

# Feasibility of Implementing Recommendations to Improve Neglected Tropical Diseases Surveillance and Response in Kenya: A Modified Delphi Study

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## Research Article

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# Abstract

**Background:** Effective health information systems are critical towards achieving timely response to preventive chemotherapy targeted neglected tropical diseases (PC-NTDs) and eventual elimination. Endemic countries should initiate disease control programmes coupled with strengthened health systems that enable prompt case detection and effective response to halt disease transmission and prevent probable outbreaks. This study aimed to assess the importance and feasibility of implementing recommendations for improving surveillance core, support and attribute functions concerning PC-NTDs in Kenya.

**Methods:** A descriptive web-based Delphi process comprising of two survey rounds was used to achieve group consensus. In the first round, participants were enrolled to complete a five-point likert-type self-administered electronic questionnaire comprising of 60 statements across 12 sub-domains on the importance of recommendations. In the second round, participants reappraised their responses following completion of a questionnaire with rephrased statements on feasibility of implementing the recommendations to improve PC-NTDs surveillance and response. Data from both rounds were analysed using descriptive statistics and thematic analysis performed for the open-ended responses.

**Results:** Sixty-two key stakeholders actively involved in surveillance and response activities in seven PC-NTDs endemic counties in Kenya were invited to participate. Of these, 50/62 completed the first round (81% response rate) and 45/50 completed the second round (90% response rate). Consensus was achieved (defined as >70% agreement) on the importance (93%) of recommendation statements and feasibility (77%) of implementing the recommendations. Stakeholders agreed on the importance and feasibility of specific recommendations across the 12 sub-domains: case detection and registration, reporting, data analysis, feedback, epidemic preparedness and response, supervision, training, resources, simplicity, acceptability, stability and flexibility. However, there was lack of consensus on the practicability of availing case registers specific for PC-NTDs (42%), confirming all cases (29%), conducting routine data analysis (31%), increasing supervisory visits (22%), involving all health workers in surveillance training (16%), retaining trained surveillance staff (27%) and increasing the number of designated surveillance personnel (38%).

**Conclusion:** Consensus among surveillance system stakeholders on implementation of the forty-six practical recommendations will inform development of a logical framework to guide decisions on strengthening specific surveillance components within the existing surveillance system in view of PC-NTDs in Kenya.

## Background

Public health surveillance systems are a critical component of health information systems, which involves systematic collection, analysis and interpretation of health data resulting in timely information dissemination to prompt appropriate public health action [1]. In 1998, the integrated disease surveillance

and response (IDSR) strategy was adopted by member states of the African region [2, 3]. This strategy was intended to harness and integrate common surveillance functions and resources, which were previously utilised through a single or vertical surveillance approach [2, 3]. In Kenya, the IDSR strategy was first adopted in the year 2000 and later in 2012 the revitalised IDSR guidelines were adopted [4]. Evidently, surveillance system assessments previously conducted in Africa have mostly put focus on diseases considered of a notifiable nature [5–8]. Consequently, there is insufficient documentary evidence of the status and performance of the surveillance and response systems concerning other diseases targeted for elimination or eradication such as the neglected tropical diseases (NTDs). Neglected tropical diseases are a diverse group of infections mainly prevalent in tropical and sub-tropical conditions [9]. The insidious diseases contribute immensely to the burden of non-communicable conditions including irreversible blindness, hepatosplenomegaly and lymphadenopathy, which are all associated with disability, disfigurement and stigmatization [9].

In the Kenyan context, majority of the NTDs are amenable to chemoprophylaxis and other basic sanitary interventions [10]. Suppressing NTDs transmission and achieving the elimination goals will alleviate their non-communicable debilitating effects. This can be achieved through an effective health system with functional health information systems that provide timely information for initiation of appropriate public health actions [11]. Effective control and prevention of NTDs is dependent on early detection and prompt action aided by effective surveillance and response systems [12]. However, there is a dearth in knowledge regarding the effectiveness and possible shortcomings of surveillance systems considering preventive chemotherapy targeted neglected tropical diseases (PC-NTDs) especially following adoption of the revised IDSR guidelines in Kenya. Therefore, the current study approach provides critical information to explore opportunities for strengthening surveillance activities for PC-NTDs and the existing information systems for evidence-based action. This is in line with the fourth strategic priority of the second Kenya National Strategic Plan for NTDs (2016–2020), the fifth strategic objective of the Kenya National Breaking Transmission Strategy for PC-NTDs (2019–2023) and the Expanded Special Project for Elimination of NTDs (ESPEN) [10, 13, 14]. Ultimately, to identify pockets of disease occurrence requires strengthened health information systems to efficiently inform targeted responses [13, 14]. In the absence of reliable information systems, targeted disease control will be impeded since interventions may be implemented in areas where NTDs are uncommon or completely absent, which may result in unnecessary use of the limited resources [15].

An initial systematic review of studies, which assessed surveillance systems in African countries post-adoption of the revised IDSR guidelines between 2010 and 2019 was undertaken and the key findings and recommendations ensuing from the assessment studies retrieved [16]. Furthermore, two studies involving primary data collection were conducted with the aim of assessing surveillance system core, support and attribute functions regarding PC-NTDs co-endemic in Kenya [17, 18]. The PC-NTDs of focus included Lymphatic Filariasis, Schistosomiasis, Soil Transmitted Helminths and Trachoma. Critical recommendations derived from the systematic literature review and primary studies were based on healthcare personnel perceptions in view of their involvement in disease surveillance and response activities. Consequently, assessing feasibility for implementing the recommendations provided in these

previous studies formed the basis for the current study. The move of NTD programmes from donor-funded agencies to local stakeholders to motivate country's self-reliance in curbing NTDs, underpins the importance of in-country perspectives and decision-making to achieve sustainable impact [19].

Sustainable NTDs control efforts remain elusive especially if little or no considerations are accorded to local stakeholders' contributions to decision-making. NTDs policy agenda setting should prioritise engaging the relevant healthcare stakeholders in the affected regions [20].

Effective implementation of recommendations is dependent on consensus among stakeholders on their acceptability and the practical feasibility of implementing the recommendations. The Delphi technique is a structured process using a set of questionnaires or iterative rounds to collect information in order to reach a consensus [21]. The method has been used widely in various disciplines and is perceived effective for studies aiming to show agreement among a group of stakeholders in a given field [22]. The Delphi process allows stakeholders to revise their opinions raised on an issue at a prior stage based on responses from their counterparts. The back and forth process of providing feedback based on an analysis of opinions from a group of experts enables reaching a consensus on a pertinent issue [22]. Strengthened surveillance systems will facilitate disease elimination programmes by improving existing health systems as regards case detection and public health response activities targeting disease transmission foci and outbreaks prevention [12]. Therefore, there is dire need to establish and implement novel surveillance approaches and strategic responses to transition from disease control to elimination [11]. However, implementation can only be guided by what is important, feasible, acceptable and tailored to the needs of surveillance system users. In this study, the term stakeholders is used to describe individual actively involved in making decisions regarding disease surveillance activities or members of the health management committees constituted at the sub national level. Therefore, the Delphi survey aimed to assess practically feasible recommendations for implementation to improve PC-NTDs surveillance and response activities in Kenya.

## Methods

### Study setting and participants

The study involved stakeholders selected from NTDs endemic regions in Kenya. Kenya comprises of 47 counties that are endemic of at least one or more NTDs. However, stakeholders were enrolled from seven specific regions including Baringo, West Pokot, Narok, Kilifi, Kwale, Embu and Kitui counties that are co-endemic of at least three or more PC-NTDs. The PC-NTDs of focus in the study are Lymphatic Filariasis, Schistosomiasis, Trachoma and Soil Transmitted Helminths. The survey involved 50 health personnel responsible for overseeing surveillance and response activities at the sub-national level. The sub-national health system constitutes the county and sub-county levels. Study participants were considered key implementers of disease surveillance-related activities and were purposely selected from seven PC-NTDs endemic counties in Kenya. The participants included directors of health, NTDs coordinators, disease surveillance coordinators, health records information personnel and public health personnel both at the county and sub-county levels.

