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A simplified method of performance indicators development for epidemiological surveillance networks – Application to the RESAPATH surveillance network

Une méthode simplifiée d'élaboration d'indicateurs de performance pour les réseaux de surveillance – Application au réseau de surveillance épidémiologique RESAPATH

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Abstract

Background. – Develop and calculate performance indicators allows to continuously follow the operation of an epidemiological surveillance network. This is an internal evaluation method, implemented by the coordinators in collaboration with all the actors of the network. Its purpose is to detect weak points in order to optimize management. A method for the development of performance indicators of epidemiological surveillance networks was developed in 2004 and was applied to several networks. Its implementation requires a thorough description of the network environment and all its activities to define priority indicators. Since this method is considered to be complex, our objective consisted in developing a simplified approach and applying it to an epidemiological surveillance network.

Methods. – We applied the initial method to a theoretical network model to obtain a list of generic indicators that can be adapted to any surveillance network.

Results. – We obtained a list of 25 generic performance indicators, intended to be reformulated and described according to the specificities of each network. It was used to develop performance indicators for RESAPATH, an epidemiological surveillance network of antimicrobial resistance in pathogenic bacteria of animal origin in France.

Conclusion. – This application allowed us to validate the simplified method, its value in terms of practical implementation, and its level of user acceptance. Its ease of use and speed of application compared to the initial method argue in favor of its use on broader scale.

Keywords: Performance indicators; Program evaluation; Population surveillance; Epidemiological surveillance; Management

Résumé

Position du problème. – Élaborer et calculer des indicateurs de performance permet de suivre en continu le fonctionnement d'un réseau de surveillance épidémiologique. Il s'agit d'une méthode d'évaluation interne, mise en œuvre par les équipes d'animation du réseau en collaboration avec l'ensemble des acteurs et qui a pour but de détecter les points faibles du fonctionnement du réseau en vue d'en optimiser le pilotage. Une méthode d'élaboration d'indicateurs de performance des réseaux de surveillance épidémiologique a été développée en 2004 et a été appliquée à plusieurs réseaux. Sa mise en œuvre nécessite un exercice approfondi de description de l'environnement du réseau et de l'ensemble de ses activités pour définir des indicateurs correspondants à ses objectifs prioritaires. Cette méthode étant jugée complexe, notre objectif a consisté à développer une approche simplifiée et à l'appliquer à un réseau d'épidémiosurveillance.

Méthodes. – L'application de la méthode initiale à un modèle de réseau théorique a permis l'obtention d'une liste d'indicateurs génériques, appropriables par tout réseau de surveillance.

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Résultats. – Le résultat de la simplification est une liste de 25 indicateurs de performance génériques, destinés à être reformulés et déclinés selon les spécificités de chaque réseau. Elle a été employée pour élaborer des indicateurs de performance pour le réseau de surveillance épidémiologique de l'antibiorésistance des bactéries pathogènes animales en France, le RESAPATH.

Conclusion. – Cette application permet d'apprécier la validité de la méthode simplifiée, son intérêt en termes de mise en œuvre pratique, ainsi que son niveau d'acceptabilité par les utilisateurs. La portée de cette méthode quant à sa facilité d'appréhension et sa rapidité d'application par rapport à la méthode initiale incite à envisager une utilisation à plus large échelle.

Mots clés : Indicateurs de performance ; Évaluation de programme ; Surveillance de population ; Épidémiosurveillance ; Pilotage

1. Introduction

Performance can be defined as ''the result obtained in the execution of a task'' (Dictionnaire Le Petit Larousse). The term ''indicator'' associated with ''performance'' can be defined as a ''significant number of *x* for a given period'' or ''a series of numbers expressing variations of *x* reflecting a trend of *y*'' (Dictionnaire Le Petit Larousse).

Performance indicators can therefore be considered ''a series of significant statistics from the results obtained in the execution of tasks used to express the variations and trends during a given period.''

The primary purpose of an epidemiological surveillance network is to produce reliable data on health or the factors contributing to the health of populations. The performance of a surveillance network therefore corresponds to its ability to produce these data. Insofar as the quality of the data produced is closely related to the quality of the network's operation, the measurement of performance could be founded on assessment of how well its activities are carried out.

By network performance indicators, we therefore mean quantitative tools for verifying the proper operation of epidemiological surveillance networks [1]. They make up essential tools for identifying the weak points of an activity in view of adopting optimal corrective measures [1–3]; these are tools for managing the network. This is an internal assessment method, implemented by a leader in collaboration with the network's actors, thus ensuring continuous follow-up of the network's operation.

