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The history of brucellosis in the Pacific Island Countries and Territories and its re-emergence

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ABSTRACT

There are few publications on brucellosis within the Pacific Island Countries and Territories (PICTs). The reason is possibly because the cattle population has been reportedly free of the disease for many years until a re-emergence occurred in the Fiji Islands (Viti Levu) in 2009. This paper reports on the outbreak of brucellosis in Fiji and its progression between 2009 and 2013 in the context of an overview of brucellosis in the Pacific Island community. Review of the literature found only 28 articles with the oldest record of brucellosis being in 1965 in Papua New Guinea (PNG) and from human cases in Tonga in 1980. The Fiji outbreak of *Brucella abortus* occurred in cattle in 2009 (Wainivesi basin) in the Tailevu province. Prior to the outbreak, Fiji declared freedom from *B. abortus* to OIE in 1996 after a successful eradication campaign. During the course of the outbreak investigation, serum samples were collected from between 9790 and 21,624 cattle per annum between 2009 and 2013 from 87 farms on the main island of Fiji (Viti Levu). Blood samples were tested for brucellosis using the Rose Bengal Test (RBT) in 2009 and the indirect ELISA test in subsequent years. At the time of the outbreak in Fiji (2009) the apparent prevalence in cattle was 1.50% and this has fluctuated since the outbreak. The True Prevalence (TP) for the main island in Fiji for the indirect ELISA tests was 2.40% in 2010, reached a peak of 3.49% in 2011 then reduced to 0.12% by 2013. The significant reduction in prevalence compared to 2010 is most likely due to the control programs being implemented in Fiji. The re-emergence of *B. abortus* in Fiji could be attributed to the lack of monitoring for the disease until 2009 combined with inadequate management of exposed animals, thus illustrating how important it is for authorities not to become complacent. Continued awareness and monitoring for brucellosis is essential if future outbreaks are to be avoided.

1. Introduction

Bovine brucellosis is a disease of importance in the Pacific Island community (PIC) as it has the potential to adversely impact both human and animal health (Garner et al., 2003) and it is listed as a multi-species disease, infections and infestations under the World Animal Health Information Database (WAHID) interface (OIE, 2013). The disease is caused by the bacterium *Brucella abortus* and has been recorded in cattle since the early 1970s in the Pacific Islands and more specifically in the associated "Food Animal Biosecurity Network" (FABN) countries, (Saville, 1996a; Brioudes et al., 2014).

Brucellosis can be found worldwide and is usually well controlled in developed countries (OIE, 2009). However in developing countries, brucellosis may be enzootic but is often not reported on as the disease is often not regarded as a priority (Garner, 1997). Brucellosis is an important zoonotic disease and like in animals, the epidemiology in humans has changed over the years due to various sanitary, socioeconomic and political factors, including increased international travel (Mohamed et al., 2010). Some areas, particularly the Middle East, appear to have an increasing prevalence of human brucellosis (*Brucella melitensis*) (Pappas et al., 2006).

The economic impacts of *B. abortus* are diverse and costs are normally associated with the loss of animal production, impact on human health, eradication and control measures as well as losses due to restriction on trade (FAO, 2002). According to the USDA, annual losses from lowered milk production, aborted calves and reduced breeding efficiency have decreased in the USA from $400 million in 1952 to less than $1 million today and this is due to a

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successful eradication program. Furthermore if eradication program efforts were ceased, the costs of producing beef and milk would increase by an estimated $80 million annually in less than 10 years (USDA APHIS Veterinary Services Report, 2013).

Even though it has always been considered that the disease impacts Pacific Island economies both in the cattle sector as well as in public health, studies on the economic impacts and formal reports of the costs of eradicating and controlling brucellosis are limited (SPC Report, 2012).

This paper presents data from a semi-systematic review of literature (grey and peer reviewed) in relation to the status and reporting of bovine brucellosis in the Pacific Island community and more specifically Fiji, Papua New Guinea (PNG), Vanuatu and the Solomon Islands, which form part of a Food Animal Biosecurity Network (FABN); it summarizes some of the key issues in relation to brucellosis reporting in these Pacific Island communities. In addition, this paper presents and discusses the brucellosis outbreak that occurred in Fiji in 2009 and the re-emergence of the disease in the Pacific Island Countries and Territories (PICTs) using retrospective data collected from the Fiji Veterinary Pathology Laboratory in Koronivia, Suva, Fiji.

2. Materials and methods

2.1. Review of the literature

2.1.1. PubMed and Web of Knowledge

A semi-systematic literature review was conducted to gather data on the extent of brucellosis in the Pacific Island communities and Territories. A search of peer reviewed studies was conducted using PubMed and Web of Sciences databases for brucellosis in the Pacific Island community. It was decided to use these search engines as the PubMed database consisted of references and abstracts on life sciences for biomedical topics, which was relevant to brucellosis. While the Web of Knowledge, formerly known as ISI Web of Knowledge, is an academic citation indexing and search service and thus relevant to peer reviewed studies on brucellosis.

