The impact of national policies on animal disease reporting within selected Pacific Island Countries and Territories (PICTs)

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ABSTRACT A semi-systematic literature review of national policies was carried out in relation to surveillance and disease reporting in Pacific Island Countries and Territories (PICTs). It also analysed the animal disease reporting structures in Fiji, Papua New Guinea (PNG), Vanuatu and the Solomon Islands. The strengths, weaknesses, opportunities and threats (SWOT) of those reporting structures were examined in relation to how they impact the detection and management of animal diseases in PICTs. Field missions collected information on animal disease reporting structures and these were discussed in detail with country officials and documented. The findings from the literature review indicated that there is very little policy to support work in surveillance and disease reporting within national government structures of the countries studied. This increases the potential for disease transmission and the introduction of exotic diseases as the efficiency of disease reporting is

low. The findings from the SWOT analysis of the reporting structures indicated that there were commonalities across the countries studied, i.e. reporting structures were long with multiple legs that were not functioning properly and this was worsened when positions were vacant in the reporting structure. The hierarchical nature of the reporting structure also reduced reporting efficiency as reports took a longer time to reach decision makers at the top of the structure. High officer turnover and the shortage of veterinarians in the countries studied also affected the efficiency of disease reporting as most in-county officials were inexperienced and could not recognise disease signs and there were no veterinarians to supervise them. Existing reporting structures need to be reviewed to remove duplication and shorten the chain. However this could override existing command structures and would need to be documented and awareness created with the officers involved. There also needs to be more collaboration with FAO, OIE, academic institutions and national governments to create an environment conducive for the development of policies that support work on surveillance to improve disease reporting in PICTs. The shortage of veterinarians could be addressed by influencing national governments to create better policies to retain veterinarians in the animal health services; this should be supported by creating reasonable work conditions and remuneration packages. This should also be supported with policies to send young graduates to study veterinary science overseas and have a career path for them when they return. Engagement of retired veterinarians from developed countries and re-evaluating the criteria for veterinarian registration could be short term solutions to address the shortage of veterinarians in PICTs.

Keywords National policies; Animal Disease; Reporting; Challenges; Pacific Island Countries

Introduction

In 2013 a Food Animal Biosecurity Network (FABN) was successfully set up between Fiji, Papua New Guinea (PNG), Vanuatu and the Solomon Islands (SI). The network implemented disease surveillance training to enhance capacities for animal health workers in the countries enabling them to identify animal diseases, collect samples, process samples appropriately and send samples to reference laboratories in the Pacific island community and to reference laboratories in Australia for analysis. However, the FABN is dependent on the reporting systems of each country to identify animal disease, generate reports and implement appropriate responses. Little has been published on those reporting systems in the Pacific Island Countries and Territories (PICTs). If existing animal reporting systems are limited and not structured well this could affect the reporting of animal diseases thus having the potential to affect the livestock sector and impact human health (Ryan S. Miller et al., 2013).

Policy support for animal disease surveillance and reporting seems to be poor in developing countries thus limiting the capacity to detect and control emerging and re-emerging zoonotic diseases (FAO, 2015).

In the Pacific island community there seems to be a shortage of veterinarians as well as a tendency for high official turnover within the various animal health organisations (Tukana et al., 2016). This could lead to poor reporting of diseases, which limits early detection and management of animal diseases, as in-country official capacity to recognise diseases is limited and therefore they do not make reports (MAF New Zealand, 2008). In addition to poor reporting structures, field services are also weak thus limiting the capacities to collect and process as well as pack samples for shipment to reference laboratories for analysis. Laboratory capacities and services in PICTs are also limited as there are no clear policies to strengthen them (FAO, 2015). Part of this limitation could be due to the perception that animal diseases are not seen as a priority since the awareness of the impacts of zoonoses has

been low. Generally laboratories in PICTs do not have the capacity to carry out basic testing, i.e. officer capacities and basic facilities for both the field and laboratory analysis are low, and expendable items such as vaccutainers, needles, centrifuge; reagents, etc. are normally out of stock (Borja, 2016), (Mosese, 2016).

The lack of policies and appropriate structures for reporting animal diseases supports a systematic loss of recognition of the potential social disruption caused by diseases of even minor trade or zoonotic potential. The lack of market access penalties for producers who do not report disease strengthens the policy perception that diseases of significance are not present or a significant cause for action. This cycle was reflected in the dropout rate of producers who initially volunteered to report disease in PNG but ceased to continue when no market advantage was evident for their work (Yombo, 2010), (Gummow et al., 2013).

This study sought to examine and compare the animal disease reporting structures in Fiji, Papua New Guinea (PNG), Vanuatu and the Solomon Islands and the related agricultural policies with the aim of assessing their impact on a functional disease surveillance system.

Materials and methods

Literature

A semi-systematic literature review was conducted to gather data on national policies and other policies that supported animal disease reporting systems and structures. A search of peer reviewed studies was conducted on 286 databases hosted by James Cook University, Townsville, Australia. The databases were screened for those associated with “agriculture”, “social sciences” and which included crops and animal sciences. Eleven databases were selected based on the above criteria, these were; Agicola, CSIRO, Green file, Google scholar, PubMed, Sage journals, Science Direct, Science Direct Reference Works, Scopus, Spring Link and Web of Science. The selected databases were then searched using the following key

words; “Agriculture” AND, OR “National Policy” AND, OR “Animal Disease Surveillance” AND, OR “Animal Disease Reporting” AND, OR “Pacific Island Countries”

The Secretariat of the Pacific Community (SPC), which has the mandate to work in 22 island countries in the Pacific region in relation to agriculture (Land Resources Division), was also a source of information on policies. This in particular was the policy inventory for Pacific Island Countries and Territories (PICTs) hosted by the Pacific Agricultural Policy Project (PAPP) under the Land Resources Division (Secretariat of the Pacific Communitiy, 2016). The inventory was accessed and the agricultural policies for Fiji, PNG, Vanuatu and the Solomon Islands were screened to determine if there were provisions for livestock production, health, disease surveillance and disease reporting. Other grey literature such as unpublished reports was also reviewed for relevance to animal disease surveillance and disease reporting policies.

