One Health Surveillance: perceived benefits and workforce motivations

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Summary

One Health Surveillance (OHS) implements the One Health approach to improving health by collecting data and producing information to support integrated action across the animal health, human health and environment sectors. The purpose of this study was to survey the biosurveillance community to assess its OHS practices and capabilities, its attitudes towards OHS (perceived value), and the factors that motivate its members to implement OHS practices. The authors used a convenience sample of 185 professionals from multiple domains and 44 nations. They examined the extent to which these professionals implemented OHS, gathered their opinions on the value of OHS, assessed their perceptions of the capacity to perform specific OHS tasks and identified their priorities for change. Over 85% of all respondents said that they considered OHS to be beneficial, with no significant differences between work domains or country income groups; over 50% indicated that they already applied OHS. Obtaining access to data collected by other domains was both the most frequent challenge and the most difficult to improve. The highest priority for improvement was having the ability to send and receive electronic data. Respondents from low-income or middle-income countries were more motivated to make improvements than stakeholders from high-income countries. These findings provide a snapshot of current opinions and practices and, together with suggestions for improvements from professionals in the field, can help to target priority needs for OHS information, training and resources.

Keywords

Animal health – Environmental health – Integrated approach – Multisectoral collaboration – One Health – Public health – Surveillance – Zoonotic disease.

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Introduction

The call for more rapid and effective responses to zoonotic diseases (1) has resulted in a conceptual shift away from traditionally siloed health approaches, towards practices that are integrated across disciplines, sectors, and agencies using a One Health approach (2, 3, 4, 5, 6).

The emerging field of One Health Surveillance (OHS) implements One Health through the collection, analysis, and sharing of the data and information needed for situational awareness and coordinated decision-making in the face of a shared health threat involving multiple sectors (7, 8, 9). A recent report of surveillance systems around the world, including global systems and those at a more local level, identified 20 different examples of systems that have already integrated human and animal data for surveillance purposes (10).

In order to initiate the system-level changes needed to implement new OHS, decision-makers must perceive a shortfall in surveillance capacity that is great enough to motivate change (11). Authors have repeatedly reported significant gaps in quantitative metrics and a need for frameworks which measure the effectiveness of One Health approaches (5, 12). However, before new surveillance practices can be implemented within a health jurisdiction, there needs to be an understanding of the underlying attitudes, capabilities and motivation for investing the resources in new approaches (11).

The purpose of this study was to explore the views of workers from the human, animal and environmental health domains on conducting integrated, multidisciplinary OHS. The authors also examined perceived capabilities in data collection, management and cross-agency communications, and the motivation for making improvements. As far as the authors are aware, this is the first study to survey the OHS global workforce directly and to gather its practical recommendations for implementing OHS.

Materials and methods

Data collection and analysis

The target population for this study was professionals working in human, animal and environmental health surveillance worldwide. The OHS Workgroup of the International Society for Disease Surveillance (ISDS), composed of subject matter experts representing these sectors from multiple nations, developed the questionnaire using Survey Monkey™. To provide a common context for survey responders, OHS was defined as, 'The collaborative, on-going, systematic collection and analysis of data from multiple domains at local, national, and global levels to detect health-related events and produce information which leads to actions aimed at attaining optimal health for people, animals, and the environment' (7). A link was e-mailed directly to approximately 2,700 people on several e-mail lists from ISDS and partners, including organisers of the International Conference on Animal Health Surveillance and the World Health Organization South-East Asia Regional Office. While there may be overlap in the lists, only one response per person could be submitted using the survey tool. Invitations to complete the questionnaire were also distributed through social media, with encouragement to distribute further through other professional networks. The questionnaire was open for submission for three weeks in October 2014.

To capture how surveillance workers perceive capabilities in their jurisdiction in key areas of OHS, respondents were asked to consider a zoonotic outbreak scenario of an undetermined respiratory disease in people exposed to farmed poultry and wild waterfowl at a nearby pond. The OHS workgroup identified seven capabilities and respondents were asked to indicate how challenging they were and how difficult it would be to make improvements in those areas. To assess the motivation for improving, respondents were also asked about the extent to which making improvements in those areas was a priority (Table I). For each of the three questions, there were a number of response options (four for the first two questions and three for the last question), but because of the small sample size, the responses were coded in a binary manner, as follows:

a) Is this a challenge in your jurisdiction? 0 = 'never' or 'occasionally'; 1= 'frequently' or 'always'

b) How difficult would it be to make improvements? 0 = 'improvements are underway' or 'not difficult'; 1 = 'somewhat difficult' or 'very difficult'

c) What priority is making improvements in your jurisdiction? 0 = 'low priority', 1 = 'medium priority' or 'high priority'.