When the indicators are being drawn up, a balance must be found between the desire to have definitions that are as precise as possible along with calculations providing reliable indicators and the organization's need to not be overburdened with too many additional data to record [4,5]. In addition, it should be noted that a set of performance indicators is never a finished product. It would be illusory to think that the quality of a network's operation can be permanently covered by such indicators. A list of indicators must be dynamic; an indicator that no longer seems to provide the opportunity to improve the system can be abandoned, whereas others may be added if they seem better adapted [6]. However, the objective is not to stretch the list of indicators indefinitely. It is imperative that the evaluation system can actually be deployed from a practical point of view [4].

In 2004, Hendrikx [7,8] developed a detailed method to identify all the activities of an epidemiological surveillance network and establish performance indicators attributed to each of them. One important limitation identified during the application of this method to several surveillance networks was the length and complexity of the tasks to implement [9,10]. The objective of the present study, therefore, based on the initial method, was to develop a simplified method, more accessible and more rapid, residing on a list of generic indicators that could be adapted to any network. We then applied this simplified method to the epidemiological surveillance network of antimicrobial resistance in pathogenic bacteria of animal origin, the RESAPATH.

The objective of the RESAPATH, created in 2001, was to follow resistance to antibiotics by collecting all the antibiogram results from adherent diagnostic laboratories, but also to compare resistance data in animals and those collected on humans given that it is the only veterinary network within the National Observatory for the Epidemiology of Bacterial Resistance to Antibiotics (Observatoire national de l'épidémiologie de la résistance bactérienne aux antibiotiques [ONERBA]).

2. Material and methods

2.1. RESAPATH

RESAPATH is the epidemiological surveillance network of antimicrobial resistance in pathogenic bacteria of animal origin, set up in 2001 on the foundations of RESABO, the antimicrobial resistance to bovine pathogenic bacteria surveillance network, which has been functioning since 1982. The objectives of RESAPATH are mainly the detection of the emergence and follow-up in space and time of antibiotic resistance to isolated bacteria of clinical cases in animals of any species. Secondarily, the network is a strain library making it possible to study new resistance mechanisms, their evolution, and their dissemination power [11–13].

Fig. 1 illustrates the institutional organization of RESAPATH. The network was founded on a principle of passive surveillance: it collects data from antibiograms performed on bacterial isolations of samples from diseased animals, performed by departmental veterinary laboratories (DVLs) on request from their clientele made up of French veterinary practitioners. The National Agency for Health Safety of Food, the Environment, and Work, (Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail

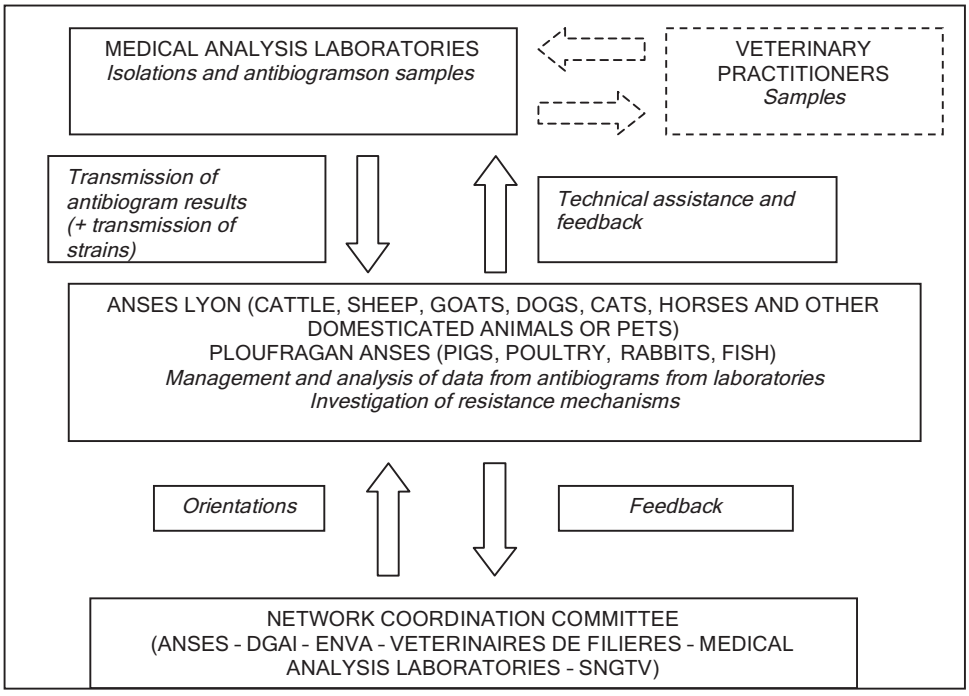

Fig. 1. Operational diagram for the RESAPATH (ANSES: Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail; DGAl: direction générale de l'alimentation; ENVA: École nationale vétérinaire de Maisons-Alfort; SNGTV: Société nationale des groupements techniques vétérinaires).

