Vol. 12(3), pp. 116-124, July-September 2020
DOI: 10.5897/JVMAH2020.0832
Article Number: 9BE28B764683
ISSN: 2141-2529

http://www.academicjournals.org/JVMAH

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Journal of Veterinary Medicine and Animal Health

Full Length Research Paper

Appraisal of management and biosecurity practices on pig farms in Makurdi, Benue State, North Central Nigeria

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Received 13 March, 2020; Accepted 4 August, 2020

The role of biosecurity at farm level is to reduce the risk of introduction of diseases in pig farms and prevent the disease transmission between animals on farms. It is an important management practice that impacts the profitability of pig production ventures. A survey was conducted to assess the biosecurity practices in 50 farms in Makurdi, Benue State, Nigeria, using a structured questionnaire and assessments through direct observations. Descriptive statistics such as frequencies, percentages and tables were used to analyse and present data generated. The results revealed that majority of the farms were semi-intensive (54%), small scale producers keeping between 1 and 50 pigs formed 96% of surveyed farms and essentially raising indigenous and crossbreed (72%). Only 12% of the farms were fenced and had gates closed to control unwanted visitors and stray animals. Most of the farms (76%) had no footbaths indicating that the risk of disease introduction was high in such farms. The use of protective clothings and foot wears by employees was only observed on 24% of the farms. Isolation of sick animal was practiced by 38% of respondents while 24% of respondents quarantined new animals to the farm. The use of disinfectants to clean the barns was practiced on 18% of the farms. Overall, there was a low level of farm biosecurity in the study area. Extension services to create awareness on the importance of biosecurity would help limit infections and boost pig production and profitability.

Key words: Biosecurity, diseases, Nigeria, pig farmers, production system.

INTRODUCTION

Pig production is one of the fastest growing livestock sectors in the world (FAO, 2012a). According to Oguniyi and Omotosho (2011), pig production plays a vital role in small scale farming far beyond pork production and income generation. The animal is an asset of wealth or safety net in time of crisis when viewed from the economic perspective and serve as a source of protein nutritionally (FAO, 2012b). Pig production has been advocated as a short-term measure towards alleviating the animal protein and calorie deficit, especially where there are no religious edicts preventing their production and consumption (Eusebio, 1984).

Apart from the shorter production time, pigs have been noted for their high conversion rate of feed to flesh

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amongst red meat animals (FAO, 2012b). Pork represents high value animal proteins. Swine production contributes significantly to the livelihood of many Nigerians either directly or indirectly (Ajala and Osuhor, 2004; FAO, 2006).

Benue State is one of the largest pig producing States in Nigeria (more than 20% of the total country production) and the pig enterprise contributes significantly to the economy of the State with most of the pigs owned by small holders operating semi-intensive pig production system (Umeh et al., 2015; Asambe et al., 2019).

Nigeria is one of the African countries with significant pig population density (Robinson et al., 2014). In the 1990s, the pig population was 3.5 million consisting of native black hairy pigs and exotic breeds (Bourn et al., 1994). The latest population estimate was reported by the Federal Department of Livestock (FDL) (2010) to have increased to 7.1 million, indicating that the population had doubled in about two decades. The pigs are reared in neighborhoods of villages and in semi-urban areas as small-scale enterprises having 12 - 50 pigs, but a few large-scale farms exist (Ajala et al., 2006; Saka et al., 2010; Abiola et al., 2015). Semi-intensive and extensive pig production systems occur in the Northern, North Central and Niger Delta regions of Nigeria (Bourn et al., 1994). Intensive pig production exists mostly in Southern Nigeria (Ajala et al., 2006; Saka et al., 2010; Nwanta et al., 2011) and consists of farms having each 50 – 200 pigs in concrete pens. Commercial piggeries rear about 3% of the national pig population with usually more than five breeding sows.

Sustainable growth of the pig production industry in Nigeria is adversely affected by factors such as unstructured pig marketing framework, fluctuation in the prices of pigs and pig products, cultural and religious prohibition of pork consumption, low demand for pork in parts of the country, high feed cost, inadequate extension services, slow integration of cost-effective equipment and genetically enhanced breeds and disease outbreaks (Ajala and Adeshinwa, 2008; Ironkwe and Amefule, 2008; Fasina et al., 2010; Anukwu and Ebong, 2011; Abiola et al., 2015; Igbokwe and Maduka, 2018).

