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To cite this article: John S. Mackenzie, Patrick Drury, Ray R. Arthur, Michael J. Ryan, Thomas Grein, Raphael Slattery, Sameera Suri, Christine Tiffany Domingo & Armand Bejtullahu (2014) The Global Outbreak Alert and Response Network, *Global Public Health*, 9:9, 1023-1039, DOI: [10.1080/17441692.2014.951870](https://doi.org/10.1080/17441692.2014.951870)

To link to this article: <https://doi.org/10.1080/17441692.2014.951870>



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Published online: 04 Sep 2014.



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The Global Outbreak Alert and Response Network

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(Received 20 August 2012; accepted 20 February 2014)

The Global Outbreak Alert and Response Network (GOARN) was established in 2000 as a network of technical institutions, research institutes, universities, international health organisations and technical networks willing to contribute and participate in internationally coordinated responses to infectious disease outbreaks. It reflected a recognition of the need to strengthen and coordinate rapid mobilisation of experts in responding to international outbreaks and to overcome the sometimes chaotic and fragmented operations characterising previous responses. The network partners agreed that the World Health Organization would coordinate the network and provide a secretariat, which would also function as the operational support team. The network has evolved to comprise 153 institutions/technical partners and 37 additional networks, the latter encompassing a further 355 members and has been directly involved in 137 missions to 79 countries, territories or areas. Future challenges will include supporting countries to achieve the capacity to detect and respond to outbreaks of international concern, as required by the International Health Regulations (2005). GOARN's increasing regional focus and expanding geographic composition will be central to meeting these challenges. The paper summarises some of network's achievements over the past 13 years and presents some of the future challenges.

Keywords: outbreak response; World Health Organization; International Health Regulations; Global Outbreak Alert and Response Network; public health emergencies

Introduction

The World Health Organization (WHO) has had control of the international spread of infectious diseases as one of its core functions since the first World Health Assembly (WHA) in 1948.

The priorities over the ensuing decades have changed, as new diseases have emerged and others have been controlled, and even eradicated as in the case of smallpox. A fundamental, core responsibility of WHO to provide disease alert and response assistance to countries, and for the global community, has never wavered. WHO has always depended

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This paper is based on a presentation to the Workshop on Politics of Disease Surveillance – How Unofficial Behaviour is Changing Official Behaviour, held at Griffith University, Griffith, QLD, Australia, in 2011. Other papers presented were published in *Global Public Health*, Volume 7, Issue 7 (2012).

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on its network of Collaborating Centres and disease experts to assist in responding to outbreaks of specific diseases or unusual events, as well as working actively with member states and donors to provide support whenever and wherever required.

At the turn of the century, WHO's role and support was recognised as increasingly critical. Newly emerging diseases and resurging epidemic-prone diseases continually threaten the health and the economic well-being of the international community. In addition, greater awareness and concern about infectious disease outbreaks and their impacts on health and other sectors were happening against the backdrop of an information revolution, which allowed unprecedented broad access to information that was sometimes unverified and sometimes inaccurate.

WHO recognised that alert and response activities could be better organised and more effectively coordinated. A 'Framework for Global Outbreak Alert and Response' was developed by the Department of Communicable Diseases Surveillance and Response, and Regional Offices. This framework introduced – *inter alia* – the concept of a global network of technical institutions and networks, coordinated by WHO, to better focus global resources and relevant expertise to respond to outbreaks which threaten to overwhelm the national capacity of countries, or to contain novel, emergent diseases about which little or nothing is known (WHO, 2000a).

The origins of GOARN

The concepts put forward in this framework document formed the basis for further discussion at a meeting convened by WHO in Geneva in April 2000. The meeting brought together 121 representatives from 67 partner institutions to address the challenges of disease outbreaks at the start of the twenty-first century and specifically the need for a coordinated approach to address these threats. It was recognised that no single organisation or institution had all the capacity to meet these challenges effectively. Not only were outbreaks too numerous and geographically distributed, but also only an effective technical partnership of national and international institutions and networks could operate effectively in the complex political, economic and environmental circumstances that are often significant factors in disease outbreaks.

The meeting participants agreed that a new approach was necessary to meet these challenges and that the solution was a global network of partners able to bring the resources of many organisations to bear on the problem. The participants agreed to establish the Global Outbreak Alert and Response Network (GOARN) as a network of technical partners and other networks with the capacity and expertise to contribute to an international, coordinated response to outbreaks of epidemic-prone and novel infectious diseases (WHO, 2000b).

GOARN would complement the existing outbreak alert and early warning systems, WHO Collaborating Centres, disease-specific surveillance networks and coordination mechanisms, national and international surveillance, and laboratory networks for emerging and re-emerging infectious diseases, related training initiatives and programmes and strengthen existing coordination of international response, particularly for outbreak alert and response in emergencies (Heymann, Rodier, & the WHO Operational Support Team to the GOARN, 2001).

The partner institutions agreed to work together to ensure that appropriate technical assistance would rapidly reach affected countries and populations and would lead to reduced morbidity and mortality and prevent further disease spread.