For further analyses, respondents were grouped by:

– the domain in which they worked: human health sector, animal health sector or multiple domains

– the income level of their country: low or middle income (LMI) or high income (HI).

Income levels were based on annual gross national income (GNI) per capita, calculated using the World Bank Atlas Method (13). According to this classification system, countries with high-income economies are those with a GNI per capita of US$ 12,236 or more. All other economy classifications (low income, lower-middle income and upper-middle income) were grouped together as LMI countries.

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Table I

Survey responses regarding seven different aspects of surveillance

Respondents (*n* = 185) answered questions about surveillance issues in terms of how challenging they were, how difficult it would be to make improvements in those areas, and to what extent making improvements was a priority

The highest value for each dimension is in bold for emphasis

Surveillance capability	Is this a challenge in your jurisdiction?	How difficult would it be to make improvements?	What priority is making improvements in your jurisdiction?
	Frequently or always	Very difficult	Medium or high
Having a surveillance system to jointly assess and respond to risk of transmission across domains	47.0%	16.2%	64.9%
Having the ability to send and receive electronic data	36.2%	8.6%	82.2%
Having access to data collected by your own surveillance domain	22.7%	4.3%	78.9%
Having access to data collected by domains outside of your own domain	**54.6%**	**28.6%**	62.2%
Having the skills to integrate, analyse and interpret data from other domains	33.0%	10.3%	63.2%
Knowing whom to contact in other domains to jointly assess risks	29.7%	5.9%	67.6%
Exchanging information with investigators from other domains	30.8%	11.4%	64.9%

Logistic regression modelling was used to compare responses from the groups of respondents for each individual surveillance capacity. All explanatory variables were individually tested to assess their univariate association with outcome variables. Explanatory variables with *p* values less than 0.20 were included in initial models and automatic backwards selection was used to select variables. Final variables were selected by adding and subtracting additional variables by hand. Models were compared using the Akaike information criterion and likelihood ratio tests (for nested models). When final models were selected, all pair-wise interaction terms were tested individually for each model. The criteria for interaction were a statistically significant interaction term and a statistically significant improvement of the model (using a likelihood ratio test). The authors report odds ratios, 95% confidence intervals (CIs), and *p* values; comparisons were considered statistically significant when *p* < 0.05. Statistical analyses were performed using R, a language and environment for statistical computing and graphics (14).

Free-text responses

Respondents could provide free-text comments on solutions for improving each of the seven OHS capabilities. Qualitative responses were analysed for common terms and categorised by two analysts for reliability.

Results

Study population

Completed questionnaires were received from 185 respondents from 44 countries. Most respondents came from the United States of America (81, 43.7%), followed by France (11, 5.9%), India (ten, 5.4%), Switzerland (eight, 4.3%), Canada (seven, 3.8%), Pakistan (six, 3.2%), and the United Kingdom (four, 2.2%). There were between one and three respondents from each of the other 37 countries.

Nearly one-third (58, 31.4%) of respondents came from LMI countries and the rest (127, 68.6%) were from HI countries. The majority of respondents (136, 73.5%) reported working in one domain only: 96 (51.9%) in the human health domain, followed by 36 (19.5%) in the animal health domain, and, lastly, four (2.2%) in the environmental domain (Table II). Forty-six (24.9%) respondents reported working in multiple domains (*n* = 15, human + animal; *n* = 14, human + environment; *n* = 2, animal + environment; *n* = 15, human + animal + environment). The remaining three respondents (1.6%) indicated 'Other' (academia, decontamination and infectious disease). Because of the low number of respondents indicating that they worked in the environmental domain only, group comparisons were limited to responses

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Table II

The number and percentage of respondents from different work domains grouped by income status

Income status	Human	Animal	Environment	Multiple	Other[a]	Total
Low income	30 (31%)	12 (33%)	0 (0%)	15 (33%)	1 (33%)	**58 (31%)**
High income	66 (69%)	24 (67%)	4 (100%)	31 (67%)	2 (66%)	**127 (69%)**
Total	**96**	**36**	**4**	**46**	**3**	**185**

a) 'Other' responses included academia, decontamination and infectious disease

submitted by those indicating that they worked in the animal health domain only, the human health domain only, or in multiple domains. The proportion of respondents working in the different domains was not significantly different between LMI and HI countries.

