Epidemiological surveillance in dairy farms in the Pastaza province of Ecuador

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Summary

A survey was carried out on dairy cattle farms in Pastaza province to analyse the degree of compliance with epidemiological surveillance activities (based on the main technical aspects in Ecuador's Guide to Good Dairy Farming Practices) and to assess the reduction of the risk

of introducing disease into dairy cattle. Visits were made to 70 dairy and dual-purpose beef/dairy farms, where the survey was conducted to evaluate technical aspects relating to epidemiological surveillance and the risk of introducing disease. In only one of the nine areas of application covered in the guide was compliance with technical requirements greater than 70%: milking and milk handling (78.59%). In the following areas, a compliance rate of 40–65% was achieved: records and traceability; siting of livestock farms and infrastructure, facilities and equipment; use and quality of water and animal feed; and management of veterinary products and agricultural pesticides. In the remaining areas, the compliance rate was less than 20%. On average, there was only 27.96% compliance with the technical elements evaluated. The results show that current guidelines for good dairy farming practices can be used to evaluate basic aspects of epidemiological surveillance and of the reduction of the risk of introducing disease into dairy farms. They also reveal shortcomings in these aspects in the Amazonian province of Pastaza, which need to be addressed appropriately to reduce their negative impact on animal health.

Keywords

Cattle – Ecuador – Epidemiological – Good husbandry practices – Surveillance.

Introduction

Epidemiological surveillance systems consist of sets of complementary components which generate information to inform risk assessment and policy formulation for both national programmes and international trade (1, 2).

Some of the activities to which surveillance contributes include: early warning of disease (re-)occurrence; detection of infection or disease; and measurement of the prevalence or incidence of pathogens or hazards found in animal populations or along the supply chain of animal-derived foodstuffs (3). In short, the information provided by

animal health surveillance helps to reduce the impact of animal diseases (4).

Animal health surveillance is essential for protecting public health, enhancing access to international markets for animals and their products, and improving animal health, production and welfare. For the proper implementation of surveillance, it is vital for all the components of livestock value chains to be involved (2). Two of these components play an important role: farmers and legislation to enhance the efficiency and quality of animal products.

Good husbandry practices are standards that have been developed to ensure, first, that animal products are healthy and suitable for their intended use, and, second, that dairy farming will remain viable in the future from an economic, social, health and environmental standpoint (5, 6, 7).

In Ecuador, a guide is in force on the accreditation of good dairy farming practices (7), with which compliance is voluntary. The guide covers technical elements that contribute to epidemiological surveillance.

Pastaza province is situated in the Amazon region of Ecuador and has a total of 136,848 hectares dedicated to livestock production, with 74,281 head of cattle distributed among approximately 1,300 farms (8). As livestock farming in Pastaza province takes place under conditions that differ from international standards for implementing this productive activity (9), it is extremely useful to ascertain the level of implementation of these standards, particularly those relating to epidemiological surveillance.

That is why the authors decided to focus the current study on analysing the extent to which the epidemiological surveillance activities under the responsibility of dairy cattle farmers in Ecuador's Pastaza province comply with standards. As the basis for their study, the authors used the main technical elements in the guidelines in force in Ecuador for the accreditation of good dairy farming practices.

Materials and methods

The study was conducted in Pastaza province in the Ecuadorian Amazon. Visits were made to 70 cattle farms (including 22 dual-purpose beef/dairy farms and 48 dairy farms).

A survey was compiled to include aspects relating to epidemiological surveillance and the risk of introducing disease into the farms, as provided for in Resolution No. 0217 of the Ecuadorian Agency for Agriculture Quality Assurance (AGROCALIDAD): Guide to Good Dairy Farming Practices (7). The survey determined the degree of compliance with the guide and the most significant shortcomings on the cattle farms visited.

The survey data were tabulated in a Microsoft Excel spreadsheet and the geographic information system software ArcGIS (version 10.1) was used to draw up a map geo-referencing the cattle farms visited (10).

