Shifting medical guidelines: Compliance and spillover effects for revised antibiotic recommendations

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Abstract

Rationale

Experts have recently argued that guidelines to take the full course of antibiotics are due for revision, instead recommending that patients stop when they feel better. It is unknown how communicating *revised* guidelines will affect beliefs, behavior, and trust in guidelines more generally.

Methods

In a pre-registered experiment, we use a national sample of 1,263 participants from UK to test the effects of a message that reverses the prior full-course guideline (versus a status quo message of take the full course). We also test a secondary intervention that emphasizes that medical guidance and evidence may change over time.

Results

Early stoppage messages shifted personal beliefs and perceived expert consensus about early stoppage (a shift of 16%, 95% CI: 13.8% to 17.9%, $p < .001$) and behavioral intent (a shift of 19%, 95% CI: 15.3 to 21.8%, $p < .001$) in the intended direction. However, the new guideline also slightly decreased acceptance of uncertainty about future guidelines (a decrease of 2%, 95% CI: .2% to 3.1%, $p = .022$) and general intention to comply with other guidelines in the future (a decrease of 6%, 95% CI: 2.6% to 8.4%, $p < .001$), but did not affect perceptions of medical researchers' or doctors' credibility or respondents' epistemic efficacy. Prior belief about early stoppage did not moderate receptivity to messages. Notably, though, receptivity to early stoppage messages was contingent on deference to experts. We find no effect of a secondary intervention that emphasizes that medical guidance and evidence may change over time.

Conclusion

Overall, findings suggest the (U.K.) public is likely to accept new guidelines that change long standing advice to take a full course of antibiotics. While respondents show wariness about further future revisions, these data do not show that changing guidelines undermines trust in the experts that produce them.

Keywords: antibiotics, public health campaigns, consensus, expertise, credibility

Medical best practices and patient guidelines evolve. This simple fact raises an important question: how does the public respond to changing advice? In the case of antibiotics, longstanding consensus on the use of antibiotics has been "always complete the full prescription, even if you feel better" (WHO, 2015a). In a recent issue of *BMJ,* Llewelyn et al. (2017) argue that this medical advice is due for revision as there is little evidence demonstrating that this behavior achieves its goal of preventing bacteria from developing resistance to antibiotics. Given the existential threat to global health posed by antibacterial resistance (WHO, 2015b; The World Bank, 2016) and the possible emergence of expert dissensus (Llewelyn et al., 2017; Del Mar & Looke, 2017; NHS, 2017) about the use of antibiotics, it is essential to measure public opinion about antibiotics (and antibacterial resistance) and to examine how the public may respond to changing expert guidance.

In this manuscript, we examine public beliefs about taking a full course of antibiotics, whether the public would accept new expert guidelines, what factors may condition their acceptance, and what effects message may have on behavioral intentions. Our goal here is not to advocate for or against the Llewelyn et al. (2017) position. Rather, as social scientists, our goal is to understand how the public may respond to a possible dramatic shift in official health advice.

While previous studies have examined the effect of public information campaigns about antibiotic use (e.g., Huttner et al. 2010; McNulty et al., 2010), these campaigns have occurred amidst the prevailing elite consensus. Consistent with the call for strategic communication campaigns to reduce unnecessary antibiotic use (Review on Antimicrobial Resistance, 2016), it is important to determine whether revised guidelines from medical experts can result in appropriate mitigative behaviors (Nisbet, 2016).

Examining how the public responds to a possible change in guidance about antibiotics may inform our broader understanding of how the public responds to emerging dissensus or shifting guidelines more generally. Evolving evidence is a key facet of public health crises (Brossard et al., 2018), but its effects on the public are poorly understood. Although researchers recently have devoted more attention to understanding the implications of conflicting medical information (e.g., Han et al., 2018; Nagler, 2014; Nagler et al., 2019), much more needs to be done (Carpenter et al., 2015).

How would the public respond to new guidelines for the use of antibiotics?

In this study, we compare how two different messages about taking antibiotics – one that patients should complete their course no matter what, and a second message that patients should stop treatment when they feel better – affect beliefs, attitudes, and behavioral intentions.

We expect the public to exhibit fairly low levels of knowledge about antibiotic use (Tamasauskiene et al., 2018). Prior work shows that individuals with less knowledge and weaker attitudes about a given issue are more receptive to new information regarding that issue (e.g., Ahluwalia, 2000). Consequently, we expect a main effect on beliefs and attitudes from messages communicating new expert health guidelines.

> **H1.** Compared to a standard "complete the course" message, the "stop when better" message will result in greater belief and behavioral intent matching the "stop when better" recommendation.

However, there may be some important conditional effects based on prior attitudes (Nyhan et al. 2014, Nyhan and Reifler 2015). If the message contradicts respondents' prior beliefs about how

staying with a course of treatment affects antibiotic resistance, then they may be less likely to accept the new guideline.

H2. Message effects will be moderated by their agreement with prior belief about best practice.

Finally, respondents who believe they personally know more about best practice in medical treatment than experts (Motta et al., 2018; Dunning, 2011) will be less influenced than those who believe that experts know more. We refer to the placement of experts' knowledge above one's own as deference to experts.

H3. Message effects will increase with deference to experts.

There may also be spillover effects of exposure to revised guidelines. Because revised guidelines by definition contradict prior consensus, exposure to these might trigger a similar set of negative psychological responses found in studies of conflicting health information (e.g., Nagler et al., 2019). Conflicting information can cause pessimism and feelings of helplessness (Lee et al., 2016; Nagler, 2014; Han et al., 2007), which may manifest in reduced perceived credibility of experts, less acceptance of uncertainty in medical guidelines, lower epistemic efficacy, and spillover effects reducing intended compliance with future guidelines in other domains.

RQ1. Does exposure to revised guidelines result in spillover effects on credibility, acceptance of uncertainty, epistemic efficacy, or general future compliance?

Communicating contingency

Evidence, and expert recommendations drawn from it, are subject to revision as newer data is collected. However, the potential effects of communicating this contingency, particularly in

conjunction with new guidelines themselves, are unknown. There are diverging views on how this uncertainty may affect the public. On the one hand, such messaging may reduce overall trust and compliance with experts (Han et al., 2018). Statements made with confidence are more persuasive (Thomas & McFadyen, 1995), and expressing uncertainty can make experts seem less credible. Introducing uncertainty may provoke a set of negative psychological reactions known as ambiguity aversion (Camerer & Weber, 1992). Messages that emphasise the potentially temporary nature of current guidelines, therefore, may induce uncertainty or even backlash about the topic in question (Lee et al., 2018; Dixon & Clarke, 2012; Jensen & Hurley, 2012; Chang, 2013; Nagler et al., 2019) or health research and expert guidance more generally (Chang, 2015; Nagler et al, 2019). Han et al. (2018) find that uncertainty about risk and efficacy reduced vaccination intention for a hypothetical vaccine-preventable disease, and messaging about the expected nature of this uncertainty ("normalized uncertainty"), which parallels our contingency messaging, did not mitigate this outcome.

Conversely, it is possible that explicitly communicating the unsettled nature of scientific and medical knowledge may reduce resistance to new guidelines (Jensen, 2008). As Jensen points out, communicating uncertainty can help maintain the trustworthiness of scientists as a strategy for communicating their objectivity, following Popper's claim about the perpetual tentativity of scientific knowledge (1961). News coverage of medical research that includes "hedges," or details of a study's limitations, has been found to increase the credibility of both scientists and journalists (Jensen, 2008; Jensen et al., 2011). Recent work on climate research communication finds that communicating fully bounded uncertainty (i.e., sea-level rise could be between 1 and 7 ft.) increases trust and message acceptance, but these gains were eliminated when acknowledging

irreducible uncertainty (the unpredictable exacerbation of sea-level rise effects brought on by global warming-induced storms).

All in all, it is unclear how the specific form of uncertainty or "hedge" we employ — a message about the contingency of all scientific findings, rather than a specific result — will affect public attitudes. We assess the possibilities with a randomized addition of text to both primary messages, allowing us to explore the effects of the presence of an embedded message about scientific evidence's contingent nature.

RQ2. Does a caveat about evolving evidence affect message receptivity (factual beliefs, behavioral intent), or broader issues of credibility, general future compliance, epistemic efficacy, and acceptance of uncertainty?

RQ3. Are "evolving evidence" message effects moderated by prior belief, do they interact with the main message condition, and is there a three-way interaction among these factors?

Methods

To measure attitudes about antibiotic use and to evaluate the effects of expert messages, we conducted an online-survey experiment in the UK (N = 1,263) using a stratified quota sample of adults in the UK age 16+. Data were collected in November 2018 by the Internet market research company Kantar. (Kantar also collected the UK data for the Special Eurobarometer 478 on Antimicrobial Resistance in September 2018.) Kantar maintains a proprietary opt-in online panel. Subjects are recruited into the general panel by "traditional advertising as well as internal

and external affiliate networks." For this specific survey, subjects from the panel were invited by email. Sample size was based on the size of Kantar's GB Online omnibus survey. Quotas were set for age, sex, and region (see Table A1 for demographics). Participants were compensated by Kantar. This research was approved by the institutional review board of the University of Exeter. Respondents who took part in the survey gave their consent. Hypotheses, design, and analyses were pre-registered using the Open Science Framework. Materials, analysis plan, and data available at: https://osf.io/8nfwc/?view_only=53f0068b0e9b4e868bbe3ec1c3c750fc. The lead author affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as originally registered have been explained.

Design

Our design employed two messages about antibiotic treatment. Prior to exposure, respondents were informed that "[w]e are interested in what people think of the following message being designed to potentially disseminate in the interest of public health. Please read the message carefully and answer the questions that follow honestly." All respondents received either a message about current best practice that patients should complete their course no matter what (n = 630) (which serves as our baseline or reference group), or a second message that patients should stop treatment when they feel better (n = 633). Participants were randomly assigned to view one of the two messages. Each message included a brief description of disagreement about antibiotics in the news, followed by the randomized suggested course of action. For our indicator variable, exposure to the "stop when better" message was scored as 1, and exposure to the "complete the course" message was scored as 0.

