SSM - Population Health 9 (2019) 100499

Contents lists available at ScienceDirect

SSM - Population Health

journal homepage: http://www.elsevier.com/locate/ssmph

Article

Who is willing to stay sick for the collective? – Individual characteristics, experience, and trust

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Introduction

Many global challenges, such as climate change, resource depletion, and the spread of communicable diseases, are so-called collective action dilemmas. These are problems that can only be solved by large groups of people contributing to a common good and/or abstaining from harmful behavior. Collective action problems are often defined as situations where the gain for the collective is largest when everyone cooperates, while the gain for each individual actor is largest if he or she abstains from cooperating, disregarding all other actors' behavior (Dawes, 1980). Nevertheless, it is well known that voluntary cooperation does frequently occur, especially in small- and medium-scale settings such as in the area of local resource extraction; scholars like Elinor Ostrom (Ostrom, 1990, 2005, 2011) and Arun Agrawal (Agrawal, 2001; Agrawal & Gibson, 1999; Agrawal & Goyal, 2001) have shown that such cooperation occurs and have explained why. Thus, the literature has identified a number of key factors that tend to increase the probability of cooperation, including smaller group size, the delimitation of the resource, low degree of anonymity, high degree of public disclosure, possibilities for communication among actors, repeated interactions, possibilities for punishing unwanted behavior, and – in particular – trust (Dietz, Dolšak, Ostrom, & Stern, 2002). Factors that have been found to decrease cooperation include the availability of a resource being perceived to be critically low and uncertainty about the state of a resource (Hine and Gifford 1996; Parks, Xu, & Van Lange, 2017).

Antibiotic resistance is a collective action dilemma. It is well known that use of antibiotics leads to the development of antibiotic resistance (Bronzwaer et al., 2002; Goossens, Ferech, Vander Stichele, & Elseviers, 2005). The more consumption there is, the less healing capacity remains. Antibiotic resistance is already causing hundreds of thousands of deaths annually and is predicted to increase radically in the future if it is not effectively counteracted (O'Neill, 2014). At the same time, even for milder medical problems, people value their own time and are therefore eager to take medications that give them faster symptom relief and enable them to return to their normal activities as soon as possible (Wilson et al., 2004). The collective action problem of antibiotic resistance is therefore best described as a situation where prescribers and patients alike have no or only few reasons to take the global levels of resistance into account when making their consumption decisions, since the individual contribution is always comparably small (Jørgensen et al., 2016; Laxminarayan & Heymann, 2012; Rönnerstrand & Andersson Sundell, 2015; Tarrant et al., 2019).

Similar to other large-scale problems, such as climate change and marine plastic pollution, reduction of the problem of antibiotic resistance will require large-scale cooperation in terms of both geographical scope and number of actors (Nannestad, 2008). Despite the large scale of the problems mentioned, and despite the limited impact one single individual can have on the outcome, we do know that some people voluntarily make certain sacrifices to contribute to reducing the negative impacts, i.e., they cooperate. Most scholarly attention in this context has been given to people's willingness to reduce their own contribution to global climate changes, and researchers have found that voluntary sacrifices are typically correlated with a number of individual characteristics. For example, individuals with higher education tend to be more concerned about climate change and younger people are usually more willing to change their behavior related to climate change, while for example right-wing voters are less willing to take such actions (Semenza, HallWilsonBontempo, Sailor, & George, 2008; Tobler, Visschers, & Siegrist, 2012). Although to a much lesser extent, there are also studies focusing on people's willingness to contribute to the

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https://doi.org/10.1016/j.ssmph.2019.100499
Received 12 June 2019; Received in revised form 18 September 2019; Accepted 9 October 2019
Available online 22 October 2019

reduction of antibiotic resistance. For example, a few studies have looked at the role of trust/reciprocity and people's general willingness to postpone or abstain from using antibiotics (Robertson, Jagers, & Rönnerstrand, 2018; Rönnerstrand & Andersson Sundell, 2015).

In most industrialized countries, antibiotic therapy requires a prescription from a medical doctor or a dentist. But for at least two reasons, we argue that the willingness of individuals to voluntary abstain from antibiotics is vital to limit overuse. Firstly, the informal influence of patients on prescribing decisions is well documented (Bradley, 1992a, 1992b; Mangione-Smith et al., 2004; McNulty, NicholsFrenchJoshi, & Butler, 2013). Patients' acceptability of restrictive prescribing of antibiotics is important because it makes it easier for physicians to follow treatment guidelines. Secondly, patients dissatisfied after being denied a prescription of antibiotics have several options on the table, including consulting another physician, using leftovers from previous prescription of antibiotics or buying antibiotics online without a prescription. Patients with a willingness to abstain from antibiotics voluntary are more unlikely to take such measures.

The focus of this study is the individual contribution to collective action to limit antibiotic use. Our particular interest is on antibiotics use in the primary care setting. We explore the links between on the one hand individual characteristics, past experiences of antibiotics use, knowledge about antibiotic resistance, and generalized and institutional trust and, on the other hand, (i) the *acceptability*[1] of a physician's decision not to prescribe antibiotics and (ii) the willingness to abstain from using antibiotics for the common good. In doing so, the paper connects to the broad literature on collective action and voluntary provision of public goods.