Disease outbreaks represent the major constraints to profitable pig production and consumption in Nigeria. Important pig diseases reported in the country include African swine fever, foot-and-mouth disease, brucellosis, tryponosomosis, babesiosis, eperythrozoonosis, helminthosis, cocciodiosis and other parasitosis (Igbokwe and Maduka, 2018). These diseases impact on the production system by negatively affecting feed conversion efficacy, reproduction and growth rates as well as causing piglet and adult mortalities. The economic losses due to the disease burden and inadequate intervention strategies are current issues facing the pig production industry (Igbokwe and Maduka, 2018).

Thus, one of the important measures to increase pig productivity should focus on disease control. As such, implementation of biosecurity measures in pig production is of paramount importance to farm profitability (Kouam et al., 2019). Several pig diseases (intestinal and miscellaneous diseases) have been successfully controlled through the implementation of biosecurity practices in some EU countries (Wallgren, 2009).

The implementation of biosecurity measures is regarded as a powerful tool in the control of diseases on the farm; its main advantage is the potential to keep pathogens off the farm and to prevent pathogens from spreading to other farms. In the World, Organisation of Animal Health (OIE) Terrestrial Animal Health Code, biosecurity is defined as a set of management and physical measures designed to reduce the risk of introduction, establishment and spread of animal diseases, infections or infestations to, from and with an animal population (Bellini, 2018). Biosecurity measures are divided into three components: isolation, traffic control and sanitation (Cardona and Kuney, 2001; FAO/OIE/World Bank, 2010). Isolation can be regarded as measures related to physical barriers (fence, showers or footbaths) and distance between farms in order to limit contacts between infected animals and contaminated objects with disease-free farms (FAO, 2008). Traffic control can be considered as the restriction of feedstuff, human, equipment and animal movement onto the farm (FAO, 2008). Sanitation refers to the cleaning and disinfection of animal housing, people, material and equipment (Cardona and Kuney, 2001).

Successful implementation of biosecurity requires the adoption of a set of attitudes and behaviours by people to reduce interactions in all activities involving domestic, captive/exotic and wild animals (pigs) and their products (FAO/OIE/World Bank, 2010). Nyaga (2007) reported that biosecurity principles include simple procedures and practices which when applied prevent the entry of disease agents in a farm or exit of disease agent from infected premises. Biosecurity entails a controlled/regulated movement of stock, persons, equipment and products into a clean farm and out of infected premises. It involves methods that enable the farm to remain in a state of sustained cleanliness referred to as sanitation. It has however been observed that many biosecurity measures are either partially observed or not observed at all, owing to several factors such as cost, inadequate veterinary extension and attitudinal dispositions (Brennan and Christley, 2012).

The aim of this study was therefore to describe the pig production management system as well as associated biosecurity practices in pig farms at Makurdi urban and peri-urban areas in Benue State, North central Nigeria.

MATERIALS AND METHODS

Study area

The study was carried out on pig farms located in Makurdi urban and peri-urban areas. Makurdi is the capital city of Benue State, Nigeria. Nigeria is a sub-Saharan African country and is located in

