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Campaign Preparation for Complex Initiatives: A Person-centered Approach to Audience Segmentation of Parents' Antibiotic Stewardship

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Abstract

The evolution of antibiotic resistance is outpacing the speed at which new antibiotics will reach the marketplace. To slow the rate of resistance, people need to engage in antibiotic stewardship, which includes acts to prevent the spread of bacteria and judicious use of antibiotics to treat infections. This study identified the patterns and predictors of antibiotic stewardship behaviors of parents ($N = 516$) related to their children. The latent class analysis revealed three profiles of parental stewardship, labeled Stewards, Requesters, and Non-Stewards. The findings implied different campaign goals: to encourage Stewards to follow through on their intentions, to encourage Requesters to stop asking providers for antibiotics when their children have ear infections, and to influence Non-Stewards to accept medical advice when an antibiotic is not indicated and to dispose of leftover antibiotics. The covariate analysis provided theoretical insight into the strategies to pursue in campaigns targeting these three groups. For example, parents who perceived antibiotic-resistant infections as less serious health conditions, felt less worry when thinking about their child getting an antibiotic-resistant infection, and had stronger misattributions of antibiotics' efficacy to treat multiple symptoms were more likely to be Requesters and Non-Stewards, instead of Stewards.

Keywords

antibiotic stewardship; parents; audience segmentation; latent class analysis

“The future of humanity and microbes likely will unfold as episodes of a suspense thriller that could be titled *Our Wits Versus Their Genes*” (Lederberg, 2000, p. 290).

Antibiotic-resistant bacteria are emerging and spreading at an unprecedented rate (CDC, 2013). The CDC (2013) estimates that more than two million people in the U.S. are infected by antibiotic resistant bacteria each year. At least 23,000 people die each year as a result of an antibiotic resistant infection (CDC, 2013). In reaction to this public health threat, President Obama (2014) issued an executive order to address antibiotic resistance and called for a national strategy to speed the rate of developing new antibiotics and slow the rate at which existing antibiotics lose effectiveness against bacterial infections (i.e., antibiotic resistance).

The two primary strategies to slow down antibiotic resistance are to reduce the number of infections and to promote judicious use of antibiotics (CDC, 2013). Biologically, the fewer bacteria that are exposed to antibiotics, the slower the evolution of resistance (Smith, M'ikanatha, & Read, 2015). Reducing the number of infections decreases the likelihood of drug exposure (CDC, 2013; Laxminarayan et al., 2013; Smith et al., 2015). Infections are controlled by reducing transmission through personal hygiene and sanitation and by reducing infection through vaccination (CDC, 2013; Laxminarayan et al., 2013; Smith et al., 2015). Judicious use entails taking antibiotics at the optimal dose, duration, and toxicity to cure a problematic bacterial infection. The use of the modifier *problematic* refers to the body's own defenses: in some cases, people's immune systems are able to clear bacterial infections without drug treatment (Levy, 1998). Judicious exposure includes avoiding antibiotics when they are not useful, such as with viral infections (Levy, 1998; Smith et al., 2015).

Antibiotic stewardship, then, involves practices by multiple stakeholders, including the general public (Laxminarayan et al., 2013; Smith et al., 2015). The public can engage in infection control behaviors, such as sanitation and vaccination, and judicious use behaviors, such as accepting evidence-based recommendations for whether an antibiotic should be used to treat an infection, taking antibiotics prescriptions as prescribed (e.g., disposing of unused antibiotics safely, taking them for the recommended number of days, and not sharing them with others; Levy, 1998; Smith et al., 2015; Smith, Quesnell, Glick, Hackman, & M'ikanatha, 2015). Levels of infection control and judicious use of antibiotics are problematic (Fleming-Dutra, Shapiro, Hicks, Gerber, & Hersh, 2014) and have been prioritized by the CDC (2013) as behaviors to promote through intervention. Previous campaigns to improve antibiotic stewardship have focused almost exclusively on antibiotic prescription behaviors within clinical encounters; these campaigns have had mixed, largely minimal, success (see Edgar, Boyd, & Palamé, 2009). This study is the first to focus on the broader goal of increasing antibiotic stewardship among the parents before they reach the doctor's office.