Statistical Analysis System software (SAS 9.0) was used for the statistical studies (11).

Results

Most of the 70 livestock farms visited are located in the cantons of Mera, Pastaza and Santa Clara, which have the largest number of cattle farms in the province (see Fig. 1).

After reviewing the provisions of AGROCALIDAD Resolution No. 0217 (7), 49 technical elements were identified that relate directly to epidemiological surveillance in the different areas of application of good dairy farming practice (see Table I).

The livestock farms visited were found to have a low percentage of compliance with the aforementioned technical elements (see Table II).

In only one of the nine areas of application covered in the Guide to Good Dairy Farming Practices was compliance with the technical aspects relating to epidemiological surveillance greater than 70%: that

of milking and milk handling (78.59%). In the following areas, a compliance rate of 40–65% was achieved: records and traceability; siting of livestock farms and infrastructure, facilities and equipment; use and quality of water and animal feed; and management of veterinary products and agricultural pesticides. In the remaining areas, the compliance rate was less than 20%. The overall average compliance rate was only 27.96%. No significant differences were found between dairy farms and dual-purpose farms.

Table III shows the principal shortcomings identified in the different areas of application covered by the Guide to Good Dairy Farming Practices (7).

One of the good dairy farming practices with the greatest impact on epidemiological surveillance is to take measures to prevent entry of disease onto the farm. The study found problems with meeting key technical criteria relating to this good practice, including: moving animals in compliance with current regulations; screening animals prior to introducing them onto a farm; quarantining animals to be introduced; and ensuring that farms are fenced off.

Even though cattle farming in Pastaza province (and throughout the Amazon region of Ecuador) takes place under conditions of relative isolation, there have been crises caused by failure to comply with these technical criteria, in particular uncontrolled animal movements leading to outbreaks of livestock disease (12), which illustrates the importance of complying with these technical criteria.

Another study (13) reports that, between 2009 and 2010, there were outbreaks of foot and mouth disease (FMD) virus serotype O in Ecuador, which set back the regional FMD control strategy at the time. The outbreaks were attributed to an uncontrolled movement of animals.

The importance of complying with certain technical elements covered by good husbandry practices, including quarantining animals and screening them prior to introducing them onto a farm, has also been pointed out internationally (14). In the United States of America,

implementation of these technical elements has significantly reduced the prevalence of certain diseases.

Another recommended good practice is to establish herd health programmes to control and eradicate animal diseases. However, there are problems of compliance with key technical elements of epidemiological surveillance, including: involvement in programmes for the prevention, control and eradication of bovine brucellosis, bovine tuberculosis and other diseases; detecting herd disease events quickly; and notifying the competent authorities. Farms should receive regular technical advice from a veterinarian for disease diagnosis and treatment. They should also keep records detailing all animals and the animal health activities they carry out.

The study found that, even though the region has successfully developed a programme to control foot and mouth disease and farmers are aware of its importance (100% of the farms visited are involved in the programme), this is not true of other diseases, such as bovine rabies, bovine tuberculosis or bovine brucellosis − all of which are zoonotic diseases with a heavy impact on veterinary public health.

According to the survey data, rabies was the leading cause of death by disease in cattle (Fig. 2), indicating the significance of rabies in the region. Existing programmes for bovine tuberculosis and bovine brucellosis are voluntary and, as most of the farms visited did not implement them fully, the status of these diseases in the Amazon region is unknown, a point acknowledged by the national control programme for these two diseases (15).

One of the cornerstones of animal disease surveillance systems is evaluating the performance of the main epidemiological indicators (2). However, lack of records in virtually 100% of the farms undermines this evaluation because it impedes the identification of changes in the behavioural pattern of certain diseases and therefore prevents the rapid implementation of measures to control them. Authors of a study in Chile (16) found similar results.