GOARN's functions would be to work as a 'network of networks' to combat the international spread of outbreaks by supporting WHO's activities in rapid identification, verification and communication of threats and by ensuring a coordinated mechanism for outbreak alert and response. Partners recognised the opportunity presented by improved international support for outbreak response to contribute also to long-term outbreak preparedness and response capacity at all levels.

It was also agreed that the structure of the network would be supported by a 'Steering Committee' consisting of about 20 representatives of network partners, and an operational support team based in WHO (WHO, 2000b).

Participants at the meeting agreed on a series of guiding principles and core functions for the proposed network. The meeting discussed the next steps in setting up the network and agreed that a small 'interim committee' would work together with WHO in identifying and implementing initial activities. These activities included finalisation of the framework document for a GOARN, establishment of a Code of Practice for network operations, for field operations and for conflict resolution, and agreeing on the Guiding Principles for International Outbreak Alert and Response (WHO, 2000c).

In addition, and in collaboration with WHO, a number of essential components were developed to support deploying people in the field and improving coordination, including linkages to the WHO event management system for epidemics, development of field logistics capability, including field kits and tools, and a mobile communications system – the latter an important component to ensure the safety and security of personnel in the field.

In May 2001, the WHA adopted a resolution and report on 'Global Health Security: Epidemic Alert and Response' that recognised WHO's leadership and efforts in creating GOARN as a cost-effective, coordinating mechanism for epidemic alert and response and as a partnership to ensure that the best expertise is harnessed wherever and whenever it is needed. In addition, it recognised that acute responses may lead to longer-term technical assistance and preparedness for outbreaks (WHO, 2001).

The structure of the network

In its original conception, GOARN is a network of technical partners and other surveillance networks which would be coordinated and supported by WHO, and with a Steering Committee reflecting the make-up of technical institutions and disciplines needed for comprehensive outbreak response. Thus the participating technical institutions and networks comprise the membership of GOARN, not individuals.

The original concept of GOARN was that it was to be a partnership of major technical institutes with WHO. It was also agreed that WHO would provide the secretariat to support the Steering Committee and provide operational support to develop the network, and in collaboration with staff in relevant WHO Departments, Programmes and Offices, to provide communications support and advocacy for the network, and to coordinate and support field missions and response activities. In addition, WHO would mobilise and provide much of the financial support for GOARN. These activities place WHO at the centre of the core functioning of the network, and thus questions could be raised about the relative independence of the network, and specifically whether WHO's role is as one of the partners in the network, or whether GOARN should be considered as a more formal initiative of WHO. The majority of partners, when approached during an external review of GOARN, believed that the balance between integration into WHO's operations and network independence was about right, and most recognised WHO as the dominant partner. GOARN is thus recognised by WHO as the body able to provide the broad

technical expertise necessary to enable it to assist member states with outbreak response, and more recently, as the ‘operational arm’ of the new International Health Regulations (IHR; 2005). These issues have been discussed elsewhere by Ansell, Sondorp, and Stevens (2012).

The initial ‘interim committee’ was established to develop and propose governance mechanisms, rules and procedures to reflect the make-up and guiding principles of the network. This interim committee became the Steering Committee in late 2001. Since then, the Steering Committee has provided direction to the network through monitoring the implementation of the network’s work plan, setting up technical working groups, and approving new member institutions in the network. In early meetings, the Steering Committee monitored the operation and outcomes of field missions and used these reviews to provide important suggestions for future deployments. As the number of missions increased, and financial pressures made it difficult to maintain the frequency of meetings, the Steering Committee has focused primarily on providing advice on the development of the network.

Over the past 13 years, the number of technical partners and participating networks has grown substantially and now numbers 153 institutions and 37 additional networks (Figure 1), the latter encompassing a further 355 members, which together provide a wide geographic reach and broad representation of technical skills and disciplines. Partners include government agencies, universities, research institutes, training programmes and networks, non-governmental organisations (NGOs), international organisations and a range of related specialist networks, especially those concerned with laboratory investigations, infection prevention and control, clinical management, and WHO networks managing chemical, environmental and food safety events.

As GOARN established a reputation for competency in major outbreak responses through the provision of technical, multi-disciplinary expertise and grew in recognition (Lazcano-Ponce, Allen, & González, 2005), it became increasingly important to ensure access to additional capacity in specific areas of expertise and to individuals with the requisite language skills and to incorporate a wider geographic representation of partners. There has therefore also been a concerted effort over recent years to ensure that the network’s composition is as broad as possible, through engaging technical partners in more countries and regions. This is both consistent with the principle of bringing the most proximate resources to bear as rapidly as possible and leveraging network activities to develop as well as employ partner institutional capacity. While this has been generally successful, there are still gaps that need to be filled over coming years.