Antibiotics use and individual behavior

Levels of antibiotics use and/or antibiotic resistance is known to be linked to a number of institutional, socioeconomic, and cultural factors. Institutional factors include type of healthcare system (Cars, Mölstad, & Melander, 2001) and variables related to it, such as national recommendations, treatment traditions and pharmaceutical marketing (Bjerrum et al., 2004), and levels of corruption (Collignon et al. 2015, 2018; Rönnerstrand & Lapuente, 2017). Examples of socioeconomic factors include economic inequality (Kirby & Herbert, 2013), GDP per capita, and public spending on healthcare (Collignon et al., 2018). Uncertainty avoidance and masculinity norms have been identified as the most relevant cultural factors affecting antibiotics use in a country (Harbarth & Monnet, 2008; Touboul-Lundgren, Jensen, Drai, & Lindbæk, 2015; Borg, 2012, 2014).

There are also individual-level factors affecting personal consumption of antibiotics. In a study of the Swedish population, knowledge about antibiotic resistance has been linked to more appropriate use of antibiotics (Vallin et al., 2016). However, the results from prior studies are partly inconclusive. Another study found that better knowledge is linked to higher stated frequency of self-medication with left-over antibiotics (McNulty, Boyle, Nichols, Clappison, & Davey, 2007). The same two studies found a link between low education and lower commitment to prudent antibiotic use and higher consumption of antibiotics. A systematic review of gender differences in the prevalence of antibiotic treatment found women to be treated with antibiotics to a larger extent than men (Schröder et al., 2016).

[1] Drawing on Kyselá, Ščasný, and Zvěřinová (2019) we prefer to use the concept "acceptability" rather than "acceptance" of the simple reason that acceptance typically refers to a passive evaluative response to an existing policy, which, in our case, would be equivalent to an individual accepting a decision *already being made* by a doctor. Acceptability, on the other hand, refers to a passive evaluative response to a proposal, i.e., an individual's potential to accept a *hypothetical decision* made by a doctor. The latter is a more appropriate description of the situation being studied in this article.

Since overconsumption is a key reason for the accelerated growth of antibiotic resistance, there is an upsurge in regulations intended to reduce antibiotics use through antibiotic stewardship programs in inpatient and outpatient care (Barlam et al., 2016; Sanchez, 2016). A majority of countermeasures are directed to medical practitioners, for example through education and implementation of treatment guidelines to reduce their prescription of antibiotics (Mölstad, Lundborg, Karlsson, & Otto, 2002; Mueller & Östergren, 2016). But since patients are known to influence the decision-making by healthcare staff (Bradley, 1992a, 1992b; Mangione-Smith et al., 2004; McNulty et al., 2013), attention is now also being given to efforts to change the behavior and attitudes of the general public. Information campaigns focusing on prudent use of antibiotics is one example (Huttner, Goossens, Verheij, & Harbarth, 2010).

However, although an increase in the public's knowledge and awareness of antibiotic use and its link to resistance is likely to be necessary in order for behavioral and attitudinal change to occur, it can hardly get the job done alone. At least, this has been a theoretical point of departure in many models of collective action, ever since the seminal work by Hardin (Hardin, 1968). Furthermore, the fact that the use of antibiotics is correlated with individual-level characteristics, attitudes or knowledge, does not necessarily mean that such factors are also correlated with people's *willingness to abstain* from taking antibiotics. We therefore investigate whether factors such as individual characteristics, past experiences, knowledge and concerns about antibiotic resistance, and generalized and institutional trust are linked to people's willingness to abstain from taking antibiotics and to accept a doctor's decision not to prescribe.

In regard to larger-scale problems, research also points to the importance of trust. High levels of generalized and institutional trust are argued to promote stability and effectiveness of a number of societal processes, including support of and compliance with a range of policies (Braithwaite & Levi, 1998; Lubell & Scholz, 2001). Trust has also been found to matter for health systems, and trust-based health systems in its turn can build value to a society (Gilson, 2003). Although highly correlated, the mechanism at work when it comes to generalized and institutional trust differ. Generalized trust is argued to stimulate voluntary cooperation while institutional trust upholds confidence in information from authorities and acceptance of their decisions (Braithwaite & Levi, 1998; Putnam, 2000; Uslaner, 2002).

Although some prior studies discuss trust as potentially important for levels of antibiotic use (Deschepper et al., 2008; Nguyen, 2011; Touboul-Lundgren et al., 2015), rather few empirically test whether this is in fact the case. Touboul-Lundgren et al. measure trust in physicians as an integrated part of their measure of culture, and show that practitioners are worried about losing patients' trust if they do not prescribe antibiotics. This is important since patients' expectations have previously been found to affect antibiotic prescription behavior (Stivers, 2005). In a survey study on public knowledge and awareness related to antibiotics and antibiotic resistance in Sweden, André, Vernby, Berg, and Lundborg (2010) found that when given a choice between a doctor who prescribed antibiotics and one who did not, more respondents reported trusting the latter. Similarly, Vallin and co-authors (2016) found that while 89 percent of their respondents had confidence in doctors who did prescribe antibiotics also as many as 79 percent had confidence in physicians who decided not to prescribe antibiotics. There are a few studies looking at the influence of trust and people's general willingness to postpone or abstain from using antibiotics (Robertson et al., 2018; Rönnerstrand & Andersson Sundell, 2015). Rönnerstrand and Andersson Sundell found reciprocity and generalized trust to be positively correlated with individuals' willingness to postpone antibiotics treatment. Similarly, Robertson et al. showed that generalized trust is an important channel for explaining willingness to abstain from using antibiotics. In addition to generalized trust, we also investigate trust in healthcare as well as beliefs, i.e., expectations, about others' willingness to abstain from taking antibiotics. Moreover, and further discussed in the design

section, we frame the willingness not to take antibiotics question such that there is real trade-off for the respondents between not taking the antibiotics and getting well sooner by taking them.