Countries reviewed

The countries reviewed were Fiji, PNG, Vanuatu and the Solomon islands. Food animals were looked at in relation to disease reporting. These were mainly cattle, pigs goats, sheep and chickens. There are no reports of buffalo in Fiji, Vanuatu and the Solomon Islands, however swamp buffalo were exported to PNG in 1974 from the Northern Territory in Australia for draft power and to date only 2 farms in Lae are reported to have some buffalo crosses, while some buffalo have reportedly become feral in those areas (Puana 2016). The cattle numbers indicated below for PNG do not take into account buffalo population numbers.

Fiji

Fiji is a Melanesian country which has 300 islands where 109 are permanently inhabited (Fig. 1). There are two main islands supporting the majority of the total population of 860,623 (Fletcher et al., 2013). Food animals are more common on the two main islands of Fiji, i.e., Viti Levu and Vanua Levu and comprise cattle, pigs, goats, sheep and chickens. The small

islands to the North, South and East have some food animals but with very small numbers. In 2009 there were 134,411 cattle, 14,068 sheep, 101,196 goats, 73,698 pigs, 3,734,835 poultry (chickens and ducks), (National Agriculture Census Report, 2009). Animal disease reporting structures in Fiji fall under the Ministry of Agriculture (MoA).

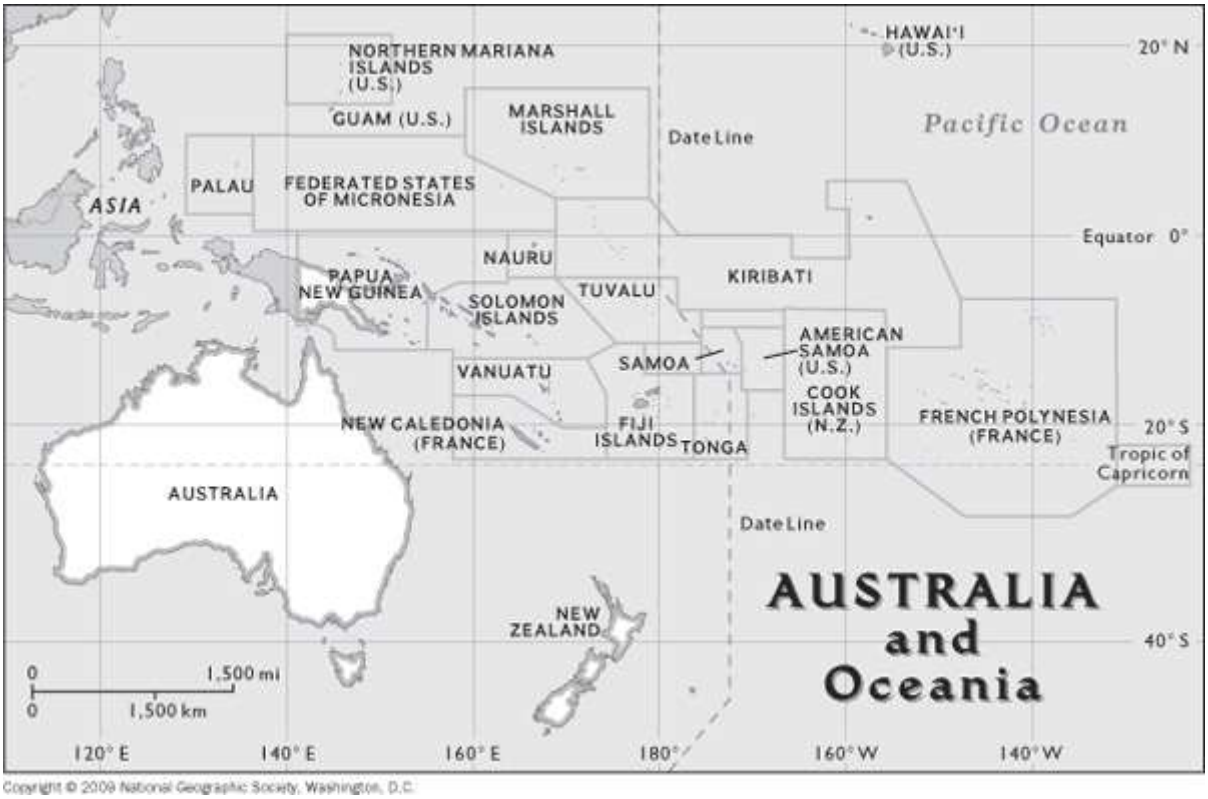

Fig.1 Map of the Pacific Island countries, showing Fiji, PNG, Vanuatu and the Solomon Islands, countries that were involved in the study (https://www.google.com.au/search?q=images+oceania+map&biw)

Papua New Guinea

Papua New Guinea (PNG) is the largest and most populous of the countries in the Pacific region with a population of 6.5 million people (Fig. 1). PNG is predominantly a Melanesian country consisting of more than 600 islands with more than 700 language groups (Monica and Rhonda, 2011). In 2009 food animals recorded in PNG were 1,832,000 pigs, 80,000 cattle, 15,000 sheep, 25,000 goats, 1,661,000 chickens and 30,000 rabbits (Ayalew et al., 2009). Animal disease reporting structures studied in PNG fall within the Ministry of

Agriculture (NAQIA) and Ministry of Provincial Affairs (MoPA). There however, is no formal consultative mechanism between these two agencies. NAQIA has responsibilities for import and export as well as domestic and exotic disease surveillance while the provinces retain the ability to implement programs for animal production but have no responsibility for reporting.

Vanuatu

Vanuatu is a 900 kilometre-long, volcanic archipelago that consists of more than 80 islands (Fig. 1). Most of the islands are inhabited, and around half are mountainous and densely forested with narrow strips of farming land on the coasts. The cattle sector in Vanuatu is quite large compared to other developing PICTs with a population of 211,152. Cattle are therefore important for the livelihood of its people. In addition, Vanuatu has 88,694 pigs and 8,797 goats (Secretariat of the Pacific Community, 2009). Animal disease reporting structures studied in Vanuatu fall within the Ministry of Agriculture, Fisheries, Forests and Biosecurity departments.

Solomon Islands

The Solomon Islands is the third largest archipelago in the South Pacific with a population of 0.5 million and more than 900 islands (Fig. 1). Ninety five percent of the population is of Melanesian ancestry and sixty-three language groups have been identified in the country (Monica and Rhonda, 2011). The livestock sector in the Solomon Islands had diminished significantly during the ethnic conflict from the years 2000-2003. Food animals recorded in 2009 were; 30,363 cattle, 120,971 pigs, 20,222 goats and 349,991 poultry in the Solomon Islands. Even though livestock numbers have diminished, small holder livestock production is still viewed as important as it has a role to play in food and income security for the rural population (FAO, 2016). Animal disease reporting structures studied in the Solomon Islands fall under the Ministry of Agriculture and Livestock.

