Public Attitudes Towards the Use of Vaccination and Antibiotics in Animals in Canada

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Abstract:

Public concerns and attitudes might influence their acceptance of technologies and consumption of food products. In this study, public attitudes about the use of vaccines and antibiotics in animals are compared. Data are from three national online surveys that were conducted in Canada in October 2012, November 2015 and January 2017. Data are analysed using Tobit regressions and net agreement percentages. Overall, respondents have more positive attitudes towards the use of vaccines in animals as compared to antibiotics. Trust in groups or institutions responsible for food and attitudes towards animal husbandry systems significantly influence public attitudes towards the use of vaccines and antibiotics in animals. Therefore, maintaining or building public trust in groups or institutions responsible for food through competence and transparency, for example is important for acceptance of the use of vaccines and antibiotics in animals.

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Key words: attitudes, antibiotics, vaccines, animals, trust, animal husbandry systems

Introduction

Antibiotic resistance is one of the largest threats to public health, food security and development globally (World Health Organization (WHO), 2017). According to the WHO (2017), with respect to agriculture, antibiotic resistance could be reduced by administering antibiotics under the supervision of a veterinary specialist, non-use of antibiotics for growth promotion and disease prevention, vaccination of animals or use of other alternatives, promotion and application of good practices at all steps of food production and improvement in biosecurity on farms.

Public concerns and attitudes might influence their acceptance of technologies such as the use of antibiotics and vaccination in livestock production and consumption of food products from these technologies. Zingg and Siegrist (2012) found that attitudes towards vaccination significantly influenced an individual's willingness to consume meat from animals that are vaccinated for an infectious disease that can be transmitted to people (zoonosis) in Switzerland. In addition, people were more concerned about the use of antibiotics in food animals as compared to vaccination (Zingg and Siegrist, 2012).

Following Zingg and Siegrist (2012), in this study the factors that influence public's attitudes towards the use of antibiotics and vaccinations in animals are also determined. Data are from three online surveys that were conducted in Canada in 2012, 2015 and 2017. Understanding consumer attitudes regarding the use of antibiotics and vaccination in food animals and the factors that drive them is important for policy regulation and communication of information to the public.

Conceptual framework

In this study, the factors that influence public attitudes towards antibiotics and vaccines in animals are assessed. Variables included as possible drivers of consumers' attitudes towards the use of vaccination and antibiotics include demographic variables, animal attitudes (Herzog et al., 1991; Herzog et al., 2015), attitudes about animal husbandry systems (Frewer et al., 2005), willingness to eat meat from pigs given vaccinations and antibiotics, generalized trust in people (Glaeser et al., 2000), trust in groups or institutions responsible for food (Roosen et al., 2015).

It is hypothesized that people who are more concerned about the use of animals are less likely to have positive attitudes towards the use of antibiotics and vaccines in animals. Those people who have positive attitudes towards current animal husbandry systems are more likely to have positive attitudes towards the use of antibiotics and vaccines in animals.

It is hypothesized that people who generally trust others and those people who trust farmers, food processors or manufacturers, research or university institutions, pharmaceutical industry which provides drugs to treat animals, government agencies or public authorities and retailers are more likely to have positive attitudes towards the use of antibiotics and vaccines in animals. People who trust advocacy consumer organizations, advocacy environmental organizations and advocacy organizations for animal welfare are less likely to have positive attitudes towards the use of antibiotics and vaccines in animals.

Empirical Methods

The factors that influence public attitudes towards use of antibiotics and vaccination of animals are determined using Tobit regression analyses. The dependent variable is attitudes towards the use of vaccinations and antibiotics in animal and it is assessed by asking respondents about their

level of agreement (1. strongly disagree … 5. strongly agree) with seven statements adopted from Zingg and Siegrist, (2012) (see Table 1). The dependent variable is the average of the responses to the seven statements. Net agreement percentages (Roselius, 1971)[1] are used to compare public attitudes towards the use of antibiotics and vaccines in animals. The questions used to measure respondents' animal attitudes, attitudes towards animal husbandry systems and their generalized trust in people and trust in groups or institutions responsible for food questions are also summarized in Table 1.