Survey design and data

The survey was administered to respondents (18–75 years old) through the Citizen Panel, which is an online panel survey administered by the Laboratory of Opinion Research (LORE) at the Faculty of Social Science, University of Gothenburg, in Sweden. The questionnaire was created in collaboration with medical doctors from primary care and medical doctors engaged in STRAMA – the Swedish strategic programme against antibiotic resistance. Two general practitioners piloted the questionnaire. The survey was conducted from March 22 to April 16 in 2018 and resulted in a total of 1906 responses. On average, respondents spent 7.3 min to complete the survey and the participation rate was 55.4 percent. The panel consist of a pool of self-recruited respondents and no remuneration was offered to the participants. To better mirror the Swedish population, the sample was stratified by education, age, and gender.

The survey consisted of four parts. The first part contained questions about the respondent's contact with the healthcare sector and use of antibiotics. The second part contained knowledge-questions about antibiotics and antibiotic resistance. In the third part, respondents were asked about their levels of generalized trust and trust in various institutions, including healthcare sector. Finally, the last part contained questions about the respondent's demographics and socio-economic status.

Dependent variables

Two separate indicators of preparedness for collective action to limit antibiotic resistance were used: Acceptability of the physician's decision not to prescribe antibiotics and willingness to abstain from taking antibiotics. In order to measure the willingness to abstain from taking antibiotics in a situation where this would not cause any serious threats to the individual, we asked the following question:

> "For a number of bacterial infections, for example tonsillitis, we know that the use of antibiotics will quicken your recovery. If you do not take antibiotics, you will continue to be ill for several additional days. How willing or unwilling are you to abstain from using antibiotics when possible, even if it means that you will be sick for some extra days?"

Respondents were told to answer on a scale from 1 (very willing) to 5 (very unwilling). In order to measure acceptability of a physician's decision, we asked the following question:

> "If a doctor would not prescribe antibiotics, even if you were sure that you needed them, how would you react?"[2] The following response alternatives were given (the respondents could mark several): (i) I would accept it, (ii) I would try to convince the doctor to prescribe antibiotics, (iii) I would be upset, but not say anything, (iv) I would contact another doctor, (v) I would ask for advice from a doctor I know, and (vi) other.

Respondents who choose option (i) are identified as "willing to accept the decision."

Independent variables

The final part of the survey consisted of questions regarding demographic and socioeconomic factors such as age, gender, education, place of residence, children, income, and self-rated health status.

The first part of the survey contained a set of questions about the use of antibiotics in the past 12 months, whether the respondents had visited a doctor in the past 12 months, and whether they had been denied antibiotics one or several times (despite them believing that they needed them). The survey also included a set of questions intended to measure the respondents' knowledge about antibiotics and antibiotic resistance. The variable consists of an index based on four knowledge questions.[3] Respondents were asked to identify whether the following statements are correct: (i) antibiotics are effective against viruses, (ii) if I have bronchitis I will get well sooner with antibiotics, (iii) antibiotics negatively affect the body's natural bacterial flora, (iv) bacteria can become resistant to antibiotics, and (v) the use of antibiotics in animal husbandry may eventually affect the effectiveness of antibiotics in humans in the long run. In addition, we asked to what extent respondents worried about antibiotic resistance on a 1–4 scale, where 4 corresponded to the highest level of concern.

Regarding trust, the survey included a question on generalized trust, reading "In your opinion, to what extent can people in general be trusted?" The respondents answered this question on a 0–10 scale, where 0 = "You cannot trust people" and 10 = "You can trust people."[4] We also asked about their trust in healthcare sector and the doctor(s) at their own healthcare center.[5] Here the response alternatives ranged from 1 (very high trust) to 6 (very low trust). In order to investigate whether perceptions about other people's willingness to reduce their consumption of antibiotics mediate the relationship between generalized trust and own willingness to limit use, we asked the following question: "How willing or unwilling do you think other people are to abstain from using antibiotics when possible, even if it means a few extra sick days?" The respondents were again told to answer on a scale from 1 (very willing) to 5 (very unwilling).

Results

Descriptive statistics

Table 1 reports variables used in our analyses and descriptive statistics for the sample. In the last column we also show corresponding mean values at the national level to be able to see whether our sample is representative considering gender, age, and education level. A large share of the respondents had visited a doctor at least once and 20 percent had taken antibiotics at least once, in the past 12 months. Overall, the subjectively rated health status of the respondents is good, with a mean

[2] It could of course be brought into question whether patients really can be "sure" that they need antibiotics, but the question is designed to target the perceptions of patients and not medical realities. Vallin et al., 2016 also asks their respondent to rate to what extent they agree with the following statements: "I often know before I visit a doctor whether I need antibiotics or not" and "I usually know how antibiotics should be treated". This indicates that medical doctors percieve this to be a reoccuring feature.

[3] Knowledge items are based on the Special Eurobarometer on antimicrobial resistance (European Commission, 2016), and Vallin et al. (2016).