Field missions

There has been a continual emergence and resurgence of epidemic-prone infectious diseases and of novel, previously unrecognised emerging diseases that threaten global health and economic stability, many of which have resulted in GOARN missions to affected member states and regions (Breiman et al., 2003; Formenty et al., 2005; Mackenzie, 2011; Mackenzie et al., 2004). Since 2000, WHO has supported and coordinated the network activities to provide an operational framework for GOARN partners to respond to major outbreaks of cholera, dengue, encephalitis, influenza, meningitis, Nipah, plague, severe acute respiratory syndrome (SARS), viral haemorrhagic fevers (VHF), yellow fever and other emerging and epidemic-prone pathogens. Partners have also provided experts for deployment to assist in addressing infectious disease impacts of major humanitarian crises, including natural disasters. Overall, GOARN

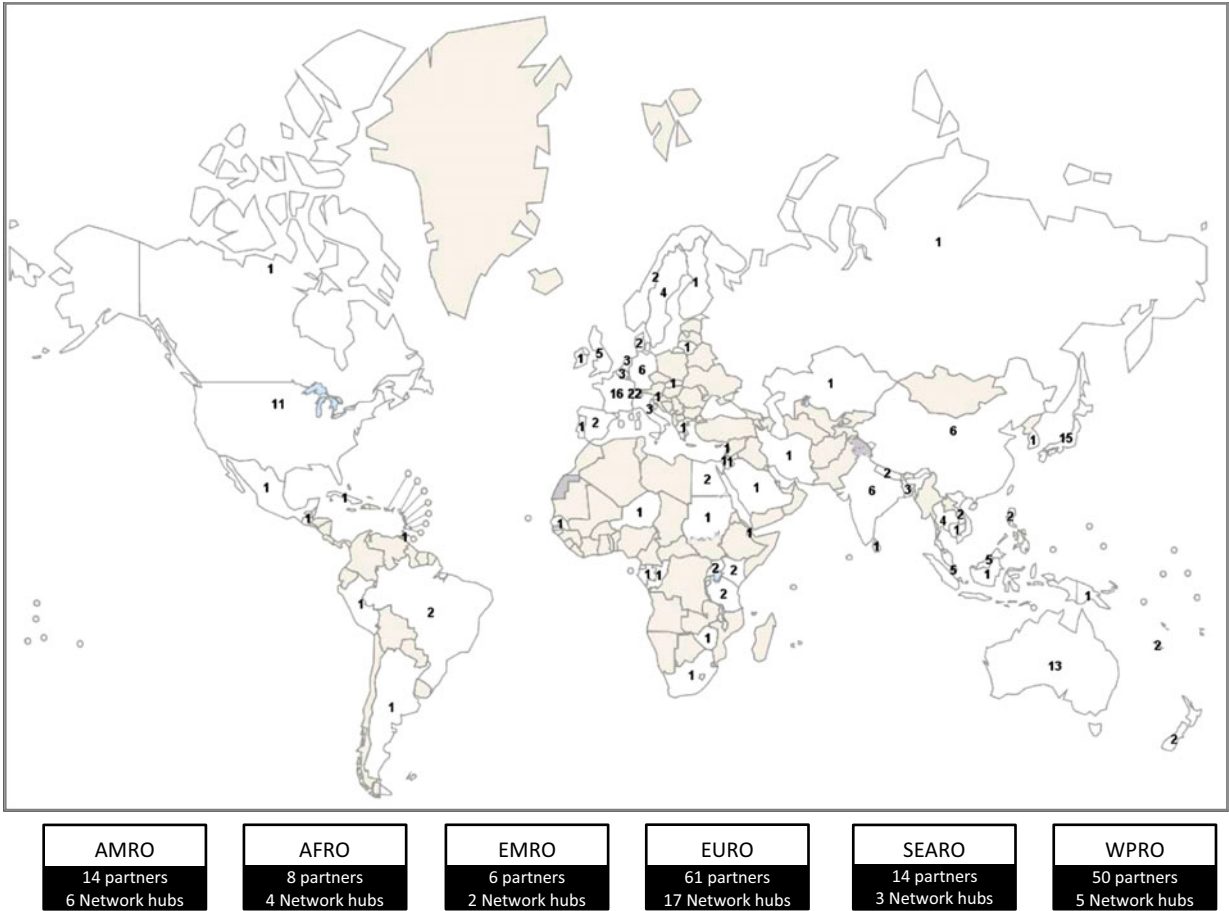


Figure 1. Map showing numbers of partner institutions and network hubs in GOARN in each country.
 Note: Shaded countries have no partner or hub at this time. The figures in boxes provide the number of partners and network hubs in each WHO region (AMRO = Regional Office of the Americas; AFRO = African Regional Office; EURO = European Regional Office; EMRO = Eastern Mediterranean Regional Office; SEARO = South-East Asian Regional Office; WPRO = Western Pacific Regional Office).

Table 1. GOARN deployments and person days in the field by disease and GOARN operation.

