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ORIGINAL ARTICLE

Antibiotic use in commercial poultry production in Bangladesh: stakeholders roles and dependencies for antibiotic transaction

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ABSTRACT

Antimicrobial resistance due to the irrational use of antibiotics in the livestock sector is a global public health problem. In Bangladesh, poultry farmers use several types of antibiotics in poultry production to promote growth as well as treat and prevent diseases. This study aimed to explore stakeholders' roles and dependencies for antibiotic transactions in commercial poultry production. We conducted an ethnographic study in an urban village of Narsingdi District in Bangladesh from June 2019-February 2020, and data were collected using in-depth interviews, key informant interviews, and observations. We analyzed data using an inductive approach and thematic analysis. The findings showed that dealers maintained the functional linkage between input producers and poultry farmers during production input transactions, including antibiotics. The companies assigned sales representatives and veterinarians to maintain marketing channels to achieve sales targets of production inputs. Large scale farmers purchase production inputs with cash from dealers. Small scale farmers purchase production inputs with credit from a particular dealer. Large scale farmers provide poultry treatment based on their own experiences and also rely on government veterinarians to treat severe poultry diseases. Small scale farmers depend on dealers and company veterinarians to treat poultry diseases. Veterinarians often prescribed antibiotics to farmers without a diagnosis of sick poultry. Both large scale and small scale farmers used different antibiotics and antibiotic medicated feed frequently to treat diseases and promote growth, without considering the administration process of antibiotic use to treat poultry diseases. This study revealed stakeholders' role and dependencies for antibiotic transactions that determine antibiotic use for broiler poultry farming. We recommended modifying the existing poultry farming system and implementing a policy regarding

antibiotic transactions for poultry production to reduce the risk of antimicrobial resistance, which may threaten, both animal and human health.

Key words: antibiotic, antimicrobial resistance, poultry production, stakeholders role, dependencies, Bangladesh

INTRODUCTION

Currently, antimicrobial resistance is the most critical concern in global public health. The extensive use of antibiotics in health care and agricultural purposes contributes to the rapid spread of antibiotic-resistant bacteria around the world, which is now a serious threat to global public health and food security [1-3]. The rise of antibiotic consumption in animal food production is an increasing concern for the emerging antimicrobial resistance in the food chain and environment [4].

In Bangladesh, the poultry industry produces 170 million broilers and layers of chickens from 115,000 farms of all sizes [5], representing 14% of the total value of livestock output and provides approximately 37% of the total animal protein in the country [6]. Small scale broiler poultry farms contribute around 78% of the total poultry meat production in Bangladesh [7]. The systematic identification of multidrug-resistant bacteria in different samples of poultry, including poultry feces, meat, and eggs demonstrated that a high proportion of antibiotics have been used for poultry production [8-11]. A study found that all poultry farms used one or more antibiotics where 47.9% of the poultry farms used antibiotics in water and animal feed for both therapeutic and prophylactic purposes and 8.2% used as growth promoters [12]. In Bangladesh, the Fish Feed and Animal Feed Act forbids antibiotic use in animal feed [13]. However, Bangladesh has a lack of governance and monitoring on drug transaction [14].

A related study revealed that the client-patron relationship among dealers and broiler farmers was the key driver that influenced farmers to use antibiotics for poultry production in Bangladesh [15]. The growing concern of antibiotic use in livestock production with its related public health impacts justifies the importance of further research to explore the political and economic factors of antibiotic use in an unregulated poultry farming system. As one part of a study regarding antibiotic use among commercial poultry farmers in Bangladesh, this paper aimed to examine stakeholders' roles and dependencies for the antibiotic transaction which influences farmers to use antibiotics for broiler production in resource-poor settings where antibiotic resistance has become an increasing threat for public health and food security.