Documentation of disease reporting structures and SWOT analysis

During the 2014 FABN training program, existing animal disease reporting structures for Fiji, Papua New Guinea, Vanuatu and the Solomon islands were documented and analysed with the officials for each country (Tukana et al., 2016). Fifty three country officials were involved in the exercise and their breakdown was as follows; Fiji (16), PNG (12), Vanuatu (15) and the Solomon islands (10). The officials involved were the directors and field officials for each country, who held qualifications of a certificate, diploma or bachelor's degree in tropical agriculture from the University of the South Pacific (USP), Fiji College of Agriculture (FCA), Vanuatu Agricultural College (VAC) and the Solomon Islands National University (SINU). Officials were first asked to discuss and document on butchers papers their respective disease reporting structures. The draft reporting structures were then displayed up front and the strengths, weaknesses, opportunities and threats (SWOT) were discussed in detail and recorded for each of the different countries. The reporting structures were then documented and circulated via email to the country officials for constructive comments before being finalised. The finalised reporting structures (Fig. 2-5) were then presented to the countries during a final project reporting mission (Gummow, 2014).

Results

Review of published literature

Nineteen references that had some relevance to policies on disease surveillance and disease reporting were reviewed. All the references however were from outside Pacific Islands Countries and Territories (PICTs) and there was nothing on national policies in the Pacific islands that related specifically to disease surveillance or animal disease reporting. The available references reviewed indicated that policies for surveillance and reporting diseases are important to support decisions on interventions such as the removal or vaccination of diseased animals to protect human and animal health and to promote animal welfare, however

these were limited to national government policies (Ha¨sler and Howe, 2012). The literature also indicated that the world animal health organisation, OIE, recognises the fact that national governments lack policy support for animal disease surveillance and disease reporting due to financial and technical capacity constraints so they have established a global web based information system for countries to report notifiable animal diseases of concern, i.e. the 'World Animal Health Information System' (WAHIS) database. This enables the provision of high quality animal disease information to be provided to stakeholders including; all national veterinary services worldwide, international organisations, livestock owners, industry, academia, media and the general public (OIE, 2010). It must be noted that this system is passive, it does not require countries to report on diseases that were not part of active surveillance programs and many fields in the database had no information available.

Literature also indicated that "resource and capacity constraints" in most national governments in PICTs, limit policy support for disease surveillance and reporting (FAO, 2015). The current trend is that there is very little policy support provided for disease surveillance as well as reporting, and resource allocation in the animal and human health sectors is poor, prompting them to work in their own silos even though many human diseases could be associated with animal hosts (Kline et al., 2013).

The Pacific Community Database

According to the inventory that was carried out by the Pacific Agriculture Policy Project (PAPP), 16 countries out of the 22 countries that the Secretariat of the Pacific Community has a mandate to work in, have national agricultural policies. From the 16 countries that had national agricultural policies, only three had livestock policies, these were Fiji, Solomon Islands and Vanuatu. The livestock policies however were more focussed on livestock production and had little on animal health and disease surveillance (SPC, 2016).