Description	Deployments	Person days
<i>Acute hepatitis E</i>	5	123
Acute hepatitis E, Chad, 2004	5	123
<i>Bolivian haemorrhagic fever (Machupo virus)</i>	2	15
Bolivian hemorrhagic fever, Bolivia 2012	2	15
<i>Cholera</i>	128	3678
Cholera assessment mission, Iraq, 2013	6	55
Cholera, Philippines, 2012	2	37
Cholera, Haiti, 2010	32	891
Cholera, Papua New Guinea, 2009	16	335
Cholera, Sierra Leone, 2012	21	456
Cholera, Democratic Republic of the Congo, 2008	1	14
Cholera, Democratic Republic of the Congo, 2011	1	28
Cholera, Mali, 2003	2	30
Cholera, Tanzania, 2002	4	56
Cholera, Uganda, 2008	1	18
Cholera/Anthrax, Zimbabwe, 2008	42	1758
<i>Coronavirus infection</i>	6	40
MERS-Cov Outbreak, Tunisia, 2013	6	40
<i>Crimean-Congo haemorrhagic fever</i>	8	233
Crimean-Congo haemorrhagic fever, Kosovo, 2001	8	233
<i>Dengue fever/dengue haemorrhagic fever</i>	38	495
Dengue, Pakistan, 2010	5	40
Dengue, Pakistan, 2011	13	97
Suspect dengue/dengue haemorrhagic fever, Sudan, 2005	4	46
Dengue haemorrhagic fever, Timor-Leste, 2005	8	172
Dengue, Cape Verde, 2009	8	140
<i>Ebola haemorrhagic fever</i>	310	9280
Ebola haemorrhagic fever, Congo, (1), 2003	18	471
Ebola haemorrhagic fever, Congo, (2), 2003	13	308
Ebola haemorrhagic fever, Congo, 2001	4	111
Ebola haemorrhagic fever, Congo, 2010	1	10
Ebola haemorrhagic fever, Democratic Republic of the Congo, 2008	9	153
Ebola haemorrhagic fever, Democratic Republic of the Congo, 2012	17	404
Ebola haemorrhagic fever, Gabon, 2001	39	1212
Ebola haemorrhagic fever, Uganda, 2000	114	3874
Ebola haemorrhagic fever, Uganda, 2012	1	14
Ebola haemorrhagic fever, Democratic Republic of the Congo, 2007	49	1208
Ebola haemorrhagic fever, South Sudan, 2004	13	331
Ebola haemorrhagic fever, Uganda, 2012	4	58
Ebola haemorrhagic fever, Uganda, 2007	28	1126
<i>Flood</i>	47	194
Cholera, Pakistan, 2010	47	194
<i>Fully characterised disease NOS</i>	4	24
Hysteria, Macedonia, 2002	4	24
<i>Influenza due to identified avian or animal influenza virus</i>	210	3783
A/H5N1, Cambodia, 2004	3	70

Table 1 (Continued)

Description	Deployments	Person days
A/H5N1, Indonesia, 2004	3	103
A/H5N1, Thailand, 2004	4	86
A/H5N1, Viet Nam, 2004	31	965
A/H5N1, Nigeria, 2007	8	114
A/H5N1, Coordination of Response Operations, 2006 ^a	161	2445
<i>Influenza due to identified human influenza virus</i>	218	3538
Influenza, Madagascar, 2002	10	250
Pandemic influenza A(H1N1) 2009 investigation and response, 2009 ^a	208	3288
<i>Lassa fever</i>	5	72
Lassa fever, Sierra Leone, 2004	5	72
<i>Leptospirosis</i>	5	76
Leptospirosis, Philippines, 2009	5	76
<i>Marburg haemorrhagic fever</i>	129	2084
Marburg, Angola, 2005	112	1848
Marburg, Uganda 2012	9	129
Marburg, Uganda, 2007	8	107
<i>Meningococcal disease</i>	23	600
Meningitis, Ethiopia, 2001	5	178
Meningitis, Burkina Faso, 2008	1	11
Meningitis, Burkina Faso, 2009	2	32
Meningitis, Chad, 2010	2	23
Meningitis, Chad, 2011	3	114
Meningitis, Nigeria, 2011	1	15
Meningitis, Philippines, 2005	9	227
<i>Myocarditis, acute infective</i>	12	281
Myocarditis, Sri Lanka, 2005	12	281
<i>Plague</i>	13	262
Plague, Algeria, 2003	5	49
Plague, Democratic Republic of the Congo, 2005	8	213
<i>Poisoning, unspecified</i>	24	118
Poisoning (unspecified), Angola, 2007	24	118
<i>Poliomyelitis</i>	11	138
Poliomyelitis, Angola, 2009	3	47
Poliomyelitis, Angola, 2010	1	10
Poliomyelitis, Chad, 2010	1	16
Poliomyelitis, Guinea, 2010	2	26
Poliomyelitis, Senegal, 2010	2	17
Poliomyelitis, Democratic Republic of the Congo, 2010	1	11
Poliomyelitis, Democratic Republic of the Congo, 2011	1	11
<i>Rift Valley fever</i>	40	430
Rift Valley fever, East Africa, 2006	15	96
Rift Valley fever, Madagascar, 2008	8	67
Rift Valley fever, Sudan, 2007	6	97
Rift Valley fever, Saudi Arabia, 2000	6	96
Rift Valley fever, Yemen, 2000	5	74
<i>Risk assessment</i>	4	113

Table 1 (Continued)