METHODS

Study Design and Data Collection

Between June 2019 and February 2020, a team consisting of social scientists and veterinarians conducted ethnographic fieldwork in Narsingdi, the largest broiler poultry farming district in Bangladesh. The team selected an urban village consisting of four large-scale and 45 small-scale poultry farms 10 km far from Narsingdi city and around 50 km far from Dhaka city, the capital of Bangladesh. We purposively selected one large scale and one small scale farm to explore the difference in poultry farming practices and conducted in-depth interviews with farmers (n=2) and workers (n=4). There were 10 poultry dealer shops

surrounding the village that had direct communication with various pharmaceutical and feed companies. We communicated with poultry dealers at their shops who provided production inputs to the poultry farms. Poultry dealers helped us to make communication with sales representatives and veterinarians of pharmaceutical and feed companies. Using convenience sampling, we conducted in-depth interviews with poultry dealers (n=3), pharmaceutical company sales representatives (n=7) and veterinarians (n=3), and feed company sales representatives (n=2) and veterinarians (n=2). The team conducted key informant interviews with the area manager of a pharmaceutical company (n=1) and feed company (n=1), general secretary of poultry farmer association (n=1), and subdistrict government livestock officer (n=1). We conducted observations with poultry farms and dealer shops to obtain a broader understanding of the poultry farming system.

Data Analysis

The team used an inductive approach and thematic analysis to analyze data. We made sense of the data by continually theorizing and capturing key issues and ideas that emerged from interviews and observation field notes. We developed different codes that included all elementary sections of the raw data and categorized the different codes in emerging themes and subthemes. A thematic map was designed to analyze the relationships between these subthemes. We conducted cross-analysis of the data from multiple tools to ensure validity. Finally, we compiled all the data based on themes to compile a report according to the research questions and objectives.

Ethics considerations

Before conducting interviews and observations, we explained to the participants about the study objectives and detailed procedures of collecting data. We obtained oral and written consent for interviews, observations and photos and maintained the confidentiality of all respondent's data and their identity. This study was approved by the Mahidol University Ethics Review Committee [MUSSIRB No: 2019/157 (B2) and Certificate of Approval No: 2019/ 131.0406].

RESULTS

Role of Poultry Farmers and Dealers/ Patron-Client Relationship

Poultry farmers are the last stackholder of antibiotic transaction for poultry production who buy production inputs from poultry dealers to raise poultry in each production cycle. In the small scale poultry farm, the farmer had three years of poultry farming experience and had no primary education. She raised 1000 broiler poultry in each production cycle and engaged with a dealer who provided day-old chicks, poultry feed and medicines, including antibiotics regularly with a credit facility. She was entirely dependent on a certain dealer to run the poultry farm from purchasing day-old chicks to selling mature poultry.

"I do not have the cash to buy chicks, feed and medicines. I do not have enough education so that it becomes difficult for me to raise poultry without supporting a dealer. I would have also faced difficulty with selling poultry without a dealer. He looks like a lord to control my farm." (small scale farmer, age 55).

In the large scale poultry farm, the farmer had a university degree and six years of poultry farming experience. He raised

10,500 poultry in three sheds in each production cycle. He reported that he purchased all production inputs with cash from any poultry dealers. He could decide by himself where to buy production inputs, who provided poultry treatment, and where to sell mature poultry. He explained,

"*I can decide by myself to buy everything related to poultry farming as I pay cash to the dealers. I also can decide on poultry treatment and selling ready poultry*" (large scale farmer, age 28).

Regarding purchasing poultry feed, the large scale farmer reported that he purchased poultry feed from some specific dealers in cash. On the other hand, the small scale farmer reported that she bought poultry feed at a different price than the actual price from the dealer under the credit system. She would be unable to buy feed from other dealers as she had an agreement with the dealer to buy all production inputs from him.

"*I have nothing to say regarding the feed brand and price he provides to me. He decides for my poultry farming. I need to run the farm according to his suggestion*" (small scale farmer, age 55).

Poultry dealers play a vital role in the poultry farming system and make a functional connection between the input producers and farmers. The input producers have developed a new system for the supply chain of poultry production inputs to the poultry farmers through poultry dealers.

"*The companies supply day-old chicks, poultry feed and medicines to the poultry dealers by cash or credit. They also provide poultry treatment to certain farms through dealers. The dealers sell these production inputs to farmers with cash or credit and support farmers to sell mature poultry in the market*" (general secretary of a poultry farmer association, age 50).