Animal disease reporting structures

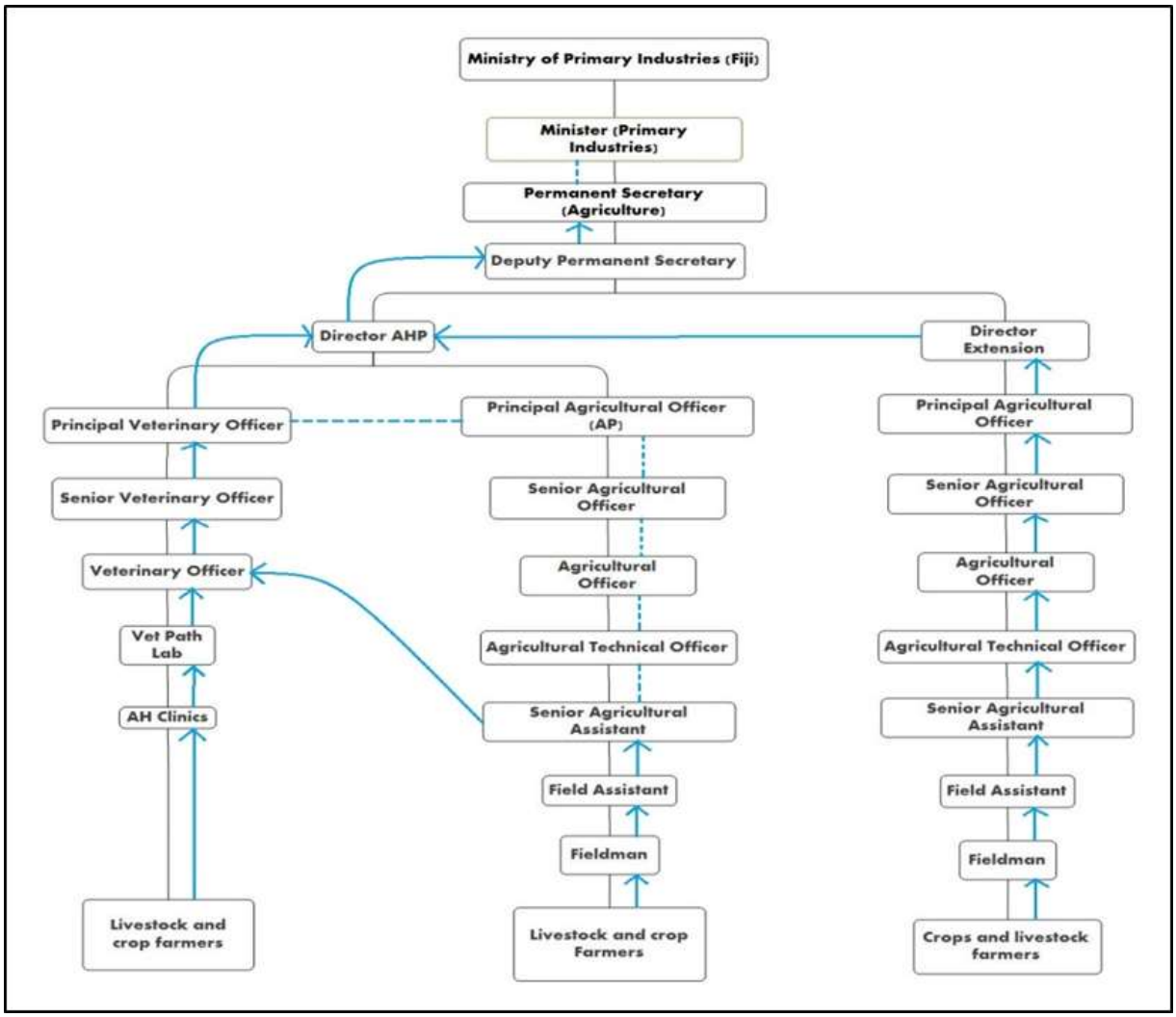

Fig.2 Fijian animal disease reporting structure (2015)

Horizontal broken lines indicate that there is opportunity to share information at that level; Vertical broken lines indicate that officers below are briefing officers above them on the disease situation and the response taken.

Animal disease reporting channels in Fiji come under the Minister for Primary Industries (MPI). Under the minister there is the Director for Animal Health and Production and the Director for Extension Services. Under the Director for Animal Health and Production, there are two branches that intercept animal disease reports from the animal level. The two branches are (i) the veterinary branch that come under the Principal Veterinary Officer and (ii) the animal production (AP) branch that come under the Principal Agricultural Officer Animal Production. Under the veterinary branch, i.e., Principal Veterinary Officer, animal

disease reports come straight up from the animal level, right up through the Principal Veterinary Officer, through the Director upwards to the Minister for Agriculture. The Minister then makes a decision on the direction to take as well as allocates resources for the response action. Under the animal production branch, i.e., Principal Agricultural Officer (AP), reports come up from the animal level up to the Agricultural Technical Officer (ATO) level where it is then communicated to the Senior Veterinary Officer level, this report then goes straight up to the Minister for Agriculture. Under the extension services branch (Director Extension), reports come all the way up from the animal level to the Director Extension, the report is then communicated with the Director Animal Health and Production who then communicates this report to Minister for Agriculture after consultation with the Principal Veterinary Officer.

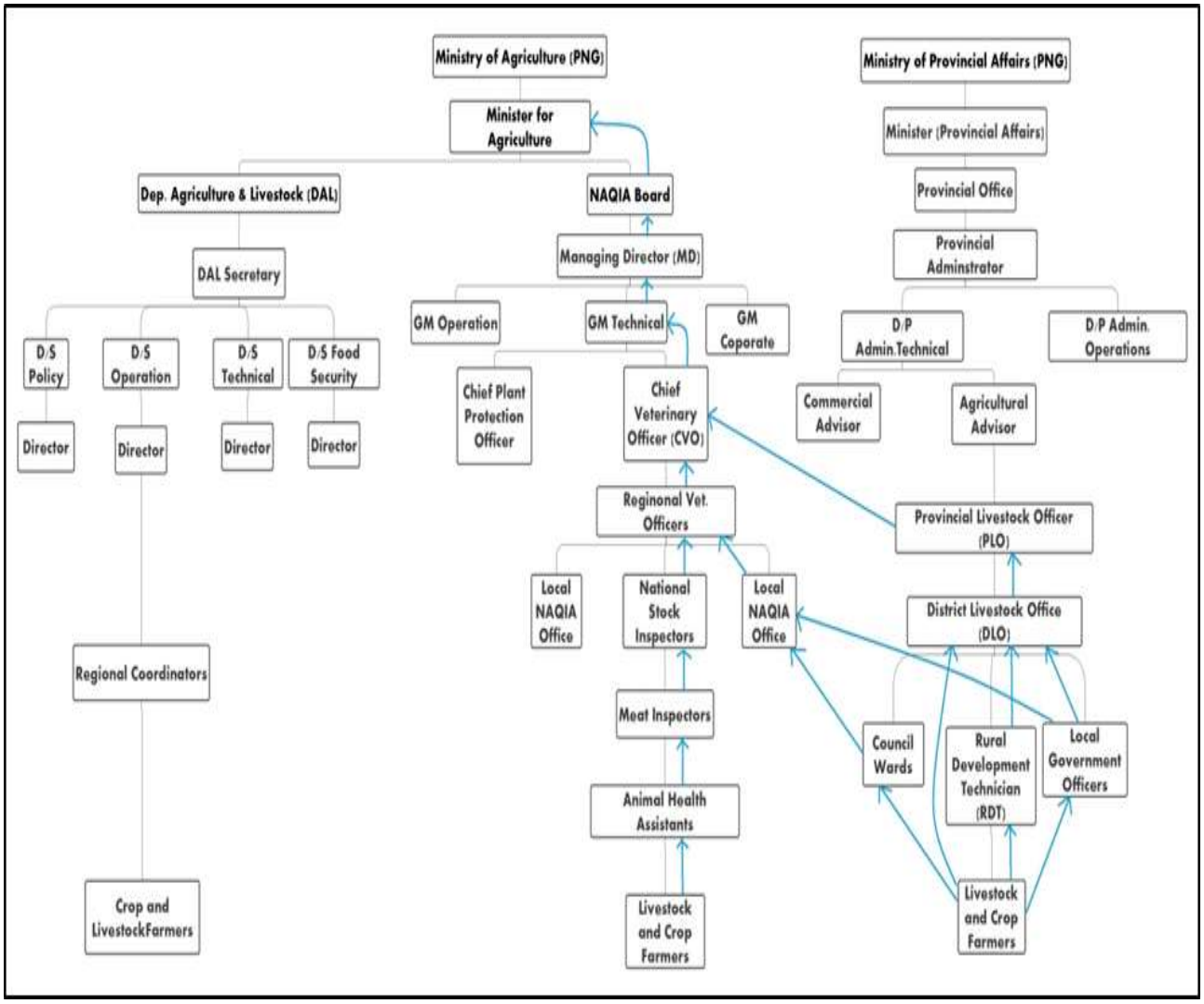

Fig.3 Papua New Guinea animal disease reporting structure (2015)

Animal disease reporting channels in Papua New Guinea come under two ministries, i.e. the Ministry of Agriculture and the Ministry of Provincial Affairs. Under the Ministry of Agriculture, there is one branch i.e. NAQIA. Under the NAQIA branch, reports come straight up from the animal level to the Chief Veterinary Officer through the Managing Director then to the Minister for Agriculture who makes a decision on the direction to take as well as allocate resources for response action. Under the Ministry of Provincial Affairs branch, reports come straight from the animal level through the Rural Development Technician and up to the District Level Officer who then communicates the report to the either the Regional

Veterinary Officer if there is one or the Chief Veterinary Officer, this then goes through the NAQIA channel to the Minister for Agriculture.