# Survey design

A two-round descriptive web-based Delphi survey was utilised. The factors assessed in the survey were retrieved from key findings of three previous studies [16-18]. The first study involved a systematic review of literature based on surveillance assessment studies, which identified priority recommendations for implementation to improve surveillance system core, support and attribute functions in the African region (PROSPERO Registration number CRD42019124108) [16]. The second and third studies involved assessment of surveillance core, support and attribute functions to identify disease-specific recommendations to improve PC-NTDs surveillance and response based on health workers' perspectives in Kenya [17, 18]. In the current study, twelve sub-domains were identified from the three main domains of surveillance core, support and attribute functions described in the initial studies. Recommendation statements were derived from the studies and for instances where common recommendations were identified, these were consolidated resulting in sixty pre-defined factors. The sixty pre-defined statements were grouped into the twelve sub-domains, namely case detection, registration and confirmation, reporting, data analysis, feedback, epidemic preparedness and response, supervision, training, resources, simplicity, acceptability, stability and flexibility. Phrasing of the survey statements used in the first round were developed directly in line with findings from the previous studies and re-phrased statements were used in the second round of study.

# Data collection

Due to the Coronavirus disease (COVID-19) pandemic situation and considering precautionary measures recommended by the Ministry of Health in Kenya, an electronic web-based self-administered questionnaires was designed using Google forms and data was securely transferred from the forms to Google spreadsheets. The five-point likert scale online questionnaires were used to obtain data from the participants. Response to the statements ranged from *strongly agree* to *strongly disagree* with provision of a neutral and *do not know* options. Consensus was defined as the combination of participants who "agreed" and "strongly agreed" to the statements. On the other hand, non-consensus was defined as the combination of those who "disagreed" and "strongly disagreed". The questionnaires had an additional comment section to elicit open responses from participants having further information not captured in the likert-scale statements. Questionnaire used in the first round consisted of 12 sub-domains with 60 statements. In the second round, all 60 initial statements were retained from the first round and rephrased. The questionnaire used in the first round contained statements phrased in a manner to prompt responses from participants regarding importance of the recommendation statements. In the second round, the statements were rephrased to elicit participants' opinion on the feasibility of implementing recommendations at the sub-national level.

# Study procedure

The Delphi technique is a scientific approach involving sequential surveys where a series of rounds are used to obtain individual expert opinions to establish consensus among participants [23, 24]. Prior to subsequent rounds, the participants are provided with the analysed outcome of each initial round to assess the level of consensus [24]. The Delphi methodology provides an opportunity to gain in depth perspectives from a diverse group of key stakeholders (in this case from multiple counties in Kenya endemic of PC-NTDs) and reach consensus on what they would consider feasible for implementation [24]. In the current study, an initial first round involved administering the online survey tool to the selected stakeholders responsible for overseeing and making decisions on surveillance and response activities in the NTD endemic regions in Kenya. Their responses on the importance of recommendation statements were obtained, analysed and the statements rephrased to assess feasibility of implementing the recommendations. The final second round involved administering the revised web-based tool and providing participants with the outcome report of the previous first round (Figure 1). Priority was accorded to county health stakeholders' perspectives since they are the key decision makers on health system functioning at the sub-national level, which is a devolved function overseen by county governments in Kenya [10]. The initial purposive sample of sixty-two participants were invited via email or WhatsApp to participate in the Delphi survey. In the first round, an internet link to the electronic form was distributed via the same channels for participants to complete the online questionnaire, following which quantitative analysis of the responses using frequencies and percentages in between the two rounds was undertaken to ascertain the degree of disagreement or agreement with the recommendation statements. A comment section was provided in the questionnaires to solicit open responses from the stakeholders on the non-consensus statements in both rounds of the survey. The participants who completed the first round were further invited via email or WhatsApp to participate in the second round. Up to three weekly email or WhatsApp message reminders were sent to participants who failed to respond in the second round. Invitation to participate in the first round was sent on June 15, 2020 and the final round was conducted on July 6, 2020.

## Data analysis

Exported data from the Google spreadsheets were analysed using Stata Version 14.0 (College Station, 77845 Texas USA). Descriptive statistics were used to summarise categorical variables and frequency distributions were described for participant responses measured on the five-point likert scale. Reliability and coherence between questionnaire items was tested using Cronbach alpha coefficient. The calculated coefficients ranged from 0.81 – 0.95 indicating sufficient reliability and inter-item correlation. The final questionnaire used in the first round comprised of 60 recommendation statements with an average of five questions in each sub-domain. All the initial questionnaire items were retained and none was excluded following factor analysis, based on the principal component analysis, to ascertain the statements relevance as constructs in each of the sub-domains. Consensus was defined as >70% of participants either “agreeing” or “strongly agreeing” with the recommendation statements in each of the two rounds. This level of consensus is considered appropriate for Delphi studies [25, 26]. Two consensus scenarios were described, the first, which excluded the ‘neither agree nor disagree’ responses in the

analysis. The second scenario involved conducting sensitivity analysis whereby responses of participants who indicated 'neither agree nor disagree' were combined with responses of those participants who were in agreement with the statements. This determined the overall consensus on importance and feasibility of implementing the recommendations. Open responses from participants were analysed thematically by deriving relevant sub-themes based on each of the pre-defined sub-domains.

## Ethical considerations

Approval for the study was obtained from the Faculty of Health Sciences Research Ethics Committee of the University of Pretoria in South Africa and the Institutional Research and Ethics Committee of Moi University/Moi Teaching and Referral Hospital in Kenya. Additionally, the National Commission for Science, Technology and Innovation (NACOSTI) provided research authorisation to undertake the study in accordance with relevant guidelines and regulations. Permission was granted by the Ministry of Health, county health authorities and written informed consent was obtained from all study participants.

## Results

Sixty-two participants were recruited in the first round of the survey and a response rate of 81% was obtained. The final sample size was 50 participants following exclusion of those who did not consent (n = 5) and those who were unavailable (n = 7) to participate in the study. The median number of years of work experience for participants in their current designation was 10 years (IQR: 8–12 years). Majority (64%) of participants were members of the county health management committee with 36% being part of the sub-county health management committee. The second round of the Delphi survey involved 45 participants translating to a response rate of 90% since five out of the 50 participants in the previous round were unavailable to participate in the second round. The stakeholders were grouped into various areas of work including health management (county directors of health); disease surveillance (county and sub-county disease surveillance and response coordinators and NTDs coordinators); public health (sub county public health personnel) and health information (county and sub-county health records and information personnel) (Table 1). The preponderance of participants reached agreement on the significance and practicability of implementing recommendations to improve surveillance and response to PC-NTDs at the sub-national level. Out of the 60 statements in 12 sub-domains in the first round of the survey, stakeholders reached consensus on importance of 56 (93%) recommendation statements (Table 2). Furthermore, in the second round, participants reached consensus on the feasibility of implementing 46 (77%) of the recommendation statements (Table 3).