Table 1 approximately here

Data

Data are from three national online surveys that were conducted in Canada through market research companies in October 2012, November 2015 and January 2017. The surveys were targeted at major household food shoppers aged at least 18. The sample sizes are 1808 in October 2012, 992 in November 2015 and 1804 in January 2017.

The summary statistics for the variables used in the regression analysis are summarized in Table 2. In summary, there were 34.9%, 49.6% and 47.7% male respondents in 2012, 2015 and 2017 respectively. On average the samples are composed of older respondents and most of the respondents have higher levels of education, than comparable census data. Fewer households have children aged below 18 (26% in 2012, 19% in 2015 and 18% in 2017), than is suggested by census data.

About 45% of the respondents in 2012 and 2015 and 47% in 2017 generally trust people. Compared to other groups that are responsible for food, farmers were more trusted across the

[1] Net agreement percentage = (Number of strongly agree/agree-Number of strongly disagree/disagree)/sample*100

years followed by research organizations/universities. Respondents had the least trust in pharmaceutical industry which provides drugs to treat animals.

Results on net agreement percentages show that respondents generally have more positive attitudes towards vaccinations as compared to antibiotics (Figure 1) which is consistent to findings from Zingg and Siegrist (2012). Most people agree or strongly agree that there is a good reason why certain animal vaccinations are recommended (68% in 2012 and 65% in 2015) and that requirements for farmers to vaccinate should be in place for serious animal diseases (63% in 2012 and 64% in 2015). For antibiotics, most people (54%) agree or strongly agree that requirements for farmers to use antibiotics should be in place for serious animal diseases and 51% state that antibiotics are not redundant.

In Figure 2 the distribution of the average scores for attitudes towards antibiotics and vaccines are illustrated. Majority of the respondents (95% in 2012 and 2015 and 86% in 2017) consume meat. Only 43% of respondents in 2012 and 2015 and 47% in 2017 are willing to consume meat from pigs given vaccines or antibiotics (Figure 3).

Table 2 approximately here

Figures 1, 2 and 3 approximately here

Results

Overall, respondents have more positive attitudes towards vaccinations as compared to antibiotics. In summary, people who trust farmers, universities or research organizations and the pharmaceutical industry which provides drugs to treat animals have positive attitudes regarding the use of both vaccines and antibiotics in animals while the opposite is true for trust in environmental advocacy groups. People who trust government agencies or public authorities have positive attitudes towards vaccination of animals while people who trust manufacturers have

positive attitudes towards the use of antibiotics. People who trust advocacy groups for animal welfare have positive attitudes towards animal vaccination. People who generally trust others are less likely to have positive attitudes as compared to people who state otherwise.

Attitudes towards animal husbandry practices positively influence attitudes regarding the use of both vaccines and antibiotics in animals. People who are willing to eat meat from pigs vaccinated or given antibiotics against pig diseases or that are given antibiotics have positive attitudes regarding the technologies. Demographic variables also matter in terms of influencing attitudes towards the use of antibiotics and vaccines in animals.

Conclusions and Implications

In this study, the factors that influence public attitudes towards the use of antibiotics and vaccines in animals are determined. Data are from three online surveys that were conducted in Canada in 2012, 2015 and 2017. Tobit regression models and net agreement percentages are used in the analysis.

In results show that trust in groups or institutions that are responsible for food and attitudes towards current animal husbandry systems significantly influence public attitudes towards the use of antibiotics and vaccine in animals. Therefore, maintaining or building public trust in individuals or institutions responsible for food through competence and transparency, for example, is important for the acceptance of the use of vaccinations and antibiotics in animals. Farmers need to maintain trust by the public because it increases acceptance of technologies such as the use of vaccines and antibiotics.