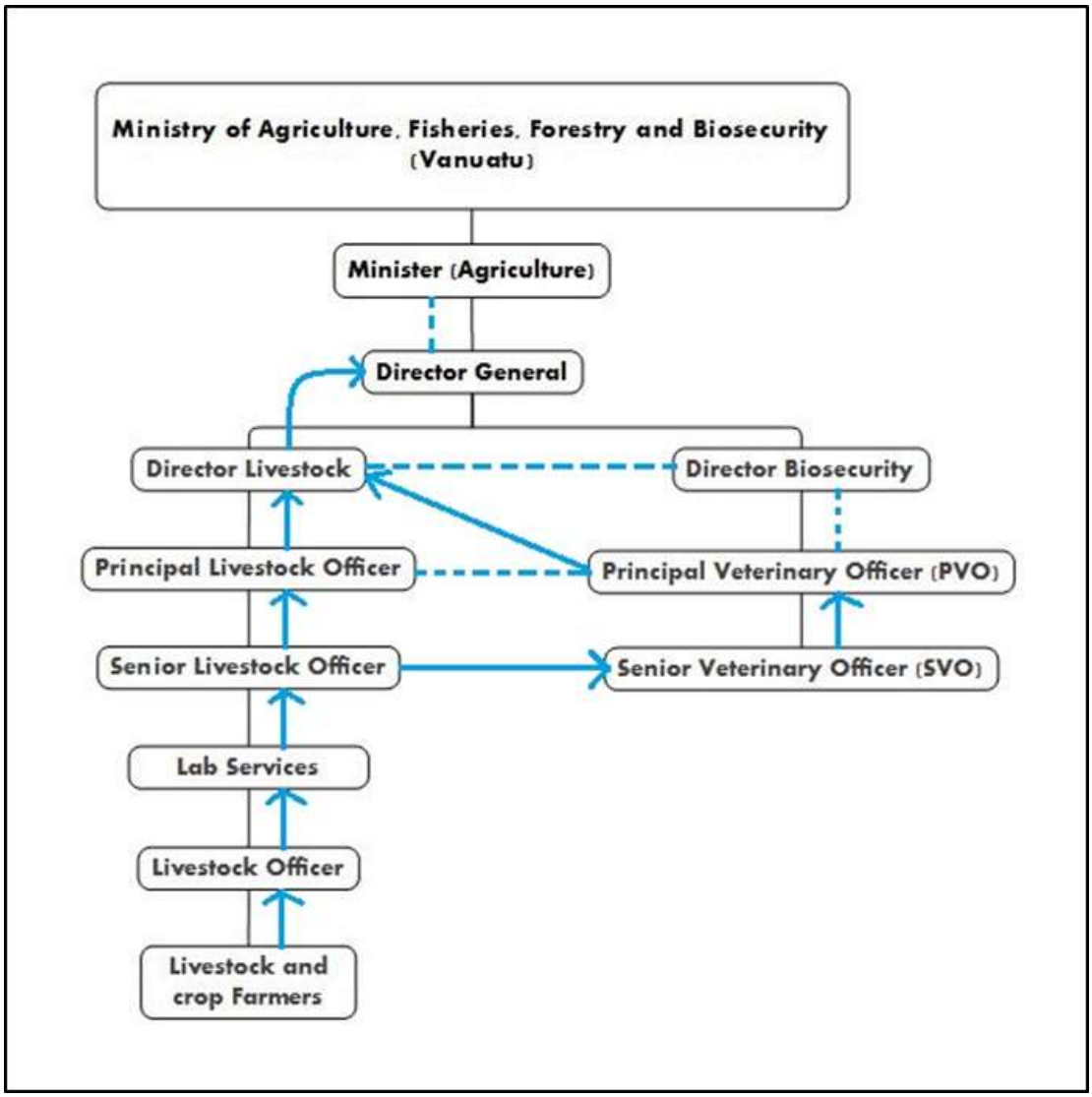

Fig.4 Vanuatu animal disease reporting structure (2015)

Horizontal broken lines indicate that there is opportunity to share information at that level; Vertical broken lines indicate that officers below are briefing officers above them on the disease situation and the response taken.

Animal disease reporting channels in Vanuatu come under two branches under the Minister for Agriculture. Under the Minister for Agriculture is the Director General for Agriculture, under this is the Director for Livestock and the Director for Biosecurity. Under the Livestock branch, animal disease reports come from the animal level right up to the Director Livestock and at the same time the Senior Livestock Officer communicates the report to the Senior

Veterinary Officer who then passes on the communication to the Principal Veterinary Officer. The Principal Veterinary Officer confirms this report to the Director Livestock who reports through the Director General to the Minister for Agriculture who makes a decision on the direction to take as well as allocate resources for response efforts. The Principal Livestock Officer and the Principal Veterinary Officer also communicate which eases the flow of animal disease reporting for both branches.