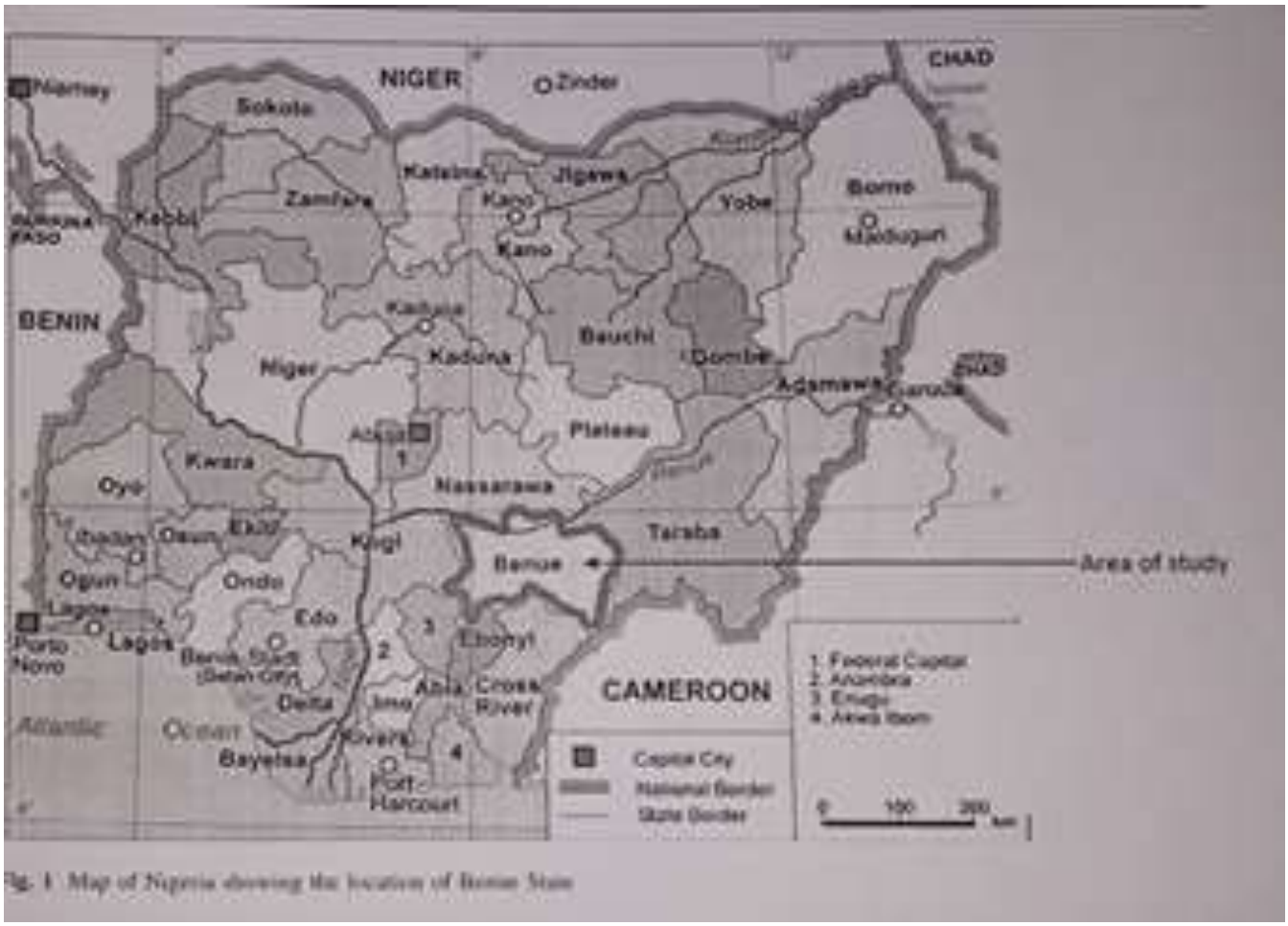

Figure 1. Map of Nigeria showing the location of Benue State.

the western part of the continent. It is the most populous country in Africa and the most populated black nation on earth (Akpotor and Agbekabu, 2010). Benue State is one of the 36 States in Nigeria. It is located in North Central Nigeria (Figure 1) and has a tropical climate with two distinct seasons: rainy and dry seasons. Makurdi is a lowland area in the Guinea savannah vegetational zone of Nigeria and is located on longitude 08°31′ and latitude 07°14′ (Abu, 2002). The rainy season starts in May and ends in October, while the dry season starts in November and ends in April. The annual rainfall ranges from 1270 to 1397 mm and the average annual temperature ranges from 22.43 to 33.41°C (Abu, 2002). During the dry season between the months of February and March, temperatures may reach 35 to 40°c in Makurdi town. The relative humidity ranges between 47 to 85% (TAC, 2002).