Another good livestock practice is to ensure that animal feed and water are of suitable quantity and quality because, under certain conditions, this may be a risk factor for the introduction of disease into herds, especially as dairy farms do not commonly conduct routine analysis of the quality of drinking water for animals or of water used for sanitation during milking (17). In the region studied, livestock farms have serious shortcomings in this regard because they have no systems for extracting and distributing water. This means that drinking water for animals and water used for sanitation during milking is obtained from natural reservoirs and is untreated, which is particularly detrimental, given that water quality can have a heavy impact on animal health and productive performance (18).

Farmer training is a further element of good dairy farming practice which studies from other countries have found to be of great importance for animal disease surveillance and control programmes (19). The current study found farmer training to be inadequate, which could affect epidemiological surveillance programmes in the region, because farmers are the first link in the surveillance chain.

Conclusions

The results of the study show that, in dairy farms, the current guidelines for good dairy farming practices can be used to evaluate basic aspects of epidemiological surveillance and that, in the Amazonian province of Pastaza, there are shortcomings in these aspects that need to be addressed appropriately to reduce their negative impact on animal health.

References

1. Agencia Ecuatoriana de Aseguramiento de la Calidad del Agro (AGROCALIDAD) (2011). – Sistema de vigilancia epidemiológica. Manual técnico. AGROCALIDAD, Quito, Ecuador. Available at: www.agrocalidad.gob.ec/agrocalidad/images/pdfs/sanidadanimal/sistema%20de%20vigilancia%20epidimemiolgica%20de%20agrocalidad.pdf (accessed on 23 May 2014).

2. Mariner J.C., Hendrickx S., Pfeiffer D.U., Costard S., Knopf L., Okuthe S., Chibeu D., Parmley J., Musenero M., Pisang C., Zingeser J., Jones B.A., Ali S.N., Bett B., McLaws M., Unger F., Araba A., Mehta P. & Jost C.C. (2011). – Integration of participatory approaches into surveillance systems. *Rev. Sci. Tech. Off. Int. Epiz.*, **30** (3), 653–659. Available at: http://web.oie.int/boutique/extrait/01mariner653659.pdf (accessed on 17 March 2016). doi:10.20506/rst.30.3.2065.

3. Häsler B., Howe K.S. & Stärk K.D.C. (2011). – Conceptualising the technical relationship of animal disease surveillance to intervention and mitigation as a basis for economic analysis. *BMC Health Services Research*, **11** (225). doi:10.1186/1472-6963-11-225.

4. Hoinville L.J., Alban L., Drewe J.A., Gibbens J.C., Gustafson L., Häsler B., Saegerman C., Salman M. & Stärk K.D.C. (2013). – Proposed terms and concepts for describing and evaluating animal-health surveillance systems. *Prev. Vet. Med.*, **112** (1–2), 1–12. doi:10.1016/j.prevetmed.2013.06.006.

5. Food and Agriculture Organization of the United Nations (FAO) and International Dairy Federation (IDF) (2011). – Guide to good dairy farming practice. FAO Animal Production and Health Guidelines. No. 8. FAO, Rome. Available at: www.fao.org/docrep/014/ba0027e/ba0027e00.pdf (accessed on 18 February 2014).

6. Agencia Ecuatoriana de Aseguramiento de la Calidad del Agro (AGROCALIDAD) (2010). – Resolución no. 111. Guía para la certificación de buenas prácticas pecuarias (BPP). AGROCALIDAD, Quito, Ecuador. Available at: www.agrocalidad.gob.ec/agrocalidad/images/pdfs/InocuidadAlimentaria/RESOLUCION_111_PECUARIA.pdf (accessed on 23 May 2014).

7. Agencia Ecuatoriana de Aseguramiento de la Calidad del Agro (AGROCALIDAD) (2012). – Resolución técnica no. 0217. Guía de buenas prácticas pecuarias para la producción de leche.

AGROCALIDAD, Quito, Ecuador. Available at: www.agrocalidad.gob.ec/wp-content/uploads/downloads/2013/10/Guia%20de%20Buenas%20Practicas%20Pecuarias%20en%20Leche%20-%20editada.pdf (accessed on 23 May 2014).