Table 1  
Socio-demographic characteristics of participants

<b>Characteristic</b>	<b>n (%)</b>
<b>Regions</b>	
Coast (Kwale and Kilifi)	20 (40%)
Rift Valley (Baringo, West Pokot and Narok)	18 (36%)
Eastern (Kitui and Embu)	12 (24%)
<b>Age of participants</b>	
31–40 years	20 (40%)
41–50 years	21 (42%)
> 50 years	9 (18%)
<b>Gender of participants</b>	
Female	14 (28%)
Male	36 (72%)
<b>Areas of work responsibility</b>	
Health management	3 (6%)
Disease surveillance	19 (38%)
Public health	14 (28%)
Health information	14 (28%)
<b>Health management committee level</b>	
Sub county	18 (36%)
County	32 (64%)

Table 2

Participants' consensus status on the importance of recommendation statements (N = 50)

Domains	Sub-domains	Statements	Consensus n (%)	Non- consensus n (%)	Neutral n (%)	
Core Functions	Case detection, registration and confirmation	Need to update surveillance guidelines currently in use at the sub-national level	49 (98)	-	1 (2)	
		Need to update the available PC-NTDs case definitions currently in use at the sub- national level	41 (82)	3 (6)	6 (12)	
		Training is required on practical application of the available PC-NTDs case definitions	50 (100)	-	-	
		Availing case registers specific for registering PC- NTD cases is necessary	<b>35 (70)*</b>	4 (8)	11 (22)	
		All PC-NTDs need confirmation at the lower surveillance levels	<b>33 (66)*</b>	4 (8)	13 (26)	
		Increased number of laboratories at lower surveillance levels to improve PC-NTDs case confirmation capacity	45 (90)	2 (4)	3 (6)	
		Need to properly equip laboratories at the health facility level to improve PC- NTDs case confirmation	49 (98)	-	1 (2)	
		Need to provide an adequate number of skilled laboratory health personnel for effective confirmation of PC-NTDs	50 (100)	-	-	
		Reporting	Need to ensure reporting forms are always readily available in all surveillance levels	50 (100)	-	-

\* - statements not achieving the &gt; 70% consensus threshold

Domains	Sub-domains	Statements	Consensus	Non-consensus	Neutral
		Need to avail updated reporting guidelines at the sub-national level	49 (98)	-	1 (2)
		Need to list all PC-NTDs in the existing reporting forms to improve surveillance data capture	45 (90)	-	5 (10)
		Immediate reporting of PC-NTD cases is required to improve planned response actions	44 (88)	2 (4)	4 (8)
		Need to adopt electronic reporting tools to improve transmission of PC-NTDs surveillance data to the next level	50 (100)	-	-
		Frequent training on reporting PC-NTDs using existing reporting forms is required	50 (100)	-	-
		Need to allocate adequate time for surveillance reports preparation and submission to the next levels	49 (98)	-	1 (2)
	Data Analysis	Need to prioritise PC-NTDs surveillance data analysis at the sub-national level	49 (98)	-	1 (2)
		Analysis of PC-NTDs surveillance data should be conducted on a routine-basis	42 (84)	4 (8)	4 (8)
		Trend analysis of PC-NTDs reported cases should be undertaken periodically	45 (90)	-	5 (10)
		Enhanced training on PC-NTDs surveillance data analysis is required	50 (100)	-	-
		Clearly formulated PC-NTDs action thresholds are required	50 (100)	-	-
		Need to provide adequate data analysis tools and equipment	50 (100)	-	-

\* - statements not achieving the > 70% consensus threshold

Domains	Sub-domains	Statements	Consensus	Non-consensus	Neutral
	Feedback	Need to prioritise feedback specifically regarding PC-NTDs surveillance data	50 (100)	-	-
		Need for timely feedback on PC-NTDs surveillance data reported to the next level	50 (100)	-	-
		Regular feedback on reported PC-NTDs surveillance data is required	47 (94)	-	3 (6)
		Need to adapt improved electronic feedback mechanisms	49 (98)	-	1 (2)
		Increased feedback on PC-NTDs to lower surveillance levels is required	46 (92)	-	4 (8)
	Epidemic preparedness and response	Updated PC-NTDs outbreak preparedness and response protocols are required	50 (100)	-	-
		Need for outbreak response teams to be well-constituted to respond to probable PC-NTDs outbreaks	47 (94)	1 (2)	2 (4)
		Need for emergency supplies to adequately respond to probable PC-NTDs outbreaks	50 (100)	-	-
		Regular training on PC-NTDs outbreak preparedness and response is required	50 (100)	-	-
<b>Support Functions</b>	Supervision	Need to prioritise supervision of PC-NTDs surveillance activities at the sub-national level	50 (100)	-	-
		Regular supervision of PC-NTDs surveillance activities undertaken at the lower levels is required	46 (92)	-	4 (8)
		Formulation of supervisory schedules for PC-NTDs surveillance activities is necessary	45 (90)	-	5 (10)

\* - statements not achieving the > 70% consensus threshold

Domains	Sub-domains	Statements	Consensus	Non-consensus	Neutral
		Increased frequency of supervisory visits at the lower surveillance levels is required	42 (84)	1 (2)	7 (14)
		Training and sensitisation of all health workers regarding supervisory activities is required	46 (92)	2 (4)	2 (4)
		Need for properly constituted supervisory teams to adequately supervise PC-NTDs surveillance activities	50 (100)	-	-
		Need for adequate resource provision to support supervision of PC-NTDs surveillance activities	49 (98)	-	1 (2)
		Need for increased participation of the community levels to support supervision of PC-NTDs surveillance activities	49 (98)	-	1 (2)
	Training	Need to prioritise PC-NTDs in surveillance trainings conducted at the sub-national level	49 (98)	-	1 (2)
		Regular training specifically on PC-NTDs surveillance activities is necessary	50 (100)	-	-
		All health workers need to be involved in training on PC-NTDs surveillance activities	<b>35 (70)*</b>	3 (6)	12 (24)
		Availing adequate training materials and equipment is necessary across all surveillance levels	50 (100)	-	-
		Need to retain trained surveillance staff across all surveillance levels	50 (100)	-	-
	Resources	Increased funding is required to support PC-NTDs surveillance activities	50 (100)	-	-

\* - statements not achieving the > 70% consensus threshold

Domains	Sub-domains	Statements	Consensus	Non-consensus	Neutral
		Availing electronic communication equipment for transmission of PC-NTDs surveillance data is required	50 (100)	-	-
		Improved transport and logistical support is necessary to facilitate PC-NTDs surveillance activities	50 (100)	-	-
		Increasing the number of health workers involved in PC-NTDs surveillance activities is necessary	41 (82)	5 (10)	4 (8)
		Increasing the number of designated surveillance focal persons is required	<b>33 (66)*</b>	6 (12)	11 (22)
		Need for to improve telecommunication channels to support transmission of surveillance data	49 (98)	1 (2)	-
		Need for improved means of transportation to facilitate surveillance activities	50 (100)	-	-
<b>Attribute Functions</b>	Simplicity	Simplification of existing guidelines for completing reporting forms is required	46 (92)	-	4 (8)
		Need to simplify available forms to ease reporting of PC-NTDs	36 (72)	-	14 (28)
		Need to simplify PC-NTDs case definitions to ease application	42 (84)	-	8 (16)
		Need to simplify methods for PC-NTDs surveillance data collection and analysis	44 (88)	-	6 (12)
	Acceptability	Need for the health managers to support PC-NTDs surveillance activities in the region	50 (100)	-	-
		PC-NTDs need to be considered of public health importance in the region	50 (100)	-	-
* - statements not achieving the > 70% consensus threshold					

Domains	Sub-domains	Statements	Consensus	Non-consensus	Neutral
	Stability	Need for challenges facing PC-NTDs surveillance activities to be addressed with minimal delays	50 (100)	-	-
		Sufficient resources to support PC-NTDs surveillance activities are required	50 (100)	-	-
	Flexibility	Need for existing surveillance systems to be well adapted to reporting all PC-NTDs in the region	50 (100)	-	-
		Existing surveillance systems need to adapt easily to changes in PC-NTDs information needs	50 (100)	-	-
* - statements not achieving the > 70% consensus threshold					

Table 3

Participants' consensus status on the feasibility of implementing recommendation statements (N = 50)