[Anses]) has the mission of operating and coordinating the network.

The data collected correspond to a data sheet on samples, transmitted by ANSES departmental laboratories (laboratories in Ploufragan in the Côtes d'Armor department for pigs, poultry, rabbits, and fish, and in Lyon for cattle, sheep, goats, dogs, cats, horses, and other domesticated animals or pets), which collects the results of the antibiogram carried out by the DVL. This data sheet provides information on the setting in which the sample was taken: the date and place the sample was collected, the animal's species and age class, the type of disease that motivated taking the sample, the type of sample, and the laboratory that did the analysis. The antibiogram provides information on the bacterium isolated, the antibiotics tested, as well as the diameter measurements of the inhibition zones allowing the bacterium studied to be characterized as sensitive, intermediate, or resistant to a specific antibiotic. The data collected are integrated into RESAPATH database in their two ANSES laboratories. Aiming for standardization, all the network's member laboratories are requested to follow the norm of the French Association of Standards (Association française de normalization, AFNOR NF-U47107) for their antibiogram technique as well as the guidelines of the Antibiogram Committee of the French Microbiology Society (Comité de l'antibiogramme de la Société française de microbiologie [CA-SFM]) in interpreting the inhibition diameters observed. Interlaboratory trials (ILTs) are undertaken every year to guarantee that the methods are standardized and to promote relevant interpretation of the results obtained by the laboratories. In addition, the ANSES can request participating laboratories to contribute certain strains that present particular relevance for more in-depth research on their resistance mechanism or for progress in the veterinary system of reference (creation of benchmarks, adaptation of guidelines to veterinary prescription, etc.). Moreover, the network produces data on antibiotic resistance in animal health that can be compared to the data collected on humans using ONERBA data.

2.2. Simplified method for elaborating performance indicators

An epidemiological surveillance network is a group of persons and organizations structured to ensure surveillance over a given area for one or several diseases [2]. Most of the epidemiological surveillance networks include at least four fundamental stages: data collection, data centralization and validation, data management and analysis, and the dissemination of information [1]. Every network respects these four stages within its own procedures, which explains the variations in operation found. Other stages can be identified. The performance indicator elaboration stage, for example, should at best be undertaken concurrently with the creation of the network so that the network's activities can be defined along with the indicators that will measure its performance.

Drawing up performance indicators following the initial method is founded on the principle that the performance of an organization should be evaluated for its three dimensions: its product (the epidemiological information and its production process), its organization (data and information circulation), and its actors (determinants of an individual's performance in the group, i.e., socialization, commitment, and comparison). The activities related to these three dimensions should be

identified and integrated into the assessment process. The initial method is based on the succession of ten stages that can describe the entire network, beginning with placing it within its context and identifying all its activities [7]. One or several performance indicators are attributed to each objective set out for an activity, thus scrupulously taking into account all of the aspects of the network's operation.

The progression of this method's stages can seem quite long and fastidious and therefore hinder the operational team's motivation to more fully achieve and consolidate the calculation tool and the indicators over time. Furthermore, a comparison of the indicators elaborated for several networks using this method shows that some of these indicators are close to one another, even identical. This was expected in that standardization of the method requires elaborating indicators for the activities considered to be priorities for the operation of the network and that these activities are generally at the basis of the operation of any surveillance network.

Within the objective of drawing up a list of indicators that are generic, acquirable, and adaptable to any surveillance network, we applied the initial method to a theoretical network.

This model is a network designed to monitor disease D or a group of diseases D. Its objectives are to determine the true importance of D and to follow its course in a given population, at a certain geographic scale, or to detect the appearance of D so as to engage in early and appropriate control actions, to modify the control modalities, or to evaluate the results of a control plan.

One case corresponds to a suspicion of or a confirmed clinical or biological case of D.

The target population comprises individuals of the animal species considered or human subpopulations that must be studied, in the geographic zone of interest.

The theoretical institutional organization of this network is established according to the structures and activities defined in Table 1. In accordance with the application of the initial method, the definition of generic performance indicators is based on the complete description of the theoretical network's activities. An expected result corresponds to each activity listed, termed a Level 1 objective, to which has been attributed one of the following performance criteria: exhaustivity, time delay, conformity, sensitivity, specificity, representativeness, simplicity, or flexibility.