The use of One Health Surveillance and its perceived benefit

Respondents were asked to consider the OHS definition provided and to answer two questions:

a) In your jurisdiction, do you think that OHS surveillance would be or is of benefit to you?

b) Are you using/applying OHS in your work?

The majority (148, 85.4%) of respondents indicated that OHS was beneficial, with no significant differences among responses from different domains or country income groups. Almost half (90, 48.7%) of all respondents reported that they used/applied OHS in their work, with the highest number of responses from respondents working in multiple sectors. None of the group comparisons was statistically significant (Fig. 1).
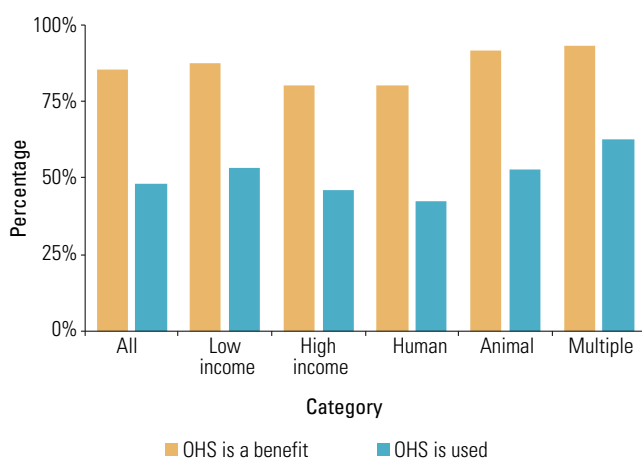
OHS: One Health Surveillance

Fig. 1

Perceived benefit and reported use of One Health Surveillance by country income and work domain

One Health Surveillance capabilities

Significant gaps existed for all seven of the OHS capabilities examined (Table I). The greatest challenge was obtaining access to data from other domains, followed by having a surveillance system that can handle joint investigations. Over 20% of the respondents indicated that having access to data from their own domain was frequently or always a challenge (42, 22.7%). Respondents also indicated that making improvements in cross-domain data exchange and in surveillance systems was extremely difficult (53, 28.6% and 30, 16.2%, respectively). For all seven OHS capabilities, making improvements was considered a medium or high priority for a large proportion of respondents, ranging from 62.2% for having access to data from outside domains to 82.2% for being able to use electronic data.

One Health Surveillance capabilities by country income

Respondents from HI countries were significantly more likely than respondents from LMI countries to report that having access to data from outside their domain was a challenge (odds ratio [OR] = 2.16, 95% CI = 1.05–4.55, p = 0.039). Similarly, respondents from HI countries were significantly more likely to report that exchanging information across domains was a challenge (OR = 1.73, 95% CI = 1.07–2.89, p = 0.028). Other comparisons between respondents in LMI and HI countries were not statistically significant.

One Health Surveillance capabilities by work domain

When responses from workers in animal and human health were compared, respondents working in animal health only were more likely than respondents working in human health only to report that having access to data from other domains was frequently or always a problem (OR = 2.36, 95% CI = 1.04–5.61, p = 0.044). Respondents working in animal health only were also more likely to indicate that knowing whom to contact in other domains to jointly assess risks was frequently or always a problem (OR = 3.08, 95% CI = 1.34–7.11, p = 0.008).

When respondents working in human health only were compared to respondents working in multiple domains, those working in multiple domains were more likely to

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report that having access to data collected in their own domain was frequently or always a problem (OR = 2.82, 95% CI = 1.14–7.04, *p* = 0.025). The replies from respondents who reported working in animal health only and those who reported working in multiple domains were not significantly different.

Making improvements: level of difficulty

A relatively small proportion of the respondents reported that making improvements would be very difficult for all surveillance capabilities (range from 4.3% to 28.6%). There were no statistically significant differences between respondents from LMI and HI countries or between respondents from different surveillance practice domains.

Priorities for improvement

For three of the seven capabilities, respondents from HI countries were less likely than respondents from LMI countries to report that making improvements was of medium to high priority:

a) having surveillance to jointly assess and respond to the risk of transmission across domains (OR = 0.39, 95% CI = 0.15–0.92, *p* = 0.038)

b) having access to data collected in their own domain (OR = 0.12, 95% CI = 0.03–0.41, *p* = 0.002)

c) having access to data collected by domains outside their own (OR = 0.43, 95% CI = 0.18–0.97, *p* = 0.047).