[4] Several studies show that there is a correlation between behavioral measures of generalized trust from experiment are correlated with stated hypothetical measures of trust used in this study (see e.g. Fehr, Fischbacher, Von Rosenbladt, Schupp, and Wagner (2003) and Ashraf, Bohnet, and Piankov (2006)). For a discussion on the measurement of generalized trust in surveys see Lundmark, Gilljam, and Dahlberg (2016) and the working paper by Carlin, Love and Smith (2017). We cannot be certain that people who say that they would trust people in general or that they trust medical doctors and health institutions indeed would behave cooperatively or interact with people or institutions.

[5] Questions of trust in health care institutions was also asked by Vallin et al. (2016) but have been adapted to the standard formulation and scale used by the SOM institute and Statistics Sweden. Trust in medical doctors on a Five-point Likert scale has been validated in comparison to a 10-point trust scale by Balkrishnan, Dugan, Camacho, and Hall (2003). To our knowledge, the response items for institutional trust have not been compared to behavior in experiments.

Table 1
Descriptive statistics of the variables used in the analysis. Mean values of our sample and mean values at the national level of the key variables. Standard deviations in parentheses.

Variable	Description	Mean value	Statistics of Sweden
Female	= 1 if respondent is female	48.10%	49.9%
Older	= If respondent is ≥ 60 years	29%	19.8%
Young	= if respondent is < 40 years	29.0%	
University	= 1 if university education ≥3 years.	26.3%	27.0%
Large city	= 1 if respondent lives in one of the 3 biggest cities in Sweden	38.6%	
Has child	= 1 if respondent has children <11 years	18.5%	
Work	= 1 if working full time	63.3%	
Income	= Monthly household income after taxes in SEK 10,000	4.067 (2.173)	
Visited doctor	= 1 if visited a doctor at least once in the last 12 months	71.0%	
Taken antibiotics	= 1 if taken antibiotics at least once in the last 12 months	20.0%	
Refused antibiotics	= 1 if having not received antibiotics, but believing that they actually need it	13.1%	
Own health status	Rating of own health status on the 1–5 scale, where 5 is very good	3.909 (0.853)	
Correct knowledge	Mean value of correct answers to 5 statements about antibiotic usage	0.769 (0.082)	
Worried about resistance	Level of concern about resistance on a 1–4 scale, where 4 means highest level of concern.	3.090 (0.982)	
Generalized trust	Rating of general trust on 0–10 scale, where 10 is very high trust	6.862 (1.980)	
Trust healthcare	Rating of trust in healthcare sector in general on a 1–5 scale, where 5 is very high trust.	3.752 (0.919)	
Trust own doctor	Rating of trust in doctor at own healthcare center on 1–5 scale, where 5 is very high trust	3.660 (1.016)	
Accept doctor's decision	= 1 if respondent would accept doctor's decision not to give antibiotics despite belief that antibiotics should be prescribed	52.8%	
N	Number of observations	1869	

value of almost 4 (on a 1–5 scale). The level of knowledge about antibiotics is high, with a mean value of 0.77, meaning that the number of correct answers is close to 4 out of 5. There is also a considerable level of concern about antibiotic resistance. Overall, the level of trust is high with an average level of generalized trust of almost 7 (on a 0–10 scale), and the level of trust in healthcare and the doctor(s) at one's own healthcare center is also high (3.8 on a 1–5 scale).[6,7] Comparing with official statistics for Sweden, we can see that our sample is representative with respect to gender and education, but there is a certain over-representation of older respondents.

A majority, 53 percent, of the sample would accept a decision by a doctor not to prescribe antibiotics, despite disagreeing.[8], [9] Table 2 presents responses to our two main questions regarding willingness not to take antibiotics. The first question concerned own willingness and the second the perceived willingness of others.

A majority stated that they are willing or very willing not to take antibiotics, while only 16 percent thought that others are willing or very willing. Furthermore, 20 percent are unwilling or very unwilling to abstain from using antibiotics, while the same fraction is 64 percent when the question concerns other people's willingness. The correlation coefficient between the responses to the two questions is 0.356. The difference in response distributions between own willingness to abstain and perception of others willingness to abstain from antibiotics s statistically significant at the 1% level (p-value is 0.000) using a sign-rank test, indicating a clear difference between the two questions.

Regression analysis

In the main text we focus on how factors correlate with the two main questions of interest, i.e., concerning (i) the likelihood of accepting the decision of a physician not to prescribe antibiotics in the case when a patient is sure to need them and (ii) the willingness to abstain from taking antibiotics, respectively. In Table A1 in the appendix, we report regression models for stated trust (both generalized and trust in healthcare sector) and for expectations about other people's willingness not to take antibiotics.[10]

Acceptability of a doctor's decision is a binary variable, equal to one if a respondent accepts and zero if not, and we report results from a

Table 2
Distribution of responses to question on willingness not to take antibiotics; own willingness to abstain from antibiotics (Self) and perceived willingness of others to abstain (Others).

	Self	Others
Very unwilling	5%	12%
Unwilling	15%	52%
Neither willing nor unwilling	15%	20%
Willing	35%	14%
Very willing	30%	2%
Number of obs.	1869	1869

[6] Figure A1 in the appendix shows the full distribution of responses to the question on generalized trust.

[7] The fact that both the self-rated health status and trust in healthcare are high in our sample is in line with the findings by Mohseni and Lindstrom (2007), who found that low trust in the healthcare system is related to poor self-perceived health.

[8] In the survey we asked respondents to state what they would do in a situation where a doctor would not give an antibiotic prescription even if the respondent him/herself was sure to need antibiotics. One of the alternatives was "I would accept it without any problem", while another alternatives were to capture whether a patient would try to convince the doctor to write the prescription anyhow, or that the person would visit another doctor, or ask advice from another doctor that she or he personally knows or that a person would be angry and not accept but not say anything to the doctor.

