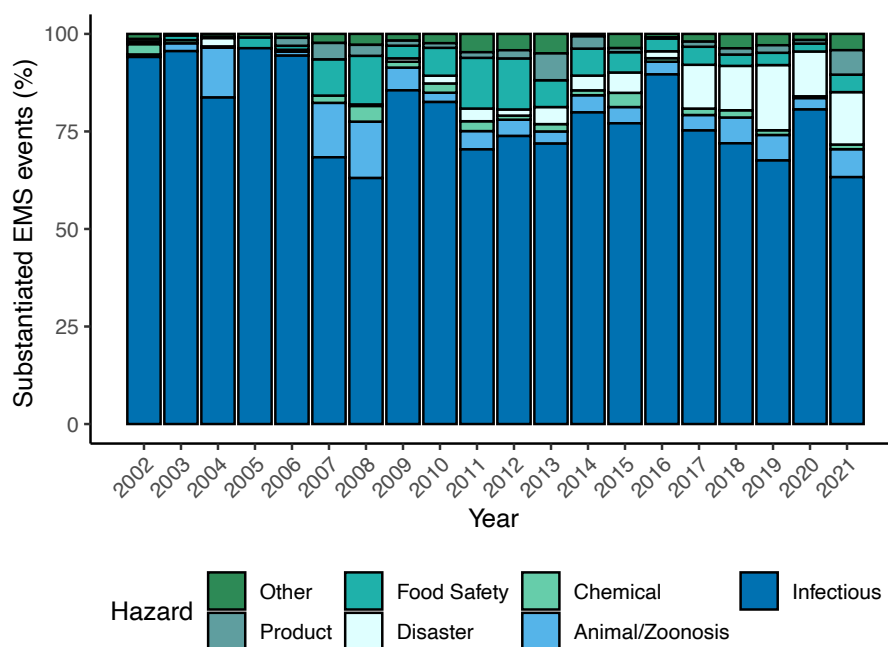
The interaction between NFPs and the WHO country or regional offices is key for early detection and verification of public health events; in particular, the WHO country offices and IHR NFPs provide and validate information on acute public health events. Further details on the verification request and response by NFPs is provided in Annex 2.

#### 4.4. Hazard type

This section summarizes the hazard type<sup>11</sup> for substantiated public health events in EMS between 2002 and 2021.

##### 4.4.1. Hazard type globally

The aetiology of the 5 466 substantiated events between 2002-2021 was predominately due to infectious diseases (4 298; 79%), followed by disaster (299; 5%), animal/zoonosis (296; 5%), food safety (263; 5%), other causes (128; 2%), product (100; 2%), and chemical (82; 2%). While the IHR (2005) uses an all-hazards approach, infectious diseases have represented the vast majority of hazards among substantiated events reported globally since 2002. However, between 2017-2021, an increasing proportion of substantiated events were non-infectious, particularly disaster related (**Figure 7**). In 2021 alone, for the 335 substantiated events, infectious diseases (212; 63%) were still the eminent aetiology, followed by disasters (45; 13%), animal/zoonosis (24; 7%), product (21; 6%), food safety (15; 4%), other causes (14; 4%), and chemical (4; 1%).



**Figure 7.** Distribution of substantiated EMS events for all WHO Regions (N= 5 466) by hazard type and year, 2002 to 2021.

<sup>11</sup> The hazard types available within the WHO event management system (EMS) are as follows: animal, chemical, disaster, food safety, infectious, nutritional deficiency, product, radionuclear, societal, undetermined, and zoonosis. For this report, animal and zoonosis hazards have been combined as ‘animal/zoonosis’, and nutritional deficiency, societal, radionuclear, and undetermined are classified as ‘other causes’.

#### 4.4.2. Hazard type by WHO Region

Between 2002 and 2021, the aetiology of the majority (>70%) of substantiated events reported in in the different WHO Regions was infectious, except in the WHO South-East Asia Region where the proportion of events with infectious aetiology was 60% (319/536) albeit still the most common (**Table 2**).

The second most common aetiology varied across WHO Regions and was generally <10%, except again, in the WHO South-East Asia Region where disasters (23%, 121/536) were the second most common aetiology. This underscores the importance of climate-related events and their impact on health in that WHO Region. In the other WHO Regions, the second most common aetiology varied between animal/zoonosis, disaster, and food safety.

Food safety as an aetiology of substantiated public health events was particularly pronounced in the WHO European Region (13%, 97/724) (**Table 2**). This is partly due to well-established partnerships for the detection and reporting of food safety-related public health events with the International Food Safety Authorities Network (INFOSAN), the European Centre for Disease Prevention and Control (ECDC) EpiPulse platform, and the European Commission's Rapid Alert System for Food and Feed (RASFF).