Grouping the Level 1 objectives according to performance criteria produced a set of more restricted objectives, called Level 2 objectives, revealing all the network's activities more globally. Each of these Level 2 objectives was then noted according to five criteria: priority, globality, realism, calculability, and precision. Thus, of the 29 Level 2 objectives listed, 22 were finally retained.

The performance indicators were determined based on each Level 2 objective retained from the preceding stage; they were defined with their title and their calculation mode (numerator and denominator).

The work then consisted in elaborating a guide that would allow transposing these generic indicators to a specific network.

2.3. Application of the simplified method to RESAPATH network

A first version of the user's guide was submitted to the RESAPATH team, to launch a discussion on the feasibility and the possible problems involved in elaborating performance indicators based on this method. The indicators were developed separately by each of the two teams involved in the network:

Table 1
Institutional organization of an epidemiological surveillance network [1].

Component	Heading	Activities
Product	Case detection	Detect all cases of a monitored disease
		Communicate destination of data sources
	Data collection	Complete data summaries
		Take samples
	Data transmission	Send data summaries and samples
	Data analysis and interpretation	Analyze samples in the laboratory
		Interpret data
	Action	Field epidemiology
		Control actions
	Feedback	Report data analyses
		Make general summary of data analyzed
		Inform on measures taken
Organization	Coordination	Manage network's activities
		Design network's technical procedures
		Supervise network's actors
	Communication	Disseminate surveillance results
Actor	Socialization	Train network's actors
		Maintain communication between network members
	Commitment	Ensure actors' participation in programing meetings
	Comparison	Ensure actors' participation in briefings
		Guarantee reception of summaries and feedback

epidemiology and bacteriology. These two approaches were then compared and merged to arrive at a consensus.

The data were collected from members of the network's coordination unit and within the database, which lists all the data gathered from the laboratories. The tools necessary for the calculation of the indicators were developed from a series of queries carried out on RESAPATH database on ANSES site in Lyon, managed by Access 2007® software. However, certain indicators do not come from data collected in this database and cannot be calculated automatically on an annual basis.

The people who participated in the development of the performance indicators were asked to respond to a questionnaire aiming to collect their impressions on the use of the simplified version.

3. Results

3.1. Generic performance indicators

Applying the initial method to our model of the theoretical network allowed us to draw up a list of 25 generic performance indicators (Table 2). The indicators were classified into five categories: data collection, active surveillance, feedback, management, and training. Each of these generic indicators was designed to be adapted to the network: the indicators that assess the active surveillance procedures are retained or rejected, and the parameters of the indicators are adapted depending on the activity sector to be evaluated.

To assist the network activity teams in setting up their indicators using the simplified method, a user's guide specified the method to follow. This guide presented the succession of steps to follow, from becoming acquainted with the generic indicators to establishing the performance indicators:

- become familiar with the generic indicators: the user is asked to review all the generic performance indicators proposed in the list;
- express the generic indicators in the terms of one's network: the user is asked to consider the generic indicators one by one, beginning by reviewing and reformulating them so as to relate the terms presented in the list with those used within one's network;
- carefully consider the case of the indicators that are not applicable: certain indicators are not relevant for assessing the network's performance; those that are not applicable must therefore be indicated, with a reason for each one. The objective is to make the user aware of the possible advantage of initiating a procedure to improve the assessment tool if the

Table 2
Generic indicators.

Data collection
- IP1: number of suspicions or cases collected
- IP2: rate of summaries and reports properly done
- IP3: rate of samplings meeting standards received in laboratory
- IP4: rate of suspicion summaries received by central unit in the x_4 days following suspicion
- IP5: rate of samples received by the laboratory in the x_5 days following suspicion
- IP6: rate of incomplete summaries requiring search for additional information in the x_6 days following their reception
- IP7: rate of usable samples analyzed in the x_7 days following their reception in the laboratory
- IP8: rate of laboratory analysis results received by the central unit in the x_8 days following reception of the sample in the laboratory
- IP9: rate of data summaries completed in the x_9 days following their reception

Active surveillance
- IP10: rate of data summaries and samplings scheduled in the active surveillance actually carried out
- IP11: rate of reports written on active surveillance visits
- IP12: rate of reports on active visit received by central unit in the x_{12} days following the field visit