8. Instituto Nacional de Estadística y Censos (INEC) (2012). – Encuesta de superficie y producción agropecuaria continua (ESPAC). Available at: www.ecuadorencifras.gob.ec/wp-content/descargas/Presentaciones/PRESENTACION-Espac.pdf (accessed on 22 June 2015).

9. Benítez Jiménez D.G., Vargas Burgos J.C., Torres Cárdenas V., Ríos S., Soria Rey S. & Navarrete H. (2015). – Herramientas para ordenar la ganadería en la provincia Pastaza de la Amazonia Ecuatoriana [Tools to quantify livestock production systems in Pastaza province of the Ecuadorian Amazon]. *Livest. Res. Rural Dev.*, **27** (1). Available at: www.lrrd.org/lrrd27/1/beni27013.html (accessed on 23 May 2015).

10. Environmental Systems Research Institute (ESRI) (2012). – ArcGIS (geographic information system software). Version 10.1. ESRI, Redlands, California, United States of America.

11. Statistical Analysis System Institute (SAS) (2001). – SAS/ STAT®. Version 9.0. Cary, North Carolina, United States of America.

12. Meunier A. (2002). – Ganadería en el sur de la Amazonía ecuatoriana: motor de la colonización y base de la economía agraria. ¿Será capaz de adaptarse a los nuevos retos? PhD Thesis. Instituto de Investigación para el Desarrollo, Quito, Ecuador. Available at: horizon.documentation.ird.fr/exl-doc/pleins_textes/divers11-03/010043076.pdf (accessed on 23 May 2014).

13. Maradei E., Pérez Beascoechea C., Malirat V., Salgado G., Seki C., Pedemonte A., Bonastre P., D'Aloia R., La Torre J.L., Mattion N., Rodríguez Toledo J. & Bergmann I.E. (2011). – Characterization of foot-and-mouth disease virus from outbreaks in

Ecuador during 2009–2010 and cross-protection studies with the vaccine strain in use in the region. *Vaccine*, **29** (46), 8230–8240. doi:10.1016/j.vaccine.2011.08.120.

14. Faust M.A., Kinsel M.L. & Kirkpatrick M.A. (2001). – Characterizing biosecurity, health, and culling during dairy herd expansions. *J. Dairy Sci.*, **84** (4), 955–965. doi:10.3168/jds.s0022-0302(01)74554-7.

15. Agencia Ecuatoriana de Aseguramiento de la Calidad del Agro (AGROCALIDAD) (2008). – Programa nacional de control de brucelosis bovina. Resolución sanitaria no. 025. AGROCALIDAD, Quito, Ecuador. Available at: www.agrocalidad.gob.ec/agrocalidad/images/pdfs/sanidadanimal/programa_nacional_brucelosis_bovina.pdf (accessed on 23 May 2014).

16. Benavides Benavides B. & Rosenfeld Miranda C. (2009). – Análisis de las buenas prácticas ganaderas y su aplicación epidemiológica [Analysis of good animal husbandry practices and their epidemiological application]. *Rev. Sci. Tech. Off. Int. Epiz.,* **28** (3), 909–916. Available at: http://web.oie.int/boutique/extrait/03benavides909916.pdf (accessed on 17 March 2016).

17. Van Eenige M.J., Counotte G.H. & Noordhuizen J.P. (2013). – Drinking water for dairy cattle: always a benefit or a microbiological risk? *Tijdschr. Diergeneeskd*., **138** (2), 86–97. Available at: www.researchgate.net/publication/235785341_Drinking_water_for_dairy_cattle_Always_a_benefit_or_a_microbiological_risk (accessed on 17 March 2016).

18. Wright C.L. (2007). – Management of water quality for beef cattle. *Vet. Clin. N. Am. (Food Anim. Pract.)*, **23** (1), 91–103. doi:10.1016/j.cvfa.2006.12.002.