To inform interventions that can increase antibiotic stewardship, research is needed to understand the current stewardship intentions of the general public, diversity in those intentions, and potential determinants of those intentions based on theory (Maibach, Leiserowitz, Roser-Renouf, & Mertz, 2011; Maibach, Maxfield, Ladin, & Slater, 1996; Slater, 1996; Slater, Kelly, & Thackeray, 2006). In this study, we investigated the patterns and predictors of antibiotic stewardship behaviors of parents related to their children, a group prioritized for intervention (CDC, 2013; Vaz et al., 2014), and the risk perception

attitude framework (RPA; Rimal & Real, 2003) as a framework to consider persuasive appeals for different target audiences.

Parental Stewardship to Address Antibiotic Resistance

Young children, in particular, may be unnecessarily exposed to antibiotics (Vaz et al., 2014). Childhood is a time of infection. Children's immature immune systems make them more susceptible to infection (Simon, Hollander, & McMichael, 2015). Young children's (2 to 5) exploration of their physical and social environments can increase exposure to infections: meta-analyses show that being in childcare and larger families (e.g., more siblings) are associated with increased odds of young children experiencing ear infections (Zhang et al., 2014) and respiratory infections (Jackson et al., 2013).

Immune development, childcare, and family size may not be changeable, but there are modifiable risk factors for infection. Incomplete vaccination is a risk factor for respiratory infections (Jackson et al., 2013), and vaccination rates remain low. For example, in the U. S., less than 50% of children are fully vaccinated for influenza (Jules et al., 2015), which contributes to outpatient visits for sick children under 3 years of age, and unnecessary use of antibiotic for influenza-associated illness (Neuzil, Mellen, Wright, Mitchel, & Griffin, 2000). Cleaning also affects infection. For example, in a study of household-acquired methicillin-resistant staphylococcus aureus (MRSA; an antibiotic-resistant bacterial infection), family members who shared washcloths, towels, and clothing with children diagnosed with MRSA had significantly higher odds of contracting it (Nerby et al., 2011). All of these modifiable factors contribute to high rates of clinical visits to treat infections. Some of these infections, such as acute respiratory infections, are caused by viruses, not bacteria (Shi, McLean, Campbell, & Nair, 2015); viruses are not cured by antibiotics (Laxminarayan et al., 2013; Levy, 1998).

There has been much attention on the medical community to improve judicious use of antibiotics for children, and some indication that these prescriptions have declined in some areas (Hersh, Shapiro, Pavia, & Shah, 2011; Vaz et al., 2014); but overall, the estimated annual rate of appropriate antibiotic prescriptions for all acute respiratory infections among youth is estimated at 33.7% (Fleming-Dutra et al., 2016). Prescription behaviors need to improve. One of the many contributors to the inappropriate rate of antibiotic prescriptions may be parents: parents may expect, request, and even attempt to persuade providers to provide antibiotics for their sick children (Cabral, Horwood, Hay, & Lucas, 2014; Harrington, Norling, Witte, Taylor, & Andrews, 2007; Stivers, 2002; Stivers, Mangione-Smith, Elliott, McDonald, & Heritage, 2003; Vaz et al., 2015). Research shows that physicians find parents' implicit expectations or explicit requests for antibiotics difficult to resist (Mangione-Smith et al., 2015; Stivers et al., 2003). In one study (Baucher, Pelton, & Klein, 1999), 30% of physicians reported prescribing antibiotics for children when pressured by their parents. Parents' requests and influence attempts could be a critical target for campaigns. Why might parents expect antibiotics? One possibility is that they are unaware that antibiotic exposure leads to the emergence and spread of antibiotic resistant infections (Vaz et al., 2015). They also may be unaware of the harms that antibiotic use, in general, may pose to their children (Vaz et al., 2015).