Feedback
- IP13: rate of summary reports published every t_{13}
- IP14: rate of feedback seminars held
- IP15: rate of participation in conclusion seminars every t_{15}
- IP16: rate of reception of analyses of results per data collector in the x_{16} days following the corresponding suspicion
- IP17: rate of reception of analyses of results corresponding to samples taken per data collector
- IP18: rate of analyses of results received per data source in the x_{18} days following the corresponding suspicion
- IP19: rate of reception of analyses of results corresponding to samples taken per data source
- IP20: rate of bulletins published

Management
- IP21: rate of management committee meetings held
- IP22: rate of technical committee meetings held

Training
- IP23: rate of supervision of data collectors per intermediate/central level
- IP24: rate of laboratory participation in ILTs
- IP25: training rate

fact that the indicator is not adaptable stems from a dysfunction problem (e.g., indicator IP21 ''coordination committee meeting rate'' will not be valuable for the network that has no coordination committee; on the other hand, it is vital to make the value of creating such a committee clear to the decision maker for the institutional organization of the network). Similarly, it may be impossible to calculate an indicator. In this case, several options are possible, depending on whether or not the indicator involves a sensitive area in the operation of the surveillance tool: the surveillance protocol can be modified so that the indicator can be quickly integrated into the performance indicators or the indicator can be kept aside and the data collection necessary over the medium or long term can be planned so as to verify at a later date that this operation mode has not shifted;

- implementing the appropriate subdivisions: a subdivision of certain indicators is sometimes necessary, depending on the assessment needs in different sectors (types of files, segments of data transmission times, etc.), the user should decide how to break down these indicators and consequently adapt and reformulate them;
- specifying the calculation formulas: define the numerator and denominator for each indicator retained and reformulated by indicating the parameters such as time delay (file, sample transmission, etc.) or frequency (publication of a summary or a bulletin, committee meetings, etc.) adapted to the protocol;
- making a list and locating the necessary data: for each indicator, the data necessary for calculations should be listed, located if they exist in the data collected by the network, or created by setting up a new collection procedure;
- creating additional indicators related to the network's specificities: this last step consists in determining whether any aspects of the network's operation are missing that need to be taken into account by other indicators. The guide therefore gives an example of a brief inventory of certain indicators encountered in networks that have developed performance indicators that do not stem from any of the generic indicators. The user is assisted in querying the possible active surveillance procedures conducted within the network that may give rise to the creation of a new indicator.

In the second part, the guide provides a description detailing each generic indicator with its components and its possibilities for adaptation. The last part concerns the implementation of the calculation tool and the use of the results. This guide is drawn up so that the user easily grasps the procedure and can alone successfully create the performance indicators adapted to his or her network.

3.2. RESAPATH performance indicators

Based on the generic performance indicators, the RESAPATH epidemiological team drew up 16 indicators versus 27 for the bacteriological team. On both sides, the meeting brought up questions on the network's objectives and the characteristics inherent to its good operation. Finally, after summarizing the performance indicators proposed by the two teams, 14 performance indicators were retained for RESAPATH (Table 3). The leaders also wished to preserve certain aspects allowing the network to be viewed in its globality, thus creating two other forms of indicator: indicators of the ''life'' of the network, to be calculated regularly but with no predefined threshold to reach, and sporadic indicators, much more difficult to calculate, to be estimated more irregularly by collecting additional data during a short period of the network's operation.

The results of the calculations were presented during a meeting with RESAPATH coordinators so as to discuss the interpretation and the consequences for the network and to organize the continuation of the work. The numerical results of the indicators to be calculated at this stage of the network's development are presented in Table 3. Of the 14 performance indicators drawn up, two currently are not applicable (IP7a and 7b, which concern publication of data on the web site online since the end of 2010), and two need to have their calculation refined or simplified through automation following changes in the network's operation so that the necessary data can be collected (modification of data at the time strains are received at the ANSES for IP2 and ''Frequently Asked Questions'' for IP8).

3.3. Assessment questionnaire

This questionnaire was designed to collect the impressions of the users of the simplified method to bring out its strong points, its weak points, and any suggestions for improvements. The five people solicited sent responses.

The method was considered for the most part rapid and acceptable, with the time spent in all cases considered to be indispensable.

On a scale from 1 (very difficult) to 5 (very easy), the ease of application was noted a mean 3.8. Even though a novice in epidemiology, one of the people questioned qualified the method as complete and explicit.

Two respondents out of four declared they had not considered that certain nonapplicable indicators for the network could conceal a dysfunction that may require improvement. This led to modifying the user's guide so that this step would be better taken into account.