Embedded within this experiment, we also randomized whether each message included a caveat about the contingent nature of medical guidelines (caveat $n = 633$, no caveat $n = 630$; for the indicator variable, exposure to the caveat was scored as 1). Therefore, we employed a fully crossed 2 x 2 factorial design (full course + caveat $n = 316$; full course + no caveat $n = 314$; stop when better + caveat $n = 317$; stop when better + no caveat $n = 316$).

Procedure

Participants first provided demographic information, as well as pre-treatment knowledge about and attitudes toward antibiotics, and a pre-treatment measure of deference to experts, before reading the treatment message. After considering the message, participants provided responses for outcomes variables. Finally, participants were debriefed using the NHS's discussion of the debate and current guidelines.

This research was done without patient involvement. Patients were not invited to comment on the study design and were not consulted to develop patient relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.

Measures

Outcome variables

Early stoppage beliefs were assessed using agreement with the following 7-pt Likert items: "I think that taking antibiotics for longer than necessary increases the risk of antibiotic resistance," and "I think that stopping antibiotic treatment early may encourage antibiotic resistance."

Because we structure our analysis to measure the effects of the "stop when better" message relative to the standard “complete the course” message, we subtract the second measure from the first, with the resulting score ranging from -6 to 6 (M = .49, SD = 2.41). We then ask whether participants agree that “most experts” endorse the same statements. Again, the second item was subtracted from the first (M = .41, SD = 2.38). These two difference scores were averaged (alpha = .82). Robustness checks show that the early stoppage message significantly affected each belief item, across personal and expert consensus beliefs, in the early-stoppage relevant direction.

Early stoppage behavioral intent (M = 2.74, SD = 1.68, alpha = .90) was measured using the average of two 7-pt Likert items: “How likely or unlikely is it that you would take [would instruct family members to take] the full course of antibiotics for yourself in the future, regardless of how you are feeling at any point in the treatment?” (each reversed such that early-stoppage aligned behaviors scored higher).

A third behavioral item, *general future compliance*, was assessed independently, as robustness checks showed that the message treatment affected it in the opposite direction as the two early-stoppage-specific behavioral intent items. General future compliance (M = 5.44, SD = 1.45) was measured with the following 7-pt. Likert item: “In general, how likely or unlikely is it that you would follow the guidelines of medical researchers on other issues in the future?”

Credibility was assessed using agreement with the average of four 7 pt. Likert items: “Medical researchers [doctors] are trustworthy,” and “medical researchers [doctors] have a high level of expertise,” (M = 5.44, SD = 1.10, alpha = .90).

Epistemic efficacy (*M* = 4.27, *SD* = 1.26, alpha = .67) was measured using average agreement with two 7 pt. Likert items: "I feel confident that I can find the truth about issues in science and medicine," and "If I wanted to, I could figure out the facts behind most scientific and medical disputes," (adapted from Pingree, 2011).

Acceptance of uncertainty (*M* = 4.39, *SD* = .83, alpha = .39) was measured using average agreement with four 7 pt. Likert items: "I am comfortable accepting uncertainty in the guidelines issued by medical institutions"; "There is no reason to follow new guidelines because they are always changing anyway" (reverse coded); "New guidelines that contradict old guidelines make me uncomfortable" (reverse coded); and "I prefer to carry out a current medical recommendation even though it may change in the future." These items draw on related research on uncertainty preferences (Carcioppolo et al., 2016; see also Han et al., 2018) but are modified to better match our research questions. The scale exhibits low reliability due to reverse-coding of two items (reversed in order to reduce acquiesence bias). Factor analysis shows the reverse-coded items form a separate subscale (alpha = .61) from the other two items (alpha = .56). According to our pre-registered analysis plan, we model agreement with each item separately in our robustness check. This analysis reveals that the primary driver of the results we discuss in the main text (the item most affected by the stop message) is agreement with the "I prefer to carry out a current medical recommendation even though it may change in the future" item. Full supplementary analysis is shown in Appendix.

Pre-treatment variables

Prior belief was measured using a forced choice item asking which of the following more closely matches the participant's belief: "I think that stopping antibiotic treatment early may encourage

antibiotic resistance," (mapping to the pre-existing consensus) or "I think that taking antibiotics for longer than necessary increases the risk of antibiotic resistance," (mapping to the recent counter-argument) or "I don't know." Participants then provided confidence in their belief ("Not at all," "Somewhat," "Very"). The prior belief measure used in statistical models is the resulting 6 pt. measure with "don't knows" (n = 221) excluded, where 6 = very confident that taking longer than necessary increases risk (M = 4.02, SD = 1.89). Excluding "don't knows" as per the analysis plan resulted in n = 517 for the full course message treatment and n = 525 for the stop when better message treatment. Overall, 29.93% responded that "stopping antibiotic treatment early may encourage antibiotic resistance" matched their beliefs more closely, while 52.57% responded that "taking antibiotics for longer than necessary increases the risk of antibiotic resistance" matched their beliefs more closely, and 17.50% were unsure.

Deference to experts was measured with the average of two items asking "Would you say you know more or less than medical doctors [scientists] about what's best for you when it comes to taking a prescribed course of medicine?" Responses ranged from 1 ("I know a lot less") to 6 ("I know a lot more") and were averaged together (M = 2.32, SD = 1.18, alpha = .83), and then reversed such that more deferent scores were higher to aid interpretation (adapted from Motta et al., 2018).

Antibiotics knowledge was assessed by gauging agreement with the following statements about antibiotics on 7-pt. Likert scales: whether they work on most coughs and colds; can kill bacteria; or can kill viruses. In our descriptive analysis, we use the average of these 7-pt. Likert responses, with the two incorrect items (regarding viruses and coughs and colds) reversed.

Antibiotic resistance concern was measured using agreement with a single item using a 7-pt. Likert scale ($M = 5.05$, $SD = 1.57$).

Results

We first report descriptive results of pre-treatment knowledge and attitudes about antibiotics. Knowledge was middling, mirroring prior studies in other countries and the U.K. (e.g., Andre et al., 2010; Hwang et al., 2015; Special Eurobarometer 478, 2018; You et al., 2008). 64% correctly agreed that antibiotics can kill bacteria, but 38% incorrectly agreed that they can kill viruses, and 20% incorrectly agreed that they work on most coughs and colds.

[Table 1]

Concern about antibacterial resistance was high; just over two-thirds (67.54%) agreed that they are worried about this issue (20.51% "strongly agree," 22.09% "agree," and 24.94% "somewhat agree"). A small but consequential proportion of the sample said they knew slightly more, quite a bit more, or a lot more than medical doctors (18%) and scientists (17%) about best practice with a prescribed course of medicine. Interestingly, deference to experts and knowledge were correlated (Spearman's rho = .14, $p < .001$) (or conversely, overconfidence and knowledge were inversely correlated) (see Motta et al., 2018).

We tested our hypotheses using ordinary least-squares regression models for each of our outcome variables, using Stata 15. The initial models included indicator variables for both manipulations (the early-stoppage message and the caveat/"evolving evidence" message), and prior belief as a covariate (thus, models included all respondents across the four cells of the experiment, while excluding those who responded "don't know" to the prior belief measure). Subsequently we assessed the hypothesized prior belief moderation. For comparison, we re-

scaled all outcome measures to range from 0-1. Main effects across outcomes are shown in Figure 1. For full models, see supplementary materials. Because many of our outcome variables are correlated, we also estimated multivariate regression models as robustness tests. The results are substantively identical to the independently estimated models.

[Figure 1]

We find that messaging indicating that patients should now stop a course of antibiotics when they feel better to reduce the risk of resistance significantly increased associated factual beliefs (b = .16, SE = .01, p < .001) and behavioral intent (b = .19, SE = .02, p < .001). However, the early-stoppage message decreased general intention to follow new guidelines of medical researchers on other issues in the future (b = -.06, SE = .01, p < .001), and decreased general acceptance of uncertainty in medical guidelines *(*b = -.02, SE = .01, p = .022). The message did not affect epistemic efficacy or trust in medical experts. Contrary to our expectations (H2a), for no outcomes were these effects contingent on prior belief. In other words, we find that holding contrary beliefs about antibiotics prior to the experiment did not induce resistance to the new guideline. However, there is a significant main effect of prior belief.

We also find that deference to experts moderates the message's effects on factual beliefs (b = .05, SE = .01, p < .001), behavioral intent (b = .06, SE = .01, p < .001), and acceptance of uncertainty (b = -.02, SE = .01, p = .005). The moderating effects of deference for factual beliefs and behavioral intent are depicted in Figure 2. As Figure 2 shows, for those who are low in deference to experts, there is very little difference in the "stop when better" and "take the full course" conditions. However, for those who are higher in deference, there is a large observed difference in the outcome variables based on message treatment condition.

In addition to the primary messaging experiment, we also examined the effects of including a caveat about the contingent nature of current medical advice (RQ2 and RQ3). However, we found no effects of the caveat on our outcomes of interest. This null effect of the caveat message holds across multiple outcome variables -- factual beliefs, behavioral intent, acceptance of uncertainty, expert credibility, general future compliance, and epistemic efficacy (RQ2). Moreover, caveat effects were not moderated by prior belief, nor by early stoppage message condition exposure, and there was no three-way interaction among these factors (RQ3). This type of contingency messaging appears to be too subtle to affect attitudes, as the manipulation check failed ($t(1,261) = -0.94$, $p = .175$). This result echoes the null effect of similar "normalized uncertainty" messaging in Han et al. (2018).

[Figure 2]

Discussion

As concerns about antibiotic resistance grow, some researchers have suggested patient guidelines be revised. A large portion of the UK public surveyed in our study hews closer to the stance in favor of early stoppage. In this context, our experiment finds that new guidelines have strong positive effects on beliefs about antibiotic treatment and behavioral intentions (see Figure 1). Contrary to our expectation, prior beliefs do not condition message acceptance (see Table A4). However, individuals who are less deferential to experts were less likely to take up new recommendations (see Figure 2). In addition, the new guidelines also appeared to increase general resistance to following future guidelines for other medical issues (see Figure 1).