Description	Deployments	Person days
Olympics Laboratory Mission, China, 2008	4	113
<i>Sequelae of war operations</i>	2	60
Food insecurity, Sahel Region, 2012	2	60
<i>Severe acute respiratory syndrome (SARS)</i>	80	2000
SARS, 2003	80	2000
<i>Tsunami and other natural disasters</i>	40	876
Tsunami, India, 2004	7	198
Tsunami, Indonesia, 2004	23	432
Tsunami, Sri Lanka, 2004	10	246
<i>Vibrio vulnificus</i>	4	48
<i>Vibrio vulnificus</i> , New Caledonia, 2009	4	48
<i>Viral diseases, other specified</i>	21	396
Nipah, Bangladesh, (1), 2004	11	285
Nipah, Bangladesh, (2), 2004	3	48
Unknown Disease, Bangladesh, 2001	7	63
<i>Yellow fever</i>	78	2612
Yellow fever, Sudan, 2005	13	268
Yellow fever, Cote d'Ivoire, 2001	8	192
Yellow fever, Cote d'Ivoire, 2008	3	30
Yellow fever, Sudan, 2012	2	39
Yellow fever, Togo, 2007	6	99
Yellow fever, Central African Republic, 2010	6	280
Yellow fever, Central African Republic, 2011	4	189
Yellow fever, Cote d'Ivoire, 2010	2	106
Yellow fever, Cote d'Ivoire, 2011	5	192
Yellow fever, Ghana, 2010	1	5
Yellow fever, Ghana, 2011	3	204
Yellow fever, Guinea, 2001	2	18
Yellow fever, Guinea, 2005	5	75
Yellow fever, Guinea, 2010	2	170
Yellow fever, Mali, 2005	5	119
Yellow fever, Senegal, 2002	11	626
<i>Other</i>	4	60
Acute haemorrhagic fever syndrome, Afghanistan, 2000	4	60
<i>Grand total</i>	1471	31,629

^aMultiple countries.

partners have been deployed on 137 missions, comprising 1471 deployments and 31,629 person days (Table 1) in 79 countries, territories or areas (Table 2). In keeping with the guiding principles agreed by partners, all missions have been to support national health authorities and were initiated at the invitation or request of the affected WHO member state(s). The primary aim has been to provide rapid support for outbreak response. However, these missions have also influenced the development of local, national and international capacities and supported more long-term initiatives and relationships. More could be done to document and develop this contribution of GOARN partners.

Alerts, requests for assistance, operational updates, offers of technical support and details of deployments (in clinical management, epidemiology, infection control,

Table 2. GOARN deployments by country, area or territory.

Country, area or territory	Total deployments	Person days
Afghanistan	4	60
Algeria	5	49
Angola	140	2023
Argentina	22	385
Armenia	6	54
Azerbaijan	17	344
Bangladesh	24	458
Belize	4	16
Bolivia (Plurinational State of)	5	33
Burkina Faso	3	43
Cambodia	3	70
Cape Verde	8	140
Central African Republic	10	469
Chad	11	276
Chile	11	172
China	47	1123
Congo	36	900
Cote d'Ivoire	18	520
Democratic Republic of the Congo	88	2072
Djibouti	2	20
Dominican Republic	8	38
Ecuador	3	17
Egypt	8	92
El Salvador	8	45
Ethiopia	5	178
Gabon	39	1212
Georgia	4	32
Ghana	4	209
Guatemala	8	46
Guinea	11	289
Haiti	35	930
Honduras	3	15
India	7	198
Indonesia	41	854
Iran (Islamic Republic of)	6	72
Iraq	19	310
Jamaica	1	20
Jordan	10	187
Kenya	15	96
Kosovo	8	233
Lebanon	5	65
Madagascar	18	317
Mali	9	209
Mexico	86	1567
New Caledonia	4	48
Nicaragua	12	73
Niger	2	27

Table 2 (*Continued*)

Country, area or territory	Total deployments	Person days
Nigeria	35	590
Pakistan	65	331
Panama	9	69
Papua New Guinea	16	335
Paraguay	2	29
Peru	1	5
Philippines	16	340
Saudi Arabia	6	96
Senegal	13	643
Sierra Leone	22	436
Singapore	5	126
South Sudan	13	331
Sri Lanka	22	527
Sudan	25	450
Switzerland	6	323
Syrian Arab Republic	8	56
Thailand	4	86
The former Yugoslav Republic of Macedonia	4	24
Timor-Leste	8	172
Togo	6	99
Trinidad and Tobago	2	50
Tunisia	6	40
Turkey	30	354
Uganda	165	5326
Ukraine	3	61
United Arab Emirates	1	9
United Republic of Tanzania	4	56
United States of America	16	358
Viet Nam	63	1829
West Bank and Gaza Strip	5	40
Yemen	5	74
Zimbabwe	42	1758
Grand total	1471	31,629

laboratory support, social mobilisation, risk communications and logistics) are posted on the GOARN SharePoint website, which also provides a mechanism to assist in communications between the operational support team and GOARN partners. Partner institutions able to respond to requests for assistance nominate expert staff members for deployment, based on a number of factors including expertise in the areas specified by the health authorities in the affected country and appropriate language skills. In most instances, the period of deployment varies between one and four weeks. Terms of reference for field missions and individual deployments are negotiated and agreed in advance with the responsible health authorities in affected countries and the framework. The number of deployments of WHO and non-WHO personnel and their fields of expertise are shown in [Figure 2](#).