All antibiotics interfere with the body's microbiota, but when people take them unnecessarily, they experience the negative consequences and no benefit. Antibiotic use can be more detrimental in children than adults. A child's immune system continues developing after birth and reaches an adult-like state at about age 3. This development is shaped, in part, by the gut microbiota (Schulfer & Blaser, 2015). The human microbiota refers to the trillions of microorganisms (e.g., bacteria) living in and on people; thousands of different species of bacteria and other organisms live in the gut (Fishman, 2006). Antibiotic treatment changes the gut microbiota. In young children, the gut microbiota usually recovers in about 4 weeks after their first exposure to an antibiotic, but recovery is less complete following the second exposure (e.g., Dethlefsen & Relman, 2011). In addition to challenging the development of the immune system, the gut microbiota is involved in absorbing nutrients, which may be why antibiotic treatment is associated with increased weight gain in humans (Schulfer & Blaser, 2015). When people take antibiotics, the non-target bacteria in the microbiota can also become resistant, and then share their resistance genes with future disease-causing bacteria (Laxminarayan et al., 2013; Levy, 1998; Smith et al., 2015). Antibiotic treatment, then, can have immediate and future costs.

A final parental consideration is treatment compliance and problematic consequences of unused antibiotics. Patients do not always take all of the antibiotics that are prescribed; a meta-analysis showed that in North America, 57% of patients were compliant (Kardas, Devine, Golembesky, & Roberts, 2005). A recent study showed that over 30% of US adults kept their unused antibiotics, and almost 15% shared those unused antibiotics with others (Smith et al., 2015). It is unclear whether pediatric patients' parents keep or share their children's remaining drugs.

Audience Segmentation

Parents of young children likely vary in their antibiotic stewardship behaviors. Audience segmentation is a campaign design strategy in which diverse audiences are categorized into sub-groups based on shared characteristics (Slater, 1996). Sub-group identification provides critical information for prioritizing targets for intervention and for planning effective campaigns for particular targets (Maibach et al., 2011). The assumption is that sub-groups may need different strategies to achieve beneficial outcomes (Slater & Flora, 1991; Storey, Saffitz, & Rimon, 2008).

Antibiotic stewardship presents a challenge to current methods for campaign research because it incorporates many diverse behaviors. The prevailing guidance on audience segmentation encourages campaign designers to identify audience segments based on shared determinants of a behavior (Slater, 1996). Indeed, some theories, like the theory of reasoned action (Fishbein & Ajzen, 2010; Yzer, 2013), limit their scope to one behavior at a time and its unique psychosocial determinants. One option, then, is to target each behavior associated with stewardship and identify its determinants. If multiple behaviors are needed to address a health threat, one behavior would need to be prioritized above another. Targeting individual behaviors also presumes that target behaviors are not patterned or behavioral patterns are not determined by a common cause; this may not be the case for every health threat. Furthermore, some health threats may not be improved by a single behavior. Previous

targeted campaigns addressing multiple behaviors have focused primarily on cancer-related behaviors (e.g., smoking, sun exposure) and weight management (e.g., nutrition and exercise; Noar, Harrington, & Aldrich, 2009). As with these other conditions, multiple behaviors are needed to achieve positive antibiotic stewardship outcomes.

An alternative strategy is to segment the audience by using latent class analysis (LCA; Collins & Lanza, 2010) to identify profiles based on shared, targeted behaviors, in this case, stewardship intentions. This focus on behaviors aligns with a lifestyle analysis (Slater & Flora, 1991), which allows one to understand how many behaviors may need to change within a given segment. Some behavioral profiles could be identified as more problematic for public health (by number of problematic behaviors or greater severity of the action), which could help to prioritize which segments to target first when resources are limited. In addition, there may also be low-hanging fruit that could make a big difference at a low cost. Assuming that profiles with more problem behaviors will be more difficult to change, researchers can anticipate which segments may need stronger persuasive appeals.

Recent developments in person-centered methods allow rigorous, quantitative identification of classes for audience segmentation. This study uses LCA (Collins & Lanza, 2010), which is similar to other latent variable models such as factor models, in that it attempts to capture latent constructs from measurable variables. LCA is used when the latent construct is categorical (Collins & Lanza, 2010), as with audience segments. The procedure provides two parameters: (a) the likelihood of membership in a latent class, and (b) the likelihood of a providing a particular response conditional on the set of classes. Goodness-of-fit indicators for models are used to select the best number of classes.