Llewelyn et al. (2017) write in their analysis that "[t]here are reasons to be optimistic that the public will accept that completing the course to prevent resistance is wrong if the medical profession openly acknowledges that this is so, rather than simply substituting subtle alternatives such as 'exactly as prescribed.'" While further research is needed to hone any messaging strategy, our results support this contention. Should health organizations decide to shift antibiotic guidelines, the public appears willing to follow specific guidance.

There are a few points of concern, however. While there is no negative spillover from shifting guidelines on perceptions of experts' credibility, patients' intended future compliance with other guidelines is in question. It appears that the public is willing to follow important, specific health recommendations even if they represent a shift from current practice, but at the same time expresses dissatisfaction by reporting lower intention to comply going forward, and accepts less uncertainty going forward. To avoid eroding confidence, guideline changes should be made sparingly. Further, resistance to new guidelines is strongest among members of the public who believe they know more than experts. As a result, some messages may need to be tailored to better reach this subpopulation (see e.g., MacFarlane et al., 2020).

It is also worth reflecting on the null effect of the additional text about evolving evidence. Arguably, even though this messaging failed to positively affect outcomes such as acceptance of uncertainty or perceived credibility of experts, these results can be seen as encouraging. Should these results hold, generalizing beyond the specific context we examine, they would allow public health communicators to more accurately convey the nature of their guidelines and the evidence that underpins them, without prompting negative responses to specific recommendations or expert advice more broadly. The notion of contingency inherent in medical guidelines — and

how the public may react — also speaks to broader questions of science literacy. Our caveat manipulation is intended to emphasise a basic fact of the process of science: the evidence base is always evolving. We find that this messaging about process does not affect reactions to a specific guideline shift that is a direct result of this process. However, further research on how best to communicate the scientific process in light of conflicts or retractions is needed (Hilgard & Jamieson, 2017; Jamieson, 2018).

Given our theory of message effects and findings, we can speculate about generalizability in terms of geographic contexts and which issues are at the heart of shifting guidelines. Based on similar levels of awareness and concern about antibiotics in other countries (Andre et al., 2010; Hwang et al., 2015; Special Eurobarometer 478, 2018; You et al. 2008), as well as relatively similar levels of deference to medical experts (Motta et al., 2018), it would be reasonable to expect similar uptake of revised guidelines in the U.S., the rest of Europe, and elsewhere. We may also expect the medical community to be effective in communicating revised guidelines for other low-salience issues that are unlikely to inspire backlash (e.g., the newly revised guideline to avoid daily aspirin unless prescribed [American Heart Association, 2019]). However, revisions concerning more contentious issues, such as vaccine schedules, may be less accepted and subject to more pushback. We may also see less acceptance on issues for which there is already guideline-shift fatigue, such as red meat consumption (Kolata, 2019).

Limitations

There are important limitations to our study, however. Our design employed experimental vignettes, which limit external validity despite their established relevance in the study of strategic health communication and allowance for causal inference. Field experiments are needed

to examine how such messages may persuade as they vie for attention outside a controlled setting. Likewise, our design only allowed for us to measure behavioral intention, although studies show intention is linked with observed behavior (Sheeran & Webb, 2006).

On the other hand, it is worth reflecting on the implications of receptivity to new medical guidelines in the absence of source cues or evidence. Although respondents were informed that they were evaluating messages that may be "disseminate[d] in the interest of public health," we did not attribute the messages to any specific medical or health organization, reasoning that to do so would be unethical. Further, the revised guidelines did not present specific evidence backing the shift, instead referencing expert consensus. However, credible sources are critical in the dissemination of new health information, particularly if it contradicts prior beliefs (Bode & Vraga, 2018), and evaluating evidence is crucial in reaching informed health decisions (Verhoef et al., 2007). Arguably, that our respondents were receptive to the message without these components may suggest too much credulity on behalf of the public. Future work may seek simultaneously to examine compliance with medical experts as well as appropriate skepticism of unsupported claims by randomizing source and evidence within revised guideline messages.

Conclusion

Medical associations and health organizations should be aware of the influence their messaging on revised antibiotic guidelines can have going forward, as the debate about best practice continues in the face of growing concern about antibacterial resistance.

But our results also speak to the broader impact of shifting medical guidelines on the public. Communicating in the interest of the public health means considering not only the effects of

revised guidelines on behaviours of immediate interest, where our results suggest we are more likely to see compliance, but also on downstream attitudes about expert recommendations in general. Frequent revisions may result in the slow erosion of public confidence.

Data sharing statement

All data and analysis scripts, along with materials and analysis plan, will be permanently available at the site of the trial registration upon publication.
https://osf.io/8nfwc/?view_only=53f0068b0e9b4e868bbe3ec1c3c750fc

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Tables and Figures

Table 1. Frequencies for pre-treatment variables: Concern, knowledge, and deference to experts

	1 (Strongly disagree)	2	3	4	5	6	7 (Strongly agree)
Antibiotic resistance concern	3.96%	4.28%	5.62%	18.61%	24.94%	22.09%	20.51%
Antibiotics kill bacteria	5.23%	5.54%	7.13%	17.66%	25.02%	22.17%	17.26%
Antibiotics work on colds	33.81%	20.35%	11.56%	14.65%	10.45%	5.94%	3.25%
Antibiotics kills viruses	25.42%	13.06%	8.79%	14.65%	18.46%	13.94%	5.70%

	1 (I know a lot less)	2	3	4	5	6 (I know a lot more)
Know more or less than medical doctors about taking a prescribed course of medicine	33.10%	25.89%	23.20%	11.56%	4.35%	1.90%
Know more or less than scientists about taking a prescribed course of medicine	34.52%	26.13%	22.01%	11.08%	4.04%	2.22%

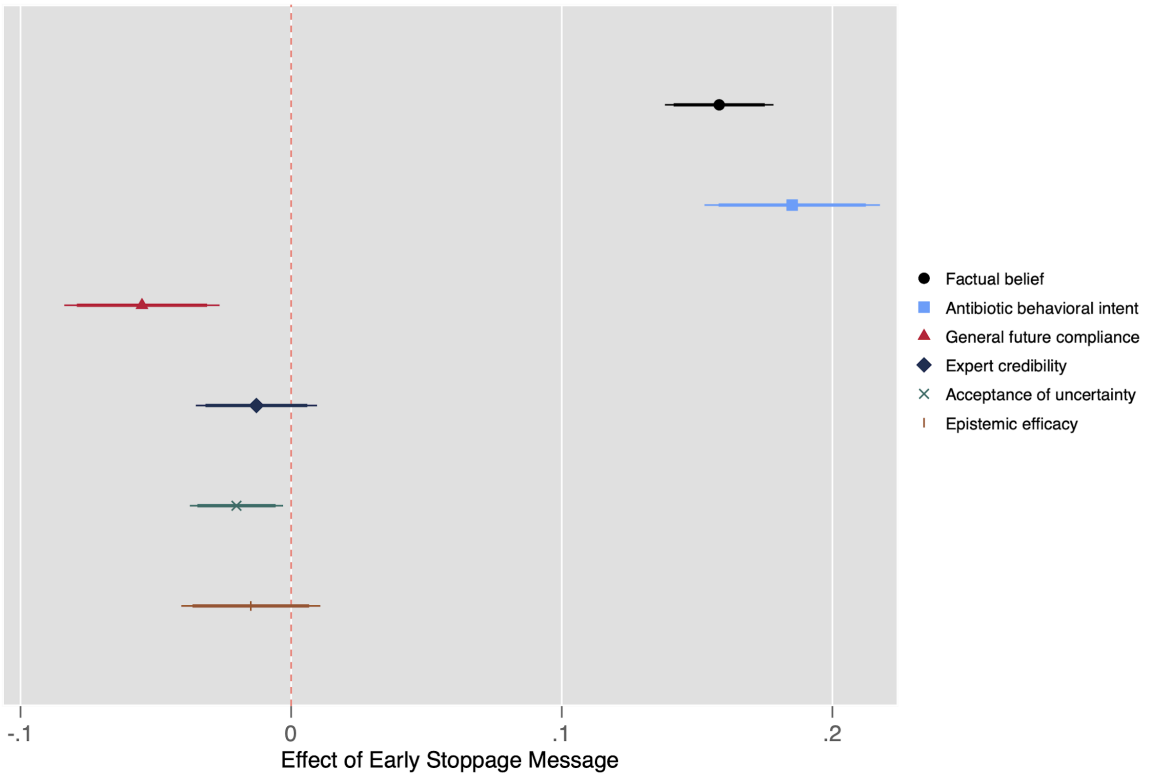

Figure 1. Effect of early stoppage message

Note: This figure reports OLS parameter estimates for multiple models. Specifically, each horizontal line reports the effect of the early stoppage message (compared to receiving the "complete the full course" message) for each outcome variable. The effect of the early stoppage message treatment is expressed as percent change in each outcome variable (with 95% confidence intervals). Each model controls for prior belief and a randomly assigned contingency message. Full model output can be found in the Supplemental Materials. To aid comparison, all variables are scored to range from zero to one. Factual belief and antibiotic behavior intent scored such that early stoppage conforming outcomes receive higher values. N = 1,042.