Domain	Sub-domains	Statements	Consensus n (%)	Non-consensus n (%)	Neutral n (%)	
Core Functions	Case detection, registration and confirmation	It is feasible update surveillance guidelines currently in use at the sub-national level	50 (100)	-	-	
		It is feasible to update the available PC-NTDs case definitions currently in use at the sub-national level	37 (82)	-	8 (18)	
		It is practical to train all health workers on the application of available PC-NTDs case definitions	<b>31 (69)*</b>	4 (9)	10 (22)	
		It is feasible to avail case registers specific for registering PC-NTD cases	<b>19 (42)*</b>	22 (49)	4 (9)	
		It is feasible to confirm all PC-NTDs at the lower surveillance levels	<b>13 (29)*</b>	23 (51)	9 (20)	
		It is practical to increase the number of laboratories at lower surveillance levels to improve PC-NTDs case confirmation capacity	<b>16 (35)*</b>	3 (7)	26 (58)	
		It is feasible to fully equip laboratories at the health facility level to improve PC-NTDs case confirmation	32 (71)	3 (7)	10 (22)	
		It is feasible to provide an adequate number of skilled laboratory health personnel for effective confirmation of PC-NTDs	39 (87)	-	6 (13)	
		Reporting	It is feasible to ensure reporting forms are always readily available in all surveillance levels	45 (100)	-	-

\* - statements not achieving the &gt; 70% consensus threshold

Domain	Sub-domains	Statements	Consensus	Non-consensus	Neutral
		It is feasible to avail updated reporting guidelines at the sub-national level	44 (98)	-	1 (2)
		It is feasible to list all PC-NTDs in the existing reporting forms to improve surveillance data capture	<b>25 (55)*</b>	3 (7)	17 (38)
		It is feasible to ensure immediate reporting of PC-NTD cases to improve planned response actions	<b>30 (66)*</b>	2 (4)	13 (29)
		It is feasible to adopt electronic reporting tools to improve transmission of PC-NTDs surveillance data to the next level	45 (100)	-	-
		It is feasible to offer frequent training on reporting PC-NTDs using existing reporting forms	44 (98)	1 (2)	-
		It is feasible to allocate adequate time for surveillance reports preparation and submission to the next levels	45 (100)	-	-
	Data Analysis	It is feasible to prioritise PC-NTDs surveillance data analysis at the sub-national level	42 (93)	-	3 (7)
		It is practical for analysis of PC-NTDs surveillance data to be conducted on a routine-basis	<b>14 (31)*</b>	22 (49)	9 (20)
		It is practical to undertake trend analysis of PC-NTDs reported cases periodically	<b>27 (60)*</b>	3 (7)	15 (33)
		It feasible to enhance training on PC-NTDs surveillance data analysis	45 (100)	-	-
		It is feasible to have clearly formulated PC-NTDs action thresholds	43 (95)	-	2 (4)

\* - statements not achieving the > 70% consensus threshold

Domain	Sub-domains	Statements	Consensus	Non-consensus	Neutral
		It is practical to provide adequate data analysis tools and equipment to all surveillance levels	44 (98)	-	1 (2)
	Feedback	It is feasible to prioritise feedback specifically regarding PC-NTDs surveillance data	41 (91)	-	4 (9)
		It is feasible to provide timely feedback on PC-NTDs surveillance data reported to the next level	44 (97)	-	1 (2)
		It is feasible to provide regular feedback on reported PC-NTDs surveillance data	42 (93)	-	3 (7)
		It is feasible to adapt improved electronic feedback mechanisms	45 (100)	-	-
		It is practical to increase feedback on PC-NTDs to lower surveillance levels	41 (91)	-	4 (9)
	Epidemic preparedness and response	It is feasible to provide all surveillance levels with updated PC-NTDs outbreak preparedness and response protocols	45 (100)	-	-
		It is feasible to have well constituted outbreak response teams to respond to probable PC-NTDs outbreaks	43 (95)	-	2 (4)
		It is feasible to provide adequate emergency supplies to respond to probable PC-NTDs outbreaks	41 (91)	-	4 (9)
		It is feasible to provide regular training on PC-NTDs outbreak preparedness and response	45 (100)	-	-
<b>Support Functions</b>	Supervision	It is feasible to prioritise supervision of PC-NTDs surveillance activities at the sub-national level	41 (91)	-	4 (9)

\* - statements not achieving the > 70% consensus threshold

Domain	Sub-domains	Statements	Consensus	Non-consensus	Neutral
		It is feasible to provide regular supervision of PC-NTDs surveillance activities undertaken at the lower levels	<b>23 (51)*</b>	2 (4)	20 (44)
		It is feasible to formulate supervisory schedules for PC-NTDs surveillance activities	45 (100)	-	-
		It is feasible to increase the frequency of supervisory visits to the lower surveillance levels	<b>10 (22)*</b>	20 (45)	15 (33)
		It is practical to train and sensitise all health workers regarding supervisory activities	43 (95)	1 (2)	1 (2)
		It is feasible to properly constitute supervisory teams to adequately supervise PC-NTDs surveillance activities	45 (100)	-	-
		It is feasible to ensure there is adequate resource provision to support supervision of PC-NTDs surveillance activities	44 (98)	-	1 (2)
		It is practical to increase community participation to support supervision of PC-NTDs surveillance activities	44 (98)	-	1 (2)
	Training	It is feasible to prioritise PC-NTDs in surveillance trainings conducted at the sub-national level	44 (97)	-	1 (2)
		It is feasible to provide regular training specifically on PC-NTDs surveillance activities	39 (87)	-	6 (13)
		It is feasible to involve all health workers in training on PC-NTDs surveillance activities	<b>7 (16)*</b>	22 (48)	16 (35)
		It is practical to avail adequate training materials and equipment across all surveillance levels	45 (100)	-	-
		It is feasible to retain trained surveillance staff across all surveillance levels	<b>12 (27)*</b>	24 (53)	9 (20)

\* - statements not achieving the > 70% consensus threshold

Domain	Sub-domains	Statements	Consensus	Non-consensus	Neutral
	Resources	It is feasible to increase funding to support PC-NTDs surveillance activities	34 (75)	-	11 (24)
		It is feasible to provide electronic communication equipment for transmission of PC-NTDs surveillance data	45 (100)	-	-
		It is feasible to improve transport and logistical support to facilitate PC-NTDs surveillance activities	45 (100)	-	-
		It is practical to increase the number of health workers involved in PC-NTDs surveillance activities	<b>18 (40)*</b>	2 (4)	25 (56)
		It is feasible to increase the number of designated surveillance focal persons	<b>17 (38)*</b>	18 (40)	10 (22)
		It is feasible to improve telecommunication channels to support transmission of surveillance data	45 (100)	-	-
		It is feasible to improve means of transportation to facilitate surveillance activities	45 (100)	-	-
<b>Attribute Functions</b>	Simplicity	It is feasible to simplify existing guidelines for completing reporting forms	45 (100)	-	-
		It is practical to simplify available forms to ease reporting of PC-NTDs	45 (100)	-	-
		It is practical to simplify PC-NTDs case definitions to ease application	37 (82)	-	8 (18)
		It is feasible to simplify methods for PC-NTDs surveillance data collection and analysis	45 (100)	-	-
		Acceptability	It is feasible for the health managers to support PC-NTDs surveillance activities in the region	45 (100)	-

\* - statements not achieving the > 70% consensus threshold

Domain	Sub-domains	Statements	Consensus	Non-consensus	Neutral
		It is feasible to influence health workers' perceptions on the public health importance of PC-NTDs in the region	43 (96)	-	2 (4)
	Stability	It is feasible to address challenges facing PC-NTDs surveillance activities with minimal delays	36 (80)	3 (7)	6 (13)
		It is feasible to avail sufficient resources to support PC-NTDs surveillance activities	44 (98)	1 (2)	-
	Flexibility	It is feasible for the existing surveillance systems to be well adapted to reporting all PC-NTDs in the region	32 (71)	2 (4)	11 (24)
		It is feasible for the existing surveillance systems to adapt easily to changes in PC-NTDs information needs	33 (73)	3 (7)	9 (20)
* - statements not achieving the > 70% consensus threshold					

## Surveillance core activities

Stakeholders agreed on the importance and feasibility of updating surveillance guidelines currently in use at the sub-national levels and were further in consensus on the need to update the available standard case definitions for PC-NTDs. Further, participants agreed on the importance of training health workers on practical use of the standard case definitions. However, there was non-consensus on the feasibility of training all health workers on use of PC-NTDs standard case definitions. There was further non-consensus on the importance (70%) and feasibility (42%) of providing case registers specific for registration of PC-NTDs cases.