A recent study (Smith et al., 2015) conducted an LCA of adults' stewardship patterns. Smith et al. identified three groups, labeled as Stewards, Stockers, and Demanders. Stewards showed intentions that aligned with stewardship goals. Stockers intended to store antibiotics for future illness and to take them along as they traveled abroad. Demanders had some intentions to keep antibiotics, but were distinguished by their intentions to ask providers for antibiotic prescriptions and to persuade their health providers to change their minds and prescribe an antibiotic if their providers were initially reluctant to provide one. Smith and colleagues' results provided novel insights into patterns of stewardship behaviors and into campaign planning for efforts to address a number of behaviors; however, its findings may not be relevant for planning campaigns for parents of young children. Only 37% of their sample reported having children, and there was no information about the age of those children. In addition, the study considered self-reported stewardship intentions, not parents' intentions for acting on behalf of their sick children. Parents may show different patterns of antibiotic stewardship in relation to caring for their children than for themselves. For example, judicious antibiotic use may be seen as fine for adults, but as depriving vulnerable children (Cabral et al., 2014).

Research Question 1: Is there a latent class structure that adequately represents the heterogeneity in U.S. parents' intentions to engage in stewardship related to their children?

Predictors of Stewardship Intentions

LCA also allows for a covariate analysis, which enables us to investigate potential persuasive strategies associated with a segment who intend to engage in the same stewardship behaviors. While LCA characterizes the patterns and diversity in stewardship (thus providing insight into how many interventions may be needed), theory is needed to understand how to intervene effectively with each segment (Slater, 1996; Slater et al., 2006; Maibach et al., 1996; Maibach et al., 2011). In this study of parents, we included variables from RPA (Rimal & Real, 2003) and health mavenism (Boster, Kotowski, Andrews, & Serota, 2011).

RPA

The RPA (Rimal & Real, 2003) explains how people's perceptions of health risks and their perceptions about the efficacy of particular responses predict their actions. Stronger perceptions of risks, such as severity, motivate people to act. In Smith et al. (2015), severity was considered in relation to antibiotic-resistant infection. As parents perceive antibiotic-resistant infections as more serious, painful, or fatal, they should be more likely to act as antibiotic stewards. In many health models, these risk assessments are motivating because they also evoke negative emotions, including worry (So, 2013; So, Kuang, & Cho, 2016). We expect that as parents worry more about antibiotic-resistant infections, they will engage in more antibiotic stewardship.

As noted earlier, the consequences of unnecessary exposure to antibiotics may also directly harm a child's health, by challenging immune system development (Dethlefsen & Relman, 2011; Schulfer & Blaser, 2015), nutrient absorption (Schulfer & Blaser, 2015), and micro biome development (Schulfer & Blaser, 2015). In general, immediate, direct consequences from an action are stronger motivators for action than future consequences with more complicated causality (Rogers, 2002). Thus, immediate consequences of unnecessary exposure may be more salient and motivating for parental antibiotic stewardship than the more distant prospect of an antibiotic-resistant infection.

Efficacy perceptions determine whether people's risk-induced motivation to act results in engaging in the recommended actions. People tend to engage in actions that they believe will work; this perception is referred to as response efficacy (Rimal & Real, 2003). Sometimes perceptions of a response's efficacy are incorrect. Antibiotics are designed to treat bacteria. Studies show, however, that people may also believe that antibiotics can treat viruses or symptoms such as fevers and pain (e.g., Pechère, 2001; Smith et al., 2015). Stronger inaccurate belief in the response efficacy of antibiotics (i.e., misattributions of their treatment capacity) may predict attempts to get, keep, and share antibiotics.

Health mavenism

In addition to using theory to anticipate persuasive strategies, it may also be important to identify the behaviors of opinion leaders. Boster and colleagues (2011) described three different personality traits of opinion leaders: mavenism, persuasiveness, and connectivity. Health mavens are particularly important because they actively maintain expertise in a

variety of areas, share their knowledge, and are likely to be resources for others on health matters (Boster et al., 2011). If health mavens are engaging in antibiotic stewardship, then they may be good candidates to diffuse health information (Boster et al., 2011) or serve as agents of change (Rogers, 2003) via opinion leadership. If health mavens are not engaging in antibiotic stewardship, they may be a source of counter-messages in the community, thus they may be prioritized as campaign targets.