[9] Vallin et al. (2016) also conducted a study in Sweden and found that over 79 percent of their respondents had confidence in decisions by doctors not to prescribe antibiotics. However, they did not inquire about the respondents' acceptability in cases where the respondents believed they really needed antibiotics.

[10] Generalized trust is correlated with a number of individual characteristics. Females and university educated have higher levels of trust, trust increases with income, and younger people have a lower level of trust. In addition, trust increases with self-reported health status. Stated trust in the healthcare sector is not correlated with as many individual characteristics, but it is positively correlated with being older, income, and health status, and in addition, those who have been refused antibiotics have a lower level of trust in the healthcare sector. The stated willingness of others to abstain from taking antibiotics is correlated with age: those who are older have higher beliefs about other people's willingness to abstain from taking antibiotics. Moreover, the stated willingness of others to abstain is negatively correlated with a high knowledge about correct antibiotics usage and positively correlated with generalized trust.

binary logit regression. Since both the antibiotics related questions and trust questions might be endogenous in sense that they are correlated with the socio-economic variables we build up the model in three stages: We first estimate a model with pure socio-economic characteristics only. In the second model, we then add variables relating to experience and knowledge regarding antibiotics and antibiotic resistance, and finally, in the third model we also include the variables of specific interest in this paper, namely trust and expected willingness of others. The results are presented in Table 3.

Acceptability of a doctor's decision not to prescribe antibiotics despite disagreeing is not to any large extent correlated with any of the individual characteristics we observe. Older respondents are more likely to accept the decision, but the effect is small and the coefficient is only statistically significant at the 5% level.[11] In the next model, we add experiences and knowledge regarding antibiotics and antibiotic resistance. Being concerned about antibiotic resistance increases the likelihood of accepting a no-prescription decision. The relationship between these variables is not strong; a one standard deviation increase in concern increases the likelihood of accepting a no-prescription decision by 0.03 units. However, experience of having been refused antibiotics in the past, despite own belief that antibiotics were needed, decreases the acceptability of the decision by 0.16 units. In the third model, we add the two measures of trust. Interestingly, generalized trust is not statistically significant[12], while trust in healthcare sector is. However, the relationship between these variables is not very strong; a one standard deviation increase in trust in healthcare (0.92) increases the likelihood of accepting a no-prescription decision by 0.07 units (the average value of the probability of accepting the decision is 0.53). Thus, in general, we cannot explain the variation in acceptability of a no-prescription decision. All three models have a low explanatory power, and the effect sizes are small.

Table 3
Marginal effects evaluated at sample mean from binary logit models for individuals' acceptability of doctor's decision not to prescribe antibiotics; 1 = accept decision and 0 = do not accept decision. Standard deviations in parentheses.

	(1)	(2)	(3)
Female	−0.018	−0.019	−0.016
	(0.024)	(0.025)	(0.025)
Older	0.076*	0.052	0.042
	(0.029)	(0.032)	(0.032)
Young	−0.024	−0.041	−0.035
	(0.029)	(0.031)	(0.031)
University	−0.021	−0.038	−0.048
	(0.028)	(0.029)	(0.030)
Large city	−0.037	−0.039	−0.036
	(0.024)	(0.025)	(0.026)
Work	−0.019	−0.019	−0.012
	(0.028)	(0.029)	(0.030)
Income	−0.005	−0.006	−0.010
	(0.006)	(0.006)	(0.007)
No response income	−0.061	−0.034	−0.034
	(0.061)	(0.063)	(0.064)
Has child	−0.017	−0.022	−0.024
	(0.033)	(0.034)	(0.034)
Visited doctor		0.019	0.015
		(0.028)	(0.028)
Taken antibiotics		−0.057	−0.058
		(0.031)	(0.032)
Refused antibiotics		−0.164***	−0.145***
		(0.035)	(0.036)
Correct knowledge		0.048	0.011
		(0.151)	(0.153)
Worried about resistance		0.033**	0.031*
		(0.013)	(0.013)
Own health status		0.019	0.002
		(0.015)	(0.015)
Trust healthcare			0.079***
			(0.015)
Generalized trust			0.009
			(0.007)
Others' willingness to abstain			−0.004
			(0.013)
Observations	1869	1786	1786
R-squared	0.010	0.024	0.039

Note: Significant at * 5%, ** 1%, and *** 0.1%.

Next, we estimate models for the willingness to abstain from using antibiotics in a case of non-fatal infection but where antibiotics would decrease the number of sick days. The stated own willingness to abstain variable has five categories (1 = very unwilling and 5 = very willing), but we report results from standard ordinary least squares regressions.[13] Similarly as in Table 3, we again build up models by starting to analyze pure socio-economic variables, then we add the health and antibiotics related variables that could be correlated with socio-economic characteristics and finally we add the three variables of main interest in this paper: trust questions and the expectation of others willingness to abstain from antibiotics. Results are shown in Table 4.