19. Ouagal M., Hendrikx P., Saegerman C. & Berkvens D. (2010). – Comparison between active and passive surveillance within

the network of epidemiological surveillance of animal diseases in Chad. *Acta Trop.,* **116** (2), 147–151. doi:10.1016/j.actatropica.2010.07.004.

Table I
Areas of application and good dairy farming practices applicable to disease surveillance and to reduction of the risk of introducing disease, as provided for in Resolution No. 0217 of the Ecuadorian Agency for Agriculture Quality Assurance (AGROCALIDAD)

Areas of application evaluated in AGROCALIDAD Resolution No. 0217	FAO-recommended good practices	Technical aspects evaluated
1. Siting of livestock farms and of infrastructure, facilities and equipment	Site livestock farms in places that minimise the health risk and away from potential sources of contamination. Design livestock farm infrastructure in such a way as to ensure the conditions for maintaining farm hygiene and biosecurity.	6
2. Farm hygiene and biosecurity measures	Take measures to prevent entry of disease onto the farm. Ensure that farm tasks are carried out safely and competently.	9
3. Use and quality of water and animal feed	Ensure that animal feed and water are of suitable quantity and quality. Ensure the traceability of feedstuffs brought onto the farm.	7
4. Animal health and welfare	Take measures to prevent entry of disease onto the farm. Establish herd health programmes to control and eradicate animal diseases. Detect herd disease events quickly and notify the competent authorities.	8
5. Management of veterinary products and agricultural pesticides	Use all chemicals and veterinary medicines as directed.	6
6. Milking and milk handling	Ensure milking routines do not injure the animals or introduce contaminants into milk.	1
7. Records and traceability	Establish herd health programmes to control and eradicate animal diseases.	4
8. Environmental management	Have an appropriate on-farm waste management system.	5
9. Workplace health, safety and welfare	Ensure that farm tasks are carried out safely and competently.	3

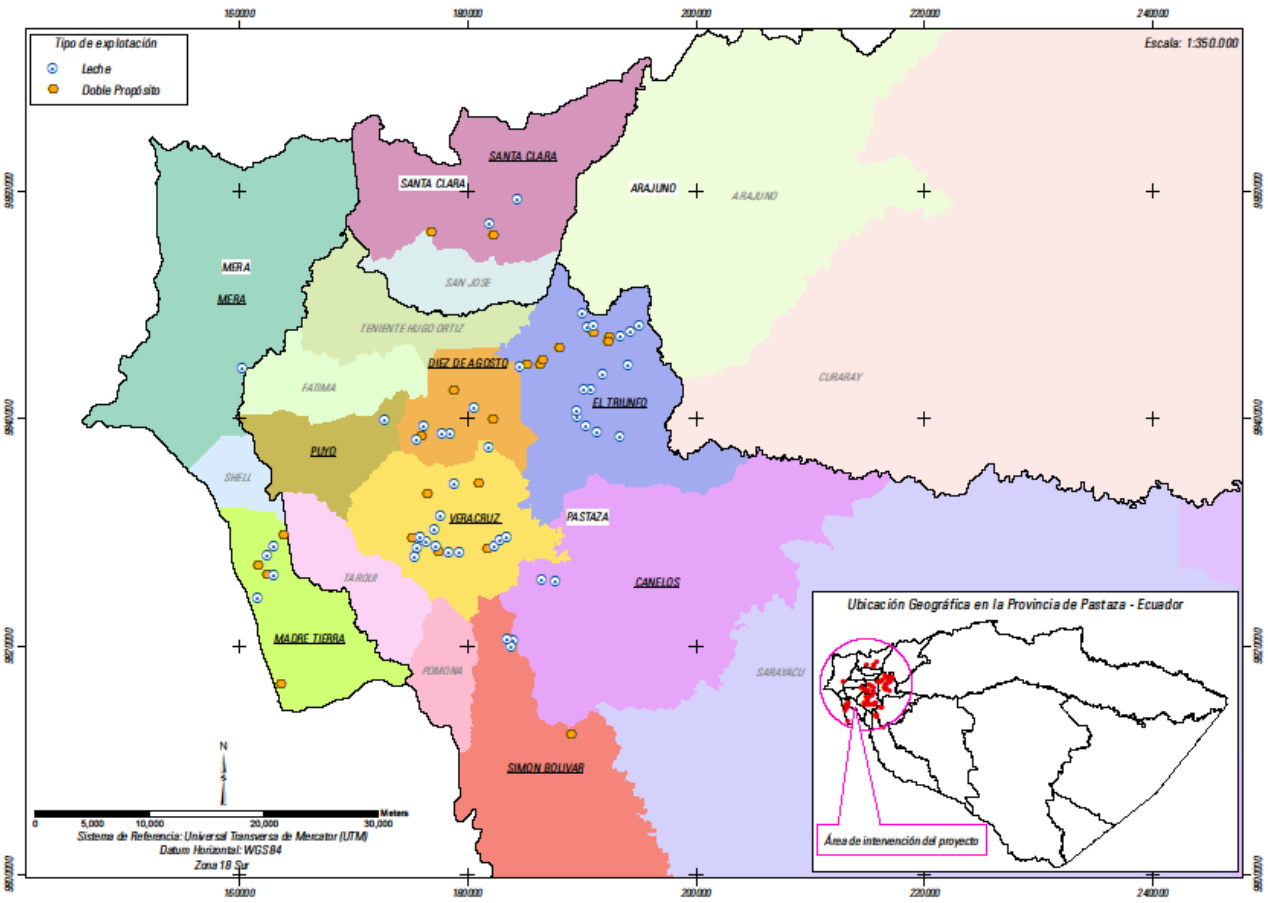
FAO: Food and Agriculture Organization of the United Nations