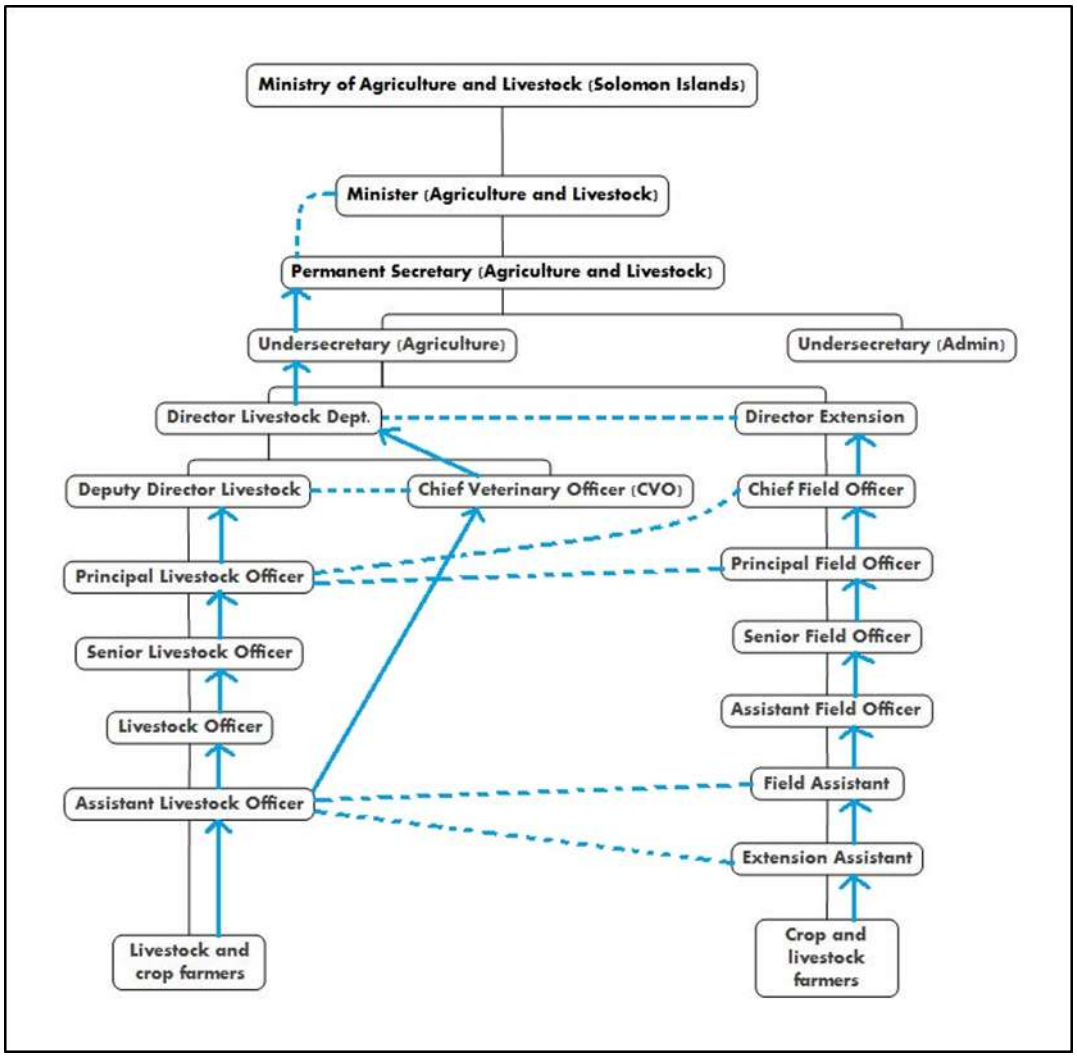

Fig. 5 Solomon Islands animal disease reporting structure (2015)
Horizontal broken lines indicate that there is opportunity to share information at that level; Vertical broken line indicates that the Minister for Agricultural is briefed on disease situations and the response taken.

Animal disease reporting channels for the Solomon Islands fall under the Ministry of Agriculture. Under the Minister of Agriculture and Livestock is the Permanent Secretary (Agriculture and Livestock) are two Under-Secretaries, i.e., (i) Under-Secretary (Agriculture) and (ii) Under-Secretary (Admin). Animal disease reporting channels fall under the Director of Livestock and the Director for Extension services. The reporting channel under the Director of Livestock branch starts from the livestock and crop farmers' right at the bottom upwards to the Deputy Director for Livestock who then passes on the report to the Chief Veterinary Officer (CVO). The CVO then passes on the report to the Director for Livestock with advice on the response to be taken. The Director Livestock then reports to the Under-secretary for Agriculture, the Under-secretary for Agriculture then reports to the Permanent Secretary for Agriculture and Livestock then briefs the Minister for Agriculture and Livestock on the disease situation and the advice from the CVO on the response needed to be taken. The other branch of reporting starts at the bottom from the crop and livestock farmers right up to the Director for the Extension Division who then passes on the information to the Director for the Livestock Division at their senior meetings at that level.

Animal disease reporting structures analysis (SWOT)

The results for the SWOT analysis for reporting structures in Fiji, PNG, Vanuatu and the Solomon islands reveal several strengths, weaknesses, opportunities and threats (Table 1). Each country's reporting structure was different to some extent while some issues were common for all of them and these are discussed below.

Table 1 Summary of SWOT Analysis for animal disease reporting structures for Fiji, PNG, Vanuatu and the Solomon Islands