In the first model with only individual characteristics, living in a large city is the only one that is significantly associated with willingness to abstain from using antibiotics. Thus, again we are unable to explain the variation in responses with individual characteristics. We then add experience and knowledge variables. Almost all characteristics related to own health status and recent experience with healthcare are statistically significant: worse health status, recent use of antibiotics, being denied antibiotics in the past, low level of concern about resistance, and lower health status are all associated with a lower willingness to abstain. Having been denied antibiotics has the largest effect: the willingness decreases by 0.6 units (mean value of the stated willingness is 3.7) if a respondent has been denied antibiotics in the situation where he or she believed they were needed. Past use of antibiotics is relatively important as well: the willingness to abstain is 0.2 units lower if the person has used antibiotics in the last 12 months. Finally, those who are concerned about antibiotic resistance are clearly more likely to state they would not take antibiotics.

In the last column we investigate the possible correlation between stated trust variables and expectation about other people's willingness to abstain from using antibiotics. Interestingly, neither of the stated trust variables is statistically significant, while expectation about what others would do is, and the effect is sizeable. An increase by one standard deviation in expectation variable (0.93) increases the stated willingness by 0.47 units (the mean value of the stated own willingness to abstain is 3.7). Clearly, expectation about others and trust may be correlated. However, if we estimate the model without expectation about others, personal trust is still not statistically significant, although the size of the coefficient increases.

Discussion

We set out to investigate whether people accept a doctor's decision not to prescribe antibiotics despite disagreeing and whether people's

[11] As shown in Table 1, we have overrepresentation of older respondents in the sample. However, the significant but small impact of being older disappears in models 2 and 3 with more controls. Therefore, we are not worried that this overrepresentation has affected our results to any significant extent.

[12] Veenstra (2000) also found that general trust was unrelated to self-reported health status, but an association between trust and self-reported mental health has been found in for example Lindstrom and Mohseni (2009).

[13] We have also estimated ordered probit models, but we report results from standard regressions since the results are very similar and the interpretation of the results is more straightforward. Results from ordered probit models are available from the authors upon request.

Table 4
Ordinary least square regression models for stated willingness to abstain from taking antibiotics; 1 = very unwilling, …, 5 = very willing), Standard deviations in parentheses.

	(1)	(2)	(3)
Female	−0.054	−0.073	−0.042
	(0.056)	(0.055)	(0.051)
Older	−0.023	−0.066	−0.107
	(0.073)	(0.070)	(0.065)
Young	0.089	0.025	0.119
	(0.069)	(0.068)	(0.063)
University	−0.008	−0.066	−0.109
	(0.065)	(0.064)	(0.060)
Large city	−0.138*	−0.141*	−0.106*
	(0.057)	(0.055)	(0.051)
Work	−0.025	−0.061	−0.041
	(0.066)	(0.064)	(0.060)
Income	−0.009	−0.017	−0.023
	(0.015)	(0.014)	(0.013)
No response income	−0.079	−0.009	−0.041
	(0.142)	(0.137)	(0.127)
Has child	0.051	0.071	0.077
	(0.077)	(0.074)	(0.069)
Visited doctor		−0.094	−0.103
		(0.062)	(0.057)
Taken antibiotics		−0.228***	−0.248***
		(0.068)	(0.063)
Refused antibiotics		−0.603***	−0.531***
		(0.079)	(0.073)
Correct knowledge		−0.372	−0.111
		(0.330)	(0.307)
Worried about resistance		0.285***	0.276***
		(0.028)	(0.026)
Own health status		0.097**	0.096**
		(0.032)	(0.031)
Trust healthcare			0.029
			(0.029)
Generalized trust			0.005
			(0.014)
Others' willingness to abstain			0.451***
			(0.027)
Constant	3.816***	3.152***	1.722***
	(0.089)	(0.293)	(0.292)
Observations	1869	1786	1786
R-squared	0.006	0.111	0.240

Note: Significant at * 5%, ** 1%, and *** 0.1%.

willingness to abstain from taking antibiotics can be explained by trust, individual characteristics, and experience and knowledge regarding antibiotics and antibiotic resistance.

We found that a substantial fraction of the respondents reported to be willing to accept a doctor's decision not to prescribe antibiotics. Their responses might be affected by two factors that can lead to over-reporting of compliant behavior. Firstly, respondents have to imagine having an infection since they are confronted with a hypothetical survey situation. Secondly, social desirability of compliant behavior might result in overestimation. With this in mind, the findings are still important. Not least in light of the existence of other sources of antibiotics available to patients who are disappointed with doctors' decisions not to prescribe antibiotics, such as leftover supplies from previous prescriptions, online pharmacies, and simply other doctors. High acceptability of doctors' no-prescription decisions is also important because it signifies that even in a low-prescribing setting, such as in Sweden, a strict antibiotics policy may be supported by the Swedish people. (André et al., 2010; Vallin et al., 2016). The low use of antibiotics in primary care in Sweden could also be viewed as a result of this high acceptability of doctors' no-prescription. In a study by André and colleges, high acceptability of physicians' decision of not prescribing antibiotics was found. However, the rate of prescriptions of antibiotics decreased substantially after the sampling of data (2006) in the study by André et al. and continued to decrease also after the data sampling (2013) in Vallin et al. (Swedres-Swarm, 2017). It is questionable whether these results are valid today in the new low-prescribing setting, and this highlights the importance of repeated large-scale surveys like ours. In set-tings with a high level of an-tibi-otic pre-scrib-ing, ac-cept-abil-ity of doc-tors' decisions not to prescribe antibiotics is probably dif-fer-ent.