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Table 1 Questions used to measure variables used in the analysis

Variable	Variable description	Reference
Attitude towards the use of vaccines and antibiotics in animals	Please identify whether you agree or disagree with the following statements. (i) Animal vaccinations (antibiotic use) cannot be seriously harmful; otherwise, authorities would ban them (ii) There is a good reason why certain animal vaccinations (antibiotics) are recommended (iii) Overall, animal vaccinations (antibiotic use) deliver more benefits than harm (iv) *We live in such a hygienic environment that animal vaccinations (antibiotics) are redundant (v) For serious animal diseases, requirements for farmers to vaccinate (use antibiotics) should be in place (vi) Vaccination (use of antibiotics) is a better strategy than destroying the affected animals (vii) *Animal vaccinations (antibiotics) are another important factor that is threatening the environment. Responses are as follows 1. strongly disagree … 5. strongly agree. The dependent variable is the average score for the seven statements.	Zingg and Siegrist (2012)
Willing to eat meat from pigs given vaccinations in pigs (or antibiotics in 2017)	Would you eat pork, ham or bacon from pigs vaccinated against a pig disease that is not dangerous for people (e.g., foot and mouth disease) but can be very serious for pigs? 0. no or don't know 1. yes	Zingg and Siegrist (2012)
Animal Attitude Scale	Please identify whether you agree or disagree with the following statements: (i) It is morally wrong to hunt animals for sport (ii) Wild animals, such as mink and raccoon, should not be trapped so that their skins can be made into fur coats (iii) *There is nothing morally wrong with hunting wild animals for food (iv) *I think people who object to raising animals for meat are too sentimental (v) *I think it is perfectly acceptable for cattle and hogs to be raised for human consumption (vi) *Basically, humans have the right to use animals as we see fit(vii) The slaughter of whales and dolphins should be immediately stopped even if it means some people will be put out of work (viii)I sometimes get upset when I see wild animals in cages at zoos (ix) *Too much fuss is made over the welfare of animals these days when there are many human problems that need to be solved (x) *Continued research with animals is necessary if we are ever to be able to conquer diseases such as cancer, heart disease and AIDS (xi)It is unethical to breed purebred dogs for pets when millions of dogs are killed in animal shelters each year (xii)*The production of inexpensive meat, eggs and dairy products justifies maintaining animals under crowded conditions Responses are anchored as follows: 1. strongly disagree … 5. strongly agree. All the twelve statements were asked in 2012 and 2015while only questions i, iii, v, vii and viii were asked in the survey in 2017 following Herzog et al. (2015). The variable for the animal attitude scale is created by summing up responses to the statements.	Herzog et al. (1991) and Herzog et al. (2015)
Animal husbandry scale	1. How important or unimportant are the following to the welfare of pigs that are reared for food production? 0. don't know. 1 not important at all … extremely important. 2. How satisfactory or unsatisfactory are the current conditions under	Frewer et al. (2005)

	which pigs are being raised in Canada? 0. don't know 1. extremely unsatisfactory 5. highly satisfactory The issues are (i) Healthy living conditions (ii) Skilled attention (iii) Clean environment (iv) Environment free from disease (v) Medical treatment when the pig is sick (vi) Comfortable living conditions (vii) Nutrition to strengthen the pig's immune system (viii) Adaptation of the housing system to the needs of the pig (ix) Food to satisfy the pig and to optimize its growth and health (x) Space to allow the pig to be on its own (xi) Variation or diversity in the living environment (xii) Prevention of stressful situations (xiii) Providing an environment that allows the animals to experience little or no fear. An aggregate animal husbandry score is created by summing the product of individuals' beliefs (question 1) and satisfaction scores (question 2).	
Generalized trust in people	Generally speaking, would you say that most people can be trusted? 1. (most) people can be trusted 0. can't be too careful in dealing with people or don't know.	Glaeser et al. (2000)
Trust in institutions responsible for food	How much trust do you have in the following groups or institutions regarding their responsibility for food production in Canada? Responses are anchored as follows: 1. no trust … 5. absolute trust The groups or institutions are farmers, food processors or manufacturers, research organizations or universities, pharmaceutical industry which provides drugs to treat animals, government agencies or public authorities, retailers, advocacy consumer organizations, advocacy environmental organizations and advocacy organizations for animal welfare	Roosen et al. (2015)