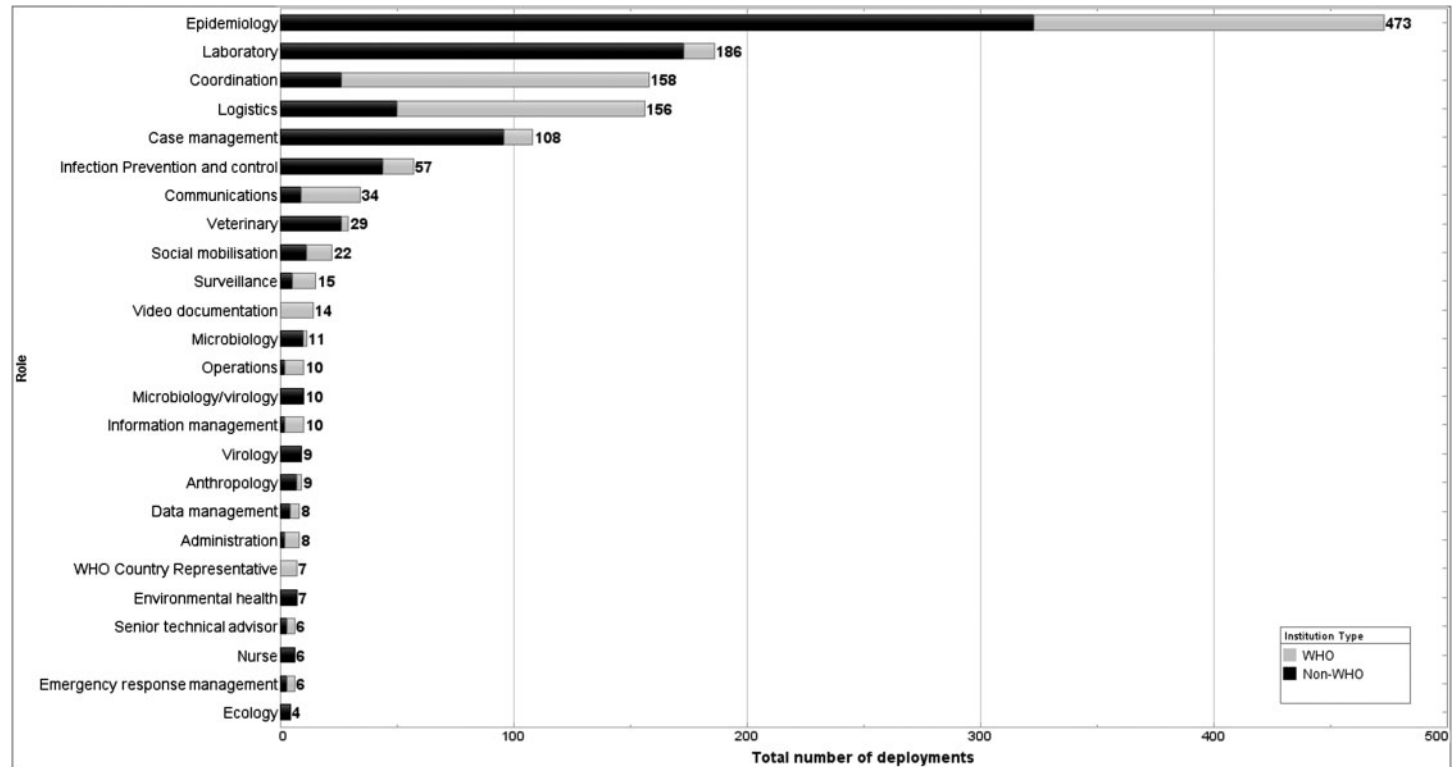


Figure 2. The areas of expertise of people deployed in GOARN missions, showing the number associated with WHO and with other network partners.

In the first years of GOARN operation, field missions were largely in response to outbreaks of disease in single countries, particularly outbreaks of VHF in African countries. These missions sometimes required significant numbers of deployments before the outbreak ended, as occurred during the 2000 outbreak of Ebola in Gulu, Uganda (Lamunu et al., 2004; Okware et al., 2002). Other outbreaks focused on unusual manifestations, such as the high death rate from an outbreak of influenza in Madagascar (WHO-GOARN Investigation Team, 2002).