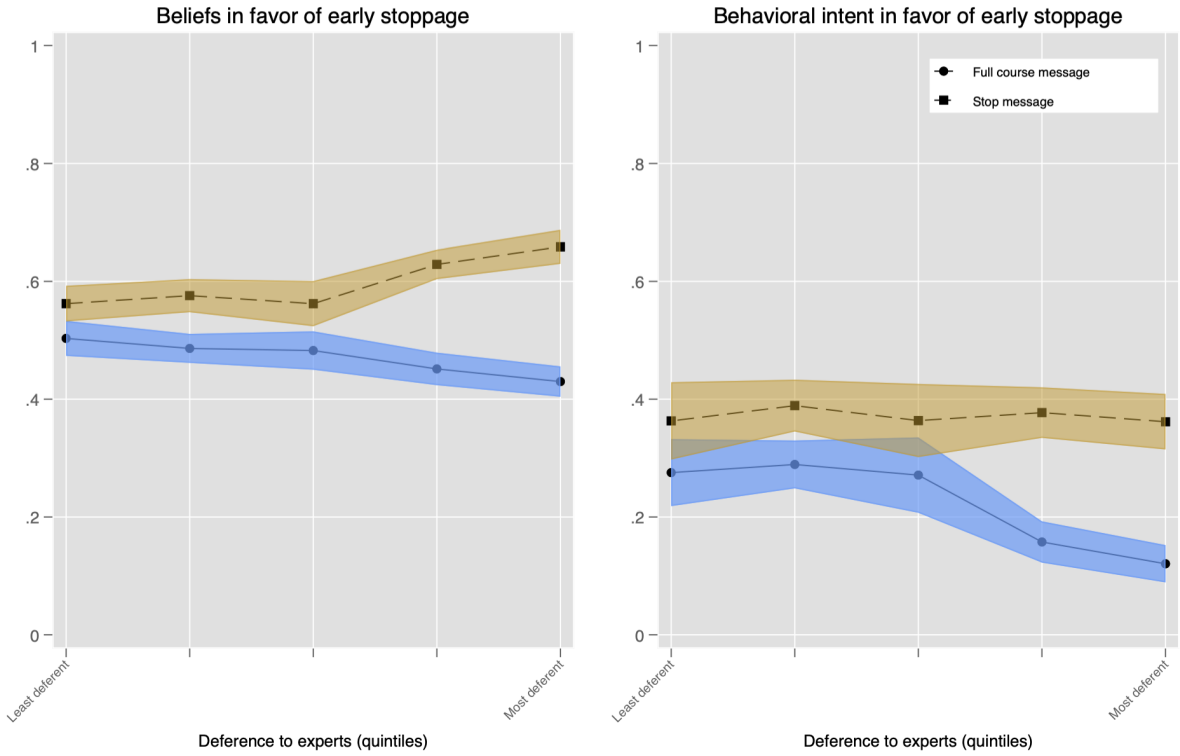

Figure 2. Message effects on factual beliefs and behavioral intent, across deference to experts

Note: Shaded areas are 95% confidence intervals. *N = 1,042.*

Appendix 1. Descriptive Statistics and Primary Analyses

Table A1. Sample demographic characteristics

	Full sample	Full Course Treatment	Early Stoppage Treatment
Age	M = 45.99, SD = 17.66	M = 46.23, SD = 18.00	M = 45.73, SD = 17.32
Sex	50.91% female	51.11% female	50.71% female
Ethnicity	85.48% British	86.81% British	84.15% British
Region	84.96% England 8.39% Scotland 4.28% Wales 2.38% Northern Ireland	85.56% England 8.25% Scotland 3.81% Wales 2.38% Northern Ireland	84.36% England 8.53% Scotland 4.74% Wales 2.37% Northern Ireland
Education (median)	Higher or secondary or further education (A-levels, BTEC, etc.)	Higher or secondary or further education (A-levels, BTEC, etc.)	Higher or secondary or further education (A-levels, BTEC, etc.)
Children in household	30.17%	30.95%	29.38%

Note: Regional population estimates from the Office for National Statistics, 2018: England: 84.3%; Scotland: 8.1%; Wales: 4.7%; and Northern Ireland: 2.7%.

Figure A1. Antibiotics knowledge response frequencies

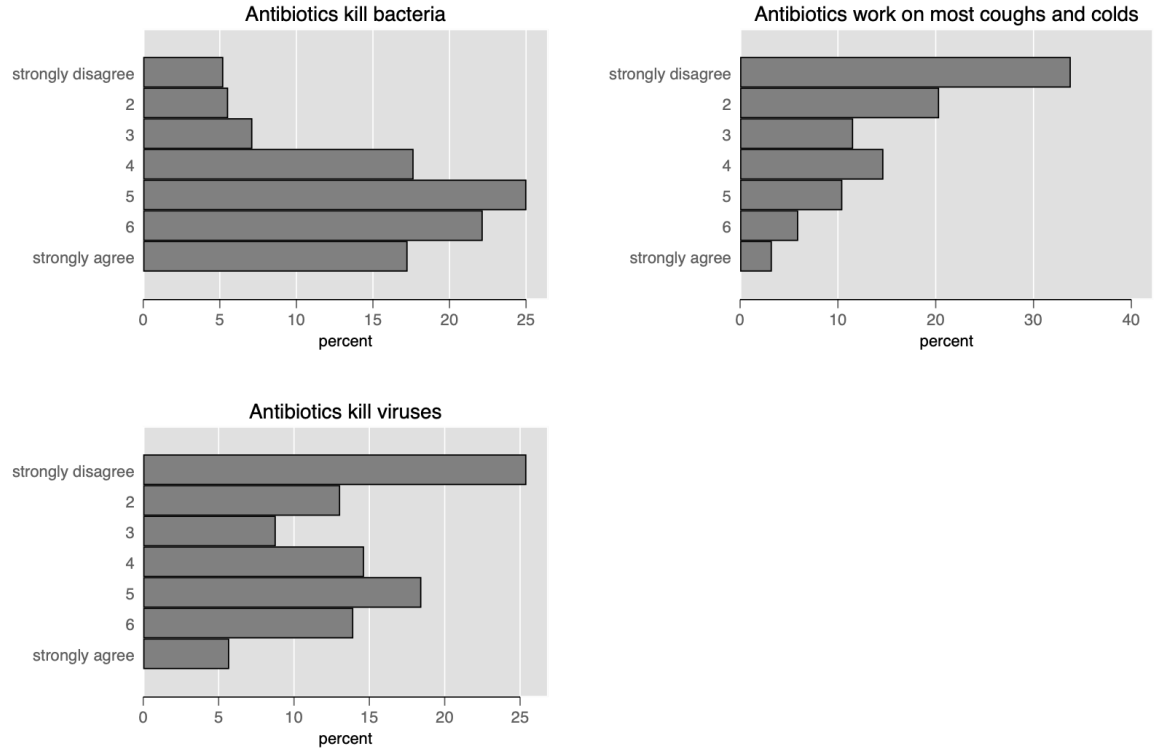

Figure A2. Deference to experts response frequencies

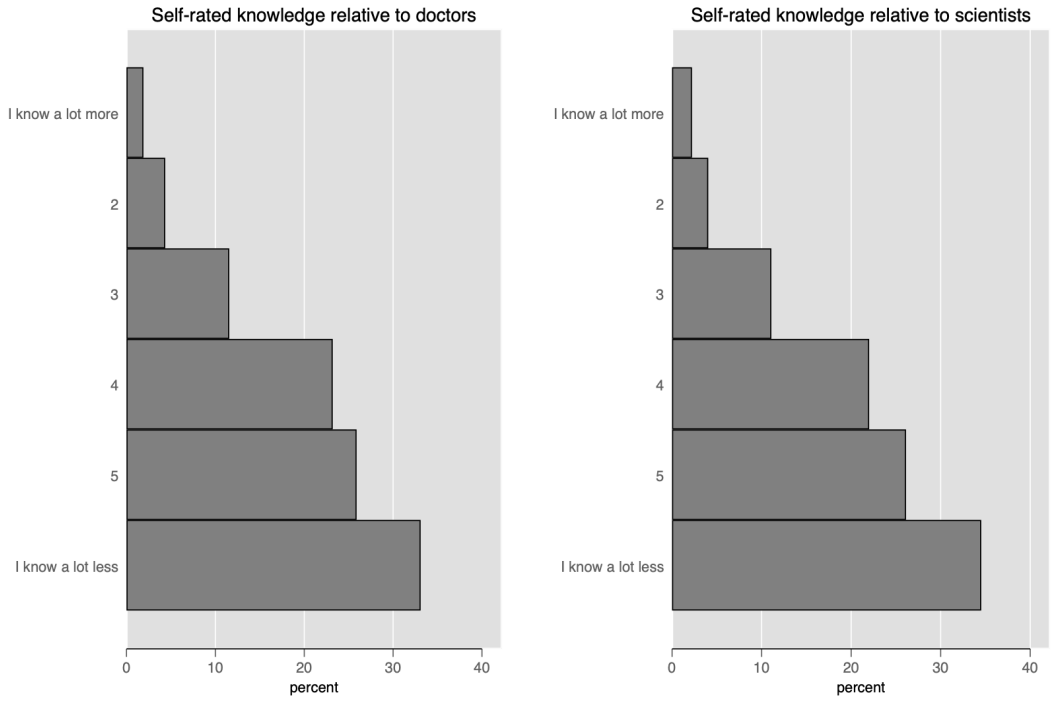

Table A2. Zero-order correlations of outcome measures

	1	2	3	4	5	6
1. Factual belief	1					
2. Behavioral intent	0.3028	1				
3. Future compliance	0.0069	-0.4907	1			
4. Expert credibility	0.0417	-0.3151	0.5089	1		
5. Acceptance of uncertainty	-0.053	-0.2018	0.3759	0.3723	1	
6. Epistemic efficacy	0.0045	-0.0661	0.1898	0.2437	0.1079	1

N = 1,263

Table A3. Effects of Early Stoppage Message versus Full Course Message

	Factual belief						**General future compliance**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	0.158	0.010	0.000	0.138	0.178	Stop message	-0.06	0.01	0.000	-0.08	-0.03
Contingency caveat	-0.004	0.010	0.700	-0.016	0.024	Contingency caveat	0.01	0.01	0.553	-0.02	0.04
Prior belief	0.032	0.003	0.000	-0.038	-0.027	Prior belief	0.00	0.00	0.754	-0.01	0.01
Constant	0.336	0.014	0.685	0.308	0.364	Constant	0.78	0.02	0.000	0.74	0.82
R2	0.267					R2	0.01				
	Expert credibility						**Acceptance of uncertainty**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	-0.013	0.011	0.261	-0.010	0.035	Stop message	-0.020	0.009	0.022	-0.00	-0.04
Contingency caveat	-0.004	0.011	0.698	-0.027	0.018	Contingency caveat	-0.002	0.009	0.832	-0.02	0.02
Prior belief	-0.004	0.003	0.232	-0.010	0.002	Prior belief	-0.001	0.002	0.631	-0.00	0.00
Constant	0.770	0.016	0.000	0.739	0.801	Constant	0.585	0.012	0.000	0.56	0.61
R2	0.003					R2	0.005				
	Epistemic efficacy						**Early stoppage behavioral intent**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	-0.015	0.013	0.255	-0.011	0.041	Stop message	0.19	0.02	0.000	0.15	0.22
Contingency caveat	-0.003	0.013	0.792	-0.029	0.022	Contingency caveat	-0.01	0.02	0.415	-0.05	0.02
Prior belief	-0.012	0.003	0.001	-0.019	-0.005	Prior belief	0.01	0.00	0.135	0.00	0.02
Constant	0.612	0.018	0.000	0.577	0.648	Constant	0.16	0.02	0.000	0.12	0.21
R2	0.013					R2	0.11				

Note: N = 1,042. Outcome measures re-scaled to range from 0-1.