Satisfaction with the result obtained was evaluated at a mean 4.4 on a scale ranging from 1 (very dissatisfied) to 5 (very satisfied). Four people declared they were satisfied with the performance indicators defined at the end of the procedure. The fifth was concerned that several indicators that would have been very useful to calculate could not be calculated or only in a limited manner, and would require changing the data recording so that they could be recorded continuously and in a less restrictive manner. This dissatisfaction does not, however, challenge the philosophy of the simplified procedure.

4. Discussion

The application of the simplified method of elaborating performance indicators of RESAPATH network is a first

Table 3
Titles and main results of the performance indicators, life indicators, and sporadic indicators for the RESAPATH network.

	Expected value	Result 2006	Result 2007	Result 2008	Result 2009
Performance indicators					
IP1a: number of antibiograms collected	Constant or increase compared to preceding year	9511	12,643	18,058	23,808
IP1b: number of RESAPATH member laboratories	Constant or increase compared to preceding year	49	51	59	60
IP1c: rate of laboratories participating in data transmission (%)	90	82	82	92	95
IP2: rate of strains requested by ANSES actually received (excluding project mode) (%)	80	56	61	50	35
IP3: rate of summaries received at ANSES and captured or integrated in database within 4 months (%)	70	59	45	50	43
IP4: rate of strains received within 31 days following ANSES request (%)	90	76	64	67	78
IP5: rate of summary report publication on the network's activity (number of reports expected per year = 1) (%)	100	100	100	100	100
IP6a: rate of RESAPATH feedback seminars, training sessions, and exchanges held (number of sessions expected per year = 1) (%)	100	100	100	100	100
IP6b: rate of laboratory participation in RESAPATH feedback seminars, training sessions, and exchanges (%)	67	69	67	68	58
IP7a: rate of newsletters sent	To be defined when site put online	Indicators calculable when site put online, end of 2010			
IP7b: how often website updated (%)	100%				
IP8: rate of responses provided within 15 days after reception of question from data collection laboratories in FAQ (%)	90	Data not available	78	74	71
IP9: rate of management committee meetings held (number of meetings expected per year = 1) (%)	100	100	0	100	100
IP10: rate of participation of laboratories in ILTs (interlaboratory trials) (%)	90	94	100	97	97
Life indicators					
IV1: total number of questions	-	34 (since May)	54	50	34
IV2: number of collaborations	-	3 laboratories	3 laboratories	14 laboratories	3 laboratories
IV3: mean number of people per laboratory participating in RESAPATH Meetings	-	1.38	1.35	1.30	1.40
IV4: number of non-laboratory participants in RESAPATH Meetings	-	8	15	26	27
IV5: distribution of laboratories present at the RESAPATH Meetings according to their activity for the network	-	Data not available			
IV6: continuity of the presence of laboratories over time in RESAPATH Meetings	-	NA	82%	68%	86%
IV7: rate of coordinating committee meetings conforming to committee composition	-	Calculable beginning in 2010			
IV8: rate of publication of coordination committee meeting report within 2 months following meeting	-	Calculable beginning in 2010			
IV9: number of ANSES consultancy visits in laboratories	-	0	1	3	1
IV10: number of immersion training sessions in ANSES laboratories	-	1	2	1	0
IV11: rate of summaries received by data transmission	-	75%	71%	77%	81%
Sporadic indictors					
IPP1: rate of antibiograms collected; IPP2: rate of French laboratories that are members of RESAPATH; IPP3: rate of strains requested by ANSES in project mode actually received; IPP4: time necessary to capture summaries; IPP5: type of FAQ questions; IPP6: rate of overall satisfaction of response to questions; IPP7: rate of summaries properly completed		To be calculated sporadically as surveys – data not available			

contribution to evaluating the validity of the list of generic indicators for a set of performance indicators specific to a network. The analysis of how this application is undertaken brings out the critical points of the simplified method as well as its acceptability, the stakes involved, and its limitations. This first validation must be completed by the application of this simplified method to other epidemiological surveillance networks presenting different operation modalities.

4.1. Application of the simplified procedure to the RESAPATH network

Certain generic performance indicators were not retained for RESAPATH either because they turned out not to be applicable to the network's operation as such or because of an obstacle to calculations and a lack of sensitivity.

Others were adapted or broken down to several modalities for a better adaptation to RESAPATH network.

Finally, some were adopted exactly as they were defined in the user's guide.

Furthermore, examination of all of the generic indicators brought out thoughts on other pertinent indicators to calculate for the network. Some nevertheless did not represent real performance indicators, but the ideas were retained to make them ''life indicators'' of the network, calculated regularly but with no preset objective of an expected value. For example, IV2, ''collaboration rate,'' which assessed the number of shared projects set up between ANSES and participating laboratories, measures the bilaterality of the relations between the coordination unit and the progression of this interaction.