* implies that the statements are reverse coded for the analysis

Table 2 Summary statistics for variables

	2012	2015	2017
Attitudes towards the use of vaccines and antibiotics in animals (average of responses to 7 statements; 1. strongly disagree … 5. strongly agree)	3.47 (0.65)	3.43 (0.61)	3.13 (0.49)
Male	34.9%	49.6%	47.7%
Age	49.1 (12.9)	50.9 (12.6)	45.2 (15.5)
Child	26.1%	18.9%	17.8%
Education	14.0 (1.94)	14.1 (1.91)	15.1 (1.98)
Total household income ($10,000.00)	5.89 (2.93)	5.77 (2.88)	7.57 (3.28)
Live in a city	60.2%	62.8%	70.6%
Completed survey in French	21.6%	30.0%	18.0%
Animal attitude scale[2]	38.4 (6.68)	39.5 (7.44)	15.7 (3.35)
Animal husbandry scale	8.44 (7.33)	9.22 (6.68)	7.61 (6.74)
Willing to eat meat from pigs given vaccines (or antibiotics in 2017)	42.6%	42.7%	40.3%
Generalized trust in people	44.7%	45.4%	46.7%
Trust in groups or institutions			
Farmers	3.67 (0.89)	3.62 (0.92)	3.37 (0.93)
Food processors or manufacturers	2.79 (0.94)	2.76 (1.02)	2.60 (0.95)
Research organizations/universities	3.19 (0.94)	3.38 (0.95)	3.33 (0.93)
Pharmaceutical industry which provides drugs to treat animals	2.48 (1.08)	2.47 (1.08)	2.35 (0.99)
Government agencies/public authorities	2.68 (1.04)	2.94 (1.03)	2.91 (1.01)
Advocacy consumer organizations	3.03 (0.99)	3.14 (1.00)	2.97 (0.92)
Advocacy environmental organizations	3.00 (1.02)	3.03 (1.02)	2.88 (0.96)
Advocacy organizations for animal welfare	2.98 (1.07)	3.06 (1.07)	2.78 (1.00)
Retailers	-	2.91 (0.97)	2.76 (0.95)
Eat meat	94.7%	95.0%	85.9%
Sample size	1808	992	1724

Standard deviations are in parentheses

[2] There are 5 statements in 2012 and 2015 and 5 statements in 2017

Table 3 Factors influencing public attitudes towards vaccination and antibiotics

	2012	2015	2017
Technology	Vaccination	Vaccination	Antibiotics
Constant	2.37***	2.35***	2.71***
	(12.4)	(9.82)	(21.6)
Male	-0.02	-0.05	-0.07***
	(-0.64)	(-1.29)	(3.10)
Age	0.01***	0.005***	0.001*
	(4.59)	(3.11)	(1.77)
Child	-0.04	0.00004	-0.03
	(-1.17)	(0.20)	(-0.98)
Education	0.004	0.01	-0.004
	(0.51)	(0.90)	(-0.60)
Household income	0.01	-0.005	0.001
	(1.02)	(-0.68)	(0.19)
Live in a city	0.03	0.07*	-0.03
	(1.01)	(1.87)	(-1.25)
Completed survey in French	-0.07**	-0.10***	-0.03
	(-1.96)	(-2.44)	(-1.04)
Animal attitude scale	-0.001	0.003	-0.005
	(-0.35))	(0.90)	(-1.28)
Animal husbandry scale	0.002	0.01**	0.01***
	(0.86)	(2.00)	(3.28)
Willing to eat meat from pigs given vaccines (or antibiotics in 2017)	0.43***	0.35***	0.34***
	(14.6)	(9.28)	(14.7)
Generalized trust in people	-0.06*	-0.01	-0.02
	(-1.92)	(-0.14)	(-1.01)
Trust in groups or institutions			
Farmers	0.05***	0.06***	0.06***
	(3.03)	(2.74)	(4.24)
Food processors or manufacturers	0.03	-0.01	0.06***
	(1.24)	(-0.47)	(3.40)
Research organizations/universities	0.06***	0.07***	0.04***
	(3.01)	(2.90)	(3.04)
Pharmaceutical industry which provides drugs to treat animals	0.01	0.05**	0.06***
	(0.67)	(2.15)	(4.68)
Government agencies/public authorities	0.08***	0.07***	0.01
	(4.37)	(3.01)	(0.93)
Advocacy consumer organizations	-0.02	-0.07**	-0.02
	(-0.81)	(-2.42)	(-1.38)
Advocacy environmental organizations	-0.05*	-0.05*	-0.04**
	(-1.65)	(-1.86)	(-2.29)
Advocacy organizations for animal welfare	0.05**	0.02	-0.01
	(2.05)	(0.86)	(-1.07)
Retailers		-0.02	-0.03**
	-	(-0.89)	(-2.09)
Eat meat	-0.01	0.06	0.01
	(-0.15)	(0.67)	(0.29)