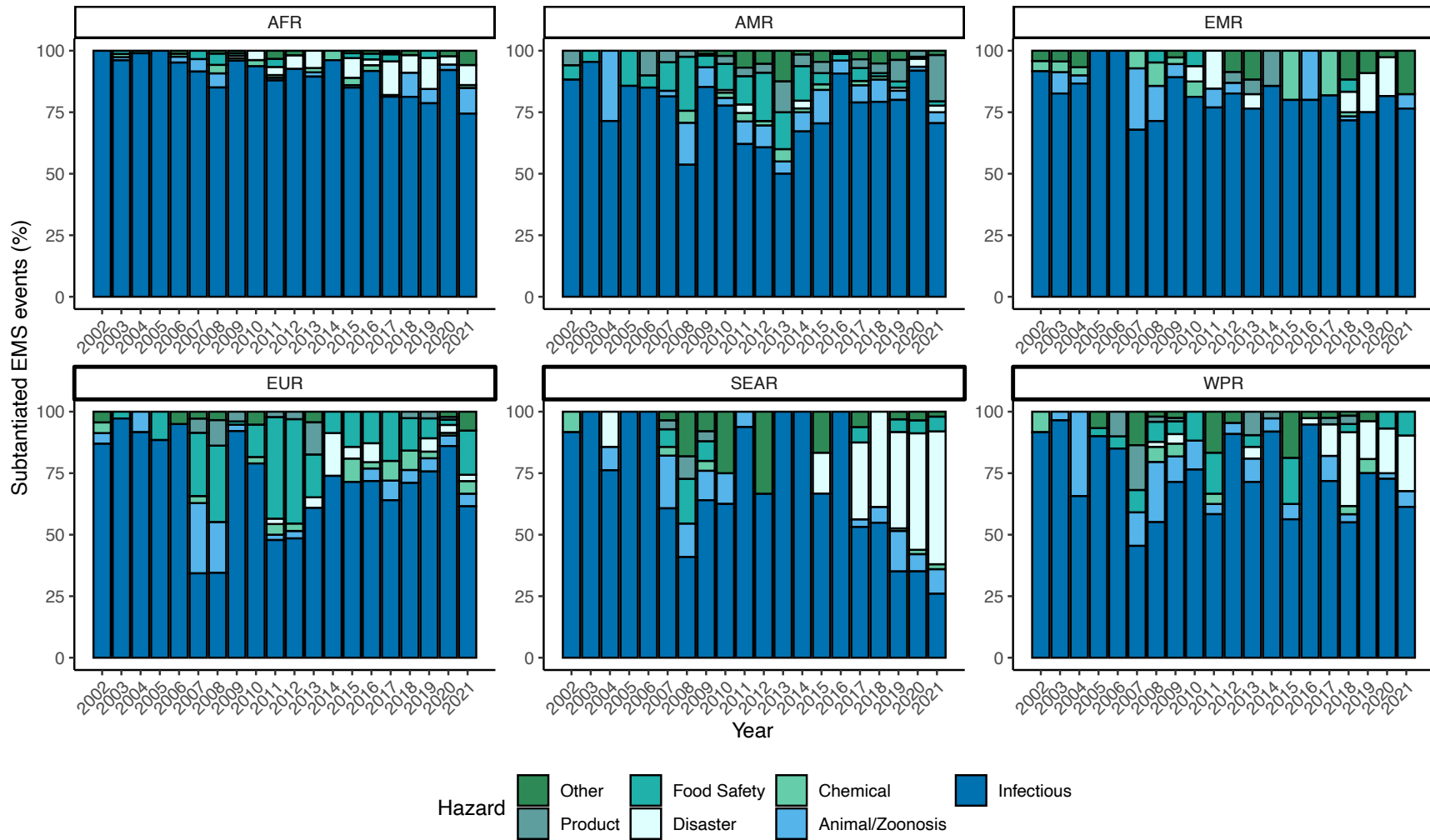
**Table 2.** Hazard type of substantiated events globally by WHO Region between 2002-2021.

Hazard type	AFR, N = 1 684	AMR, N = 1 312	EMR, N = 475	EUR, N = 724	SEAR, N = 536	WPR, N = 735
<b>Animal/Zoonosis</b>	43 (2.6%)	84 (6.4%)	20 (4.2%)	37 (5.1%)	46 (8.6%)	66 (9%)
<b>Chemical</b>	17 (1.0%)	14 (1.1%)	13 (2.7%)	18 (2.5%)	6 (1.1%)	14 (1.9%)
<b>Disaster</b>	74 (4.4%)	14 (1.1%)	22 (4.6%)	16 (2.2%)	121 (23%)	52 (7.1%)
<b>Food Safety</b>	23 (1.4%)	87 (6.6%)	5 (1.1%)	97 (13%)	21 (3.9%)	30 (4.1%)
<b>Infectious</b>	1 507 (89%)	1 018 (78%)	388 (82%)	528 (73%)	319 (60%)	538 (73%)
<b>Other</b>	19 (1.1%)	33 (2.5%)	24 (5.1%)	12 (1.7%)	19 (3.5%)	21 (2.9%)
<b>Product</b>	1 (<0.1%)	62 (4.7%)	3 (0.6%)	16 (2.2%)	4 (0.7%)	14 (1.9%)

*AFR: WHO African Region, AMR: WHO Region of the Americas, EMR: WHO Eastern Mediterranean Region, EUR: WHO European Region, SEAR: WHO South-East Asia Region, WPR: WHO Western Pacific Region.*

Animal/zoonosis as an aetiology of acute public health events ranked second or third in the WHO Western Pacific Region (9%, 66/735), the WHO South-East Asia Region (9%, 46/536) and the WHO Region of the Americas (6%, 84/1 312). This emphasises the importance of a One Health approach when monitoring events of potential international public health concern.

When examining the aetiology of substantiated public health events between 2002 and 2021 by year and WHO Region, we found interesting differences in the trend across years between WHO Regions (**Figure 8**). Substantiated events with infectious aetiology generally made up the majority of public health events in all WHO Regions.



**Figure 8.** Distribution of substantiated EMS events (N= 5 466) by WHO Region, hazard type and year, 2002–2021. *AFR: WHO African Region, AMR: WHO Region of the Americas, EMR: WHO Eastern Mediterranean Region, EUR: WHO European Region, SEAR: WHO South-East Asia Region, WPR: WHO Western Pacific Region.*

However, in recent years disasters have become an increasing aetiology of events, with the proportion growing over time since 2015 or 2016 in WHO Western Pacific Region, WHO South-East Asia Region and WHO Eastern Mediterranean Region. Since 2019, in the WHO South-East Asia Region, substantiated events with disaster aetiology made up the plurality of events, however it should be noted that COVID-19 likely impacted surveillance and reporting of other diseases.

In 2021, in all WHO Regions, except one, infectious agents were the main aetiology of public health events (74%, 64/86, WHO African Region; 76%, 13/17, WHO Eastern Mediterranean Region; 62%, 24/39, WHO European Region; 71%, 79/112, WHO Region of the Americas; 61%, 19/31, WHO Western Pacific Region) whereas in the WHO South-East Asia Region disasters were the main aetiology (54%, 27/50) (**Figure 8**).

## 4.5. COVID-19

### 4.5.1. *Public health intelligence activities related to COVID-19*

COVID-19 was first reported to WHO on 31 December 2019. SARS-CoV-2 rapidly spread across the globe in early 2020, which led to a public health emergency of international concern (PHEIC) being declared by the WHO Director-General on 30 January 2020.

COVID-19 strongly impacted public health intelligence activities across WHO. When assessing the substantiated events in EMS we observed that, globally, in 2020 225 (51%) of 444 substantiated events were for COVID-19. This decreased, in 2021, to 61 (18%) of 335 substantiated events, which is largely because most countries globally experienced the occurrence of COVID-19 in 2020. The entries in EMS for COVID-19 include the occurrence and spread of COVID-19 in a country but also, for example, the emergence of SARS-CoV-2 variants, instances of multisystem inflammatory syndrome among children and adolescents temporally related to COVID-19, and adverse events following immunisation for COVID-19.