Table A4. Effects of Early Stoppage Message versus Full Course Message, by Prior Belief

Factual belief						**General future compliance**					
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	0.162	0.024	0.000	0.115	0.209	Stop message	-0.08	0.03	0.023	-0.15	-0.01
Contingency caveat	-0.004	0.010	0.701	-0.016	0.024	Contingency caveat	0.01	0.01	0.557	-0.02	0.04
Prior belief	0.032	0.004	0.000	-0.039	-0.024	Prior belief	0.00	0.01	0.454	-0.02	0.01
Stop message X prior belief	-0.001	0.005	0.857	-0.012	0.010	Stop message X prior belief	0.01	0.01	0.458	-0.01	0.02
Constant	0.334	0.018	0.830	0.299	0.369	Constant	0.79	0.03	0.000	0.74	0.85
R2	0.267					R2	0.01				
Expert credibility						**Acceptance of uncertainty**					
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	-0.039	0.027	0.152	-0.014	0.091	Stop message	-0.036	0.021	0.079	-0.004	0.077
Contingency caveat	-0.005	0.011	0.693	-0.027	0.018	Contingency caveat	-0.002	0.009	0.827	-0.019	0.015
Prior belief	-0.000	0.004	0.910	-0.009	0.008	Prior belief	-0.001	0.003	0.792	-0.006	0.007
Stop message X prior belief	0.006	0.006	0.290	-0.018	0.005	Stop message X prior belief	0.004	0.005	0.386	-0.013	0.005
Constant	0.783	0.020	0.000	0.744	0.823	Constant	0.593	0.015	0.000	0.563	0.623
R2	0.004					R2	0.006				
Epistemic efficacy						**Early stoppage behavioral intent**					
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	-0.018	0.031	0.571	-0.043	0.078	Stop message	0.17	0.04	0.000	0.10	0.25
Contingency caveat	-0.003	0.013	0.791	-0.029	0.022	Contingency caveat	-0.01	0.02	0.414	-0.05	0.02
Prior belief	-0.012	0.005	0.016	-0.021	-0.002	Prior belief	0.01	0.01	0.414	-0.01	0.02
Stop message X prior belief	0.001	0.007	0.925	-0.014	0.013	Stop message X prior belief	0.00	0.01	0.747	-0.01	0.02
Constant	0.614	0.023	0.000	0.568	0.659	Constant	0.17	0.03	0.000	0.11	0.23

R2	0.013	R2	0.11

Note: N = 1,042. Outcome measures re-scaled to range from 0-1.

Table A5. Effects of Early Stoppage Message versus Full Course Message, by Deference to Experts

	Factual belief						**General future compliance**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	-0.10	0.04	0.010	-0.17	-0.02	Stop message	0.04	0.05	0.466	-0.07	0.15
Contingency caveat	-0.01	0.01	0.463	-0.03	0.01	Contingency caveat	0.01	0.01	0.676	-0.02	0.03
Deference	-0.02	0.01	0.000	-0.03	-0.01	Deference	0.06	0.01	0.000	0.04	0.07
Stop message X deference	0.05	0.01	0.000	0.04	0.07	Stop message X deference	-0.02	0.01	0.104	-0.04	0.00
Constant	0.57	0.03	0.000	0.51	0.62	Constant	0.50	0.04	0.000	0.43	0.57
R2	0.19					R2	0.06				
	Expert credibility						**Acceptance of uncertainty**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	0.03	0.04	0.527	-0.05	0.11	Stop message	0.06	0.03	0.056	0.00	0.12
Contingency caveat	0.00	0.01	0.819	-0.02	0.02	Contingency caveat	0.00	0.01	0.863	-0.01	0.02
Deference	0.04	0.01	0.000	0.03	0.05	Deference	0.04	0.00	0.000	0.03	0.05
Stop message X deference	-0.01	0.01	0.397	-0.02	0.01	Stop message X deference	-0.02	0.01	0.005	-0.03	-0.01
Constant	0.55	0.03	0.000	0.50	0.61	Constant	0.39	0.02	0.000	0.35	0.44
R2	0.06					R2	0.08				
	Epistemic efficacy						**Early stoppage behavioral intent**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	-0.02	0.05	0.706	-0.11	0.07	Stop message	-0.11	0.06	0.081	-0.23	0.01
Contingency caveat	-0.01	0.01	0.377	-0.03	0.01	Contingency caveat	-0.02	0.01	0.195	-0.05	0.01
Deference	-0.04	0.01	0.000	-0.05	-0.03	Deference	-0.05	0.01	0.000	-0.07	-0.04

Stop message X deference	0.00	0.01	0.865	-0.02	0.02	Stop message X deference	0.06	0.01	0.000	0.03	0.08
Constant	0.75	0.03	0.000	0.68	0.81	Constant	0.46	0.04	0.000	0.38	0.55
R2	0.05					R2	0.12				

Note: N = 1,042. Outcome measures re-scaled to range from 0-1.

Table A6. Effects of Contingency Caveat by Prior Belief

	Factual belief						**General future compliance**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	0.158	0.010	0.000	0.1381943	0.1783437	Stop message	-0.06	0.01	0.000	-0.08	-0.03
Contingency caveat	0.025	0.024	0.303	-0.0721444	0.0224934	Contingency caveat	.00	.03	0.967	-.07	.07
Prior belief	0.036	0.004	0.000	-0.0433322	-0.0284208	Prior belief	0.00	0.01	0.653	-0.01	0.01
Caveat X prior belief	-0.007	0.005	0.188	-0.0035013	0.0178075	Caveat X prior belief	0.00	0.01	0.747	-0.01	0.02
Constant	0.322	0.018	0.000	0.287	0.357	Constant	0.79	0.03	0.000	0.74	0.84
R2	0.267					R2	0.01				
	Expert credibility						**Acceptance of uncertainty**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	-0.013	0.011	0.264	-0.0096508	0.0351738	Stop message	-0.020	0.009	0.021	0.0030525	0.0374973
Contingency caveat	0.021	0.027	0.446	-0.0323139	0.073344	Contingency caveat	-0.026	0.021	0.210	-0.0665503	0.0146411
Prior belief	-0.001	0.004	0.890	-0.0089098	0.0077379	Prior belief	-0.004	0.003	0.214	-0.010449	0.0023437
Caveat X prior belief	-0.006	0.006	0.306	-0.0180979	0.0056922	Caveat X prior belief	0.006	0.005	0.199	-0.0031517	0.0151296
Constant	0.758	0.020	0.000	0.719	0.797	Constant	0.596	0.015	0.000	0.567	0.626
R2	0.004					R2	0.007				
	Epistemic efficacy						**Early stoppage behavioral intent**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	-0.015	0.013	0.258	-0.0108728	0.0405299	Stop message	0.01	0.04	0.803	-0.07	0.09

Contingency caveat	0.020	0.031	0.510	-0.0402569	0.0809066	Contingency caveat	0.19	0.02	0.000	0.15	0.22
Prior belief	-0.009	0.005	0.060	-0.0187087	0.0003821	Prior belief	0.01	0.01	0.126	0.00	0.02
Caveat X prior belief	-0.006	0.007	0.395	-0.0195546	0.0077268	Caveat X prior belief	-0.01	0.01	0.510	-0.02	0.01
Constant	0.601	0.023	0.000	0.556	0.645	Constant	0.15	0.03	0.000	0.10	0.21
R2	0.013					R2	0.11				

Note: N = 1,042. Outcome measures re-scaled to range from 0-1.