Research Question 2: Do perceived severity of and worry about antibiotic-resistant infections, perceived severity of side effects of unnecessary antibiotics, misattributions of antibiotic efficacy, and health mavenism predict parents' membership in antibiotic-stewardship classes?

Method

Participants

Participants ($N = 516$; 81% female) were caregivers of at least one child aged 5 years or younger, recruited from participant panels through [Qualtrics.com](https://www.qualtrics.com). Participants on average were 32 years old ($M = 32.18$, $SD = 7.34$, $Median = 31$, $Minimum = 21$, $Maximum = 68$). (Other studies also find that it is not uncommon for adults 50 and older to be pediatric caregivers; Vaz et al., 2015.) Participants identified themselves as Caucasian (79%), Asian (4%), African American (8%), and Native Hawaiian or Pacific Islander (>1%); 16 percent identified as Hispanic. Sixty-eight percent of participants reported being married. Participants on average reported having two children ($M = 2.09$, $SD = 1.19$, $Median = 2$, $Minimum = 1$, $Maximum = 8$). Participants self-reported their occupation as full time student (8%), employee in a company they did not own (47%), self-employed (12%), unemployed (38%), and retired (3%). They reported their household's annual income as less than \$20,000 (13%), \$20–\$40,000 (30%), \$40–\$60,000 (21%), \$60–\$80,000 (16%), \$80–\$100,000 (10%), or more than \$100,000 (10%). Participants varied in their highest levels of formal education: 2% attended some high school, 38% graduated from high school, 22% graduated with an associate degree, 22% graduated with an undergraduate degree, 10% completed graduate education, and 6% completed post-graduate education.

Participants resided in multiple states in the US: 47 states were represented. The CDC (2012) classified states into 5 categories based on their antibiotic prescription rates (see also Hicks & Taylor, 2013). Almost 10% of parents reported living in a state at the highest level, and 16% reported living in a state designated at the second highest level.

Design and Procedures

The study used a cross-sectional design. An institutional review board approved the study before data were collected. This study was conducted through [Qualtrics.com](https://www.qualtrics.com). Qualtrics participant panels are increasingly used by health and health communication scholars seeking nationally or regionally representative samples (e.g., Moran & Sussman, 2014; Rosoff, Siko, John, & Burns, 2013), and research indicates that samples obtained through Qualtrics have demographic attributes that align (with approximately 10% variation) with the 2010 Census (Heen, Lieberman, & Miethe, 2014). For the current study, potential participants completed screening questions assessing whether they were 21 or older,

currently had a child aged 5 years or younger, were U.S. citizens, and were the only parent in their household completing the survey; only those who fit these inclusion criteria were allowed to complete the survey.

The average time per survey was 30 minutes. Participants were compensated even if they did not answer every question in the survey. The survey included items about their intentions to engage in behaviors related to antibiotic stewardship, psychological scales, and demographics. These data are a subset of a larger project; different parts of the dataset are analyzed elsewhere (Authors, in press).

Latent Class Indicators

Six items (adapted from Smith et al., 2015) were used to assess participants' intentions to engage in antibiotic stewardship actions related to their children. The response options for the six items were *no*, *yes*, and *unsure*. These three options were collapsed into two categories for the latent class analysis. For the four problematic behaviors, *no* was separated from *yes* or *unsure*. This coding emphasizes that even the potential for engaging in these actions is problematic. For the two recommended behaviors (vaccinations and sanitation), *no* and *unsure* were separated from *yes*. This coding emphasizes the goal of persuading people to intend to engage in the recommended actions; those who were uncertain would be targeted to move toward intending to engage in the recommended behavior. Table 1 shows the codes assigned to responses for each item.

Covariates

A confirmatory factor analysis of scales—perceived severity, antibiotic efficacy misattributions, antibiotic harm, and health mavenism—was estimated with maximum likelihood; all factors were allowed to covary, but error terms were not. The model showed reasonable goodness of fit (Holbert & Stephenson, 2002): $RMSEA = .06$ [90% CI, .05, .07], $SRMR = .05$, with $X^2 (df = 71, N = 516) = 176.98, p < .001$.