Intriguingly, we have a hard time explaining acceptability of a doctor's decision. A few of the individual characteristics and experiences are statistically significant, but with small effect sizes. The factors significantly associated with acceptability of a doctor's decisions include trust in the healthcare system. This finding fits well with prior studies investigating the link between institutional trust and health-related collective action problems, such as vaccinations (Rönnerstrand, 2013) and other protective measures to limit the spread of transferable diseases (Chuang, HuangTseng, Yen, & Yang, 2015). As Ancilotti et al. (2018) point out, patients often trust their own healthcare centers and rely on proper information about antibiotic resistance and why antibiotics are not needed in some situations. If a patient perceives that the information is not accurate, his or her trust in and acceptability of a doctor's decision is likely to diminish. Trust in the healthcare system is thus conditional not only on decisions on antibiotic prescriptions but also on information provided by healthcare workers.

The willingness to abstain from using antibiotics is rather strongly correlated with experience and concerns about resistance. Again, individual characteristics do not explain the variation in responses. Interestingly, we did not find generalized or institutional trust to be correlated with willingness to abstain from using antibiotics. This contradicts what has been demonstrated in other studies on antibiotic use (Robertson et al., 2018; Rönnerstrand & Andersson Sundell, 2015). One possible explanation for the lack of association between institutional trust in the healthcare sector and willingness to limit one's use of antibiotics might be that this kind of trust makes people more inclined to believe that antibiotic resistance is a problem that can be effectively resolved by the healthcare system, and hence that voluntary behavioral change by individuals is unnecessary. However, the importance of expectations about what others would do suggests that the willingness to abstain from antibiotics is linked to cooperation through norms of reciprocity (Fehr & Schmidt, 2006; Gächter & Herrmann, 2009). This is in line with prior scenario-experimental results (Rönnerstrand & Andersson Sundell, 2015). The willingness to abstain from antibiotics is not only about contribution to the common good. Patients are aware of the benefits of not taking antibiotics on the individual level, i.e. less risk of being a carrier of resistant bacteria, less risk of *Clostridium difficile* infections, and less risk of side-effects. A healthcare-giver who informs the patient about both the problem with antibiotic resistance in general and the individual consequence of taking antibiotics has maybe a greater share of patients who report willingness to abstain from antibiotics. The relative importance of other factors, than worry about the antibiotic resistance, for abstaining from antibiotics is unclear, but merits further studies.

Yet again, we highlight that the respondents were asked to imagine an infection in a hypothetical scenario and then respond to whether they were willing to abstain from using antibiotics. This one of the limitations of the study since we did not measure actual behavior. It is possible that if respondent were indeed sick with a bacterial infection at the point of responding to the survey they would be less willing to abstain from using antibiotics. Social desirability bias could therefore have influenced the results.

Moreover, we observe that there was a large difference between what respondents think they would do personally and what they think other people would do. At the individual level, this might be correct of course, but in total a rather large share of the respondents are either over-estimating their own willingness not to take antibiotics or under-estimating others' willingness not to take antibiotics. The phenomenon of trusting one's own ability to make decisions relates to the literature on overconfidence (Moore and Healy 2008; Benoît and Dubra 2011; Benoît et al., 2015). In the overconfidence literature, a person's

belief that his or her own judgment is better than other people's judgment is known as *overconfidence* or *illusionary superiority* if person's beliefs are identified as biased. Bias occurs if more than half of the population believes that their behavior or decisions are better than those of half of the population.

Our interest, however, was not primarily in the exact levels of the responses to the two questions. Instead, we are interested in the variation in responses across individuals and in the correlation and relative difference between the responses to the two questions. Thus, even if there is an element of overconfidence in the responses, we have assumed that an individual who claims to be very willing is actually more willing to abstain than one who claims to be, for example, unwilling.

This is why it is difficult to use observational data to study acceptability and voluntary collective action. A number of studies have used experiments to investigate cooperation, and then cooperation in smaller scale settings in the lab (Chaudhuri, 2011). Field studies have focused on donations (Frey and Meier 2004; Shang & Croson, 2009) or resource use at the local level (Cardenas, Ahn, & Ostrom, 2004; Velez, Stranlund, & Murphy, 2009). Since our primary interest is in large-scale settings, and we used a survey-based method, where we construct scenarios and ask the respondents what they would do under those specific circumstances. Our focus for this study was on antibiotic use in the primary care sector. It is also noteworthy that the study was carried out in Sweden, where both the level of knowledge about antibiotics is high (Vallin et al., 2016; Special Eurobarometer 445: antimicrobial resistance. (2016) and antibiotics are solely available by prescription. In addition, we explained the definition of antibiotic resistance in our survey. Our respondents were therefore aware of the link between antibiotics use and antibiotic resistance and knew that the availability of antibiotics is regulated by prescriptions from physicians.

Thus, while we find that individuals in this study are willing to take action to reduce the use of antibiotics and to accept a doctor's decisions not to prescribe, we cannot explain the determinants behind the behavior to any large extent. This means that our paper provides little guidance on how to increase the likelihood of voluntary cooperation. It still remains an open question whether there are other factors that can explain the variation to a larger degree. We believe this points to the need for research using qualitative methods to explore the reasons behind these decisions. Future research may also further explore the potential link between personality types and attitudes and behavior related to antibiotic use (Axelsson, 2013). Also, patient's experience of expecting a prescription of antibiotics, but being refused, should be examined in settings with low rates of antibiotic prescriptions. Still, the decision of not prescribing antibiotics requires considerations of high medical skill. Gharbi et al. (2019) have shown that in elderly patients with a diagnosis of urinary tract infection in primary care, no antibiotics and deferred antibiotics were associated with a significant increase in bloodstream infection and all-cause mortality compared with immediate antibiotics. Patient's experience of being denied antibiotics and institutional trust should be examined in different healthcare systems, cultural norms, and in the context of changing regulatory frameworks, for example when no prescribing of antibiotics is conceived as more desirable. Otherwise a judicious use of antibiotics may suffer setbacks, and the rate of antibiotic resistance will accelerate.