As part of the response to the COVID-19 pandemic, WHO regularly produced multiple information products. In 2020, 209 daily situation reports on COVID-19, 19 weekly COVID-19 epidemiological and 20 weekly COVID-19 operational updates were published. These updates continued unabated in 2021, with 52 weekly COVID-19 epidemiological and 46 weekly COVID-19 operational updates published. Moreover, there were 17 RRAs published in 2020 and 2021; 12 global RRAs (eight published in 2020 and four published in 2021) and four for specific countries due to the emergence of SARS-CoV-2 variants. Moreover, one RRA was published on SARS-CoV-2 in animals used for fur farming as part of GLEWS+, the Joint FAO–OIE–WHO Global Early Warning System for health threats and emerging risks at the human–animal–ecosystems interface.

WHO also launched a global COVID-19 Dashboard<sup>12</sup> in 2020 to rapidly share daily epidemic situation updates with the number of cases and deaths that were reported by Member States through the International Health Regulations (2005), based on the WHO case definitions. Since then, WHO has added features to the WHO COVID-19 Dashboard in response to evolving needs and interests related to the pandemic. Some examples include the addition of data visualisation for: Vaccination and Public Health and Social Measures (PHSM) and the types of PHSM implemented by countries at any given time.

COVID-19 data collection and analysis are continuously updated and reviewed by WHO, including through verification requests. As a result of data cleaning and information review, there might be small differences in the number of events related to COVID-19 between the 2020 and the 2021 annual global report. The latest information on COVID-19 is available in the COVID-19 situation reports, accessible via WHO webpages.

#### **4.5.2. Regional COVID-19 information products**

All WHO regional offices have published specific information products related to COVID-19.

The WHO African Region published COVID-19 situation reports, a COVID-19 newsletter and COVID-19 readiness situation updates. Similarly, the WHO Regional Office for Europe has been producing weekly surveillance bulletins with disaggregated data by country, severity, vaccination, variants, a daily updatable dashboard with various features, including a subnational explorer, trends analyses and vaccination coverage explorer, and a dashboard for COVID-19 signals, in partnership with the ECDC. Similarly, the WHO Regional Office for the Eastern Mediterranean has been producing weekly and biweekly COVID-19 situation reports.

The WHO Regional Office of the Americas published information for public dissemination regarding COVID-19 in the Region on a daily basis through the PAHO COVID-19 GeoHub, as well as 304 COVID-19 Epidemiological Situation Reports, 76 COVID-19 Situation Reports on the PAHO/WHO Response, and 56 COVID-19 Epidemiological Alerts/Updates related to COVID-19 or other diseases in the context of the COVID-19 pandemic.

In addition, the WHO Regional Office for the Western Pacific has published a weekly COVID-19 external situation report from May 2020 onwards. For WHO Member States in the Region, weekly situation report was provided and weekly COVID-19 literature updates were shared through WHO country offices. Also, the WHO shared information COVID-19 transmission at the subnational level of WHO Member States in the Region through a COVID-19 dashboard. Moreover, the WHO Regional Office for South-East Asia has published weekly situation reports on COVID-19 summarizing

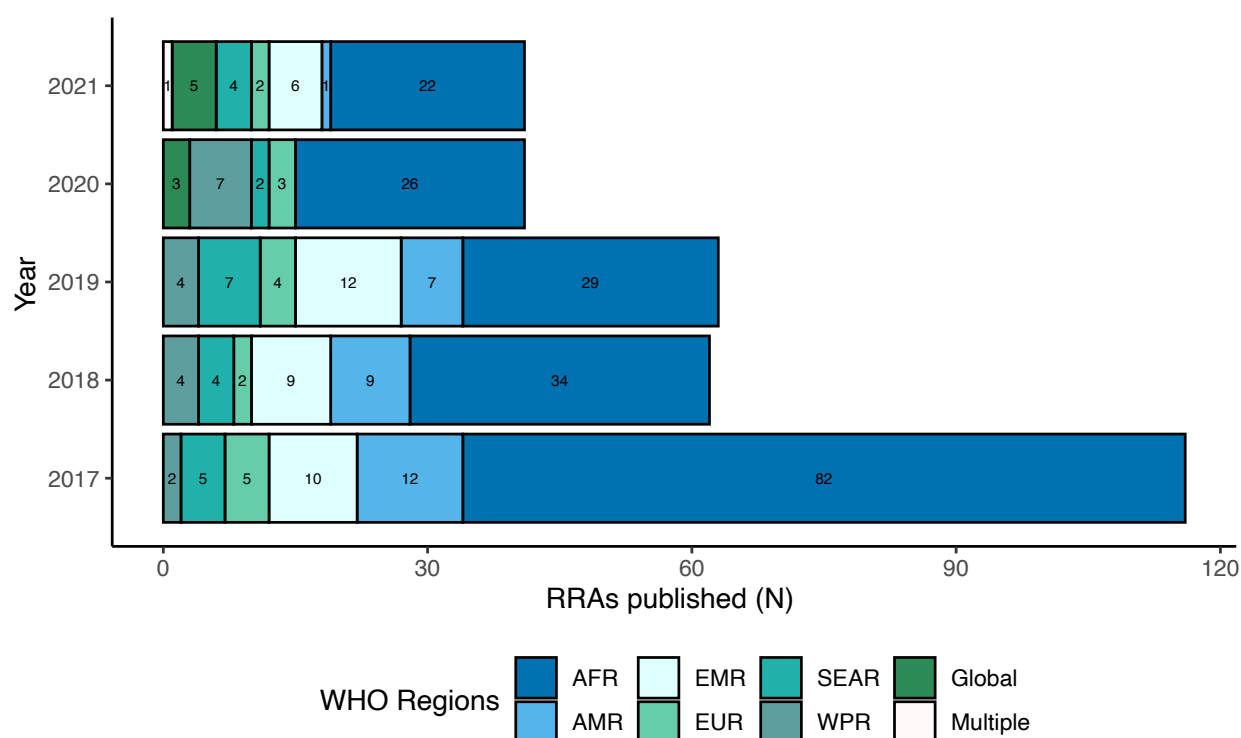
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<sup>12</sup> <https://covid19.who.int/>

regional epidemiological situation, operational updates and overview of country response, such as COVID-19 vaccination, public health and social measures, and international travel measures.