Perceived severity—Three items (adapted from Witte, Meyer, & Martell, 2001) assessed the perceived severity of antibiotic resistant infections (e.g., *An antibiotic resistant infection is a severe medical condition*). Responses, marked on five-point scales (1 = *strongly disagree* to 5 = *strongly agree*), were averaged into one score ($\alpha = .79, M = 4.20, SD = 0.69$), with higher scores indicating stronger perceived severity.

Worry—A single item was used to assess the degree to which participants felt worry when thinking about their children getting an antibiotic resistant infection. The response was marked on a five-point scale (1 = *not at all* to 5 = *strongly*), with higher scores indicating greater worry ($M = 4.09, SD = 1.13$).

Antibiotic efficacy misattributions—Four items (adapted from Smith et al., 2015) were used to assess the perceived efficacy of antibiotics to treat *viral infections, pain, swelling, and fevers*, which antibiotics cannot treat. Responses, marked on five-point scales (1 = *not effective at all* to 5 = *completely effective*), were averaged into one score ($M = 2.97, SD =$

0.99, $\alpha = .77$; $\alpha = .82$ reported in Smith et al., 2015); higher scores indicated stronger efficacy misattributions.

Antibiotic harm—Two items were used to assess the potential harm of unnecessary exposure to antibiotics (e.g., *if my child takes an antibiotic when they are not medically necessary is harmful to his or her health*). Responses, marked on five-point scales (1 = *strongly disagree* to 5 = *strongly agree*), were averaged into one score ($r = .60$); higher scores indicated stronger harm ($M = 3.64$, $SD = 0.95$).

Health mavenism—Five items (adapted from Boster et al., 2011) were used to assess identification as a health maven (e.g., *I like to be aware of the most up-to-date healthy lifestyle information so I can help others by sharing it*). Responses, marked on five-point scales (later coded as 1 = *strongly disagree* to 5 = *strongly agree*), were averaged into one score ($\alpha = .84$); higher scores indicated stronger mavenism ($M = 3.76$, $SD = 0.67$).

Results

Descriptive Statistics

As seen in Table 1, when their children had an ear infection, over half of participants intended to ask their providers for antibiotics or were unsure whether they would ask for antibiotics. About 27% intended to try or might try to persuade their health providers to change their minds and prescribe an antibiotic if their providers were initially reluctant to write a prescription for their sick child. Over 26% intended to or might store antibiotics for future illnesses, and 18% intended to or indicated that they may share leftover antibiotics with others, like a child's sick sibling. These findings suggest that there is a nontrivial portion of parents that intends to or may be inclined to engage in problematic behaviors that may exacerbate the appearance and spread of antibiotic resistance.

Most participants reported intentions to engage in prevention, including making sure their child received recommended vaccinations (93%) and sanitizing their environment (87%). About ten percent, then, need to be encouraged to engage in prevention behaviors related to antibiotic resistance.

As reported by Smith et al. (2015), in this study eighty-four percent of participants had heard of the term antibiotic resistance. About 34% of participants reported personally knowing someone who had been diagnosed with an antibiotic-resistant infection, which was higher than the 24% reported by Smith et al., 2015.

Latent Class Analysis

To address RQ1, PROC LCA (Lanza et al., 2007) was used to calculate the fit indices for two- to seven-class models (see Table 2). Each test was run using 100 random starting values. The lowest Akaike information criterion (AIC) and Bayesian information criterion (BIC) estimates were used to identify the best-fitting model (Collins & Lanza, 2010). The AIC and BIC estimates both converged at a minimum value on the three-class model, replicating the findings of Smith et al. (2015). These findings suggested that there are three

latent classes of parents based on their antibiotic stewardship behaviors related to their children.

Table 3 shows the item-response probabilities for the three-class model and the likelihood of reporting a behavior (i.e., the responses that were coded as 2 in Table 1) within a class. One large group (40%), labeled *Stewards*, had low likelihoods of intending to engage in problematic behaviors related to antibiotics and high intentions of getting vaccinated and sanitizing their environments. The other two classes also had some likelihood of reporting these prevention behaviors (vaccination and sanitation); they differed principally in their pattern of problematic behaviors. The second group (40%), labeled *Requesters*, had high likelihoods of intending to ask a provider for antibiotics if their child had an ear infection. The last group (21%), labeled *Non-Stewards*, had high likelihoods of intending to ask for antibiotics for their sick child, intending to persuade providers to prescribe their child antibiotics when the providers did not do it, intending to store antibiotics, and intending to share leftovers antibiotics with others (e.g., a sick sibling).