*"Having in place case registers for registering PC-NTDs only may not be practical and cost effective since we have many other conditions to be registered and it would be easier to do this using one common register"* (Participant 5)

*"It is only feasible to issue facilities designated as treatment sites with the registers since they receive NTD patients more often compared to the other facilities"* (Participant 16)

*"Providing registers specific for NTDs to all levels might require additional resources which are currently unavailable"* (Participant 32)

Furthermore, participants disagreed on the need and feasibility of confirming all the PC-NTDs cases at the lower surveillance levels. Nonetheless, participants reached consensus (90%) on the importance of increasing the number laboratory facilities at the peripheral levels to confirm PC-NTDs, although there was non-consensus on the practicability of having additional laboratories at lower surveillance levels.

*“It will not be quite possible to always confirm all the NTDs due to low capacity of the lower levels to undertake case confirmation due to unavailability of laboratory facilities” (Participant 4)*

*“Confirmation of all PC-NTDs at the lower levels would require increased provision of laboratory facilities and equipment in the region to achieve this target” (Participant 8)*

*“Confirming all cases requires adequate supply of laboratory reagents and supplies that may not be the case for most of the lower levels” (Participant 29)*

There was agreement among stakeholders on the importance and feasibility of adequately equipping existing laboratories at the facility level and providing sufficient number of skilled laboratory personnel to enhance PC-NTDs case confirmation.

Further findings showed agreement on the importance and feasibility of ensuring reporting forms are always readily available and on providing updated reporting guidelines across all surveillance levels. Stakeholders were also in consensus on the importance (90%) of listing all the PC-NTDs in the reporting forms but there was non-consensus on the feasibility of including all the diseases in the existing report forms. Further, participants agreed (88%) on the need to ensure immediate reporting of PC-NTD cases to improve planned response actions. However, there was non-consensus on the achievability of immediate case reporting on first detection. There was unanimity among stakeholders on the importance and feasibility of adopting electronic reporting tools to improve transmission of PC-NTDs surveillance data. Participants further reached consensus on the significance and practicality of providing regular training on PC-NTDs reporting and allocating ample time for preparation and submission of surveillance reports.

Stakeholders had a converging opinion on the importance (98%) and feasibility (93%) of prioritising analysis of PC-NTD surveillance data. Participants also agreed on the need to conduct routine data analysis and undertake periodic trend analysis for PC-NTDs. However, there was lack of consensus on the practicability of conducting regular data analysis and periodic assessment of PC-NTDs trends.

*“Analysis of PC-NTDs data may not be routinely done due to other competing activities but can be done whenever there is an increased number of cases in the region” (Participant 5)*

*“We first need to improve the quality and quantity of data collected on PC-NTDs to be able to undertake routine analysis of these data” (Participant 9)*

Moreover, participants were in consensus on the importance and practicality of enhancing training on data analysis, formulation of coherent action thresholds and provision of sufficient data analysis tools and equipment considering PC-NTDs.

There was consensus among stakeholders on the importance and feasibility of prioritising feedback specific to PC-NTDs and providing timely and regular feedback across all surveillance levels. In addition, participants agreed on the need and practicality of adopting electronic feedback mechanisms and enhancing feedback on PC-NTDs to lower surveillance levels. Agreement was also reached on the importance and possibilities of updating outbreak preparedness and response protocols for all PC-NTDs and having well-constituted outbreak response teams at the sub-national level to adequately respond to PC-NTDs outbreaks. Participants further reached consensus on the need and feasibility of provision of sufficient emergency supplies in anticipation of probable outbreaks and providing frequent training on PC-NTDs epidemic preparedness and response.

## Surveillance support activities

Stakeholders reached consensus on the importance (100%) and feasibility (91%) of prioritising supervision of PC-NTDs surveillance activities at the sub-national levels. There was further agreement on the need to undertake regular supervision of surveillance activities concerning PC-NTDs and heightening the frequency of supervisory visits at the peripheral levels. However, participants disagreed on the feasibility (51%) of consistently conducting supervision of surveillance activities and there was lack of consensus (22%) on the possibility of increasing the frequency of supervisory visits at the lower levels.

*“Conducting regular supervision of surveillance activities requires resources for transportation and purchase of other materials which may not be feasible at this time due to other priority activities”*  
(Participant 12)

*“Due to the nature of the region which has very poor terrain, this pose a challenge to accessing some of the remote regions and conducting frequent supervision at the peripheral levels may not be practical”*  
(Participant 16)

Participants were in consensus on the necessity and feasibility to formulate supervisory schedules, train all health personnel on supervisory activities and establish supervisory teams capable of providing support supervision for PC-NTDs surveillance activities. Moreover, stakeholders agreed on the importance and practicality of resource provision to support supervisory activities and involvement of the community levels to support supervision of PC-NTDs surveillance activities.

*“Support supervision should be strengthened especially at the peripheral levels with the involvement of the community units throughout the process”* (Participant 13)

*“Supervision of surveillance activities at the peripheral level requires the involvement of community health workers working within a functional community health unit”* (Participant 21)

Stakeholders had converging points of view on the importance and practicality of prioritising and providing regular training on PC-NTDs surveillance activities. Participants further agreed on the need and feasibility of availing sufficient training materials and tools across all surveillance levels. However,

participants ruled out consensus on the importance (70%) and possibilities (16%) of involving all health workers in training concerning surveillance activities for PC-NTDs.

*“Involving all the health workers in the region in surveillance training might not be cost effective and practical given the scarcity of resources set aside for conducting training” (Participant 2)*

*“This may not be feasible but we only need to ensure that an adequate number of staff are trained on surveillance of NTDs that are common in the region then they can pass on the knowledge gained to other health workers in their area of work” (Participant 39)*

There was unanimity on the importance of limiting high turnover of surveillance staff. However, stakeholders disagreed (53%) on the feasibility of retaining trained surveillance personnel across all surveillance levels.

*“Retention of health workers across surveillance levels may not be feasible since health workers are frequently transferred whenever there is need to adjust to given work circumstances” (Participant 3)*

*“This might not be feasible since staff progression and transfers normally happen regularly so it is better to train other staff to replace the ones transferred” (Participant 37)*

The stakeholders concurred on the need and feasibility of increased funding provision and logistical support for PC-NTDs surveillance activities and provision of electronic communication equipment for transmission of surveillance data. There was also consensus (82%) on the importance of involving more health personnel in PC-NTDs surveillance activities but from a practical perspective, there was lack of consensus (40%) among stakeholders on providing additional staff to be engaged in the surveillance activities. There was further lack of consensus on the importance (66%) and feasibility (38%) of increasing the number of designated surveillance focal persons.

*“This may not be feasible due to lack of adequate resources to have additional staff and since we already have enough surveillance coordinators in the region” (Participant 30)*

*“This might lead to duplication of roles of the surveillance staff already in post, so the available staff should be able to handle all surveillance issues efficiently” (Participant 38)*

Additionally, stakeholders concurred on the need and feasibility of improving the surveillance data transmission and communication channels and providing reliable means of transport to facilitate surveillance activities.

## **Surveillance attributes**

Recommendation statements on improving simplicity, acceptability, stability and flexibility of the surveillance system concerning PC-NTDs were assessed in the two rounds. Findings showed that participants reached consensus regarding the importance and feasibility of simplifying existing reporting

guidelines and forms, simplifying PC-NTDs case definitions for ease of application by health workers and simplifying methods of data collection and analysis of surveillance data. Further, there was unanimity among stakeholders on the need and practicability for health managers across all levels to support PC-NTDs surveillance activities and for all health workers to consider PC-NTDs of public health importance in the endemic regions. In addition, participants agreed on the need and feasibility of promptly addressing challenges facing PC-NTDs surveillance activities and provision of adequate resources to support surveillance of the neglected tropical conditions. Stakeholders also reached consensus on the importance and feasibility of the existing surveillance system to adapt to reporting all PC-NTDs and for the system to adapt to changes in information needs regarding the diseases.