Poultry dealers mentioned that they have a good relationship with hatcheries, poultry feed companies and pharmaceutical companies. Based on experience, one dealer selected one feed company for the dealership who offered a convenient credit system and profit among the feed companies. The feed companies fix a sales target and commission yearly for the dealers. For example, when a dealer fulfils a target of 1000 ton feed, he gets 30 to 40 hundred-thousand-taka commission yearly. Besides yearly commission, the feed companies provide a 4% resale commission to the dealers. The companies offer an additional commission if the dealer buys feed directly by cash.

"*We invest much money in small scale farmers using a credit system where most of the investments go to poultry feed. We receive highest credit from feed companies for purchasing poultry feed. The feed company's commission system is also convenient for us to gain profit by selling feed to the farmers*" (poultry dealer, age 50).

Poultry dealers reported that pharmaceutical companies offer lucrative credit and commission to the dealers to sell medicines to the farmers. They offer three types of selling systems to the dealers, including cash, short term and long term credit. Pharmaceutical companies do not set sales targets for their dealers. Pharmaceutical companies sell medicine to the dealers, mostly antibiotics.

"*We do not have a specific sales target for selling medicines to farmers. We purchase medicines from pharmaceutical companies and sell them to the farmers. Most medicines comprise antibiotics because antibiotics are popular among farmers, dealers and veterinarians to effectively treat poultry* " (poultry dealer, age 45).

Role of Pharmaceutical and Feed Company Sales Representatives

The pharmaceutical and feed companies have a massive influence on commercial poultry farming in this area. The role of sales representatives of

pharmaceutical and feed companies is vital to supply and promote poultry feed and medicines, including antibiotics to the poultry farms through poultry dealers. They reported that they execute several activities to fulfil their sales targets. They regularly visit dealer shops to increase the sale of production inputs and take updates for the quality of production inputs. The companies set a sales target of production inputs for them where companies provide incentives when successful or penalties when unsuccessful regarding fulfilling the target.

"*I make a weekly and monthly plan with the Area Manager about visiting dealer shops in different locations. My company fixes a target for every sales representative to sell feed to the dealers. For example, one sales representative has a sales target of 460-ton feed monthly. If he fulfils the target, he gets 200-taka commission per ton feed; otherwise, he will receive 100-taka penalty per one-ton feed if not successful*" (feed company sales representative, age 35).

"*My company sets a sales target of medicines every month, every three months and every six months. The winter season is the peak season to fulfil the highest sales target within a year by the sales representatives because the prevalence of poultry diseases is higher in winter than other seasons. We receive incentives from companies when we fulfil our sales targets; otherwise, we do not receive incentives nor our yearly increased salary*" (pharmaceutical sales representative, age 38).

The subdistrict government livestock officer is responsible for overall supervison and monitoring of livestock production in the study area. He reported that feed companies include antibiotics with other ingredients in the feed although the laws of Bangladesh forbid antibiotic use in animal feed. The sales representatives of feed companies sell these antibiotic contained feed to the poultry farmers through poultry dealers.

"*Feed companies include antibiotics with other ingredients in the feed. However, I do not know the name of the antibiotics used in feed. The feed companies do not write the antibiotics name in the ingredient list of the feed bags. This becomes a hidden issue for each company which they do not want to disclose because Bangladeshi laws forbid antibiotic use in poultry feed*" (government livestock officer, age 48).

The sales representatives of pharmaceutical and feed companies reported that they maintain a good relationship with the company and government veterinarians to promote their products by sharing their product information and providing incentives. They also visit poultry farms regularly to collect information about poultry, medicines and poultry feed. Sometimes they suggest medicines including antibiotics to farmers to treat poultry. Moreover, they organize seminars for dealers and farmers to provide information about farm management and the use of poultry feed and medicines including antibiotics.

Role of Veterinarians

The veterinarians of feed and pharmaceutical companies provide technical support free of cost to the small scale farmers for poultry treatment and farm management. They reported that they have a regular schedule to visit dealer shops and farms in different locations. Dealers provide a list of farms where they need to visit to treat poultry.

"I visit different dealer shops that have a business with my company to take information about their fellow farms. Dealers request me to visit certain farms to

provide poultry treatment. Sometimes, I need to visit some farms in case of emergency poultry treatment upon the dealer's request, which are unscheduled" (company veterinarian, age 33).