A total of 29 key words were used to search for brucellosis articles for the different regions within the Pacific Island community. The key words used were; ("Brucellosis" AND "Pacific" AND "Oceania" AND "Micronesia" AND "Melanesia" AND "Polynesia" AND "American Samoa" AND "Cook Island" AND "Federated States of Micronesia" AND "Fiji" AND "French Polynesia" AND "Guam" AND "Kiribati" AND "Marshall Islands" AND "Nauru" AND "New Caledonia" AND "Niue" AND "Northern Mariana Islands" AND "Palau" AND "Papua New Guinea" AND "Pitcairn Islands" AND "Samoa" AND "Solomon Islands" AND "Tokelau" AND "Tonga" AND "Tuvalu" AND "Vanuatu" AND "Wallis" AND "Futuna").

The key words "Brucellosis" and "Pacific" were used to restrict the search to the Pacific Island community. The other key words used were the names of the countries that exist within the Pacific Island community.

The "fields option" (PubMed) and "topic option" (Web of Science) were used to retrieve articles for the review. The articles were then screened for their relevance by reading through the abstracts and selecting them if they related to Pacific studies on the prevalence of brucellosis in relation to when and where the studies were conducted.

2.1.2. Secretariat of the Pacific Community

The Secretariat of the Pacific Community (SPC) has Pacific Island country mandates to carry out work in 22 countries in relation to agriculture (Land Resources Division) and was also used as a source of literature for the brucellosis study. Literature at the Secretariat of the Pacific Community library/database as well as electronic unpublished literature were searched and collated. These were then screened according to their relevance on brucellosis studies in the Pacific Island community in relation to when and where the studies were done.

Table 1
RBT Prevalence of brucellosis for the Tailevu province of Fiji in 2009.

Nos	Localities	No. farms	No. cattle tested	RBT +ve	AP%	TP%
1	Wainivesi	12	1252	87	6.95	6.43
2	Waimaro	8	3551	9	0.25	0.00
3	Waidewara	11	912	5	0.55	0.03
4	Waidalice	15	690	6	0.87	0.35
5	Verata/Babavoce	4	315	4	1.27	0.76
6	Tailevu South	3	479	7	1.46	0.95
7	Sawakasa	12	723	0	0.00	0.00
8	Namalata	3	181	2	1.10	0.59
9	Naitutu	6	255	5	1.96	1.45
10	Nabilo	3	177	1	0.56	0.05
11	Deepwater	10	1255	21	1.67	1.16

RBT—Rose Bengal Test; AP—apparent prevalence; TP—true prevalence.

2.1.3. WAHIS and WAHID databases

The World Animal Health Information System (WAHIS) and the World Animal Health Information Database (WAHID) databases of OIE were searched for reports of bovine brucellosis status in the Pacific Island community.

Two areas were searched on the WAHID database of OIE; these were (1) disease distribution maps of bovine brucellosis for the Oceania region under the "Disease Information" tab and (2) country reports on *B. abortus* for Fiji, Papua New Guinea, Vanuatu and the Solomon Islands, under the "Animal Health Situation" and "Country Information" tab.

2.2. The re-emergence of brucellosis in Fiji

2.2.1. Outbreak investigation

Prior to the re-emergence of the disease in 2009, Fiji declared freedom from *B. abortus* in 1996 to OIE after a combination of vaccination (using S19 vaccine) as well as test and slaughter strategies using the RBT for screening herds and CFT for confirmation (Borja, 2014). The last case of brucellosis in cattle in Fiji before declaration of freedom to OIE was recorded in 1990 (Cokanasiga, 2015).

In June 2009, an outbreak of abortions were observed in cows and reported from a dairy farm in the Wainivesi basin of the Tailevu province on the main island of Fiji (Viti Levu). The farm was visited by the government veterinarian and the farm was quarantined for suspected presence of *B. abortus*. In total there were 12 farms in the Wainivesi basin and all the cattle on those farms were tested using the Rose Bengal Test (RBT). The RBT used spot agglutination methods where antigen was added to serum on a white tile plate, mixed, agitated and read after 4 min, visible reactions were considered positive (OIE, 2012b). In addition there were 11 localities in the Tailevu province with a total of 87 farms, and all the cattle (Table 1) on the remaining farms were also tested using the RBT. In 2010 samples (Table 2) were collected from farms that tested positive to RBT in 2009 and tested at the Fiji veterinary laboratory using the indirect ELISA test for confirmation of diagnosis, where standard procedures were used while testing the sera (OIE, 2012b). Samples that tested positive for *Brucella* antibodies were then sent for the Complement Fixation Test (CFT) at the Australian Animal Health Laboratory (AAHL), Australia. This was done to confirm the indirect ELISA positives from the Fiji Veterinary Pathology Laboratory.

Eradication efforts commenced with the culling of infected cattle on those farms based on the confirmation of the CFT from AAHL and this also prompted the sending of a report to OIE on the re-emergence of brucellosis in cattle based on the clinical symptoms