#### 4.6. Rapid risk assessments

Between 2017 and 2021, 323 RRAs were published<sup>13</sup>. The number of RRAs published annually have decreased in the last five years. In 2017, almost 120 RRAs were published, followed by a two-year period in which approximately 60 RRAs were published each year, after which the number decreased to approximately 40 per year in 2020 and 2021 (**Figure 9**).



**Figure 9:** Rapid risk assessments published by year and WHO Region

The majority of RRAs published in the last five years were about public health events in the WHO African Region (60%, 193/323), followed by events the WHO Eastern Mediterranean Region (11%, 37/326) and the WHO Region of the Americas (9%, 29/323). In the remaining three WHO Regions,

<sup>13</sup> Rapid risk assessments across the three levels of WHO are not the only type of risk assessment conducted by WHO. The WHO regional offices also conduct other types of risk assessments including, for example, a regional risk assessment for measles conducted by the WHO Regional Office for Europe in 2019, two COVID-19 regional risk assessments conducted in 2020 by the WHO Regional Office for the Americas, and ten risk assessments done by the WHO Regional Office for the Western Pacific for various infectious diseases and a natural disaster.



the numbers of RRAs related to public health events those regions were comparable, ranging from 16-22 (5-7%) over the five-year period (**Figure 9**).

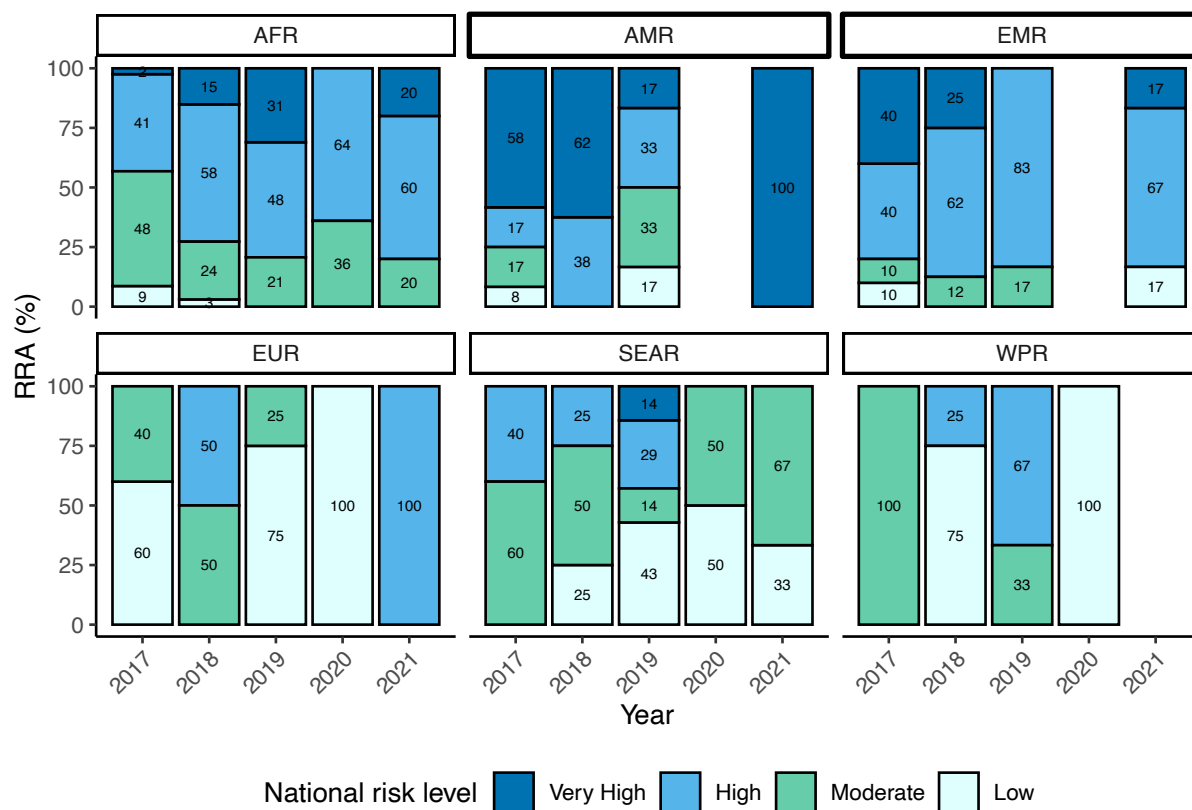
During this period, nine RRAs were published that solely focussed on a regional or multi-country public health event. Of these, three pertained to the WHO African Region (one regional RRA each for Lassa fever, cholera and yellow fever), two concerned the WHO Region of the Americas (one regional RRA each for measles and whooping cough)<sup>14</sup>, and one regional RRA was published for the WHO Eastern Mediterranean Region (cholera in the Horn of Africa and Yemen), for the WHO Western Pacific Region (measles in the Pacific Island Countries and Areas) and for the WHO European Region (circulating vaccine-derived poliovirus type 2). Finally, one RRA on undiagnosed disease was linked to two countries that spanned two WHO Regions; the WHO Eastern Mediterranean Region and the WHO African Region. In addition, the production of regional or multi-country RRAs is increasing; none were published in 2017 while three and two, respectively, were conducted in 2018 and 2019, followed by four in 2021. This type of RRA involves a larger workload (as more countries are involved) and simultaneously covers multiple countries, which could partially explain the reduction in the overall number of RRAs. Moreover, as part of the response to COVID-19, 17 RRAs related to COVID-19 were published; these have been discussed in detail in the previous section.

When examining the RRAs that were related to a single country, and excluding the RRAs pertaining to COVID-19, the distribution of national risk level for the acute public health threat assessed in the RRAs differed between WHO Regions and over time (**Figure 10**). Note that this pertains only to non-COVID-19 and non-multi-country or regional level RRAs. Also, one RRA on Hepatitis E in Chad was excluded as only an overall risk level was provided and not a national risk level separately.