According to the 2006 census, Benue State is estimated to have a population of about 4,253,641 inhabitants and a land size of about 33,955 km^2 (Akaakohol and Aye, 2014). The average population density is 99 persons per km^2, which makes Benue State the 9th most populous State in Nigeria. Population distribution between male and females in Benue State is almost equal (with 50.4% male and 49.6% female) (Nigeria Data Portal, 2006). Makurdi, the State capital has a population density of over 380 person per km^2. Agriculture is the backbone of Benue State's economy, and the State is the primary source of food in Nigeria acclaiming the slogan 'the Food Basket of the Nation.' Benue State is endowed with fertile arable land and abundant raw materials and human resources with about 80% of the population directly involved in agriculture (Akaakohol and Aye, 2014). Important cash crops include soybeans, rice, peanuts, mango varieties, citrus, etc. Other cash crops include palm oil, melon, African pear, chili, cassava, sweet potato, beans, maize, millet, guinea corn, vegetables etc. There is very little irrigation agriculture and techniques. Livestock species include pigs, small ruminants, cattle and poultry (Wikipedia, 2020).

Study design and data collection

Fifty pig farms were randomly selected for the study based on the presence of pigs in their farms during the period of the study. Fifty structured questionnaires and biosecurity assessment forms were used to obtain information from the farmers, while visits to the farm facilities for direct observation were also undertaken for data collection according to the methods described by Augustine et al. (2010). Each farm was visited twice to first distribute the data collection instruments and make observations, and secondly retrieve the completed instruments.

Data analysis

Data obtained from the study were analysed and summarised in

tables using simple descriptive statistics. This involved the use of statistical tools to generate frequency distribution and percentages (SAS, 2003).

RESULTS

Demographic characteristics

Data in Table 1 shows that majority of the farmers were males (72%) and 28% females. The literacy level of the respondents was very high and most of the respondents were married. Most (96%) of the respondents were aged between 21 years to 50 years.

Most of the farms were semi-intensive (54%), followed by 34% extensive farms (Table 2). A minority of 12% farms were intensive. The most frequently used crossbreeds (40%) and 66% of the farmers used farm-mixed feeds and kitchen wastes to feed their pigs. Most of the farmers were relatively new to the industry with less than 5 years of farming experience. This study also revealed that the respondents are small-scale farmers and as such generally had small flock size. It was also observed that 54% of the farmers kept other livestock species in their farms. The farmers purchased 64% of their replacement stock for breeding locally from other farmers within their locality (within and around Makurdi urban and sub-urban areas). The source of labour was divided into 2 categories (family and hired labour) but family was by far the greatest source of labour (62%).

Biosecurity practices on farms

Traffic Control and isolation

Only 12% of farms were fenced and none had warning signs at their farm entrance forbidding access to piggeries for visitors (Table 3). Furthermore, functional footbaths were available in only 24% of farms, 16% of farms had feedstuff protected from rodents and 22% of the farms had a pest control programme in place. Majority of the farms (66%) were properly ventilated. This study further revealed that 54% of the farmers also kept other domestic animals in their farms. Only 24% of farmers kept newly arrived animals in quarantined.

Hygienic and sanitation

Use of protective clothings and boots was done by only 24% of the farmers (Table 4). Cleaning of facilities on a daily basis and the use of disinfectants were practiced by only 18% of farmers. When animals fell sick, 38.0% of the farms practiced isolation of sick animals.

DISCUSSION

The demographic characteristics of the pig farmers in this study showed that majority of the farmers were males suggesting that men who are relatively stronger are mostly involved in pig production in the study area. Females in this study area were usually involved as helpers or suppliers of labour in light farm operations such as serving of feed, water or cleaning the piggery. Umeh et al. (2015) and Uddin and Osasogie (2016) in previous studies also reported higher presence of male farmers. Literacy level of the respondents was high as 92% of the farmers had attended high schools or higher learning institutions. According to Moreki et al. (2014), educational level could influence farmers' adoption of modern technologies needed for the improvement of productivity. The good educational background of these farmers could be beneficial in the areas of farm record keeping, reading of drug/vaccine prescription, adoption of innovations and other management functions to ensure productivity (Uddin and Osasogie, 2016).

Table 1 also revealed that most of the respondents were married and aged between 21 years to 50 years indicating that majority of the farmers were adults. Okoro (2012) and Egbule (2010) revealed in separate studies that majority of farmers in Nigeria are married. This result shows that married people dominate pig production in the study area. Married farmers could have more persons in the household to cater for and helping hands in taking care of pigs in their farms.