Others, more complex to calculate, were adopted as sporadic indicators, estimated on samples of data collected irregularly over a short period of the network's operation. For example, IPP1, ''collected antibiogram rate,'' designed to be calculated by occasional surveys every 3–5 years, by integrating additional questions into the questionnaire for interlaboratory trials, would provide data on the number of antibiograms done by the laboratories in the year. This rate, detailed for each laboratory, should make it possible to observe which laboratories deviate from the exhaustivity expected in sending antibiogram results and therefore to assess the sensitivity and the representativeness of RESAPATH network.

We identified three critical points for the method used.

The appropriation and reformulation phase for each indicator according to the network's terms is the first such point. A few divergences were noted in the adaptations or subdivisions implemented by the two teams. Finally, these varying viewpoints instigated discussion on a wide range of possible indicators and led to agreement on a more restricted panel. To remedy this first critical point, a wide variety of actors should be included in the thinking process to debate on a wide foundation of possible indicators before agreeing on a final list whose objective remains following the critical points of the network to ensure its proper operation, a guarantee of the quality of its results.

The phase verifying that a nonadaptable indicator does not result from dysfunction of the network was a second critical point. For RESAPATH network, the indicators considered to be ''unfounded'' were for the most part identical for both teams, and the questions raised on them brought out no major network dysfunctions that could be corrected. The possibility of challenging the operation of the method nonetheless remains an indispensable step in the method.

The last critical point was the identification of possible striking indicators among the generic performance indicators. In RESAPATH example, the generic indicators provided frequently acted as a starting point for identifying the network's activities that needed to be taken into account with new indicators. The type of additional indicators, however, did not identify new generic indicators that needed to be integrated into the method. Generally speaking, the examples given in the user's guide should supplement the list of indicators adapted to the network.

A discussion on the definition of the indicators' expected values was conducted with RESAPATH teams to determine whether the defined value was considered a realistic objective that could be reached, with the possibility of the network progressing in its current operation, or whether it was a warning threshold, i.e., a lower limit value that the indicator should always surpass. This stage of defining the expected values turned out to be delicate, but joining the teams of actors from different horizons made it possible to reach consensus on the final values.

The elaboration of performance indicators therefore encourages thinking about the pertinence of the network's surveillance protocol and the institutional organization. Similarly, the need to define deadlines clarifies the network's objectives in certain activities and results in reconsidering all the data collection steps.

4.2. Acceptability of the simplified method

The methodological guide was judged to be globally easy to use. The method is conceptually simple to understand, but the assistance of an outside advisor already familiar with the method, although not indispensable, facilitates the process.

Use of the procedure with RESAPATH teams was generally perceived to be rapid. The first two meetings lasted 1.5 hours, the joint meeting grouped the four members of the two teams for 2 hours, and the calculations were completed within a few weeks.

The acceptability of the simplified method was therefore judged to be very good.

4.3. Advantages and limitations of the simplified procedure

The definition of the expected threshold values for the indicators was often deemed difficult and subjective. This required thinking about the expected changes in the network in relation to possible changes to be made in the most pragmatic manner possible. An expected value that was too low had no interest in terms of improvements, whereas a value that was too high, seemingly impossible to reach, would also fail to stir motivation. This led to discussing the possibilities of orienting

improvement actions for the network and the possibility of determining which improvements had priority. This is what contributes to making performance indicators a management tool in their ability to detect weak points in a network's functioning and thus lead to improvements.

The simplified method preserves its power to challenge the network's operation, giving it a formative power. Indeed, the reflections raised by setting up and calculating performance indicators make it possible to imagine new ones, but most particularly to rethink the network in order to improve it. These discussions force one to formalize deadlines, meeting schedules, and the conformity criteria in terms of the protocol. Thus, setting up indicators can retroact on the network's operation (modifying or setting up a new data collection procedure, modifying data recording rules, exchanges between the network's actors, etc.), and thus renew discussion on the network's objectives and the limits of its activities.

Even simplified, the proposed method still requires a strong initial impulse from the management structure, which must engage the entire network throughout the procedure, encouraging members to accept that demonstrating dysfunctions may lead to certain modifications. The adherence of the network's actors is obtained by their involvement in the procedure. Thus, they should gain awareness that the list of generic indicators is not imposed as is. It should be a source of inspiration that will lead them to elaborating the indicators best adapted to the specificities of their network. Each team is free to adjust the indicators proposed (while preserving their meaning) and to define new ones to achieve performance indicators that are adapted to what is considered pertinent to assess. In this way, the simplified method is a standardized method for drawing up performance indicators of surveillance networks, without imposing identical indicators for all networks.