Not all public health events undergo a RRA but examining the national risk level only for single country public health events that have been assessed, it is important to note that several WHO Regions (WHO European Region, WHO South-East Asia Region and the WHO Western Pacific Region) either very rarely or never had an RRA with the national risk level designated as very high. This is in contrast with the WHO African Region, the WHO Region of the Americas and the WHO Eastern Mediterranean Region, which all had RRAs with the highest possible national risk level (very high). The contrasting distributions of national risk levels between the WHO Regions underscores the different public health threats faced and national level capacity to respond within the different WHO Regions (**Figure 10**).

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<sup>14</sup> Five further rapid risk assessments (one on diphtheria, two on measles and two on malaria) assessed the national risk but also the risk in neighbouring countries although they were not solely regional or multi-country rapid risk assessments.



**Figure 10:** National risk level for an acute public health event assessed as part of the rapid risk assessment (RRA) process by year and WHO Region. *Note that this Figure only pertains to non-COVID-19 and non-multi-country or regional level rapid risk assessments.*

#### 4.7. Information Dissemination

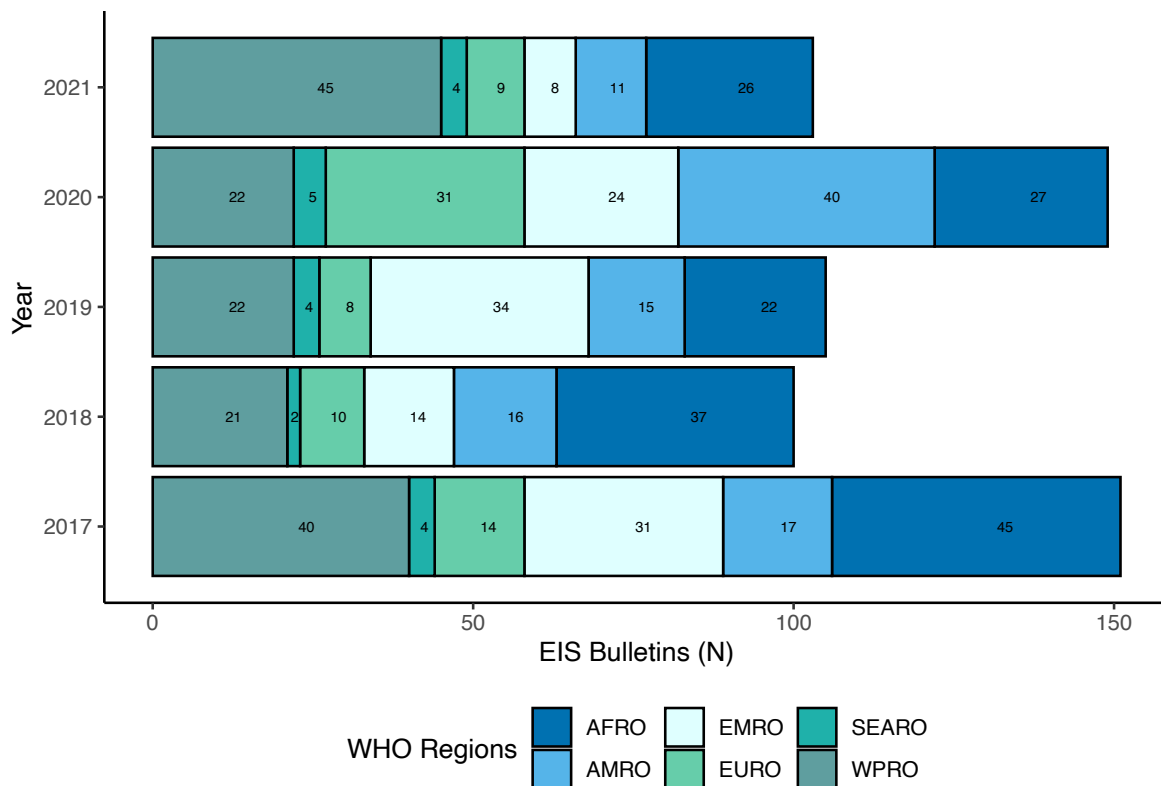
Under the provisions of the IHR, WHO is mandated to share independent and authoritative information on potential public health emergencies of international concern with States Parties, stakeholders, and the general public, to prepare for and prevent the occurrence of similar events. In order to fulfil this mandate to alert and inform the international community about new, ongoing, and updated public health events, WHO uses EIS postings, DON publications, situation reports, health cluster bulletins and external dashboards, such as the COVID-19 dashboard, as well as respective WHO Regional Office bulletins and webpages. Moreover, WHO communicates about public health events using social media, including Twitter and Facebook.

In 2021, events monitored by WHO resulted in 103 EIS publications (disseminated to State Parties via their NFPs), which were mostly related to acute hepatitis E, cholera, influenza, Ebola virus disease, Middle East respiratory syndrome, yellow fever, and monkeypox. In parallel, 127 announcements

were published on EIS, mainly relating to additional health measures in response to COVID-19. Finally, 38 DONs were disseminated to the general public via WHO webpages.

In the last ten years, the average number of annual EIS posts has ranged from 100 to 151, with the majority of EIS posts relating to events in either the WHO African Region, the WHO Eastern Mediterranean Region or the WHO Western Pacific Region (**Figure 11**). In 2021, 103 EIS posts were created of which 44% (45/103) were related to the WHO Western Pacific Region, 25% (26/103) were related to the WHO African Region and approximately 10% each to the WHO Eastern Mediterranean Region, the WHO European Region, and the WHO Region for the Americas. Only four EIS posts were published in 2021 for events in the WHO South-East Asia Region.