Respondents from HI countries were more likely than respondents from LMI countries to report that improvements with regard to knowing whom to contact

to jointly assess risks were a medium to high priority (OR = 4.95, 95% CI = 1.88–14.48, *p* = 0.002).

A comparison of responses across sectors found that respondents working in human health only were less likely than those working in multiple domains to report that improving access to data from other domains was of medium or high priority (OR = 0.41, 95% CI = 0.18–0.89, *p* = 0.026), and more likely to report that improvements regarding knowing whom to contact in other domains to jointly assess risks were of medium or high priority (OR = 2.38, 95% CI = 1.03–5.80, *p* = 0.047). Respondents working in animal health only were less likely than those working in multiple domains to report that improving surveillance to assess the risk of transmission across domains was of medium or high priority (OR = 0.16, 95% CI = 0.03–0.59, *p* = 0.012).

Suggestions from the field

The suggestions from respondents for addressing OHS challenges were categorised into broad areas of focus for five OHS capabilities (comments related to the three cross-domain interactions; namely, having a surveillance system for joint assessment, knowing whom to contact in other domains, and exchanging information with investigators from other domains, were pooled into one capability: 'surveillance system capacity'). The results reveal variability in the top suggestions for improving each of the OHS capabilities (Fig. 2).

For all capabilities, enhancing communication/collaboration was mentioned as a means of bringing about improvements, and it was the most frequent suggestion for improving
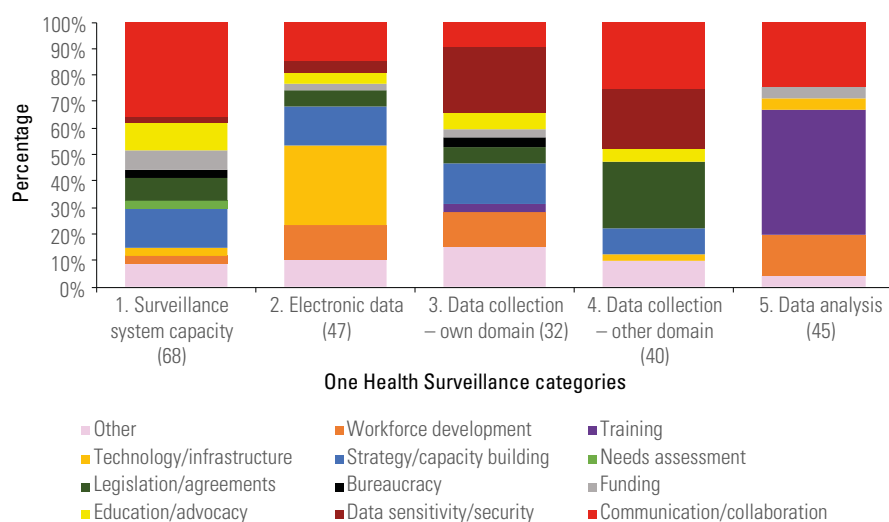

Fig. 2

Categorisation of topics proposed by survey respondents to advance five areas of One Health Surveillance capability
The total number of responses for each topic appears in brackets at the end of the topic name

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surveillance system capacity. The most frequent suggestion for improving the use of electronic data was to improve technology and infrastructure. A common suggestion for improving data collection within the respondents' domains was to strengthen data security measures to protect sensitive information, while increasing collaboration/communication and introducing legislation/agreements were suggested as improvements for data collection across domains. Training was suggested most often for improving data analysis.

Discussion

This is the first study to examine the perceived need among the surveillance workforce for OHS practice. The authors addressed three elements believed to be necessary for changing surveillance practice: dissatisfaction, access to information and motivation to act (11). As expected, health workers indicated that access to data in their own domain was the least challenging task. The high priority placed on the ability to send and receive electronic data may reflect a desire to take advantage of new digital technologies in data collection, management and rapid exchange (15, 16). Widespread adoption of electronic data can be a stimulus for developing standards and interoperable systems that facilitate data sharing, as demonstrated by the increased use of electronic health records for health surveillance in both the animal and human domains (17, 18).

Among the capabilities surveyed, having access to data from other domains was the surveillance capacity most frequently reported to be a challenge, the most difficult to improve and the lowest priority for improvement. Having access to data and contacts from other domains was especially challenging for animal health professionals. An assessment of communication systems and the culture of information exchange across sectors is warranted. The need for human health stakeholders to be more aware of animal health practices has previously been highlighted by surveillance professionals (19). Data-sharing restrictions are known to be a major impediment to integrating surveillance practices (20, 21, 22). A deeper analysis of the correlations between challenge, difficulty and improvements could be used to identify capacity-building activities that could potentially have the greatest impact.