	0.57***	0.55***	0.43***
σ	(60.1)	(44.5)	(58.7)
Log likelihood	-1562.7	-810.5	-978.9
Sample size	1808	992	1724

-Implies that the variable is not available in the survey; z values are in parentheses; ***, ** and * significant at 1%, 5% and 10% levels respectively

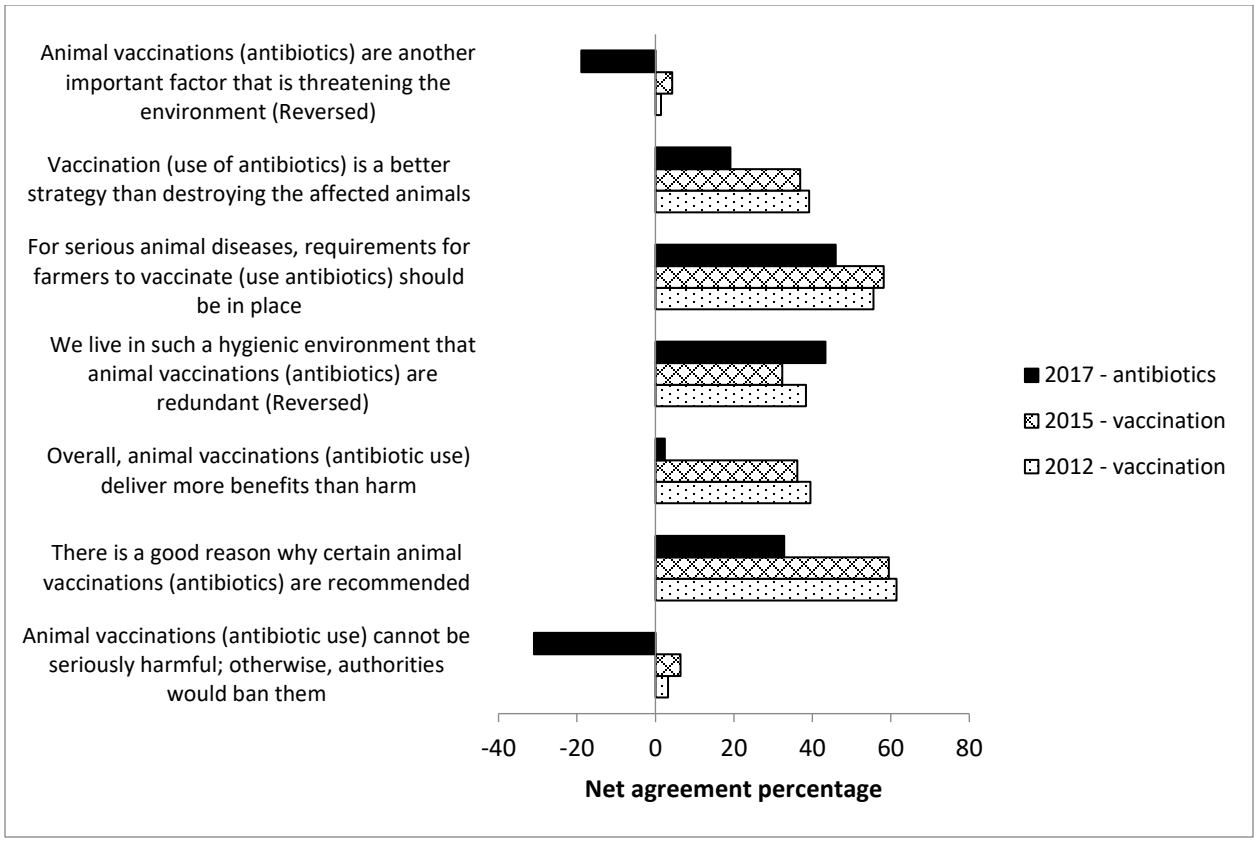

Figure 1 Net agreement percentages for public attitudes towards antibiotics and vaccination in animals