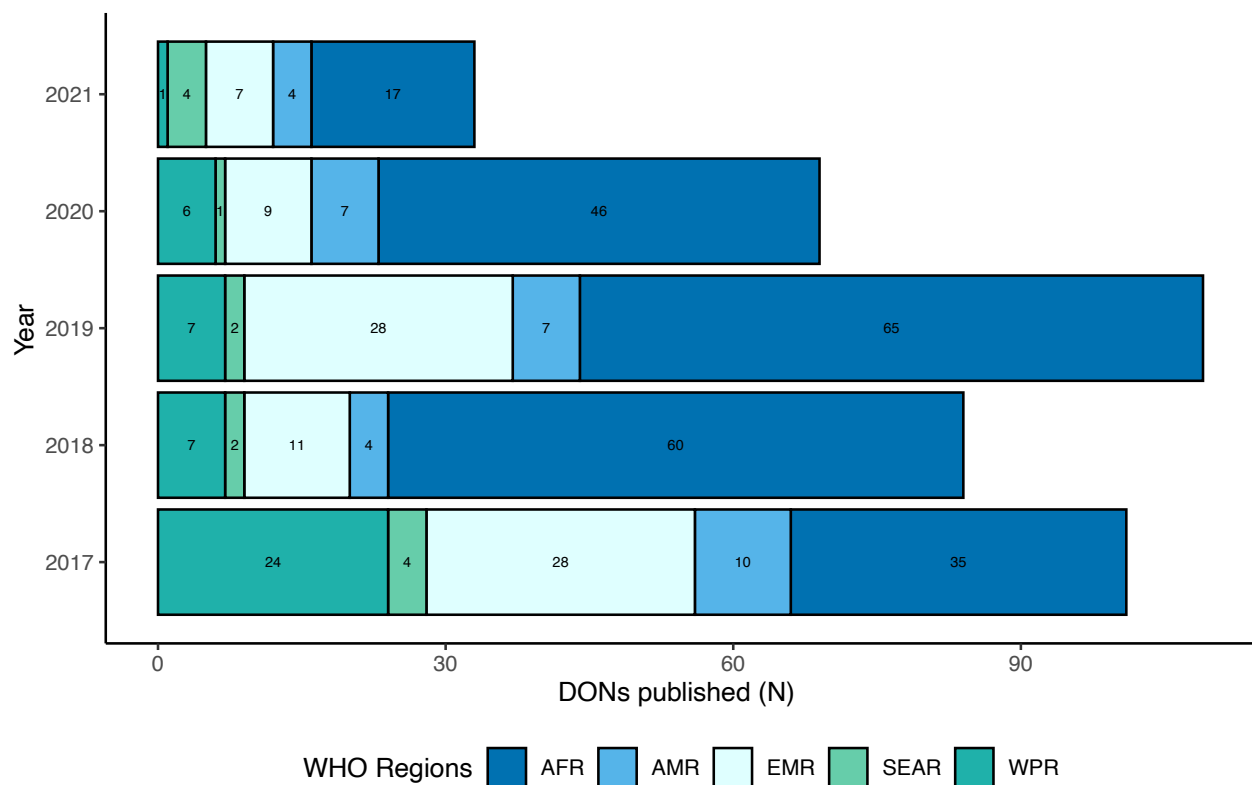
When examining DONs over time by WHO Region (2017-2021), the year in which the most DONs were published was 2019, this was partially due to the 52 DONs disseminated on the Ebola outbreak in the Democratic Republic of the Congo (**Figure 12**). Across the last five years, the WHO Region with the most DONs published is the WHO African Region, followed by the WHO Eastern Mediterranean Region.



**Figure 9:** Event information site (EIS) bulletins published by WHO Region and year.

In addition to EIS and DON publications, other information products related to public health events are disseminated by the WHO Regions to Member States and the international community. In 2021, the WHO African Region produced 52 editions of a regional weekly bulletin on outbreaks and other emergencies, which was launched in March 2017<sup>15</sup>. In 2021, the WHO Region of the Americas shared 13 reports on events occurring in the Region directly with NFPs by email and 37 Epidemiological Alerts and Updates were disseminated via the regional website, which mostly pertained to COVID-19, measles, diphtheria, and arboviruses (dengue, chikungunya, Zika, and yellow fever)<sup>16</sup>.

Similarly, in the WHO European Region regional featured stories were published on the official WHO Europe’s website (e.g., measles, West Nile, Omicron variant of COVID-19) while the WHO South-East Asia Region produced influenza situation updates (as monthly epidemiological slide deck, and annual fact sheet) which were disseminated through the WHO Regional Office for South-East Asia Influenza webpage.



**Figure 10: Disease Outbreak News (DONs) by WHO Region and year.**

<sup>15</sup> <https://www.afro.who.int/health-topics/disease-outbreaks/outbreaks-and-other-emergencies-updates>

<sup>16</sup> PAHO Epidemiological Alerts and Updates available at: <https://www.paho.org/en/epidemiological-alerts-and-updates>

Moreover, the WHO Western Pacific Region created 53 weekly avian influenza, 25 biweekly dengue and 25 biweekly seasonal influenza reports in 2021. In addition, the WHO Eastern Mediterranean Region has been producing a weekly Summary of Signals and Events which were circulated to internal WHO staff; a total of 208 weekly bulletins were circulated since November 2017 to nearly 4,000 recipients.

## 5. Discussion and conclusions

This report highlights the importance of public health intelligence activities for the detection, assessment and reporting of infectious and non-infectious hazards under the IHR framework globally, in coordination with States Parties. It emphasizes the critical role of public health intelligence activities and the IHR framework in timely event detection and information sharing between States Parties and WHO for events of potential international public health concern.

Although the number of public health events recorded in EMS has varied in the last 20 years, they have steadily increased since 2013. This is, in part, due to an improved use of EMS and increased trainings for WHO Regions, along with systematic engagement with States Parties to improve national surveillance systems (e.g., joint external evaluations, simulation exercises, NFP workshops.). However, in 2020 and 2021, a decrease was observed in the reported public health events, likely a result of the COVID-19 pandemic, due to competing priorities for and diversion of public health staff and resources. In addition, movement restrictions, non-pharmaceutical interventions and individual behavioural changes related to COVID-19 reduced the exposure to other public health hazards and also likely contributed to the reduction in the reported number of acute public health events in the immediate term.

The COVID-19 pandemic also influenced the mode of communication by some Ministry of Health officials for reporting of events. During the initial phase of the pandemic some national government officials increased their use of social media for direct communication with the general public prior to (or instead of) communicating via routine IHR channels, which impacted the processes for detection and follow-up of public health events.

The majority of the 7 572 public health events recorded in EMS between 2002 and 2021 were found to be substantiated. Approximately 70% (5 466) of the public health events were verified and constituted a true hazard through WHO assessment and verification by NFPs and/or other relevant authorities. Approximately one fifth of reported public health events (1 683, 22%) were designated as no outbreak or discarded after assessment and verification and less than 1% (44 public health events) were still under verification as of 1 April 2022. In addition, only a small fraction, 379 public health events (5%) were unverifiable or had no designation. This emphasizes the strength, critical role and usefulness of public health intelligence activities for international surveillance and reporting of public health events.