Table A7. Effects of Early Stoppage Message versus Full Course Message, by Contingency Caveat and Prior Belief

	Factual belief					**General future compliance**			
	b	*p*	95% CI			*b*	*p*	95% CI	
Stop message	0.15	0.000	0.12	0.18	Stop message	-0.05	0.009	-0.09	-0.01
Contingency caveat	0.01	0.757	-0.05	0.07	Contingency caveat	0.02	0.616	-0.06	0.11
Prior belief	0.04	0.000	0.03	0.04	Prior belief	0.00	0.653	-0.01	0.01
Caveat X prior belief	-0.01	0.371	-0.02	0.01	Caveat X prior belief	0.00	0.746	-0.02	0.02
Stop message X caveat	0.03	0.425	-0.04	0.10	Stop message X caveat	-0.05	0.393	-0.15	0.06
Stop message X caveat X prior	0.00	0.791	-0.02	0.01	Stop message X caveat X prior	0.01	0.328	-0.01	0.03
Constant	0.33	0.000	0.29	0.36	Constant	0.79	0.000	0.74	0.84
R2	0.27				R2	0.01			

	Expert credibility					**Acceptance of uncertainty**			
	b	*p*	95% CI			*b*	*p*	95% CI	
Stop message	-0.01	0.707	-0.04	0.03	Stop message	-0.02	0.085	-0.05	0.00
Contingency caveat	0.06	0.090	-0.01	0.13	Contingency caveat	-0.05	0.071	-0.10	0.00
Prior belief	0.00	0.894	-0.01	0.01	Prior belief	0.00	0.214	-0.01	0.00
Caveat X prior belief	-0.01	0.064	-0.03	0.00	Caveat X prior belief	0.01	0.054	0.00	0.02
Stop message X caveat	-0.07	0.078	-0.15	0.01	Stop message X caveat	0.04	0.186	-0.02	0.11
Stop message X caveat X prior	0.01	0.085	0.00	0.03	Stop message X caveat X prior	-0.01	0.133	-0.02	0.00
Constant	0.75	0.000	0.71	0.79	Constant	0.60	0.000	0.57	0.63

R2	0.01				R2	0.01			
	Epistemic efficacy					**Early stoppage behavioral intent**			
	b	*p*	95% CI			*b*	*p*	95% CI	
Stop message	-0.01	0.653	-0.04	0.03	Stop message	0.20	0.000	0.16	0.25
Contingency caveat	0.01	0.877	-0.07	0.08	Contingency caveat	0.04	0.453	-0.06	0.14
Prior belief	-0.01	0.061	-0.02	0.00	Prior belief	0.01	0.124	0.00	0.02
Caveat X prior belief	0.00	0.934	-0.02	0.02	Caveat X prior belief	-0.01	0.444	-0.03	0.01
Stop message X caveat	0.03	0.568	-0.07	0.12	Stop message X caveat	-0.05	0.371	-0.17	0.06
Stop message X caveat X prior	-0.01	0.312	-0.03	0.01	Stop message X caveat X prior	0.00	0.697	-0.02	0.03
Constant	0.60	0.000	0.55	0.64	Constant	0.14	0.000	0.08	0.20
R2	0.01				R2	0.11			

Note: N = 1,042. Outcome measures re-scaled to range from 0-1.

Appendix 2. Additional pre-registered moderation analyses

We expect deference's effect will be strongest when the message matches the respondent's prior belief about antibiotic use (or conversely, less deferent individuals will resist messaging most when it contradicts prior belief).

H3. Message effects will increase with deference to experts, especially when the message is consistent with prior belief about best practice.

We plot defefrence's effect on factual belief, behavioral intent, and acceptance of uncertainty across prior belief below. As the figures show, deference's moderation effect does not consistently increase with the message's concordance with prior belief. Full results are included in Table A7.

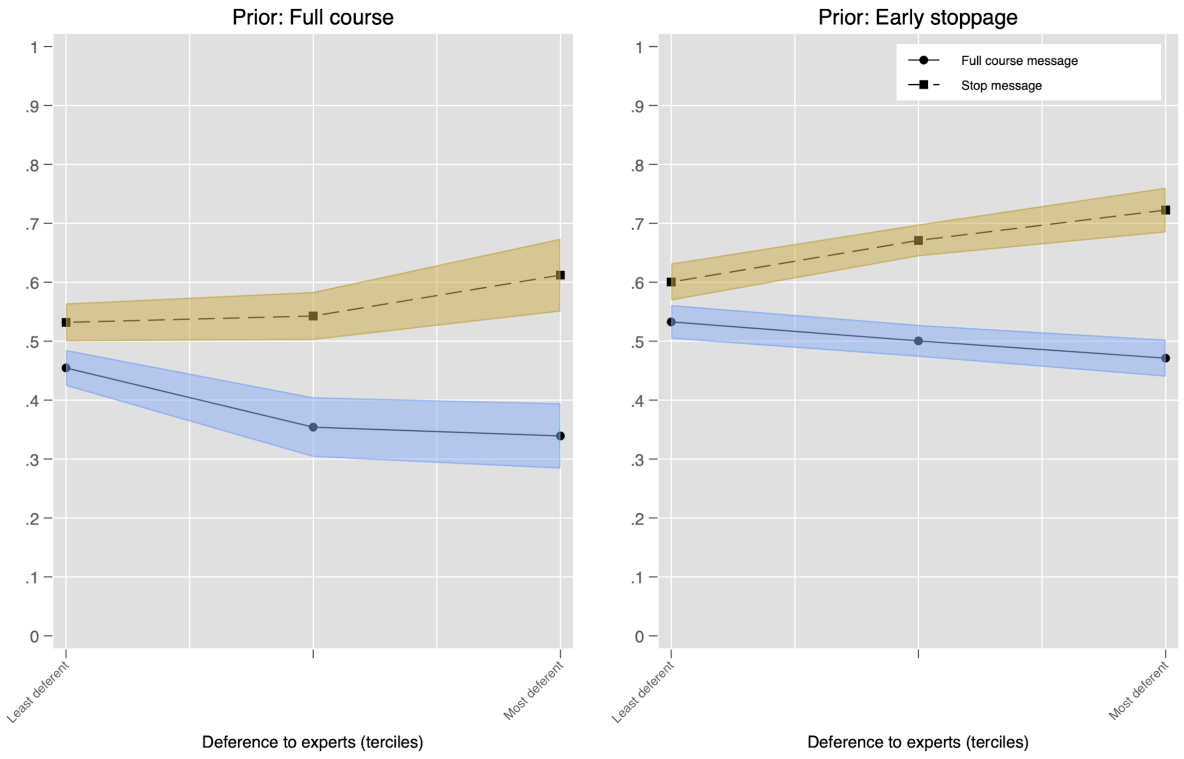

Figure A3. Early stoppage beliefs across message, prior belief, and deference to experts

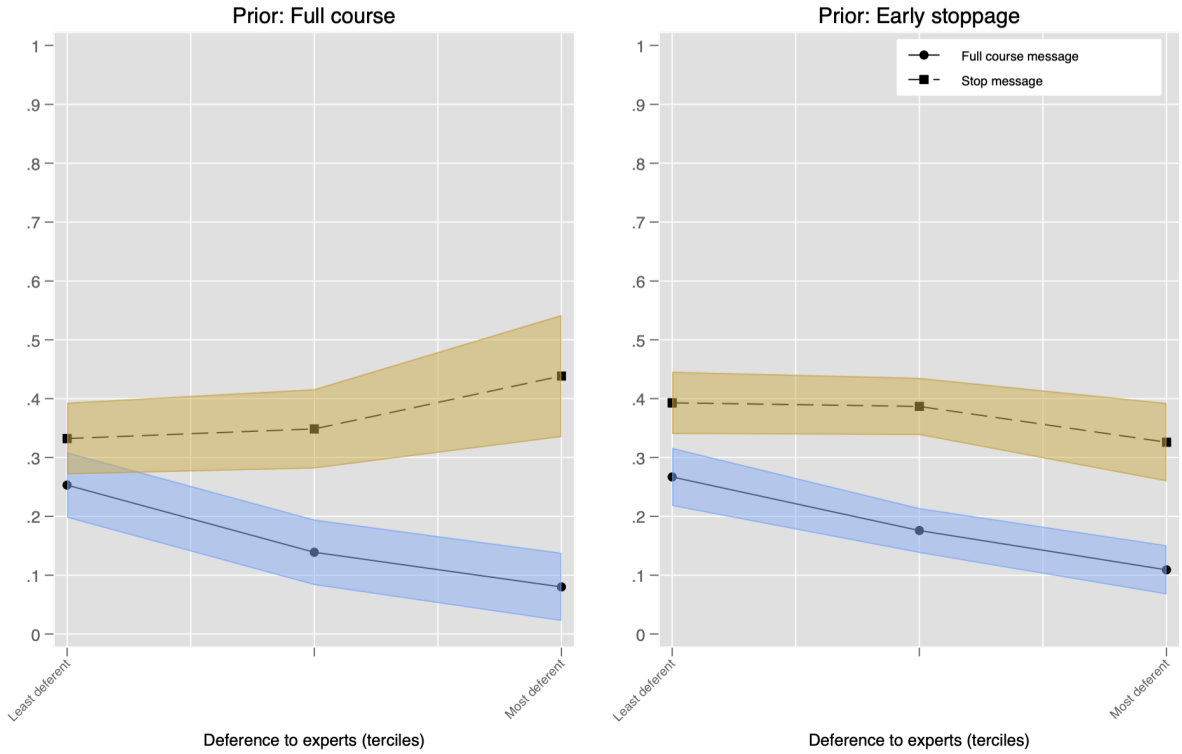

Figure A4. Early stoppage intent across message, prior belief, and deference to experts