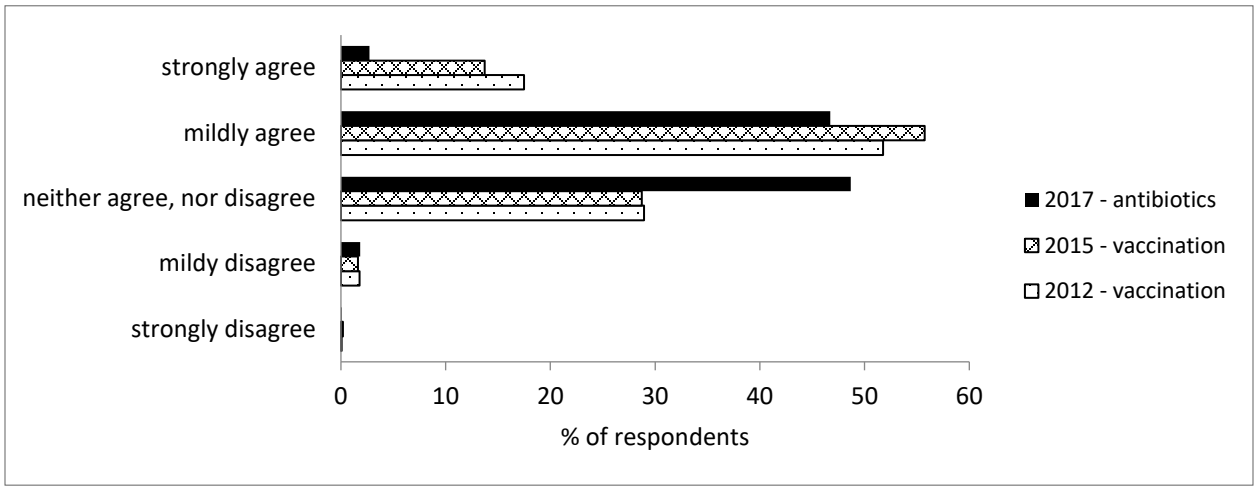

Figure 2 Distribution of the dependent variable (average scores to statements in Figure 1)

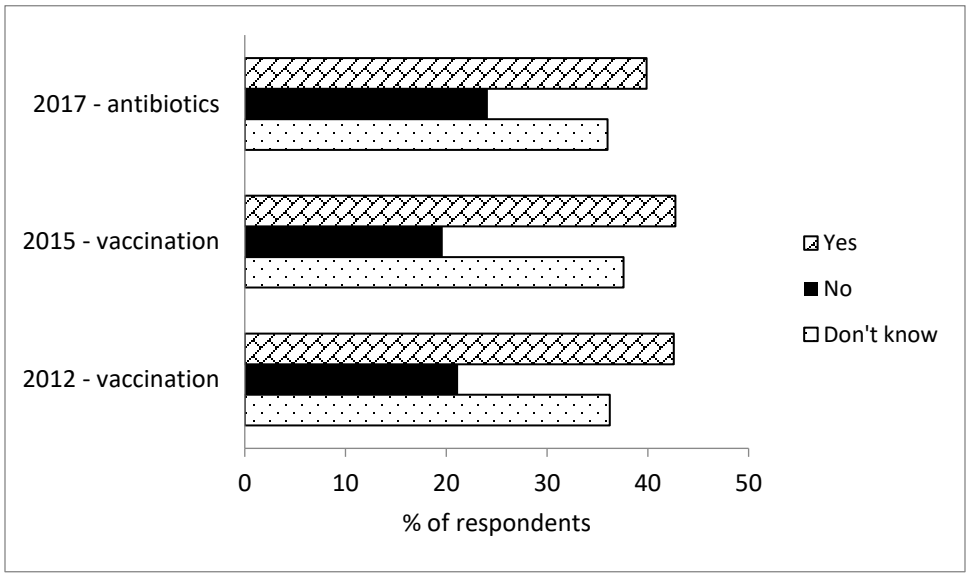

Figure 3 Would you eat pork, ham or bacon from pigs vaccinated against a pig disease that is not dangerous for people (e.g., foot and mouth disease) but can be very serious for pigs?