The WHO Regions vary in the number of overall and substantiated public health events recorded in EMS between 2002 and 2021. These differences are a direct result of the distinct pathogen presence and epidemiological dynamics in the different member states that constitute a WHO Region (for example viral haemorrhagic fevers circulate in the WHO African Region and not in countries that constitute the WHO European Region) as well as the geographical location, with corresponding climatic factors, and socio-political context of State Parties (for example severe weather events in the WHO South-East Asia Region), all of which can influence and determine the occurrence, spread and severity of public health events.

The breakdown of the overall number of public health events by event designation and, in particular, the variation in relative proportion of the different types of events between WHO Regions is influenced by data entry practices. For example, the proportion of substantiated events ranged around 80% for some WHO Regions while it was approximately 60-70% for other WHO Regions. In particular the WHO African Region (84%) and the WHO Eastern Mediterranean Region (81%) have a markedly higher proportion of substantiated events. This is a direct consequence of the differences in the use of EMS and which type of public health events are recorded between WHO Regions. In the WHO African Region and the WHO Eastern Mediterranean Region not all requests for verification are entered into EMS. Those that are not true events are less likely to be recorded, leading to a higher proportion of substantiated events among the total recorded events and an underrepresentation of the total number of events detected and monitored in these Regions. In addition, the difference in use of EMS and entry of type of events is also reflected in the proportion of events without designation; five WHO Regions have close to none while the other WHO Region had less than 3%.

Regardless of the differences between WHO Regions in the use of and with regard to data entry practices in EMS, when examining substantiated public health events (public health events found to constitute a true hazard) an increase in the absolute number globally has been observed since 2014. This decreased slightly from 2020 to 2021, likely as a result of the COVID-19 pandemic reducing the reporting of other public health events. Differences between WHO Regions exist when examining the trend of absolute number of substantiated public health events, due to inherent differences between WHO Regions (as outlined above). For example, a clear drop in the absolute number of substantiated public health events was observed in 2014 in the WHO African Region and in 2017 in the WHO Region of the Americas. This is due to the Ebola outbreak in West Africa and the Zika outbreak in Latin America, respectively. Overall, this underscores the importance of public health intelligence in early detection and initiating rapid response for a growing number of public health events and emphasises the need to ensure adequate resources tailored to regional realities.

The source of information for the majority of public health events globally (65%) between 2002 and 2021 is WHO, most commonly via its event-based surveillance activities. However, there are substantial variations in the source of information between WHO Regions. When looking at the trend over time by WHO Region, several Regions (the WHO Region of the Americas, the WHO Western Pacific Region and the WHO European Region) show a trend in which the source of information for the majority of public health events is increasingly not WHO but rather the NFP and national government. This regional variation might reflect differing networks and relationship of WHO regional and country offices with NFPs as well as stronger national public health institutes. However, it cannot be ruled out that differences by WHO Region in event reporting and data recording practices could contribute to the variations observed. In addition, there has been an increased collaboration across WHO levels and between WHO regional offices; initial signals of public health events captured by one WHO Region that relates to another are shared immediately, which has led to improved public health response.

In 2021, the proportion of requests for verification for which a response (i.e., provision of information allowing an informed risk assessment)<sup>17</sup> received within 24 hours across all WHO Regions was 48% while the response rate overall (including responses that came after 24h) was 74%. These requests for verification related to signals including but not limited to suspected measles, human rabies, healthcare-associated infections, the detection of SARS-CoV-2 variants amongst others. Therefore, the time and process required to confirm some of these signals (for instance, genomic sequencing capacity to confirm the detection of SARS-CoV-2 variants), contributed to lower response rate when looking at the 24h cut-off. In the WHO Region of the Americas, since at least 2015, additional means of communication (i.e., text messages and instant messaging services via mobile devices) have consistently and increasingly been used to improve event notification by NFPs.

Between 2002 and 2021, infectious diseases were the most common hazard type for substantiated public health events recorded in EMS globally. However, in the last five years, the overall proportion of events related to non-infectious hazards, particularly disaster-related hazards, has increased. This emphasises the importance of an all-hazards approach, as adopted by the revised IHR (2005). The inherent differences between WHO Regions are reflected in the type of hazards they predominantly encounter. The foremost hazard experienced by all WHO Regions were related to infectious diseases. However, the second most common aetiology varied between animal/zoonosis, food safety, other hazards and disaster-related hazards. Moreover, the proportion of public health events related to disasters has increased over time since 2015 or 2016 in several WHO Regions, including the WHO Western Pacific Region, WHO Eastern Mediterranean Region, and WHO South-East Asia Region. In the latter Region, disasters made up the majority of public health events in 2021. The differences between WHO Regions and rise of specific hazards underlines the complex environment in which WHO operates and the multitude of hazards impacting human health globally.

The public health intelligence teams across the three levels of WHO regularly produce information products to inform State Parties and/or the general public on acute or ongoing public health events. The dissemination of DONs in particular is strongly linked to the potential impact of the public health event; for example, 119 DONs on Ebola were disseminated during the outbreaks in the Democratic Republic of the Congo (2017-2021). In 2021, we observed a decrease in the number of EIS and DON postings but a similar number of RRAs, compared to 2020.

There are several limitations to this report. First, a multitude of public health events are detected every day by Member States and WHO. However, EMS is not intended to be a unique repository for

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<sup>17</sup> Pursuant to IHR (2005) Article 10, Verification: “2. Pursuant to the foregoing paragraph [Article 10.1] and to Article 9, each State Party, when requested by WHO, shall verify and provide: (a) within 24 hours, an initial reply to, or acknowledgement of, the request from WHO; (b) within 24 hours, available public health information on the status of events referred to in WHO’s request; and (c) information to WHO in the context of an assessment under Article 6, including relevant information as described in that Article.”



every public health event, but rather only for those that are assessed and reported under the IHR framework. Second, there are differing protocols and data entry practices between the WHO Regions that contribute to the type of events recorded in EMS. Nonetheless, despite these differences, the use of an online platform continues to be instrumental for the efficient management of data related to public health events that may pose a threat to global health security, and serves as a historical repository of such events. Moreover, the platform allows the Organization to rapidly communicate information on public health events and share RRAs in a consistent, timely, and transparent manner across its three levels. In addition, focusing on substantiated public health events only does allow for comparison between WHO Regions, as all Regions have an obligation under IHR to track and follow-up these events. Finally, this report does not discuss the signal detection aspect of public health intelligence. The database for signals of putative public health events is currently undergoing an update, which hampers the ability of including this part of activities in this report but will allow for future inclusion.