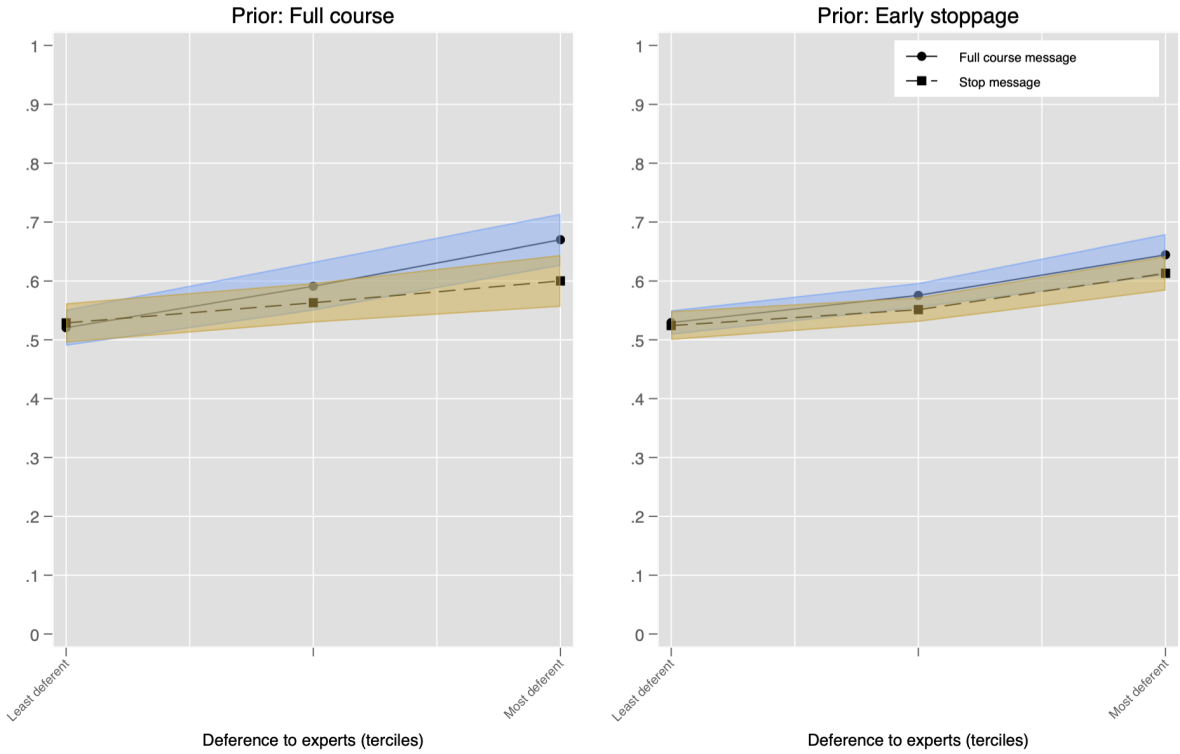

Figure A5. Acceptance of uncertainty across message, prior belief, and deference to experts

Table A8. Effects of Early Stoppage Message versus Full Course Message, by Deference and Prior Belief

	Factual belief						General future compliance				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	-0.04	0.05	0.474	-0.14	0.06	Stop message	0.20	0.07	0.008	0.05	0.34
Contingency caveat	0.00	0.01	0.895	-0.02	0.02	Contingency caveat	0.01	0.01	0.478	-0.02	0.04
Prior belief	0.01	0.01	0.228	-0.01	0.03	Prior belief	-0.01	0.01	0.561	-0.04	0.02
Deference	-0.05	0.01	0.000	-0.07	-0.03	Deference	0.05	0.01	0.000	0.03	0.08
Stop message X deference	0.06	0.01	0.000	0.05	0.08	Stop message X deference	-0.01	0.01	0.236	-0.04	0.01
Stop message X prior belief	-0.07	0.02	0.003	-0.12	-0.02	Stop message X prior belief	-0.17	0.04	0.000	-0.24	-0.10
Prior belief X deference	0.01	0.00	0.012	0.00	0.01	Prior belief X deference	0.00	0.00	0.975	-0.01	0.01

Stop message X deference X prior belief	0.01	0.00	0.005	0.00	0.02	Stop message X deference X prior belief	0.03	0.00	0.000	0.02	0.03
Constant	0.55	0.04	0.000	0.46	0.63	Constant	0.56	0.06	0.000	0.44	0.68
R2	0.32					R2	0.09				

	Expert credibility						**Acceptance of uncertainty**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	0.19	0.06	0.001	0.08	0.30	Stop message	0.13	0.04	0.004	0.04	0.21
Contingency caveat	0.00	0.01	0.806	-0.02	0.02	Contingency caveat	0.00	0.01	0.857	-0.02	0.01
Prior belief	-0.02	0.01	0.069	-0.04	0.00	Prior belief	-0.01	0.01	0.359	-0.02	0.01
Deference	0.03	0.01	0.001	0.01	0.05	Deference	0.04	0.01	0.000	0.03	0.06
Stop message X deference	0.00	0.01	0.649	-0.02	0.01	Stop message X deference	-0.02	0.01	0.007	-0.03	-0.01
Stop message X prior belief	-0.17	0.03	0.000	-0.22	-0.11	Stop message X prior belief	-0.06	0.02	0.003	-0.10	-0.02
Prior belief X deference	0.00	0.00	0.340	0.00	0.01	Prior belief X deference	0.00	0.00	0.902	0.00	0.00
Stop message X deference X prior belief	0.02	0.00	0.000	0.02	0.03	Stop message X deference X prior belief	0.01	0.00	0.001	0.00	0.02
Constant	0.64	0.05	0.000	0.55	0.74	Constant	0.41	0.04	0.000	0.34	0.48
R2	0.10					R2	0.10				

	Epistemic efficacy						**Early stoppage behavioral intent**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	0.11	0.07	0.103	-0.02	0.24	Stop message	-0.34	0.08	0.000	-0.50	-0.17
Contingency caveat	-0.01	0.01	0.669	-0.03	0.02	Contingency caveat	-0.01	0.02	0.535	-0.04	0.02
Prior belief	-0.01	0.01	0.352	-0.04	0.01	Prior belief	0.04	0.02	0.026	0.00	0.07
Deference	-0.04	0.01	0.000	-0.07	-0.02	Deference	-0.04	0.01	0.017	-0.06	-0.01
Stop message X deference	0.00	0.01	0.723	-0.02	0.03	Stop message X deference	0.07	0.01	0.000	0.04	0.09
Stop message X prior belief	-0.11	0.03	0.001	-0.17	-0.05	Stop message X prior belief	0.17	0.04	0.000	0.09	0.25
Prior belief X deference	0.00	0.00	0.794	0.00	0.01	Prior belief X deference	-0.01	0.00	0.078	-0.01	0.00

Stop message X deference X prior belief	0.02	0.00	0.000	0.01	0.02	Stop message X deference X prior belief	-0.02	0.01	0.000	-0.04	-0.01
Constant	0.81	0.06	0.000	0.70	0.92	Constant	0.32	0.07	0.000	0.18	0.46
R2	0.08					R2	0.16				

Note: N = 1,042. Outcome measures re-scaled to range from 0-1.

We also assessed one other potential source of heterogeneous effects. Acceptance of new guideline messages should also be greater for those higher in antibiotic resistance concern, as the reasoning for treatment recommendation is based on reducing antibiotic resistance.

H4. Message effects will increase with antibacterial resistance concern**.**

We tested this hypothesis using ordinary least-squares regression models for each of our outcome variables. We assessed each hypothesized moderation by adding concern and the interaction terms to the main effects model. Again, all outcome measures were re-scaled 0-1.

Prior concern about antibacterial resistance appears to strengthen the effects of the "stop" message on relevant factual beliefs (b = .03, SE = .01, p < .001) and behavioral intention (b = .02, SE = .01, p = .002), supporting H4 on key outcomes. Those who were more concerned were especially likely to accept the guideline.

Table A9. Effects of Early Stoppage Message versus Full Course Message, by Antibacterial Resistance Concern

	Factual belief						**General future compliance**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	-0.02	0.03	0.544	-0.08	0.04	Stop message	-0.02	0.04	0.717	-0.10	0.07
Contingency caveat	0.01	0.01	0.248	-0.01	0.03	Contingency caveat	0.00	0.01	0.734	-0.02	0.03
Concern	-0.02	0.00	0.000	-0.03	-0.02	Concern	0.05	0.01	0.000	0.03	0.06
Stop message X concern	0.03	0.01	0.000	0.02	0.04	Stop message X concern	-0.01	0.01	0.541	-0.02	0.01
Constant	0.51	0.02	0.000	0.47	0.56	Constant	0.53	0.03	0.000	0.46	0.59
R2	0.19					R2	0.09				

	Expert credibility						**Acceptance of uncertainty**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	0.03	0.03	0.312	-0.03	0.10	Stop message	0.01	0.03	0.616	-0.04	0.06
Contingency caveat	0.00	0.01	0.697	-0.02	0.02	Contingency caveat	0.00	0.01	0.890	-0.01	0.02
Concern	0.04	0.00	0.000	0.03	0.05	Concern	0.02	0.00	0.000	0.011	0.02
Stop message X concern	-0.01	0.01	0.354	-0.02	0.01	Stop message X concern	0.00	0.00	0.713	-0.01	0.01
Constant	0.57	0.02	0.000	0.52	0.62	Constant	0.48	0.02	0.000	0.44	0.51
R2	0.10					R2	0.05				

	Epistemic efficacy						**Early stoppage behavioral intent**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message	-0.03	0.04	0.519	-0.10	0.05	Stop message	-0.01	0.05	0.918	-0.10	0.09
Contingency caveat	-0.01	0.01	0.444	-0.03	0.01	Contingency caveat	-0.02	0.01	0.133	-0.05	0.01
Concern	0.02	0.01	0.000	0.01	0.03	Concern	-0.06	0.01	0.000	-0.07	-0.04

Stop message X concern	0.01	0.01	0.314	-0.01	0.02	Stop message X concern	0.03	0.01	0.000	0.02	0.05
Constant	0.43	0.03	0.000	0.37	0.48	Constant	0.50	0.04	0.000	0.43	0.57
R2	0.03					R2	0.14				

Note: N = 1,042. Outcome measures re-scaled to range from 0-1.

Appendix 3. Robustness checks

Table A10. Acceptance of uncertainty individual scale item models.

	Item 1					Item 2					Item 3					Item 4				
	b	*SE*	*p*	95% CI		*b*	*SE*	*p*	95% CI		*b*	*SE*	*p*	95% CI		*b*	*SE*	*p*	95% CI	
Stop message	-0.04	0.09	0.630	-.22	.13	- 0.10	0.09	0.261	-0.28	0.08	-0.14	0.10	0.137	-0.34	0.05	-0.19	0.08	0.011	-.34	-.05
Contingency caveat	0.16	0.09	0.073	-0.01	0.33	-0.11	0.09	0.224	-0.29	0.07	-0.10	0.10	0.325	-0.29	0.10	0.00	0.08	0.964	-0.15	0.15
Prior belief	-0.09	0.02	0.000	-0.14	-0.05	0.04	0.02	0.067	0.00	0.09	0.07	0.03	0.006	0.02	0.12	-0.05	0.02	0.015	-0.09	-0.01
Constant	4.82	0.12	0.000	4.58	5.06	3.47	0.13	0.000	3.23	3.73	4.39	0.13	0.000	4.13	4.65	5.34	0.10	0.000	5.14	5.55
R2	0.02					0.01					0.01					0.01				

N = 1,042. Unstandardized, unscaled coefficients. Item 1: "I am comfortable accepting uncertainty in the guidelines issued by medical institutions"; Item 2: "New guidelines that contradict old guidelines make me uncomfortable" (reverse coded); Item 3: "There is no reason to follow new guidelines because they are always changing anyway" (reverse coded); Item 4: "I prefer to carry out a current medical recommendation even though it may change in the future."