The general secretary of district poultry farmer association is responsible for negotiating poultry farmer's problem with the government and input producers. While asking about antibiotic transaction for poultry production he reported that the company veterinarians prescribe excessive medicines, including antibiotics to treat poultry because they receive more incentives from pharmaceutical companies. The veterinarians from pharmaceutical companies prescribed their own company's antibiotics to treat poultry. On the other hand, the hatchery and feed company's veterinarians prescribed antibiotics for poultry treatment influenced by the pharmaceutical sales representatives.

"*I have also run my poultry farm for many years. The company veterinarians prescribe excessive medicines for poultry treatment because they receive a commission from certain pharmaceutical companies. For this, farming cost increases for farmers*" (general secretary of district poultry farmer association, age 50).

The dealers reported that their fellow farmers need to buy medicines, including antibiotics from them prescribed by company veterinarians. This strategy helps them to obtain more commission from pharmaceutical companies by selling medicines. For this, they provide a monthly honorarium to the company veterinarians to encourage them to provide the right poultry treatment by prescribing medicines including antibiotics.

"I pay a monthly honorarium to certain company veterinarians based on their expertise in poultry treatment when visiting my fellow farms. The honorarium may encourage them to provide efficient poultry treatment by prescribing medicines. The farmers need to buy these medicines from us, which help us to receive a commission from pharmaceutical companies" (dealer, age 45).

Only two government veterinarians are employed in the subdistrict level who provide livestock treatment free of cost in the study area. They reported that they are unable to provide veterinary treatment to all poultry farms due to a lack of assets, including human resources, medicines and laboratory facilities. They also provide poultry treatment with honorium in private chambers after office hours. When they prescribe medicines including antibiotics for poultry treatment, those medicines become popular among dealers and farmers.

Decision Making Processes of Antibiotic Application for Broiler Production

Dealers provide instructions on applying medicines, including antibiotics for common poultry diseases to small scale farmers based on combined knowledge including their experiences, veterinary prescriptions and pharmaceutical promotions. Small scale farmer reported that the dealer requests company veterinarians to treat severe poultry diseases when he fails to treat them. On the other hand, large scale farmer reported that he treats common poultry diseases with antibiotics, which he learned from government veterinarians and pharmaceutical sales representatives. The government veterinarians treated severe poultry diseases with antibiotics when he were unable to treat them.

Both small and large scale farmers reported that they believed antibiotics are strong medicine for treating poultry diseases and promoting poultry growth throughout the poultry production cycle. They applied antibiotics in poultry as medicine and feed additives from the beginning of the brooding period until selling the mature poultry.

"*I use antibiotics and antibiotic medicated feed from day 1 to the last day of rearing poultry to treat poultry diseases and as growth promotion. I believe that antibiotics are strong medicine to fight against diseases and to increase poultry meat*" (small-scale farmer, age 55).

"*There is no alternative to use antibiotics and antibiotic medicated feed regularly during rearing poultry for treating poultry diseases and growth promotion*" (large-scale farmer, age 28).

Both farmers reported that they applied more antibiotics for treating poultry diseases in winter more than in other seasons as poultry diseases were more prevalent in winter. They applied antibiotics to the whole poultry flock to prevent and treat poultry diseases due to fear of transmitting infection to healthy poultry from sick poultry.

"*I apply antibiotics for the whole batch of the poultry, even if only some poultry get sick. I do it for both preventive and treatment measures of poultry diseases. I always fear the outbreak of poultry diseases that causes a lot of poultry death. Previously, I got huge financial loss due to massive poultry death*" (small-scale farmer, age 55).

"*I only understand which poultry get sick by observing signs and symptoms. I believe that there is some sick poultry that do not show any signs and symptoms. It also prevents the transmission of diseases from sick poultry to healthy poultry. In this situation, I provide antibiotics to all poultry*" (large-scale farmer, age 28).