A comparison of responses from professionals from LMI and HI countries provides insight into some of the factors that facilitate investment in OHS and those that create barriers to it. Higher-income countries, in general, typically have better data-management, communications, and surveillance capacity (23, 24, 25). Over all, respondents from LMI countries were more concerned about gaps in OHS capabilities and more committed to improving OHS than respondents from HI countries. Combining single-domain surveillance

systems, or parts thereof (e.g. laboratory networks), into one system, as has been done for foodborne illness surveillance, has been shown to expedite data sharing and be more cost effective than maintaining two independent domain-specific systems (26, 27). In low-resource settings, cost-effectiveness may be a stronger motivator for improvement than it is in HI countries, although cost-cutting in the health sector is under way at all levels. It may be that one of the other reasons that respondents from LMI countries reported higher levels of motivation than those in HI countries is that, in LMI countries, zoonotic diseases (including foodborne diseases) account for a greater proportion of the infectious disease burden than they do in HI countries (28, 29, 30, 31).

In terms of differences in perceived OHS capabilities across domains, respondents working solely in human health reported fewer gaps in surveillance capabilities than their counterparts working in animal health only or in multiple domains. Differences in resource availability, levels of data-sharing, and surveillance infrastructure may explain some of the differences in perceived surveillance gaps between the domains.

When put into practice, OHS will need to address differences across domains, including differences in lexicon, diagnostic tests, and standards for sampling and reporting surveillance data. Surveillance to support One Health has implications not only for infrastructure, technology and analytical methods, but also for governance. Health legislation is still largely delivered by domain-specific agencies; however, there are emerging efforts to make legislative changes to support One Health systems (32).

This study has a number of limitations, which include the small sample size and the bias inherent in voluntary population surveys. As a result of the broadcast invitation to complete the survey, the number of potential respondents contacted is unknown and the overall survey response rate could not be calculated. Furthermore, One Health may be conceptualised in many ways, especially by people working in different sectors (33, 34). To address this, the authors provided both a working definition of OHS and a zoonotic outbreak scenario, which gave respondents a common context within which to consider OHS as it would relate to a threat in their jurisdiction. Nevertheless, it is possible that presenting a different scenario could have resulted in different responses.

The high level of OHS use and the high degree of perceived benefit among the study population may be because it was drawn from the ISDS and partner networks, such as the International Conference on Animal Health Surveillance mailing list, which may be especially aware of innovations in surveillance. The under-representation of professionals working in environmental health has been noted previously, with a call for deliberate action to engage with partners

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from the environment sector and incorporate ecosystem health ideas and concepts into One Health initiatives (35). The authors are also uncertain whether the reach extended to individuals working in wildlife, aquaculture or other areas of animal surveillance. Similarly, professionals from different areas of human health may have differing viewpoints that were not identified in this study. A more thorough assessment of attitudes toward OHS among these groups should be explored, as their members may have different perceptions of the importance of OHS.

Direct input from surveillance professionals across sectors on solutions to the challenges they face is critical for successful OHS implementation. While the number of free-text responses in this observational study was insufficient for an in-depth analysis, they do indicate that a 'one-size-fits-all' approach to OHS training and implementation may not be optimally effective. However, the results should have value for guiding further investigation into attitudes towards OHS and strategies for robust economic and other analyses of the drivers of and barriers to OHS implementation. They could also contribute to more informed strategies for targeted workforce training in OHS. However, because this study sample is small and biased, surveillance practitioners should consider confirming its findings in their own jurisdiction before investing in expensive communication programmes.

Conclusions

This is the first published study aimed at exploring the attitudes of surveillance professionals towards the need for surveillance specifically aimed at supporting One Health activities. The high proportion of respondents reporting that they would benefit from OHS should provide at least some certainty that there is a need for OHS in the field. The limitations of this study, however, should be taken into account and these results should be used to target more comprehensive and in-depth studies aimed at exploring the need for OHS in more detail. The results also suggest that, among the health professionals in this study, there is significant awareness of and interest in One Health and that there is a perceived need for One Health approaches.