Covariate Analysis

RQ2 explored whether perceived severity of antibiotic-resistant infections, feeling worry when thinking about their child getting an antibiotic resistant infection, misattributions of antibiotic efficacy, perceived harm from unnecessary exposure to antibiotics, and health mavenism predicted membership in latent classes of antibiotic stewardship. The covariate analysis was tested with *Stewards* as the reference class. We also conducted a second covariate analysis with demographics, including ethnicity, gender, unemployment, household income, and living in a state classified as having the highest or second highest rates of antibiotic prescriptions (CDC, 2012). Table 4 shows the results of these covariate analyses.

Perceived severity of and susceptibility to antibiotic resistant infections, worry, antibiotic efficacy misattributions, and health mavenism were all statistically significant covariates of class membership. Those who perceived antibiotic resistant infections as more serious health conditions and those who felt greater worry when thinking about their child getting an antibiotic-resistant infection had lower odds of being *Requesters* or *Non-Stewards* than of being *Stewards*. Participants with stronger misattributions of antibiotics' efficacy to treat multiple symptoms and those with stronger health mavenism had higher odds of being *Requesters* or *Non-Stewards* than of being *Stewards*. Of note, while the analysis showed that people with greater perceptions of their child being harmed from unnecessary exposure to antibiotics had lower odds of being *Requesters* or *Non-Stewards*, these differences were not statistically significant.

Demographically, unemployed parents had lower odds of being *Requesters* or *Non-Stewards* than *Stewards*. In fact, higher income parents were more likely to be *Non-Stewards*, but less likely to be *Requesters*, in comparison to *Non-Stewards*. Ethnicity (identifying as non-Hispanic White in comparison to other groups), gender, and living in a state with the highest rates of antibiotic prescription behavior did not predict membership in an antibiotic stewardship profile.

Discussion

This study explored the levels and patterns of antibiotic stewardship behaviors among parents related to their children and potential determinants of stewardship profiles. These findings suggest that a nontrivial portion of parents intended or may be inclined to engage in problematic behaviors that will exacerbate the appearance and spread of antibiotic resistance. This study replicated an innovative approach to audience segmentation for a multifaceted goal (Smith et al., 2015), by using the person-centered approach of latent class analysis. The latent class analysis revealed three profiles of parental stewardship that were labeled as Stewards, Non-Stewards, and Requesters. These results provided a sophisticated way to segment audiences based on their pattern of responses, and the results suggest two different types of campaign goals: to embolden Stewards to follow through on their intentions, and to influence Non-Stewards to accept medical advice when an antibiotic is not indicated (e.g., stop arguing with providers) and to dispose of their leftover antibiotics.

These findings showed some similarities to the previous segmentation of adults' stewardship behaviors. Smith et al (2015) also identified three classes of stewardship related to adults' personal health: Stewards, Demanders and Stockers. While the profiles of Stewards showed marked similarity, more people appeared as personal Stewards (65% in Smith et al.) than we saw of parental Stewards (40%). People may be more "protective" of their children than of themselves, making it less difficult to encourage infection control, but more difficult to encourage judicious antibiotic use (because it is seen as depriving vulnerable children; Cabral et al., 2014). In the study of personal stewardship, Demanders were strongly characterized by trying to persuade providers to give them a prescription when the provider did not want to do so. In this study of parental stewardship, instead, Requesters were characterized by asking providers for antibiotics, but not attempting to persuade them to change their minds. In the personal stewardship study, Stockers stored and shared unused antibiotics. In this study of parental stewardship, Non-Stewards showed a lack of stewardship in every category, except for vaccination and sanitation.