Stakeholders Role and Dependencies

The critical roles and dependencies of stakeholders for poultry farming and antibiotic transaction, that constitute important factors for antibiotic use for poultry production, are shown in the conceptual framework (Figure 1). The pharmaceutical and feed companies promote their production inputs including antibiotics and antibiotic medicated feed to farmers, dealers and veterinarians through their sales representatives and veterinarians. The sales representatives of pharmaceutical and feed companies provide incentives to the government and company veterinarians to promote their production inputs. Dealers invest money and time in small-scale farms to earn profit from pharmaceutical and feed companies. Dealers also provide information and treatment facilities to small-scale farmers. The company veterinarians visited small scale farms through dealers for poultry treatment and prescribed excessive antibiotics when dealers were unable to treat poultry diseases. However, large scale farmers buy production inputs from dealers in cash. The government veterinarians prescribe antibiotics to treat severe poultry diseases in large scale poultry farms. Both small and large scale poultry farmers believe in antibiotics to treat poultry diseases and promote poultry growth. Overall, political and economic factors influence stakeholder's roles and dependencies for poultry farming creating the need of antibiotic use for poultry production.

DISCUSSION

Pharmaceutical and feed companies invest a significant amount of money to produce antibiotics and antibiotic medicated feed and promote those production inputs through various marketing channels. They assign sales representatives and veterinarians to maintain marketing channels to achieve sales targets. The dealers are the central characters of the transaction of production

inputs for poultry farming. They maintain the functional linkage between companies and poultry farmers during the transaction of production inputs. They purchase antibiotics and antibiotic medicated feed with cash or credit from companies and sell those production inputs to the farmers to increase their profit by fulfilling their sales targets set by the companies. The farmers use antibiotics, and antibiotic medicated feed to treat poultry and increase poultry growth to secure their investment and maximize profits. The dealers continue the poultry production cycle by distributing production inputs to farmers and supporting them for mature poultry selling [15, 16].

This study examined the poultry farming practices of large and small scale poultry farms where antibiotic use is an essential issue for broiler poultry farming. The farmers provide a wide range of antibiotics, and antibiotic medicated feed to the poultry from the first day of each production cycle until selling mature poultry to avoid the severe consequences of poultry diseases and to increase poultry growth. The farmers consider antibiotics are an essential and robust medicine that can fight against poultry diseases and increase poultry growth rapidly to secure investment and increase profits [15, 17]. They also used the banned antibiotic 'colistin' to treat poultry diseases. In China, poultry farmers use some banned antibiotics for poultry production [18]. The commercial feed producers mix antibiotics in poultry feed that increase poultry growth quickly. A similar finding was revealed in Cambodia and China [17, 19, 20]. Our study revealed that farmers applied antibiotics to treat poultry diseases without veterinary prescriptions most of the time [12]. They applied antibiotics to the poultry without considering laboratory tests, completing the antibiotic course or withdrawal period; instead they relied on their own experiences or advice from dealers [21]. Small scale farms use more antibiotics than large scale farms. Low doses of continued antibiotics used in livestock production create emerging resistant bacteria in animals [22]. The drug-resistant bacteria in poultry meat can quickly transfer to humans, which poses a risk for human health [23].

With phenomenal use of antibiotics in broiler production with Critical Medical Anthropology (CMA), the study revealed various political and economic forces and power relations that influences stakeholders' activities with the transaction of antibiotics to the poultry farms [24]. Company sales representatives and veterinarians motivate dealers with a commission to sell their production inputs to farmers. Veterinarians still have significant legal status to support pharmaceutical companies and farmers concerning medicalized entities. However, their role has become more inferior in the expansion of pharmaceutical marketing and promotional activities [25]. Under the credit-based farming system, small scale farmers are committed to buy chicks, feed and antibiotics from dealers and to sell mature poultry through dealers. Small scale farmers do not have a choice of purchasing production inputs, receiving poultry treatment and selling mature poultry; instead, they need to follow the dealer's instructions. The dealers control the information flow of poultry farming including poultry treatment between companies and farmers. Our findings revealed that laypeople are a vital source of providing advice and knowledge for treating animals which has also been documented in several studies in low middle income countries [26]. Poor farmers have limited capital, limited or no access to the institutional credit systems and poultry marketing channels and insufficient information flow of poultry farming. By encouraging the use of antibiotics and antibiotic medicated feed to farmers, the dealer obtains more income through sales commissions from the companies. Dealers

do not take responsibility when farmers experience economic loss due to poultry death; instead, they demand to pay the credit. Thus, they are economically tied to dealers and become trapped in the poultry farming system [15].