The first major test of the resilience of the network came in 2003 with the multi-country response to the emergence of SARS, the first global threat by a novel agent in the new Millennium. GOARN played a significant role in the rapid deployment of international teams for missions to China, Hong Kong SAR, Vietnam and Singapore, as well as supporting the participation of a large number of experts from partner institutions in virtual networks which were rapidly established to investigate the novel, previously unknown infectious agent as well as its epidemiology, infection control and clinical course of disease. The role of WHO and the contribution of GOARN partners has been discussed in detail elsewhere (Heymann, 2004; Mackenzie et al., 2004; WHO, 2006). The SARS global response provided important lessons for the teams at WHO regional offices, particularly the Regional Office for the Western Pacific (WPRO), and at WHO headquarters, as well as GOARN partners. SARS highlighted the technical and operational challenges of identifying and deploying international teams to respond simultaneously to requests for assistance from multiple countries. The contribution of GOARN partners to controlling SARS was recognised by the WHA, which urged the member states to 'continue to collaborate with and, when appropriate, provide assistance to WHO's GOARN as the operational arm of the global response', and requested the director general to 'strengthen the functions of WHO's Global Outbreak Alert and Response Network' (WHO, 2003).

Additional multi-country and/or prolonged responses have occurred in the past few years, including for highly pathogenic avian influenza (H5N1) (Dinh et al., 2006; WHO, 2007), for pandemic H1N1 influenza and for cholera outbreaks in Zimbabwe (WHO, 2009) and Haiti (WHO, 2010).

GOARN partners also provided assistance to health authorities in Indonesia and Sri Lanka following the Asian tsunami. In Indonesia, this assistance was provided to support the Aceh Provincial Health Office to develop a surveillance/early warning and response network system for the detection of epidemic-prone diseases; to investigate outbreaks, with confirmation of potential pathogen, mode of transmission and individuals at risk, and appropriate control measures; and to prepare for outbreak management and control (Ministry of Health, Indonesia, WHO assisted by GOARN partners, UNICEF, 2005).

Increasingly, WHO regional offices play a critical role in the coordination and deployment of GOARN teams, in close collaboration with the operational support team at WHO headquarters. Important disease outbreaks, including leptospirosis in the Philippines, cholera in Papua New Guinea, viral haemorrhagic fevers (VHF) outbreaks in African countries and outbreaks of H1N1 in Mexico and Central and South America have been important catalysts for this change.

One important outcome from GOARN deployments has been the successful development of field laboratories for haemorrhagic fever outbreaks. The use of a field laboratory to provide rapid diagnosis was first successfully employed by the Centers for Disease Control and Prevention (CDC) during the Ebola outbreak in Gulu, Uganda, in 2000–2001, using antigen capture and reverse transcription-polymerase chain reaction (RT-PCR) to diagnose infection in suspect patients and based in one of the two major

hospitals in Gulu (Centres for Disease Control and Prevention [CDC], 2001; Okware et al., 2002; Towner et al., 2004). The same laboratory also assisted in the rapid diagnosis of patients in a secondary outbreak in Masindi, 170 km south of Gulu (Borchert et al., 2011). The success of the laboratory in Gulu prompted further developments in truly mobile laboratories for the diagnosis of haemorrhagic fever cases and to assist epidemiological surveillance, and two novel mobile laboratories were subsequently employed successfully during the Marburg virus outbreak in Angola in 2005, with one laboratory in Uige, the epicentre of the outbreak, operated by the Public Health Agency of Canada (Grolla et al., 2011) using quantitative real-time PCR, and a second laboratory operated by CDC in the capital, Luanda, using a new, safe, rapid and reliable high-throughput protocol for RNA extraction and quantitative RT-PCR analysis (Towner, Sealy, Ksiazek, & Nichol, 2007). There was a high concordance in test results between the two laboratories, strongly suggesting that field capacity should be enhanced and expanded and be an essential component in future outbreak investigations. A large, shipping container-sized mobile laboratory was developed by members of the Universiti Malaysia Sarawak and successfully deployed to Meulaboh, Aceh Province, during the tsunami relief activities.

Other network activities

Among the early initiatives of the Steering Committee was the recognition that while the network's partners represented a large body of expertise in epidemiology, microbiology or clinical management, there was relatively limited expertise in team leadership and overall coordination of response. To address this gap, the GOARN partners and WHO developed training courses in international outbreak response leadership. The first course was held in 2005. Subsequently, WHO regional offices and headquarters provided further training courses, primarily to develop regional capacity for international response. A faculty drawn from GOARN partners and from across WHO has developed and adapted training material, and provided training on field team leadership, management of complex international outbreak response, disease-specific scenarios and rapid containment operations. In the Western Pacific Region, GOARN partners and WHO have collaborated in innovative training approaches and pilot courses. These activities have supported the development of a GOARN training faculty and provided a cadre of trained experts in different technical areas of outbreak response. This resource represents an important asset on which to build future response capacity and improve performance in the field.

GOARN and the new IHR (2005)

The revised IHR (2005; WHO, 2008) came into force in mid-2007 and have a number of implications for GOARN operations and activities.

The purpose and scope of the IHR 2005 are 'to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade' (Art. 2, IHR 2005). The revised regulations require the states' parties to develop specific minimum core public health capacities for surveillance and response, and specifically with regard to 'surveillance, reporting, notification, verification, response and collaboration activities' (IHR Annex 1).