Internal		**External**	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
Fiji (Fig. 2)			
1. Structure and office locations allows for interaction between the officers of both the AHP and Extension to share information. 2. The SAA which is the lowest official that is linked to field assistants and field man are allowed to report directly to the Senior Veterinarian. 3. The PVO and PAO interact frequently enabling disease information to be shared. 4. The Director AHP and Director Extension interact frequently, sharing information.	1. Reporting structure falls under 2 divisions with 3 branches, i.e. AHP and Extension which is quite large. 2. Protocol of reporting upwards and not by-passing superior officers directly above reporting officers. 3. Some positons in the structure are vacant. So reports may not reach the decision makers.	1. Enhance information sharing and networking between AHP and Extension officers at the locality level. 2. Enhance networking and information sharing between locality officers and farmers. 3. Provide training of officer to recognise disease signs enabling reports to be made. 4. Create policy to retain veterinarians in key positions.	1. Inexperienced officials who do not recognise disease signs. 2. Some crop extension officers do not have experience in recognising animal diseases so will not make reports. 3. Vacant positions in the reporting structure due to shortage of funds and a slow recruitment process. 4. Veterinarian positions vacant due to low salary scale. 5. Political instability.
PNG (Fig. 3)			
1. The creation of council wards shortens reporting channel. 2. PLO reporting to CVO shortens the reporting process so it enhances the reporting structure. 3. LGO being able to report directly to LNO enhances the reporting structure. 4. Farmers' reporting directly to the DLO also enhances the reporting structure.	1. Reporting structure has omitted the Dep. Of Agriculture and Livestock (DAL). 2. Current reporting structure falls within NAQIA and the Provincial Office which is quite large. 3. Some positions are vacant in the reporting structure so reports do not reach the decision makers, e.g. RVO.	1. Enhance information sharing and networking between council wards (CW), rural development technicians (RDT) and local government officers (LGO) and the farmers. 2. Provide training on animal health issues and recognition of animal diseases for frontline officers, i.e. CW, RDT and LGO. 3. Create policies to retain RVOs in strategic locations.	1. Some provincial office officials are inexperienced. 2. Vacant positions in the reporting structure due to shortage of funds and a slow recruitment process. 3. Veterinarian positions due to a low salary scale. 4. Security risks. 5. Geographical isolation.
Vanuatu (Fig. 4)			
1. The reporting structure is short. 2. PLO and PVO link frequently, enabling disease information sharing. 3. PVO communicates directly with the Director Livestock on disease reports. 4. Director Livestock communicates frequently the Director for Biosecurity.	1. The Biosecurity department have the veterinarians and they focus mostly on border control. 2. Interaction between the PVO and PLO is weak. 3. Interaction between the PVO and Director Biosecurity with Livestock issues is weak.	1. Enhance information sharing and networking between the Livestock department and Biosecurity department. Strengthen weak links 2. Create policy to retain veterinarians in key positions. 3. Create awareness on the impacts of animal diseases. 4. Capacity building training surveillance.	1. Some livestock officials are new and inexperienced. 2. Vacant veterinarian positions due to low salary scale and slow recruitment process. 3. Vacant positions in the livestock department due to a shortage of funds.
Solomon Islands (Fig. 5)			
1. The Assistant Livestock officer is allowed to report directly to the CVO. 2. The CVO is allowed to report directly to the Director for Livestock. 3. The Field assistant and Extension Assistant under the Extension Division are allowed to report to the Assistant Livestock Officer.	1. Reporting structure is quite large. 2. Link between the field assistant and extension assistant with the assistant livestock officer is weak. 3. The link between the Chief Field Officer and Principal Field Officer with the Principal Livestock Officer is weak. 4. Protocol of reporting upwards and not by-passing officers directly above them.	1. Enhance information sharing and networking between the frontline officers for both the Livestock and Extension Divisions. 2. Create policy to retain veterinarians in key positions. 3. Create awareness on the impacts of animal diseases and authorities to contact. 4. Capacity building training on surveillance.	1. Inexperienced officers at the Extension Division. 2. Inexperienced officers at the Livestock Division. 3. Vacant livestock positions due to limited funding. 4. Vacant veterinarian positions due to low salary scale and slow recruitment process.

AHP; Animal Health and Production, SAA; Senior Agriculture Assistant, PVO; Principal Veterinary Officer, PAO; Principal Agriculture Officer, PLO; Provincial Livestock Officer, DAL; Department of Agriculture and Livestock, NAQIA; National Agriculture Inspection Authority, RVO; Regional Veterinary Officer, CW; Council Wards, RDT; Rural Development Technician, LGO; Local Government Officer

Discussion

The literature review revealed that there is very little national policy for animal disease surveillance and animal disease reporting in the Pacific Island Countries and Territories (PICTs). Since there are little or no specific policies in PICTs to support disease reporting and surveillance, this could increase the chances of the spread of transboundary animal diseases as diseases are not detected and contained until they have been well established (Tukana et al., 2015).

Furthermore the lack of national policies to support animal disease surveillance and or animal disease reporting could be due to the perception that animal health is of minor importance compared to other issues such as HIV and TB in the region. The limited priority placed on animal diseases by national governments leads to a lack of resource allocation from national government budgets (Rich et al., 2013).

Literature also indicated that use of the World Animal Health Information System (WAHIS) is a good platform for countries to use to report notifiable animal diseases and their country disease status. However only those countries that are World Animal Health Organisation (OIE) members are obligated to submit animal disease reports as they are supported through training on how to use the database and have nominated OIE delegates for reporting. Very few Pacific Island Countries and Territories (PICTs) in the South West Pacific region are members of OIE, and those countries that are not, are not obliged to submit reports of disease occurrence. Apart from New Zealand and Australia, only Fiji, Papua New Guinea, Vanuatu, New Caledonia and the Federated States of Micronesia are members of OIE in the South West Pacific region (Tukana et al., 2016).

Furthermore there are no frameworks in place particularly in PICTs, to bring different sectors together to address animal disease surveillance. The World Health Organisation views this as important and have been doing work in this area in collaboration with OIE and FAO,

e.g. a workshop was held recently in Fiji (March 2017) in Fiji for different stakeholders to address the Human Animal Ecosystem Interface (HAEI). The aim was to strengthen collaboration and coordination between the public health and animal health sectors to improve the prevention and control of zoonotic diseases (WHO, 2017).

The SWOT analysis (Table 1) of reporting structures for Fiji, PNG, Vanuatu and the Solomon Islands reveals that each country had their own strengths, weaknesses, opportunities and threats, however some issues were common across the countries studied.

In Fiji the reporting structure allowed for interaction between field officers based in different localities in the country; this allowed for the sharing of information on animal diseases and disease reporting. The lowest ranking officer in the animal production (AP) branch, i.e. the Senior Agriculture Assistant (SAA) has the ability to report directly to the Senior Veterinary Officer shortening the reporting process, but other SAA under the extension division do not have that opportunity. The reporting structure however is too long and cumbersome, as it falls under two ministries and three divisions and some positions in the structure are vacant. Officers are expected to report directly above them as there is a culture of not by-passing immediate supervising officers. This created a challenge in reporting animal diseases as the process is time consuming and if supervising officers are away from the office, the reports may not reach their destination. The number of government veterinarians in Fiji has been limited to non-existent in the past; this has also created a gap in the detection of animal diseases as subordinate officers do not have the capacity to recognise animal diseases and thus do not make reports, e.g. in the outbreak of bovine Brucellosis in Fiji, there were no definite signs of the disease until there was a re-emergence of the disease in 2009 (Tukana et al., 2015). The high turnover of animal health officers in the reporting structure means that the capacities of existing officers to carry out reporting is weak, as most of them are inexperienced. Recruitment policies which do not provide a reasonable

remuneration and the reduction of the retirement age in Fiji from 60 years to 55 years have also contributed to this inexperience. The political environment at the moment in Fiji is stable; however the instability in the past may have contributed to the migration of a lot of skilled people out of Fiji. Opportunities exist when the senior officers in the reporting structure have the opportunity to share disease information when they meet at senior officers meetings (horizontal broken lines Fig. 2), e.g. the Principal Agricultural Officer (PAO) and the Principal Veterinary Officer (PVO) have the opportunity to share information during senior officer meetings that they attend. Briefing on disease situations and response also take place (vertical broken lines, Fig. 2), i.e. officers report upwards in the structure, even though it is not compulsory but done out of courtesy and this improves reporting efficiency.