Our study revealed that pharmaceutical and feed sales representatives provide gifts to poultry dealers, farmers and veterinarians, and sell medicines including antibiotics by the dealers without having a "Grade C pharmacist" certificate, which is inconsistent with drug regulations [27]. Fish Feed and Animal Feed Act-2010 emphasizes the ban of production, import, export, marketing, sale, distribution and use of antibiotics in animal feed. Still, our study revealed that farmers frequently use antibiotic medicated poultry feed as growth promotion. The activities of input-producers and dealers regarding the promotion and selling of antibiotics and antibiotic medicated feed remains unmonitored and policies are not enforced by the government authorities because of lacking capacity and corruption at the grassroots level [14].

RECOMMENDATIONS

This study identified different stakholders roles and dependencies for poultry farming and antibiotic transaction which are influenced by political and economic factors and power dynamics that contributes excessive antibiotic use for broiler poultry production. Behavioral change education should be provided to farmers to maintain appropriate farm management to reduce the prevalence of poultry disease and unnecessary antibiotic use to treat poultry diseases. Modification of the existing poultry farming system is necessary to prevent unethical practices in the poultry farming system and antibiotic transaction inconsistent with the laws and policy of Bangladesh. The government should be implement policy regarding antibiotic distributing, prescribing and using for poultry production. Local government veterinary offices should strengthen monitoring activities of each stakeholder and provide the necessary support for rational antibiotic use in poultry production.

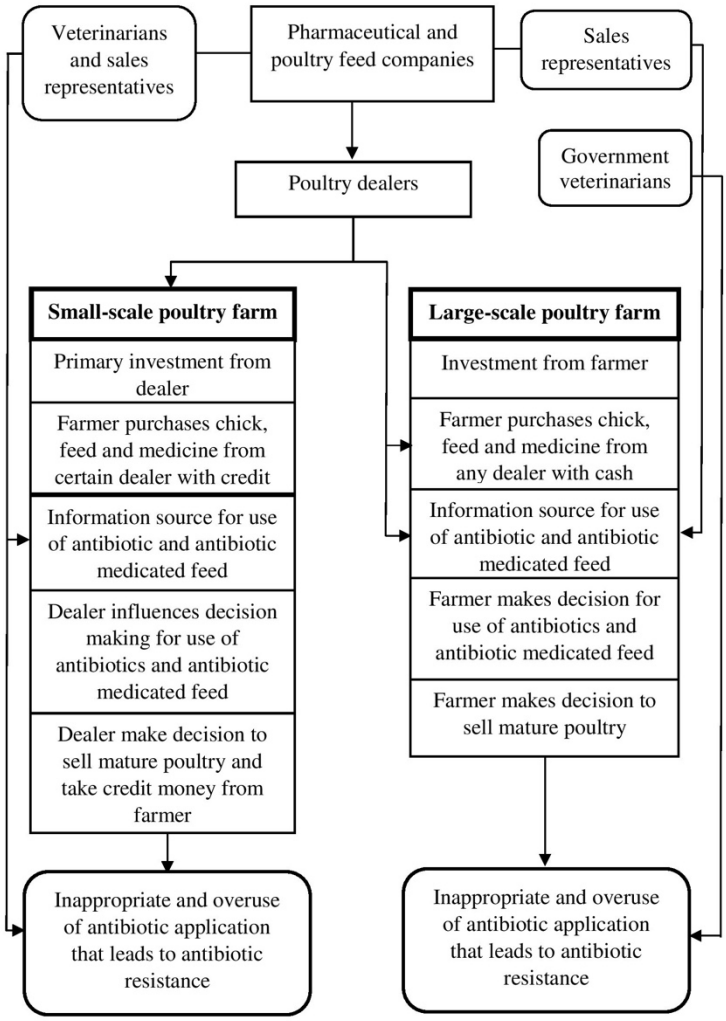

Figure 1 Stakeholders roles and dependencies influencing antibiotic use in small and large scale broiler poultry farms in Narsingdi District, Bangladesh

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