Sensitivity analysis was undertaken with the assumption that participants with neutral responses were in agreement with the recommendation statements on both perspectives of importance and feasibility (Tables 4 & 5). Considering this scenario, findings indicated that stakeholders reached consensus on the importance of availing case registers specific for PC-NTDs but all the same disagreed (51%) on the feasibility of providing the case registers. Furthermore, there was consensus on the importance of confirming the cases but there was still lack of consensus (49%) on the feasibility of confirming all PC-NTDs cases at the lower surveillance levels. Stakeholders further reached consensus on the importance of involving all health personnel in training on PC-NTDs surveillance activities and increasing the number of health workers involved in surveillance activities having assumed that those with neutral responses were in agreement with the statements. Further sensitivity analysis indicated that participants were in consensus on the feasibility of training all health workers on applying the available standard case definitions for PC-NTDs, increasing the number of laboratories at the lower levels, including all PC-NTDs in the existing reporting forms, ensuring immediate reporting and undertaking periodic trend analysis concerning PC-NTDs. However, further findings showed that stakeholders still lacked consensus on the feasibility of conducting routine data analysis for PC-NTDs surveillance data, increasing the frequency of supervisory visits at the lower surveillance levels, involving all health workers in surveillance training, retaining trained surveillance staff and increasing the number designated surveillance focal persons.

Table 4  
Sensitivity analysis of non-consensus statements in the first round (N = 50)

Statements	Scenario 1: 'Neither agree nor disagree' excluded in analysis			Scenario 2: 'Neither agree nor disagree' included in analysis	
	Consensus	Non-consensus	Neutral	Consensus	Non-consensus
Availing case registers specific for registering PC-NTD cases is necessary	<b>35 (70)*</b>	4 (8)	11 (22)	46 (92)	4 (8)
All PC-NTDs need confirmation at the lower surveillance levels	<b>33 (66)*</b>	4 (8)	13 (26)	46 (92)	4 (8)
All health workers need to be involved in training on PC-NTDs surveillance activities	<b>35 (70)*</b>	3 (6)	12 (24)	47 (94)	3 (6)
Increasing the number of designated surveillance focal persons is required	<b>33 (66)*</b>	6 (12)	11 (22)	44 (88)	6 (12)
* - statements not achieving the > 70% consensus threshold					

Table 5  
Sensitivity analysis of non-consensus statements in the second round (N = 50)

Statements	Scenario 1: 'Neither agree nor disagree' excluded in analysis			Scenario 2: 'Neither agree nor disagree' included in analysis	
	Consensus	Non-consensus	Neutral	Consensus	Non-consensus
It is practical to train all health workers on the application of available PC-NTDs case definitions	<b>31 (69)*</b>	4 (9)	10 (22)	41 (91)	4 (9)
It is feasible to avail case registers specific for registering PC-NTD cases	<b>19 (42)*</b>	22 (49)	4 (9)	<b>23 (51)*</b>	22 (49)
It is feasible to confirm all PC-NTDs at the lower surveillance levels	<b>13 (29)*</b>	23 (51)	9 (20)	<b>22 (49)*</b>	23 (51)
It is practical to increase the number of laboratories at lower surveillance levels to improve PC-NTDs case confirmation capacity	<b>16 (35)*</b>	3 (7)	26 (58)	42 (93)	3 (7)
It is feasible to list all PC-NTDs in the existing reporting forms to improve surveillance data capture	<b>25 (55)*</b>	3 (7)	17 (38)	42 (93)	3 (7)
It is feasible to ensure immediate reporting of PC-NTD cases to improve planned response actions	<b>30 (66)*</b>	2 (4)	13 (29)	43 (95)	2 (4)
It is practical for analysis of PC-NTDs surveillance data to be conducted on a routine-basis	<b>14 (31)*</b>	22 (49)	9 (20)	<b>23 (51)*</b>	22 (49)
It is practical to undertake trend analysis of PC-NTDs reported cases periodically	<b>27 (60)*</b>	3 (7)	15 (33)	42 (93)	3 (7)
It is feasible to provide regular supervision of PC-NTDs surveillance activities undertaken at the lower levels	<b>23 (51)*</b>	2 (4)	20 (44)	43 (95)	2 (4)
It is feasible to increase the frequency of supervisory visits to the lower surveillance levels	<b>10 (22)*</b>	20 (45)	15 (33)	<b>25 (55)*</b>	20 (45)

\* - statements not achieving the > 70% consensus threshold

Statements	Scenario 1: 'Neither agree nor disagree' excluded in analysis			Scenario 2: 'Neither agree nor disagree' included in analysis	
It is feasible to involve all health workers in training on PC-NTDs surveillance activities	<b>7 (16)*</b>	22 (48)	16 (35)	<b>23 (51)*</b>	22 (48)
It is feasible to retain trained surveillance staff across all surveillance levels	<b>12 (27)*</b>	24 (53)	9 (20)	<b>21 (47)*</b>	24 (53)
It is practical to increase the number of health workers involved in PC-NTDs surveillance activities	<b>18 (40)*</b>	2 (4)	25 (56)	43 (96)	2 (4)
It is feasible to increase the number of designated surveillance focal persons	<b>17 (38)*</b>	18 (40)	10 (22)	<b>27 (60)*</b>	18 (40)
* - statements not achieving the > 70% consensus threshold					

## Discussion

For effective implementation of the feasible recommendations, the process relies on the performance of other crosscutting health system aspects relating to leadership and governance, health workforce and financial implications at the sub-national levels [27]. Additionally, implementation of recommendations and the decision-making process to strengthen health information systems should be within the human, technological and organisational context of the local setting [28]. This survey approach involved an assessment of participants' opinions towards reaching group consensus. Utilisation of the Delphi process enabled practical assessment regarding the importance and feasibility of implementing generalised recommendations to improve surveillance systems derived from an initial systematic review of studies conducted in the African region and further disease-specific recommendations derived from primary studies conducted in NTD endemic regions in Kenya [16–18]. By combining the opinions and perspectives of key stakeholders, the survey described consensus reached on the most feasible recommendations for implementation to improve surveillance and response to NTDs at the sub-national level in Kenya. The enrolled stakeholders participated in a two-round electronic survey. Participants were provided with summarised findings from the previous first round on importance of the recommendations to enable them reassess their opinions when responding to feasibility statements in the subsequent second round [29]. Final analysis of 60 recommendations categorised into 12 sub-domains indicated that stakeholders reached consensus on the importance of 56 recommendation statements and further reached consensus on the feasibility of implementing 47 of the recommendations at sub-national level. There was convergence of opinion among stakeholders on the importance and feasibility of all recommendations in six sub-domains relating to feedback, epidemic preparedness and response and on all the four surveillance attributes. Contrarily, stakeholders failed to reach consensus on specific

recommendations making up the remaining six sub-domains regarding their importance or practicability of implementing the recommendations. Further sensitivity analysis indicated that participants considered all recommendation statements to be of importance. However, there was still non-consensus on the feasibility of availing NTDs-specific case registers, confirmation of all PC-NTDs cases, undertaking routine data analysis, increasing frequency of supervisory visits at the lower levels, involvement of all health workers in surveillance training, retaining trained surveillance staff and increasing human resource capacity to oversee surveillance activities at the sub-national level.