Table II
Degree of compliance with good dairy farming practices applicable to disease surveillance and to reduction of the risk of introducing disease, as provided for in Resolutions 111 and 0217 of the Ecuadorian Agency for Agriculture Quality Assurance (AGROCALIDAD)

Areas evaluated	Good practices	Technical aspects evaluated	Percentage of compliance
1. Siting of livestock farms and infrastructure, facilities and equipment	2	6	44.76
2. Farm hygiene and biosecurity measures	2	9	11.27
3. Use and quality of water and animal feed	2	7	42.45
4. Animal health and welfare	3	8	15.00
5. Management of veterinary products and agricultural pesticides	1	6	40.24
6. Milking and milk handling	1	1	78.57
7. Records and traceability	2	4	62.86
8. Environmental management	1	5	2.00
9. Workplace health, safety and welfare	1	3	0.48
Total	15	49	27.96

Table III
Principal shortcomings identified in the different areas covered by good dairy farming practices

Areas evaluated	Principal shortcomings identified
1. Siting of livestock farms and infrastructure, facilities and equipment	There is no perimeter or internal fencing
	There are no serviceable gates or doors to control the entry of people and vehicles onto the premises
2. Farm hygiene and biosecurity measures	There is no farm signposting
	There are no personal hygiene areas
	Animals entering the farm are not quarantined
	The necessary biosecurity measures are not taken with visitors
3. Use and quality of water and animal feed	Water for animal consumption does not meet quality requirements
	Drinking water for animals is not analysed regularly
	No water treatment measures are carried out
	Feed is stored poorly
4. Animal health and welfare	Haulage trucks are not cleaned and disinfected prior to loading and unloading animals
	Farms receive no regular technical advice from a veterinarian for disease diagnosis and treatment
	There are no proper controls on the introduction and departure of farm animals
	There are no annual animal health management plans developed with the advice of a veterinarian
	Farms are not involved in programmes for the prevention, control and eradication of brucellosis, tuberculosis and other diseases
	Herd disease events are not detected and notified to the competent authorities quickly
5. Management of veterinary products and agricultural pesticides	Pharmaceuticals, biologicals, chemicals and medicated feed for animal use and consumption are not always prescribed under the direction of a veterinarian
6. Milking and milk handling	
7. Records and traceability	No identification is performed when an animal enters the livestock farm as a result of birth or purchase
	Farms have no records detailing all animals and the animal health activities they carry out
8. Environmental management	Dead animals are not disposed of immediately and in accordance with current regulations
	No animal death records are kept
	The death of animals is not reported to the animal health authority to enable it to follow the regulations applicable to each case
9. Workplace health, safety and welfare	Not all farm staff are given continuing training on technical and security matters