The development of this tool is shown here with its use for RESAPATH, a network for the epidemiological surveillance network of antimicrobial resistance in pathogenic bacteria of animal origin, with its implications for human health: detecting microbial resistance in animals can provide an early warning system, thus allowing the detection of emerging and resistance mechanisms potentially transmissible to human pathogens. Since the method developed is based on generic operational principles for a surveillance tool, at this stage we did not identify any particular methodological limit in terms of a possible application of this method to human health surveillance networks.

Designing the elaboration of performance indicators as a fully internal procedure engages a discussion on the reliability of a procedure that is strictly specific to a network's actors. The share of subjectivity often brought out while applying the procedure indicates that the involvement of a committee external to the network could be profitable in view of guaranteeing the validity of the results. It should be remembered that the elaboration of performance indicators is an internal management tool and is complementary to external evaluation that could be based on a technical and economic audit [1].

4.4. RESAPATH performance indicators

Of the 12 indicators that can be currently calculated, five did not reach the expected value (IP 1c, 2, 3, 4, and 8) for the year 2008, i.e., 42%. The indicators are interpreted differently depending on the type of information they contribute: binary (e.g., whether or not to schedule a meeting), or continuous (e.g., rate of forms received). Furthermore, all the indicators are not weighted identically: a poor result for one of them (rate of strains received at the ANSES within 31 days) could be considered less alarming than for another one (participation rate in the ILTs).

The RESAPATH coordination team divided the overall interpretation of the results of the performance indicators into three headings:

- the participation results (in the network itself but also in RESAPATH Meetings and the ILT) are good. The protocol for recording the strains received (IP2 analysis criteria) needs to be improved to ensure reliable calculation of the indicator that, for the moment, is undoubtedly underestimated;
- the results on functioning in terms of deadlines (reception of strains, data capture on forms, responses to questions from laboratories) indicate that there are improvements to be made to reduce the time necessary and meet the objectives, even if these aspects are not indispensable to the network's functioning properly and reaching its objectives;
- the results on managing the network (publication of reports, feedback seminars, coordination committee meetings) are very good.

The indicators that indicate a good level of participation and illustrate that the network is in good health over the long-term. It must be emphasized that the result of these indicators should be related to the high level of the leadership indicators, an essential activity in the stability of a network, and that the other operational indicators deserve to be improved as well to make the network secure in time. This analysis illustrates the diversity of the indicators and the value of associating indicators at different levels. The operational indicators, for example, make it possible to be proactive, before a dysfunction becomes visible to an indicator of the system's result.

At a more general level, elaboration of performance indicators and life indicators had the great advantage of assisting management in reflecting on the foundations and the objectives of the RESAPATH network, which in the future can improve its functioning. This exercise has also raised awareness of the benefit and the complementarity of the viewpoints generated by involving bacteriologists and epidemiologists within the coordination committee.

The entire team declared they were in favor of pursuing the work setting up the performance indicators. This would require refining the calculation tools. Part of the indicators can be calculated in a nearly automatic fashion by queries in the database; the others have to be calculated manually. Nevertheless, the calculations require human interpretation. Progressively completing the data to record in the database to optimize the calculations has been planned. The indicators are

calculated annually, at the same time the annual report of the results collected is written, which started in 2010 [14]. The team anticipates regularly considering the question of reviewing the performance indicators (adding or removing indicators, modifying the expected value thresholds, etc.), depending on how the network's operation and the results obtained evolve.

5. Conclusion

The definition of a conceptual epidemiological surveillance network model and the application of the first stages of the initial method for elaborating performance indicators allowed us to retain a list of 25 generic indicators that could be adapted to any network. This list covers the activities that are considered to be priorities for ensuring a network's performance and it allows users of the method to adopt them and think of other complementary indicators that they deem more pertinent for their network. Application of this simplified method, based on adapting the generic indicators has made it possible to obtain the expected result, i.e., performance indicators for the RESAPATH network. Evaluation of acceptability and satisfaction concerning the results obtained direct the final report toward a validation of the procedure as it was conceived. The ease with which it was understood and the rapidity of application argue in favor of generalizing this method on a broader scale. This extension would complete the validation of the procedure and provide epidemiological surveillance networks with a simple method for elaborating performance indicators in both animal and human health.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.respe.2011.01.006.

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