Findings from the Delphi survey identified critical and feasible recommendations for consideration and implementation by decision makers at the sub-national level to improve PC-NTDs surveillance and response in the endemic regions in Kenya. The survey approach aimed to guide stakeholders' decisions given the complexities and challenges of reaching an agreement on the most practical strategies to improve surveillance activities concerning PC-NTDs. This is in line with development and validation of surveillance strategies that are cost effective and able to integrate all NTDs to ultimately achieve control and elimination [30]. Despite abundant evidence on the endemicity of NTDs amenable to chemoprophylaxis interventions in Kenya, there is limited data generated through the health information systems to adequately guide evidence-based approaches for informed planning and implementation of sustainable interventions [31]. The results indicated consensus on the need to update surveillance guidelines and standard case definitions on PC-NTDs currently in use at the sub-national level. The IDSR guidelines bearing the standard case definitions were updated in 2015 by the IDSR Unit within the Ministry of Health (MOH) in Kenya [32]. Consensus among stakeholders on the importance of updating surveillance guidelines were in line with outcomes from the First Forum on Surveillance-Response System Leading to Tropical Disease Elimination held in June 2012 in Shanghai, which recognised that containment of emergence and transmission of tropical conditions requires early and active case detection [11, 33]. Further, shifting emphasis from control to elimination entails utilisation of standard case definitions for prompt case detection and confirmation of suspected cases [2, 12]. There was agreement among stakeholders on the feasibility of adequately equipping laboratories and increasing the number of skilled laboratory staff in NTD endemic regions. This concurs with calls for improving case confirmation efforts regarding NTDs by increasing capacity of health facilities for routine diagnosis, increasing health workers laboratory skills and provision of laboratory equipment [34]. However, there was non-consensus among participants on the need and feasibility to provide case registers specific for registering PC-NTDs. The reason was that most facilities were not regularly receiving NTD cases but would be feasible to have the registers in facilities designated as treatment centres.

Current findings further indicated consensus on the critical need and feasibility for adopting electronic reporting tools and availing paper-based forms in areas with limited access to telecommunication infrastructure. Effective reporting systems can limit the burden on public health systems of highly endemic regions by informing the establishment of sentinel sites for assessing disease control interventions for targeted conditions [11]. Therefore, having reliable reporting systems will provide stakeholders with relevant information on the geographical distribution of NTD cases to conduct effective transmission assessment surveys [15]. Furthermore, the health ministry in Kenya intends to

formulate comprehensive NTDs reporting tools and advocates for joint reporting by both community drug distributors and health facility workers for further dissemination to the county, national and global levels [13]. Notably, there was lack of consensus on the feasibility of including all PC-NTDs in the reporting forms and instituting immediate reporting of the cases. In Sub Saharan regions, absence of clear indicators for specific NTDs in health management information systems (HMIS) hinders integration of the diseases into the existing reporting tools [34]. Emphasis on priority diseases including malaria, HIV/AIDS and tuberculosis and confining NTDs to conditions of low priority that do not require prompt action limits the effectiveness of a range of interventions [35]. Specifically in Kenya, NTDs are mostly categorised as “other diseases” in the summary report forms, which creates the perception that the conditions are of a lesser priority [10]. However, according to the second Kenya National NTD Strategic Plan, there are efforts to include NTDs in the HMIS register in order to capture all cases and ensure that they are immediately reportable upon detection [10].

Stakeholders agreed on the need and feasibility to prioritise data analysis, enhancing training on data analysis and provision of sufficient data analysis tools and equipment across all surveillance levels. These recommendations are in line with efforts to ensuring public health surveillance and response systems institute rigorous data analysis and management tools that are vital in assessing attainment of elimination goals [11, 36, 37]. However, there was non-consensus on the feasibility of undertaking routine data analysis and periodically assessing trends for PC-NTDs cases. Utilisation of newly developed rapid diagnostic tests and drugs in NTD-endemic regions requires health systems with a proper disease surveillance framework providing routine data on disease morbidity and trends [34]. Further, rapid data analysis facilitate assessments of disease trends over a given time period especially since reduced transmission leads to focalised case distribution that may inform implementation of targeted and appropriate responses [12, 38]. Current findings further identified the importance of enhancing training on data analysis, which is likely to provide health workers with the relevant skills and motivation to undertake routine data analysis. Moreover, provision of feedback within and across all health system levels is a vital undertaking within surveillance and response systems toward achieving disease elimination goals [12]. Correspondingly, there was consensus on the importance of prioritising feedback on PC-NTDs surveillance data at the sub-national level and feasibility of adopting electronic feedback channels to ensure information is provided regularly and in a timely manner. An effective feedback mechanism within existing surveillance systems limits information inundation and delayed transmission that may hinder initiating prompt public health actions [11]. Furthermore, stakeholders’ consensus on increased feedback to lower levels would heighten community engagement in surveillance activities since evidence shows community involvement and sensitisation is fundamental to achieving effective implementation of NTD interventions [34]. Similarly, the Kenya Breaking Transmission Strategy (BTS) for NTDs identifies the need for provision of joint feedback forums involving community health volunteers, community drug distributors and the wider community [13]. Moreover, there was unanimity among stakeholders on the feasibility of providing updated outbreak response guidelines, constituting outbreak response teams, providing sufficient epidemic response supplies and enhancing training on outbreak preparedness and response concerning PC-NTDs. These recommendations were deemed feasible given

that majority of stakeholders enrolled in the survey had a role to play in the existing sub-national level epidemic preparedness and response committees. Their direct involvement in the committees translated to a converging opinion on the importance and feasibility of improving outbreak preparedness and response to PC-NTDs.

Non-consensus on the feasibility of undertaking regular supervision of surveillance activities concerning PC-NTDs at the lower levels was hardly surprising. This could be attributed to endemic regions having non-functional community health units to coordinate supervisory activities at the peripheral level. Essentially, engagement of community health personnel is critical to achieving effective implementation of NTD interventions [39]. Furthermore, in line with the breaking transmission strategy for NTDs, there are calls to ensure that supportive supervision is provided for all diseases being reported in Kenya [13]. On the other hand, training of health workers regarding surveillance activities is linked to improved reporting performance and overall strengthening of national disease surveillance systems [40]. Similar to our findings, there was agreement among stakeholders on prioritisation of surveillance training, enhancing training frequency of health personnel and adequate provision of training materials and tools regarding PC-NTDs. However, stakeholders held the view that involvement of health workers of all cadres in surveillance training might not be feasible due to the cost implications of numerous training activities. However, most regional levels in African countries provide both technical and financial support for training of trainers, which facilitates cascade training [40]. Moreover, increasing the number of health personnel trained on disease surveillance could be made more feasible by adopting on-the-job training and pre-service training mechanisms [40]. Nevertheless, stakeholders were not in consensus with practicability of expanding the health workforce responsible for disease surveillance and response activities at the sub-national level. This could be attributed to scarcity of resources to increase the number of surveillance staff and the general shortage of health personnel [10]. Therefore, the sub-national levels ought to leverage on efficient use of the existing workforce and other surveillance resources. A unified approach to utilise the available resources is a key principle of the IDSR framework [4]. Furthermore, integrated efforts to control NTDs are encouraged to augment utilisation of the limited resources [10]. The geographical overlap and co-endemicity of PC-NTDs rationalises the need for integration of surveillance and control efforts [13, 35].