Área de intervención del proyecto = Project área
Datum Horizontal: WGS 84 = Horizontal datum: WGS 84
Doble propósito = Dual-purpose beef/dairy
Escala = Scale
Leche = Dairy
Sistema de Referencia: Universal Transversa de Mercator (UTM) = Reference System: Universal Transverse Mercator (UTM)
Tipo de explotación = Type of farm
Ubicación geográfica en la Provincia de Pastaza – Ecuador = Geographic location in Ecuador's Pastaza province
Zona 18 Sur = Zone 18 South

Fig. 1

Location map of the 70 livestock farms visited and surveyed in the Amazonian province of Pastaza

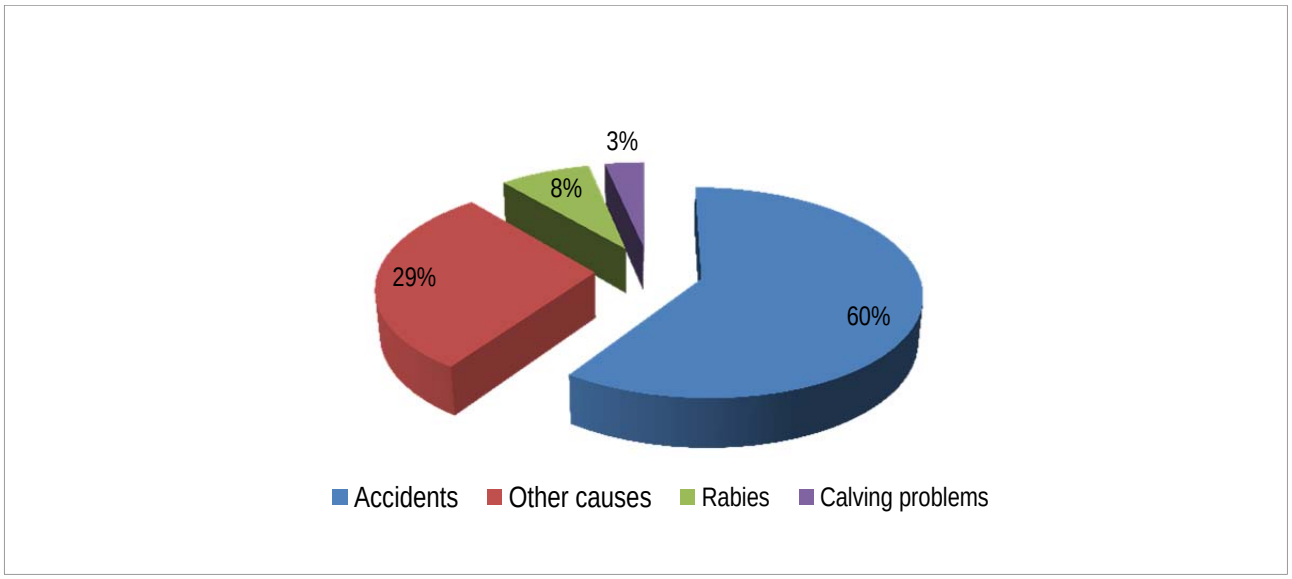


Fig. 2
Relative mortality rate (percentage) in herds visited and surveyed in the Amazonian province of Pastaza