In Papua New Guinea, disease reporting is challenging as the reporting channels fall under two separate ministries making it more complex for information sharing. Regional Veterinary Officers (RVO) are supposed to be present in each of the four regions (Lae, Rabaul, Goroka and Port Moresby) in Papua New Guinea. However, because the posts are often vacant, the chances of animal disease reports coming from the different provinces are limited, e.g. in 2013, only 1 RVO existed, i.e. in Lae (AusAid Report, 2010). Farmer capacities to recognise signs of disease are limited in Papua New Guinea and reports of animal disease would be made only when high mortality in animals is observed. The exclusion of the Department of Agriculture and Livestock (DAL) from the reporting structure reduces the sensitivity of the system as DAL also deal with livestock. Opportunities in reporting eventuate when interaction and information sharing occurs between the local NAQIA office and council wards under the Ministry of Provincial Affairs, as this shortens the time for reports to reach the decision makers at NAQIA.

In Vanuatu, disease reporting is challenging as numbers of veterinarians are limited and often non-existent, and subordinate officers (non-veterinarians) do not have the authority to

confirm animal diseases (Mosese, 2016). The available veterinarian normally spends more time doing border control work rather than work on livestock farms, so disease reporting is normally handled by the livestock department workers. Capacities of the livestock department workers and farmers in recognising animal diseases are also limited so this affects the frequency of animal disease reports submitted (Philips, 2014). Opportunities eventuate as the reporting channel is shorter compared to the other countries studied, so information reaches the Minister for Agriculture in a shorter time. Initial investigation by a qualified veterinarian for disease outbreaks is quick as there is interaction between the Senior Livestock Officer and the Senior Veterinary Officer at their level (horizontal broken lines, Fig. 4), The Director for Livestock and Director for Biosecurity, as well as the Principal Veterinary Officer and Principal Livestock Officer, have the opportunity to share information during senior officer meetings. The vertical broken lines (Fig. 4), i.e. officers' report upwards in the structure, even though it is not compulsory it is done out of courtesy and this improves reporting efficiency.

In the Solomon Islands, reporting is challenging due to limited and to the unavailability of veterinarians, i.e. the Chief Veterinary Officer post has been vacant for many years and when the post is filled, normally it is not for long, and the subordinate livestock officers do not have authority to confirm signs of diseases and take appropriate action (Atalupe, 2014). The numbers of livestock workers in the provinces are lower compared to field assistants and extension assistants under the extension division so the probability is high that the extension officers may not be able to recognize animal disease signs as they have had no training and therefore do not make reports. Capacity for farmers to recognize disease signs is low, so reports may only be made if high mortality occurs. Opportunities eventuate when there is interaction (horizontal broken lines, Fig. 5) between the officers from different branches at their level to share information, i.e. the Assistant Livestock Officer with the Field Assistant

and Extension Assistant, the Principal Livestock Officer with the Principal Field Officer and Chief Field Officer, the Director Livestock and the Director Extension, This interaction promotes information sharing and increases the efficiency of disease reporting. The broken vertical lines (Fig. 5) indicate the briefing to the Minister by the Permanent Secretary the disease situation and response taken.

In general, the reporting structures for the countries studied were too long and cumbersome except for Vanuatu. All the reporting structures were created during the colonial days and may no longer be suited to the present environment, thus limiting the capacity for disease surveillance and reporting. A shortage of veterinarians and high in-country officer turnover were common across the countries studied. This affected the capacities for disease surveillance and reporting as most of the officers on the ground were inexperienced.

Conclusions

Animal disease reporting structures in the Pacific Island Countries and Territories (PICTs) have the potential to impact the detection of animal diseases as well as how those diseases are managed if reporting structures are improved, but this is affected by the lack of policies to support work in this area (FAO, 2002). This is compounded by the fact that Pacific island communities and the countries studied are affected by a shortage of veterinarians and a high officer turnover, which was evident in the SWOT analysis carried out in this study (MAF New Zealand, 2008).

The lack of veterinarians and high officer turnover mean that most frontline animal health officials are inexperienced and not able to recognise disease signs so are not able to make disease reports. Furthermore, the lack of policies to support work in animal health and surveillance in PICTs, leads to a reduction in the efficiency of reporting systems in PICTs. The multiple reporting branches in the reporting structures for the countries studied are not functioning properly so are also contributing to reducing the efficiency of reporting diseases

in Fiji, PNG, Vanuatu and the Solomon Islands. The upward hierarchical nature of the reporting systems is also affecting the efficiency of reporting as the normal practice in the countries studied is that officers in a branch cannot bypass immediate superior officers.

Recommendations

The reporting structures in the PICTs studied should be restructured to remove duplication and shorten the chain of reporting. The shortened chain could override existing command structures that exist within the countries studied and the actual reporting chain should be documented and more awareness should be created with the officers that are part of the command structure for Fiji, PNG, Vanuatu and the Solomon Islands.

There needs to be more collaboration with FAO, OIE, academic institutions and national governments to create policies that support work on animal health, surveillance to improve disease reporting in PICTs. Increased opportunity for internal collaboration between ministries and directorates should be supported to improve networking and sharing of animal health information.

The shortage of veterinarians could be addressed by having national governments create better policies to retain veterinarians in the animal health services; this should be supported by creating reasonable work conditions and remuneration packages. The policy should create programs to support young graduates to study veterinary sciences overseas in universities that have good track records. The policy should also provide scholarships and career pathways, i.e. a position for graduates when they return from studies and a pathway for promotion.

The program could also collaborate with other developed countries and engage retired veterinarians to support surveillance and disease reporting work in the short term when there currently is a shortage of veterinarians in PICTs.

The veterinary registration criteria in PICTs could also be re-evaluated to accommodate veterinarians with qualifications from countries that have competent veterinary institutions,

e.g. in Fiji, veterinarians with qualifications from New Zealand, Australia and England are allowed to practice in the country while veterinarians with qualifications from other countries cannot do so.

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Conflict of interest The authors declare that they have no competing interests.

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