## **Strengths And Limitations**

The study approach enabled an extensive assessment on the cardinal and feasible recommendations based on consensus among concerned stakeholders, which are pertinent to improving disease surveillance and response to PC-NTDs in Kenya. First, the survey focused on assessing stakeholders' perceptions at the sub-national level, because this level provides first contact to healthcare services for communities living in NTD endemic regions. However, subsequent surveys could further assess stakeholders' perspectives at the national surveillance level, since decisions made at the national level may influence implementation of feasible recommendations sub-nationally. Secondly, due to the existing COVID-19 pandemic while conducting the study, it required strict adherence to physical distancing measures between the interviewer and study participants. Therefore, the Delphi consensus survey that

can be conducted electronically was an appropriate methodological approach for collating stakeholders' views and assessing consensus among the participants. However, criticisms regarding the validity of the Delphi technique relate to a form of bias in its conduct, in that the consensus reached can be influenced by the way the researcher administers the data collection tool to the group of experts [21]. Additionally, as a common practice in most Delphi studies, the use of interviews to obtain expert opinions in the first rounds may be biased by stronger opinions coming from highly regarded experts [21]. However, in the current study, both Delphi study rounds utilised electronic self-administered likert-type tools bearing standardised recommendation statements to measure the degree of agreement among stakeholders on their importance and feasibility for implementation. Therefore, use of electronic data collection instruments provided an equal chance for participation and avoided bias resulting from participants with dominant opinions. Furthermore, the identity of the participants enrolled in the two analytic rounds were kept anonymous to mitigate biasness during analysis. The size and composition of the group of stakeholders may not represent all decision makers at the sub-national level and may not be representative of all PC-NTD endemic regions in Kenya, hence reducing generalisability of the findings. However, the minimum threshold of at least twelve experts in a Delphi survey was met and having more participants with limited interaction increases reliability of group judgement [41].

## Conclusion

Sustained efforts to control and eliminate PC-NTDs are hinged on optimal functioning of health information systems. Essentially, surveillance and response activities form part of the definitive phase to achieving NTDs elimination through halted disease transmission [11]. Therefore, this survey outcome intends to guide decision-making processes having considered feasibility of implementing generalised recommendations provided by health workers on improving surveillance activities within IDSR systems based on findings from systematically reviewing literature on previous surveillance assessment studies conducted within the African region. In addition, the survey considered NTD-specific recommendations to improve the existing surveillance and response efforts based on health personnel perspectives in endemic regions in Kenya. Achieving consensus among stakeholders on the implementable recommendations will prioritise NTDs agenda setting at the sub-national levels. However, non-consensus recommendations relating to PC-NTDs case confirmation capacities, routine data analysis, increased supervision, trained surveillance staff turnover and adequacy of surveillance personnel may require further consultations with concerned stakeholders to ensure implementation of effective policies to achieve the intended outcomes. NTDs agenda setting requires consolidation of all stakeholders' views and further formulation of NTDs policies relies on adequate partnership and coordination at the sub-national and national levels of the health system [20]. Lack of reliable health information systems will limit data utilisation resulting to sub-optimal planning and coordination of NTDs programme activities. Therefore, stakeholders' consensus on the most important and feasible recommendations identifies key opportunities for policy refinement and will inform development of a logical framework for decision-making on NTDs surveillance activities at the sub-national level. Ultimately, the envisaged framework will contribute towards efforts to halt transmission of PC-NTDs in endemic regions. Furthermore,

implementation of feasible recommendations will inform rolling out of cost effective and sustainable interventions to achieve NTDs elimination as outlined in the sustainable development goals.

## Abbreviations

BTS: Breaking Transmission Strategy; COVID-19: Coronavirus disease; ESPEN: Expanded Special Project for Elimination of Neglected Tropical Diseases; HMIS: Health Management Information Systems; IDSR: Integrated Diseases Surveillance and Response; IQR: Inter Quartile Range; IREC: Institutional Research and Ethics Committee; MOH: Ministry of Health; NACOSTI: National Commission for Science, Technology and Innovation; NTDs: Neglected Tropical Diseases; PC-NTDs: Preventive Chemotherapy-targeted Neglected Tropical Diseases; PROSPERO: International Prospective Register of Systematic Reviews; USA: United States of America; WHO: World Health Organization.

## Declarations

### Ethics approval and consent to participate

The study protocol was approved by the Faculty of Health Sciences Research Ethics Committee of the University of Pretoria in South Africa (Ethics Reference No: 27/2018) and the Institutional Research and Ethics Committee of Moi University/Moi Teaching and Referral Hospital in Kenya (Formal Approval No: IREC 2099). In addition, the National Commission for Science, Technology and Innovation provided research authorisation in Kenya (Reference No: NACOSTI/P/18/62894/21393) to undertake the study in accordance with relevant guidelines and regulations. Permission to conduct the study was granted by the Ministry of Health, county health authorities and written informed consent was obtained from all study participants.

### Consent for publication

Not applicable. The manuscript only draws on data from a healthcare personnel survey in which unique identifiers were assigned to each participant and no personal information was collected.

### Availability of data and material

The datasets generated and/or analysed to assess the surveillance system attributes are not publicly available due to the need to keep the identities of participants confidential as they granted consent to be enrolled in the study on the basis of remaining anonymous, but are available from the corresponding author on reasonable request.

### Competing interests

The authors declare that they have no competing interests.

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## Authors' contributions

AKSN: conceived and designed the study, conducted data collection, analysis and writing the manuscript. CMM and KV: supervised all stages of the study, provided intellectual input and contributed to writing the manuscript. All the authors reviewed and approved the final version of the manuscript before submission.

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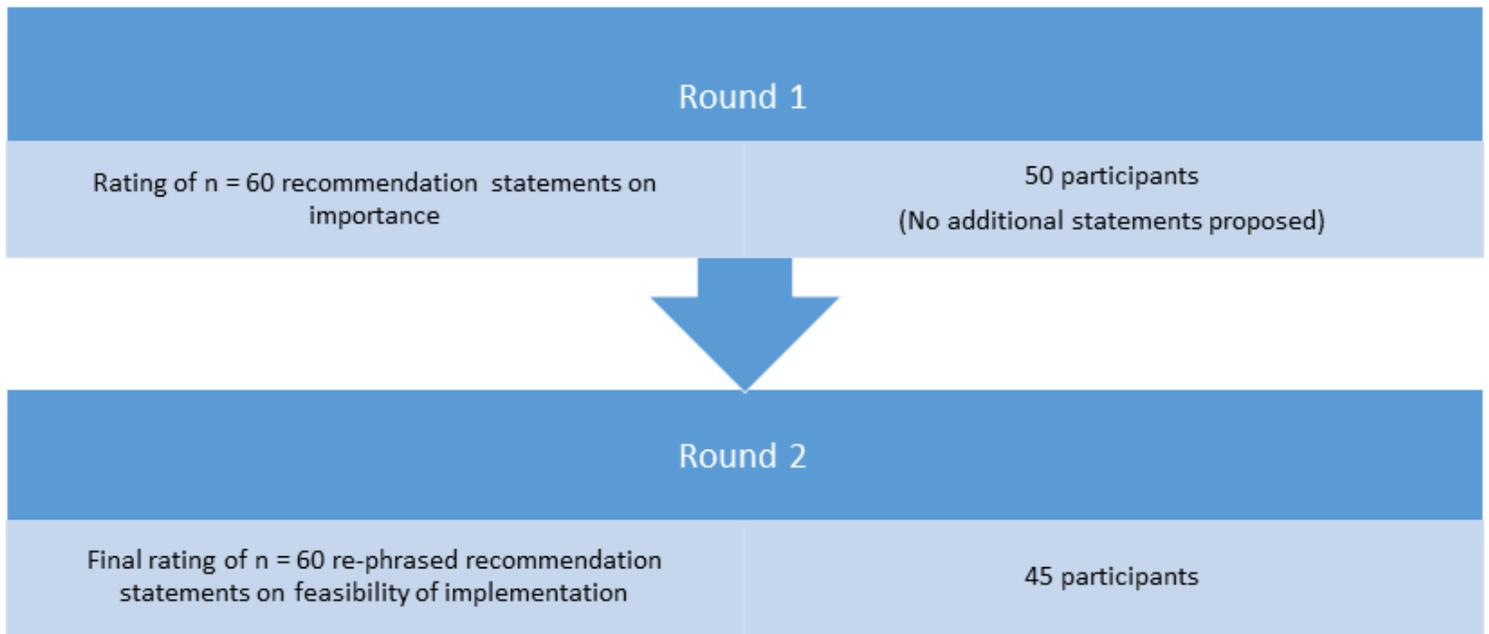
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## Figures



**Figure 1**

Flow diagram illustrating the survey rounds of the Delphi study