This report underscores the increase of public health events globally, particularly during the last five years, and the importance of public health intelligence activities in the detection, verification, and contribution to initial response and control efforts. The impact of COVID-19 and other public health events, such as the Zika and Ebola outbreaks, on public health intelligence activities has been profound but even during these challenging times the teams continued to produce information products to inform both Member States and the general public of potential health threats. However, these experiences emphasise the need for sufficient resources to maintain routine activities while simultaneously also responding to considerable public health threats

Overall, as hazards that have profound impact on public health, such as climate change, (protracted) humanitarian crises, and disasters become more frequent and gain prominence, public health events will continue to rise. The COVID-19 pandemic has emphasised the importance of a strong public health intelligence infrastructure and with increasing hazards on the horizon, this lesson-learnt is now more important than ever when looking to the future.

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**Annexes**

## *Annex 1. List of States Parties of the WHO Regions*

### **WHO African Region**

The **WHO African Region** consists of the following 47 States Parties:

Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cabo Verde, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of Congo, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, South Sudan, Swaziland, Togo, Uganda, United Republic of Tanzania, Zambia, Zimbabwe.

### **WHO Eastern Mediterranean Region**

The **WHO Eastern Mediterranean Region** consists of the following 21 State Parties and the occupied Palestinian territory (including East Jerusalem):

Afghanistan, Bahrain, Djibouti, Egypt, Islamic Republic of Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Occupied Palestinian territory, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Tunisia, United Arab Emirates, Yemen.

### **WHO European Region**

The **WHO European Region** consists of the following 55 States Parties:

Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Holy See, Hungary, Iceland, Ireland, Israel, Italy, Kazakhstan, Kyrgyzstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Republic of Moldova, Romania, Russian Federation, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, The former Yugoslav Republic of Macedonia, Turkey, Turkmenistan, Ukraine, United Kingdom, Uzbekistan.

### **WHO Region of the Americas**

The **WHO Region of the Americas** consists of the following 35 States Parties:

Antigua and Barbuda, Argentina, the Bahamas, Barbados, Belize, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominica, the Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, the United States of America, Uruguay, Venezuela.

### **WHO South-East Asia Region**

The **WHO South-East Asia Region** consists of the following 11 States Parties:

Bangladesh, Bhutan, Democratic People's Republic of Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand, Timor-Leste.

### **WHO Western Pacific Region**

The **WHO Western Pacific Region** consists of the following 37 States Parties and areas:

American Samoa, Australia, Brunei Darussalam, Cambodia, China, Cook Islands, Fiji, French Polynesia, Guam, Hong Kong SAR, Japan, Kiribati, Lao People's Democratic Republic, Macao SAR, Malaysia, Marshall Islands, Federated States of Micronesia, Mongolia, Nauru, New Caledonia, New Zealand, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Philippines, Pitcairn Island, Republic of Korea, Samoa, Singapore, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu Viet Nam, Wallis and Futuna.

## *Annex 2. Verification request information*

### **WHO African Region**

In 2021, of the 86 substantiated events recorded in the WHO African Region, 37 events (43%) had the NFPs and national governments listed as the initial source of information, and 49 (57%) had WHO or other sources listed. For the substantiated events a total of 90 verification request were sent of which 32 (36%) were responded to within 24-48h. In addition, a further 16 (18%) received a response after 48h, thus in total 53% of requests were responded to.

### **WHO Eastern Mediterranean Region**

In the WHO Eastern Mediterranean Region, in 2021, of the 17 substantiated events, 3 (18%) had NFPs, and national governments indicated as the initial source of information, while the remaining 14 events (82%) had WHO or other sources listed. For the substantiated events a total of 53 verification request were sent of which 34 (64%) were responded to within 24-48h. In addition, a further 12 (23%) received a response after 48h, thus in total 87% of requests were responded to.

### **WHO European Region**

In 2021, in the WHO European Region, of the 39 substantiated events, the number was roughly equally split by source of information with 49% having NFPs, and national governments indicated as the initial source of information, and 51% having WHO or other sources listed. During 2021, requests for verification were sent to NFPs to verify information and obtain further details for 5 events. Of these, NFP responses were received within 24-48 hours for 3 (60%) events, and beyond 48 hours for 2 (40%) events. In 2021, the overall response rate for verification requests was 100%, similar to 2020 and compared to 95% in 2019.

### **WHO Region of the Americas**

In the WHO Region of the Americas, in 2021, of the 112 substantiated events, 91 (81%) had NFPs and national governments listed as the initial source of information, while the remaining 21 events (19%) had WHO or other sources listed. During this year, requests for verification were sent to NFPs to verify information and obtain further details for 31 events. Of these, NFP responses were

received within less than 24 hours for 10 (32%) events, between 24 and 48 hours for 4 (13%) events, and more than 48 hours for 13 (42%) events; no response was received for 4 events (13%). The overall response rate in 2021 was 87% and, in 2021, the overall response rate for verification requests received within 24 hours decreased compared to the average of the previous years (88% in 2020, 43% in 2019, to 39% in 2018, 34% in 2017, 28% in 2016, and 52% in 2015).

### **WHO South-East Asia Region**

In 2021 in the WHO South-East Asia Region, in 2021, 5 (10%) of the 50 substantiated events had NFPs and national governments indicated as the initial source of information, while the remaining 45 events (90%) had WHO or other sources listed. Seven verification requests were sent to obtain additional information, of which five (71%) received a reply within 48h and two (29%) were responded to later. In total, all verification requests received a response.

### **WHO Western Pacific Region**

In the WHO Western Pacific Region, in 2021, 22 (71%) of the 31 substantiated events had NFPs and national governments indicated as the initial source of information. The remaining 9 events (29%) had WHO or other sources listed. In 2021, 15 verification request were sent and for eight (53%) a reply was received within 48h. All requests were answered as the remaining seven (47%) received a response after 48h.



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