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Surveillance Une seule santé : avantages perçus et motivation des intervenants

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Résumé
La surveillance Une seule santé opérationnalise la méthode Une seule santé pour une meilleure santé à travers la collecte de données et la production d'informations visant à soutenir la mobilisation transversale des secteurs de la santé animale, de la santé publique et de la santé environnementale en vue d'une action intégrée. Les auteurs présentent les résultats d'une enquête menée auprès des professionnels en charge de la biosurveillance afin d'évaluer leurs pratiques et capacités en matière de surveillance Une seule santé, leurs attitudes à l'égard de cette surveillance (c'est-à-dire leur perception de l'intérêt de la démarche) et les facteurs susceptibles de les motiver à la mettre en œuvre. Les auteurs ont procédé à un échantillonnage de commodité de 185 intervenants issus de plusieurs secteurs dans 44 pays. Ils ont ensuite analysé le niveau de mise en œuvre de la surveillance Une seule santé chez ces intervenants, recueilli leurs opinions concernant l'intérêt de la démarche, évalué la perception qu'ils avaient de leur capacité à mener à bien certaine tâches spécifiques dans ce domaine et identifié leurs priorités en vue du changement. Plus de 85 % des répondants ont déclaré considérer la surveillance Une seule santé comme étant bénéfique, résultat ne présentant pas de corrélation significative avec le secteur professionnel des personnes interrogées ni avec le niveau de revenu de leur pays ; plus de 50 % des répondants ont

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par ailleurs indiqué qu'ils appliquaient déjà les principes d'une surveillance Une seule santé. La difficulté la plus fréquente et qui paraissait la plus difficile à résoudre était celle de pouvoir accéder aux données enregistrées par d'autres secteurs. La première des priorités identifiées en vue d'une amélioration concernait la capacité d'envoyer et de recevoir des données électroniques. La motivation à introduire des améliorations était plus forte chez les répondants des pays à revenu faible ou intermédiaire que chez les parties prenantes des pays à revenus élevés. Ces résultats, qui offrent un instantané des opinions et des pratiques actuelles assorti de propositions concrètes d'amélioration formulées par les professionnels de terrain devraient pouvoir contribuer à cibler les besoins prioritaires en matière d'information, de formation et de ressources dédiées à la surveillance Une seule santé.

Mots-clés
Approche intégrée – Collaboration multisectorielle – Santé animale – Santé environnementale – Santé publique – Surveillance – Une seule santé – Zoonose.

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Beneficios atribuidos a la vigilancia en clave de Una sola salud y motivación de los profesionales

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Resumen
Practicar la vigilancia en clave de Una sola salud significa traducir esta idea en la práctica con el fin de mejorar la salud reuniendo datos y generando información a partir de la cual actuar de forma integrada en los sectores de la sanidad animal, la salud humana y el medio ambiente. Los autores describen un estudio de los círculos dedicados a la vigilancia biológica que tenía por objetivo evaluar sus procedimientos y capacidades de vigilancia en clave de Una sola salud, sus actitudes al respecto (valor atribuido) y los factores que los motivan a instaurar procedimientos concebidos desde la lógica de Una sola salud. Para ello los autores utilizaron una muestra de conveniencia de 185 profesionales de múltiples disciplinas y 44 países. Tras determinar en qué medida esos profesionales practicaban la vigilancia en clave de Una sola salud, les pidieron su opinión sobre la utilidad de este tipo de vigilancia, evaluaron la capacidad que subjetivamente se atribuían de efectuar labores específicas de vigilancia en clave de Una sola salud y determinaron aquellos cambios que esas personas juzgaban prioritarios. Más de un 85% de los encuestados dijo considerar beneficiosa la vigilancia en clave de Una sola salud, sin que se observaran diferencias significativas por ámbito de trabajo o por países según el grupo de ingresos. Más de un 50% afirmó que ya aplicaba este tipo de vigilancia. El problema señalado con más frecuencia y juzgado a la vez más difícil de resolver era el del acceso a datos obtenidos desde otros ámbitos de trabajo. El aspecto que más urgía mejorar era el de la capacidad de enviar y recibir datos electrónicos. Los encuestados de países de nivel bajo o medio de ingresos mostraban mayor motivación a la hora de introducir mejoras que sus homólogos de países de ingresos altos. Estas conclusiones, que ofrecen una «instantánea» de las opiniones y prácticas imperantes, pueden ayudar, junto con las propuestas de mejora procedentes de esos profesionales que trabajan sobre el terreno, a seleccionar las necesidades prioritarias de información, formación y recursos para la práctica de la vigilancia en clave de Una sola salud.

Palabras clave
Colaboración multisectorial – Enfermedad zoonótica – Planteamiento integrado – Salud ambiental – Salud pública – Sanidad animal – Una sola salud – Vigilancia.

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