Animal husbandry was not the main occupation of pig farmers within the study area. Other occupations also included Civil/Public servants, Business/Trader, Crop farmers and retirees. This picture gives the impression that pig farming alone does not allow the farmers to make a living within the study area. The reason for this may be related to the recurrent epidemics of ASF that has been decimating the herds in different localities of the country.

The general pig husbandry characteristics in the study area as shown in Table 2 revealed that most of the farms were semi-intensive (54.0%). A minority of 12.0% farms were intensive. Family was by far the greatest source of labour. This finding is similar to that of Kouam et al. (2019) in Western Cameroon. This study further reveal that the farmers are small scale farmers and as such generally have small flock size and hence family labour may be adequate. The low herd size may also be partly due to the common disease challenges faced by the pig industry in Benue State, especially the regular outbreaks of contagious diseases, such as ASF (Asambe et al., 2017). In fact, the high mortality rate of these diseases (close to 100% for ASF) in affected farms causes farm owners either to remain only with the few survivors, to restock the farms with few animals or to take less risk in investing for a larger farm (Kouam and Moussala, 2018). The results of this study show that the average farming experience of pig farmers was less than 5 years. This is in contrast to a previous study by Umeh et al. (2015), who reported the average farming experience of pig farmers in Benue State as 11.08 years. It should be noted however, that the study of Umeh et al. (2015) covered all the three agricultural zones of Benue State

Table 1. Demographic characteristics of the respondents in the study area.

Category	Frequency	%
Gender		
Male	36	72.00
Female	14	28.00
Educational status		
Non formal education	-	-
Primary school completed	4	8.00
Secondary school completed	9	18.00
Tertiary education	37	74.00
Occupation		
Farmer	11	22.00
Trader	7	14.00
Business	10	20.00
Retiree	8	16.00
Civil/public service	14	28.00
Age		
11 - 20 years (under 20 years)	**2**	**4.00**
21 - 30	10	20.00
31 - 40	21	42.00
41 - 50	16	32.00
>50	1	2.00
Marital status		
Married	29	58.00
Single	17	34.00
Widower	3	6.50
Widow	1	2.00

Table 2. General characteristics of pig husbandry.

Category	Frequency	%
Breed		
Indigenous	16	32.00
Exotic	14	28.00
Crossbreeds	20	40.00
Age (years)		
0 - 1	16	32.00
1 - 2	13	26.00
2 - 3	14	28.00
3 - 4	7	14.00
> 5	-	-
Purpose of production		
Meat	2	4.00
Income	19	38.00
Both	29	58.00

Table 2. Cont'd

Number of pigs (flock size)		
1 - 10	10	20.00
10 - 20	14	28.00
20 - 30	6	12.00
30 - 40	8	16.00
40 - 50	8	16.00
> 50	4	8.00
Management system		
Extensive	17	34.00
Intensive	6	12.00
Semi-intensive	27	54.00
Source of pig		
Pig market	18	36.00
Other breeders	32	64.00
Years of experience		
less than 3	30	60.00
3 - 5 years	19	38.00
> 5	1	2.00
Feed source		
Commercial	4	8.00
Farm-mix	17	34.00
Commercial/farm mix	13	26.00
Kitchen (home remains)	16	32.00
Other livestock species kept		
Sheep	5	10.00
Goat	7	14.00
Cattle	1	2.00
Rabbit	2	4.00
Poultry	11	22.00
None	23	46.00
Fish	1	2.00
Source of labour		
Hired	19	38.00
Family	31	62.00
Others	-	-

while this present study covered only Makurdi, the capital of the State. According to Umeh et al. (2015), farming experience may increase technical efficiency as experience has positive influence on managerial ability as it tends to improve ability of the farmers to obtain and process information about technology which in turn increases efficiency. Combining farm-mixing of feeds and kitchen wastes may be more economical than using commercial feeds alone. However, kitchen wastes are not properly heated before feeding it to animals, the risk of transmitting diseases such as African Swine Fever (ASF) among other diseases is high (Asambe et al., 2017). Purchasing replacement stock for breeding within the same locality predisposes to inbreeding and subsequently low production, reproduction and poor health (Kirima et al., 2017).