Funding

Centre for Antibiotic Resistance Research, University of Gothenburg, Sweden.

Centre for Collective Action Research, University of Gothenburg, Sweden.

Foundation for Economic Research in West Sweden, Sweden (E 2017/539).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2019.100499.

Appendix

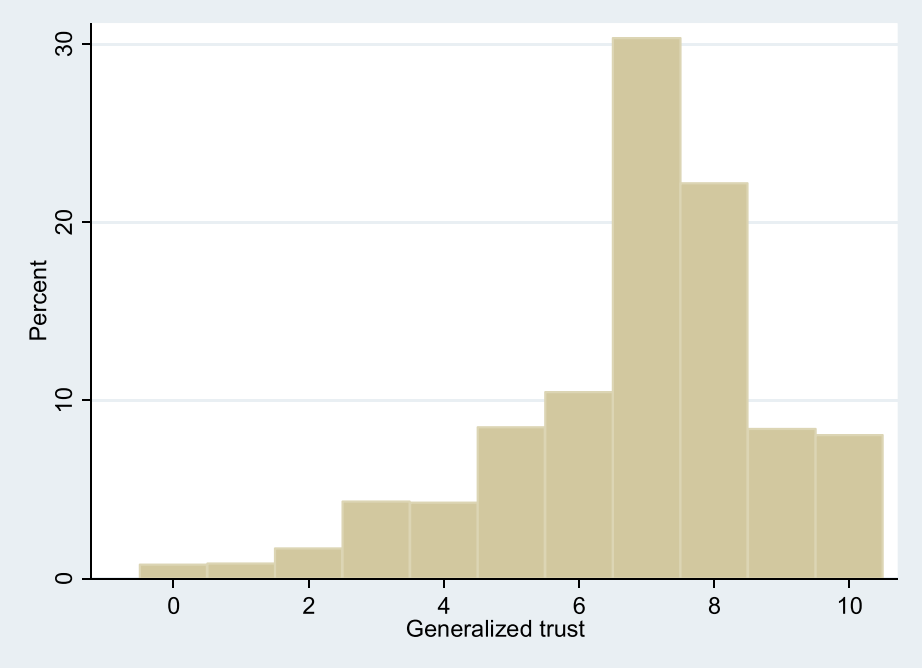

Fig. A1. Histogram, generalized trust (0 = You cannot trust people in general, …., 10 = You can trust people in general)

Table A1
OLS regression models, generalized trust, trust in healthcare, and stated willingness of others to abstain. Standard deviations in parentheses.

	Generalized trust	Trust in healthcare	Willingness of others	Willingness of others
Female	0.249**	−0.068	−0.067	−0.077
	(0.092)	(0.044)	(0.046)	(0.046)
Older	0.057	0.140*	0.081	0.075
	(0.119)	(0.056)	(0.059)	(0.059)
Young	−0.361**	−0.061	−0.200***	−0.181**
	(0.114)	(0.054)	(0.056)	(0.056)
University	0.518***	0.068	0.086	0.059
	(0.108)	(0.051)	(0.053)	(0.053)
Large city	0.085	−0.070	−0.076	−0.078
	(0.094)	(0.044)	(0.046)	(0.046)
Work	−0.084	−0.088	−0.038	−0.032
	(0.109)	(0.052)	(0.054)	(0.054)
Income	0.083***	0.027*	0.009	0.004
	(0.024)	(0.011)	(0.012)	(0.012)
No response income	−0.258	0.009	0.073	0.085
	(0.233)	(0.110)	(0.115)	(0.114)
Have child	−0.113	0.040	−0.015	−0.010
	(0.126)	(0.059)	(0.062)	(0.062)
Visited doctor	−0.0607	0.062	0.016	0.017
	(0.104)	(0.049)	(0.052)	(0.051)
Taken antibiotics	−0.059	0.013	0.043	0.046
	(0.116)	(0.055)	(0.057)	(0.057)
Refused antibiotics	−0.241	−0.285***	−0.138*	−0.119
	(0.133)	(0.063)	(0.066)	(0.066)
Correct knowledge	1.100*	0.337	−0.612*	−0.674*
	(0.560)	(0.265)	(0.276)	(0.275)
Worried about resistance	0.130**	0.012	0.016	0.009
	(0.047)	(0.022)	(0.023)	(0.023)
Own health status	0.444***	0.158***	−0.013	−0.038
	(0.055)	(0.026)	(0.027)	(0.027)
Generalized trust				0.049***
				(0.012)
Trust healthcare				0.024
				(0.026)
Constant	3.515***	2.795***	2.951***	2.712***
	(0.497)	(0.235)	(0.245)	(0.254)
Observations	1786	1786	1786	1786
R-squared	0.106	0.056	0.024	0.035

Note: Dependent variables are categorical: generalized trust (0 = You cannot trust people in general, …., 10 = You can trust people in general), trust in healthcare sector (0 = very low trust, …, 4 = very high trust), and stated willingness of others to abstain from not taking antibiotics (1 = very unwilling, and 5 = very willing). Results are reported for ordinary least squares. Significant at * 5%, ** 1%, and *** 0.1%.

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