The IHR also reaffirmed the central role of WHO in assisting countries in controlling the international spread of infectious diseases, stating that WHO shall, at the request of a

state party, 'provide technical guidance and assistance ... including the mobilisation of international teams of experts for on-site assistance' (Art. 13.3, IHR 2005), and 'the offer to mobilise international assistance in order to support the national authorities in conducting and coordinating on-site assessments' (Art. 13.4, IHR 2005), both of which would be largely undertaken through GOARN.

For GOARN partners, the revised IHR have resulted in a significant change with respect to the increased sensitivity about rapid information sharing on acute public health events. Confidentiality requirements implicit in the revised IHR led to the discontinuation of the WHO Outbreak Verification List (OVL). Prior to the IHR (2005), the OVL was published weekly as a source of information on disease outbreaks provided by WHO. The OVL was disseminated to subscribers, including WHO staff worldwide, UN agencies, national health authorities, WHO collaborating centres, field epidemiology programmes and NGOs, many of which were also GOARN partners at the time (Grein et al., 2000).

To reinforce information flows among GOARN and to ensure the network's capacity to respond rapidly to requests for assistance, the operational support team developed a SharePoint website to provide partners with alerts and details of requests for assistance, together with information on mission planning and deployments, and to support coordination and information sharing on the involvement of partners in ongoing outbreak response. GOARN partners do not have privileged access to confidential information that WHO shared with national focal points for the IHR (2005). The SharePoint site is also used to share relevant information on GOARN activities not related to specific events, such as meetings of the Steering Committee and its working groups.

As countries make progress towards attaining core national capacities in detection, verification and surveillance, there is an expectation that this increasing self-sufficiency to respond to disease outbreaks and public health events (Art.13.1, IHR 2005) will impact the type and nature of future requests for international assistance to WHO, the nature of international collaboration to address emerging disease threats and the support of GOARN partners.

In May 2012, the WHA discussed progress on implementation of the IHR 2005. In light of the gaps which remain in core capacities and the continuing concern about epidemic and pandemic prone diseases and public health events of international concern, the member states and WHO renewed their commitment to the full implementation of the regulations.

Future directions

The performance of GOARN has recently been subject to an external independent review and evaluation commissioned by the Steering Committee (Sondorp, Ansell, Stevens, & Denton, 2011). It concluded that over its initial 9 years, GOARN had proved to be a capable and effective mechanism for multilateral responses to disease outbreaks through improving field coordination and by rapidly deploying experts when and where needed. In addition, the Report of the Review Committee on the Functioning of the IHR (2005) in relation to Influenza A (H1N1) Pandemic (WHO, 2011) also concluded that network partners play a vital role in enabling WHO to fulfil its international alert and response responsibilities.

The findings of these two review processes and their recommendations have been supportive of GOARN's core activities with respect to outbreak responses and in humanitarian crises where there was a potential for outbreaks of disease. They also recognise that the network provides important capacity to address aspects of IHR (2005)

implementation. They clearly demonstrate that GOARN has been a major asset to WHO, and the partners have supported WHO in fulfilling its role of assisting the member states in containing and controlling epidemic-prone and emerging diseases, as well as providing a response mechanism to assist in other public health emergencies.

These reviews have suggested that the GOARN partnership consider developing new directions and strategies that leverage the assets of partner institutions to ensure the network remains relevant and effective. The core activities concerned with outbreak response will continue, with support for increased regional response activities coordinated by WHO regional offices and with a greater use of regional partners in deployments. To support this, further partner institutions will be sought to expand the broad geographic range. In addition, partner institutions will be encouraged to assist the member states in capacity-building in order to fully develop core capacities required for compliance in the revised IHR. The breadth of expertise will be expanded to incorporate the capacity to respond to chemical events or toxic additions to food or accidental release into the environment. These and other initiatives are currently under discussion by the Steering Committee.¹

Acknowledgements

The authors would like to acknowledge the seminal contributions of Dr D.L. Heymann, Dr G. Rodier, Dr R. St John, Dr Cathy Roth and the late Professor Aileen Plant in the concept and initial establishment of GOARN, and the contributions made by a large number of people and partner institutions to the subsequent development of GOARN since 2000, including current and past members of the GOARN Steering Committee, the GOARN partners and networks, and the staff at the World Health Organization at headquarters and in regional offices for their involvement and commitment to its development and ongoing activities. In particular, the authors would also like to acknowledge and thank all those who have made themselves available at short notice to rapidly support outbreak responses in the field – it is their achievements and support which have led to the success of the network.

Note

1. As at 20 June, 2014, GOARN missions have been deployed to the Philippines in response to Typhoon Haiyan at multiple locations and to floods in Zamboanga (36 deployments); to multiple locations in the Middle East (Qatar, United Arab Emirates, and the Kingdom of Saudi Arabia) in response to the MERS-CoV outbreaks (17 deployments); to West Africa to multiple locations in Guinea, Liberia and Sierra Leone for Ebola (77 deployments); to South Sudan for cholera (2 deployments) and to Iraq for cholera (3 deployments). Missions are continuing in each of these countries, and especially in West Africa where the Ebola outbreak is now the largest on record and likely to require many additional deployments until it can be brought under control.

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