Concerning biosecurity practices, perimeter fence was present in only 12% of the farms and all the farm visited

Table 3. Biosecurity practices associated with traffic control and isolation.

Practices	Frequency	%
Biosecurity information sign at entrance	-	-
No information sign at entrance	100	100
Perimeter fence and gate	6	12
No perimeter fence and gate	44	88
Use of footbath	12	24
No footbath	38	76
Maintain pest control programme	11	22
Do not maintain pest control programme	39	78
Farms with rodent proof feed store	8	16
Farms without rodent proof feed store	42	84
Farms with good ventilation	33	66
Farms without good ventilation	17	34
Other species are present on the farm		
Yes	27	54
No	23	46
New animals are quarantined	12	24
New animals are not quarantined	38	76

Table 4. Biosecurity practices associated with sanitation

Practices	Frequency	%
Protective clothing for employees	8	16
No protective clothing for employees	42	84
Protective foot wears (boots) for employees and visitors	8	16
No protective foot wears (boots) for employees and visitors	42	84
Disinfectants are used for cleaning	9	18
Disinfectants are not used for cleaning	41	82
Drinking water is treated with chemical (chlorine)	-	-
Drinking water is not treated with chemical (chlorine)	-	100
Isolation of sick pigs	19	38
No isolation for sick pigs	31	65

did not have a sign board or any physical notice preventing access on farms for visitors. These results agree with the findings of Kouam et al. (2019) in Western Cameroon. Physical barriers are meant to protect the herd from stray animals or human intruder entering the farm. The risk of disease introduction in those farms without gates was therefore high. Cobb Avian 48 (2006) stated that each farm must have a perimeter fence to prevent unwanted entry of people, vehicles and animals. Other animal species were found in 54.0% of farms, which is a serious biosecurity threat since cross transmission of pathogens between different species has been demonstrated (Wall et al., 1995, Kouam et al., 2019). Footbaths were available in only 24% of the farms, which can be explained by the small number of farms under intensive system in this study. Footbaths are essential for disinfection of foot wears and should be renewed on a daily basis. Poor or absence of disease control strategies such as footbaths and inadequate management like replenishing footbaths after disinfection dries up are some of the factors that can increase disease outbreak. Majority of the farms had poor pest control programme. Rodents have been reported to be mechanical vectors for pathogenic microorganisms (Annette and Claes, 2012). There was a poor implementation of quarantine of new animals which might be explained by the fact that majority of the farmers are not experienced and have not been trained in pig farming and biosecurity practices. Majority of the farms were properly ventilated (66.0%). The provision of good ventilation is an attempt to reduce the effect of heat stress as a result of hot and humid climate in the study area.

This study also showed that most of the farmers do not

possess dedicated clothings and boots for use on the farm. The practice of owning dedicated clothing and boots was observed only in the intensive farms which are less represented in this study. Farmers non-compliance with the practice of use of herd specific overall and boots is very risky as humans can act as mechanical vectors of diseases to pigs. The practice of cleaning and disinfection of farms was only practiced by 18.0% of farmers. This practice if properly implemented will help to break the cycle of diseases on the farm. The low implementation of use of disinfectant and daily cleaning indicate that most of the farmers do not understand the need to keep farms properly clean and disease free. The practice of isolating sick animals by farmers in this study was low (38.0%). Disease can develop within a farm at any time, so farmers should practice separation of sick animals to protect the healthy animals.

CONCLUSION AND RECOMMENDATIONS

This study has shown that the production system in the study area was dominated by the semi-intensive system of pig production.

The most important biosecurity measures of concern and to improve are:

(i) Fencing of pig farms.
(ii) Training of pig farmers
(iii) Farmers compliance with the practice of use of herd specific overalls and boots.
(iv) Implementation of the use of disinfectants and daily cleaning.
(v) Keeping newly arrived animals in quarantine and the practice of isolation of sick animals.
(vi) Not feeding kitchen wastes to pigs without adequate heating.

It is also recommended that extension services should be aimed at creating awareness on the importance of biosecurity in pig farms in order to keep out infections. Improved biosecurity would lead to increase in productivity and profitability.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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