Table A11. Effects of Early Stoppage Message versus Full Course Message by Caveat, Alternative Treatment Dummies Model

	Factual belief						General future compliance				
	b	***SE***	***p***	**95% CI**			***b***	***SE***	***p***	**95% CI**	
Stop message, no caveat	-1.77	0.17	0.000	-2.11	-1.43	Stop message, no caveat	0.32	0.12	0.009	0.08	0.57
Stop message, caveat	-1.95	0.17	0.000	-2.29	-1.61	Stop message, caveat	0.38	0.12	0.002	0.14	0.63
Full course message, caveat	0.08	0.17	0.636	-0.26	0.42	Full course message, caveat	0.05	0.12	0.709	-0.20	0.29
Prior belief	0.39	0.03	0.000	0.32	0.45	Prior belief	-0.01	0.02	0.754	-0.05	0.04
Constant	-0.13	0.18	0.461	-0.48	0.22	Constant	5.37	0.13	0.000	5.12	5.62
R2	0.27					R2	0.01				
	Expert credibility						**Acceptance of uncertainty**				

	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message, no caveat	0.04	0.10	0.700	-0.15	0.23	Stop message, no caveat	0.13	0.07	0.088	-0.02	0.27
Stop message, caveat	0.05	0.10	0.599	-0.14	0.24	Stop message, caveat	0.11	0.07	0.141	-0.04	0.26
Full course message, caveat	-0.07	0.10	0.493	-0.26	0.12	Full course message, caveat	-0.01	0.07	0.941	-0.15	0.14
Prior belief	-0.02	0.02	0.234	-0.06	0.01	Prior belief	-0.01	0.01	0.630	-0.03	0.02
Constant	5.56	0.10	0.000	5.37	5.76	Constant	4.38	0.08	0.000	4.23	4.53
R2	0.00					R2	0.01				

	Epistemic efficacy						**Early stoppage behavioral intent**				
	b	*SE*	*p*	95% CI			*b*	*SE*	*p*	95% CI	
Stop message, no caveat	0.05	0.11	0.647	-0.17	0.27	Stop message, no caveat	-1.21	0.14	0.000	-1.49	-0.94
Stop message, caveat	0.07	0.11	0.534	-0.15	0.29	Stop message, caveat	-1.19	0.14	0.000	-1.47	-0.92
Full course message, caveat	-0.06	0.11	0.592	-0.28	0.16	Full course message, caveat	-0.18	0.14	0.191	-0.46	0.09
Prior belief	-0.07	0.02	0.001	-0.11	-0.03	Prior belief	0.04	0.03	0.133	-0.01	0.09
Constant	4.60	0.11	0.000	4.38	4.83	Constant	3.14	0.14	0.000	2.86	3.42
R2	0.01					R2	0.11				

Note: N = 1,042. Outcome measures re-scaled to range from 0-1. Reference group is full course message, no caveat.

Appendix 4: Stimuli text.

Condition 1: stop -- *Message 1.*

Antibiotics are used to treat or prevent some types of bacterial infection. But they don't work for everything. Antibiotics don't work for viral infections such as colds and flu, and most coughs and sore throats.

You may have heard about antibiotics in the news recently. There has been some disagreement about when or if patients should stop treatment.

Medical experts want to let you know the consensus view on this matter. Experts recommend that for common bacterial infections:

Patients should stop taking antibiotics when they feel better.

Recent studies show that stopping antibiotic treatment early does not encourage antibiotic resistance as once thought, while taking antibiotics for longer than necessary increases the risk of resistance.

As always, you should *consult* with *your* healthcare provider about *your* specific health needs.

Condition: stop + caveat -- *Message 2.*

Antibiotics are used to treat or prevent some types of bacterial infection. But they don't work for everything. Antibiotics don't work for viral infections such as colds and flu, and most coughs and sore throats.

You may have heard about antibiotics in the news recently. There has been some disagreement about when or if patients should stop treatment.

Medical experts want to let you know the consensus view on this matter. Experts recommend that for common bacterial infections:

Patients should stop taking antibiotics when they feel better.

Recent studies show that stopping antibiotic treatment early does not encourage antibiotic resistance as once thought, while taking antibiotics for longer than necessary increases the risk of resistance.

However, the advice of medical professionals is contingent on the best current evidence and may evolve over time.

As always, you should *consult* with *your* healthcare provider about *your* specific health needs.

Condition: full course -- *Message 3.*

Antibiotics are used to treat or prevent some types of bacterial infection. But they don't work for everything. Antibiotics don't work for viral infections such as colds and flu, and most coughs and sore throats.

You may have heard about antibiotics in the news recently. There has been some disagreement about when or if patients should stop treatment.

Medical experts want to let you know the consensus view on this matter. Experts recommend:

Patients should take the full course of antibiotics, even if they feel better.

Stopping antibiotic treatment early may encourage antibiotic resistance.

As always, you should *consult* with *your* healthcare provider about *your* specific health needs.

Condition: full course + caveat -- *Message 4.*

Antibiotics are used to treat or prevent some types of bacterial infection. But they don't work for everything. Antibiotics don't work for viral infections such as colds and flu, and most coughs and sore throats.

You may have heard about antibiotics in the news recently. There has been some disagreement about when or if patients should stop treatment.

Medical experts want to let you know the consensus view on this matter. Experts recommend:

Patients should take the full course of antibiotics, even if they feel better.

Stopping antibiotic treatment early may encourage antibiotic resistance.

However, the advice of medical professionals is contingent on the best current evidence and may evolve over time.

As always, you should *consult* with *your* healthcare provider about *your* specific health needs.

Appendix 4. CONSORT-SPI 2018 checklist

Section	Item #	CONSORT 2010	CONSORT-SPI 2018	Checklist (page numbers)
Title and abstract				
	1a	Identification as a randomised trial in the title[§]		1
	1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for Abstracts)[§]	Refer to CONSORT extension for social and psychological intervention trial abstracts	2
Introduction				
Background and objectives	2a	Scientific background and explanation of rationale[§]		3-8
	2b	Specific objectives or hypotheses[§]	If pre-specified, how the intervention was hypothesised to work	5-8
Methods				
Trial design	3a	Description of trial design (such as parallel, factorial), including allocation ratio[§]	If the unit of random assignment is not the individual, please refer to CONSORT for Cluster Randomised Trials [33]	8-9
	3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons		N/A
Participants	4a	Eligibility criteria for participants[§]	When applicable, eligibility criteria for settings and those delivering the interventions	8
	4b	Settings and locations where the data were collected		8

Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered[§]		8-10
	5a		Extent to which interventions were actually delivered by providers and taken up by participants as planned	N/A
	5b		Where other informational materials about delivering the intervention can be accessed	N/A
	5c		When applicable, how intervention providers were assigned to each group	N/A
Outcomes	6a	Completely defined pre-specified outcomes, including how and when they were assessed[§]		10-12
	6b	Any changes to trial outcomes after the trial commenced, with reasons		N/A
Sample size	7a	How sample size was determined[§]		8
	7b	When applicable, explanation of any interim analyses and stopping guidelines		N/A
Randomisation				
Sequence generation	8a	Method used to generate the random allocation sequence		N/A
	8b	Type of randomisation; details of any restriction (such as blocking and block size)[§]		8
Allocation concealment mechanism	9	Mechanism used to implement the random allocation sequence, describing any steps taken to conceal the sequence until interventions were assigned[§]		N/A

Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions[§]		8
Awareness of assignment	11a	Who was aware of intervention assignment after allocation (for example, participants, providers, those assessing outcomes), and how any masking was done		N/A
	11b	If relevant, description of the similarity of interventions		N/A
Analytical methods	12a	Statistical methods used to compare group outcomes[§]	How missing data were handled, with details of any imputation method	15
	12b	Methods for additional analyses, such as subgroup analyses, adjusted analyses, and process evaluations		13-15
Results				
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers randomly assigned, receiving the intended intervention, and analysed for the outcomes[§]	Where possible, the number approached, screened, and eligible prior to random assignment, with reasons for non-enrolment	8-9
	13b	For each group, losses and exclusions after randomisation, together with reasons[§]		8-9
Recruitment	14a	Dates defining the periods of recruitment and follow-up		8
	14b	Why the trial ended or was stopped		N/A
Baseline data	15	A table showing baseline characteristics for each group[§]	Include socioeconomic variables where applicable	27
Numbers analysed	16	For each group, number included in each analysis and whether the analysis was by original assigned groups[§]		13-15

Outcomes and estimation	17a	For each outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)[§]	Indicate availability of trial data	13-15
	17b	For binary outcomes, the presentation of both absolute and relative effect sizes is recommended		N/A
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses, adjusted analyses, and process evaluations, distinguishing pre-specified from exploratory		N/A
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for Harms)		N/A
Discussion				
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses		17-18
Generalisability	21	Generalisability (external validity, applicability) of the trial findings[§]		17
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence		15-18
Important information				
Registration	23	Registration number and name of trial registry		8
Protocol	24	Where the full trial protocol can be accessed, if available		8
Declaration of interests	25	Sources of funding and other support; role of funders	Declaration of any other potential interests	1
Stakeholder involvement*	26a		Any involvement of the intervention developer in the	N/A

			design, conduct, analysis, or reporting of the trial	
	26b		Other stakeholder involvement in trial design, conduct, or analyses	N/A
	26c		Incentives offered as part of the trial	8