The presence of Requesters aligns with studies of how parents approach providers as they seek care to treat their child's symptoms (Cabral et al., 2014; Harrington et al., 2007; Stivers, 2002; Stivers, Mangione-Smith, Elliott, McDonald, & Heritage, 2003; Vaz et al., 2015). The goal for Requesters is not self-evident. A parent asking a question is not inherently a problem to fix. What is not clear from the data is whether parents ask providers about antibiotics with the goal of obtaining antibiotics, or if they ask for antibiotics as due diligence. Further, they may be asking questions as they engage in shared medical decision making with providers, which generally promotes health outcomes and satisfaction with medical encounters (Stivers, 2005). Requesters' low likelihood of counter-arguing providers who recommend against antibiotics suggests that not all requests may be an indication of an impending fight (Stivers, 2005). In fact, in contrast to providers' concerns about highly argumentative parents (Stivers et al., 2003), considerably more parents appeared in the Requester category (40%) than in the Non-Steward (20%) category. It was only Non-Stewards who did report intention to persuade providers to give their children an antibiotic prescription if the provider did not feel a prescription was appropriate. One implication of these findings is that providers may need to alter their perception of parents' questions: a

parent asking about antibiotics is not necessarily a signal for an impending conflict and can be an opportunity to educate concerned parents about antibiotic resistance and stewardship. The goal for Requesters may be work with both parents and providers on how to best work with shared decision-making (Stivers, 2005).

Anticipating Targeted Campaigns

The covariate analysis provided theoretical insight into the strategies to pursue in campaigns targeting these three groups. Parents who perceived antibiotic-resistant infections as less serious health conditions, felt less worry when thinking about their child getting an antibiotic-resistant infection, and had stronger misattributions of antibiotics' efficacy to treat multiple symptoms were more likely to be Requesters and Non-Stewards, instead of Stewards. The covariate analysis also showed that parents with more concern about the immediate consequences of unnecessary exposure to antibiotics were more likely to be Stewards, but this difference was not statistically significant. Theoretically, these findings align with RPA (Rimal & Real, 2003). Without a perception of antibiotic-resistant infections as a risk for their children and with over-confidence in the efficacy of antibiotics, parents do not act as antibiotic stewards.

Over-confidence in the efficacy of antibiotics was also predictive of showing problematic personal stewardship (Smith et al., 2015). While we have theoretical guidance on how to increase efficacy (e.g., extended parallel process model, Witte, 1994; Witte et al., 2001), less attention has been paid to constructing messages that correct inaccurate perceptions of response efficacy. Clearly, there is a need to correct perceptions of the response efficacy of antibiotics and an exigency to provide theoretical guidance on effective ways to do so.

An interesting insight from the analysis is that the same cluster of beliefs predicted being Requesters and Non-Stewards. Both segments may be moved to change their actions by increasing their risk and efficacy perceptions. Non-Stewards have further to move than Requesters, so Non-Stewards, versus Requesters, may need stronger or repeated exposure to campaigns to move them to become Stewards. The RPA (Rimal & Real, 2003) was written as an audience-analysis theory that would connect with message-based theories (e.g., extended parallel process model, Witte, 1994; Witte, Meyer, & Martell, 2001) to support the crafting of efficacious threat appeals. While this connection makes intuitive sense, to date there is no empirical evidence on how well those theories align. A next extension for person-based methods as modes of research is to analyze how well threat appeals, in fact, move people in one state (e.g., Requesters) to another (e.g., Stewards). For campaign planning, it is important to conduct follow-up studies, quantitative and qualitative, to determine whether the low concern about antibiotic harms (which was at the 'neutral' part of the scale, $M = 3.64$) is due to lack of awareness or skepticism, because different persuasive strategies are needed to increase awareness versus changing beliefs (Slater, 2006).

A difference between the two segments appeared in two economic variables. Non-Stewards were less likely than Stewards to be unemployed and Non-Stewards had higher incomes. In contrast, Requesters showed about the same unemployment status as Stewards, but had less income than Stewards. Risk and efficacy appeals targeting Non-Stewards versus Requesters may benefit from appeals presented in different formats (e.g., Slater & Flora, 1991).

Economic resources may also serve as a proxy for other variables (e.g., medical access) that may shape antibiotic stewardship, which should be considered in future research. Notably, these were the only two demographic variables that predicted membership in a parental stewardship class, suggesting that social-psychological variables may be more useful predictors of patterns of stewardship behavior than demographic variables. Furthermore, the findings suggest that while there are differences in antibiotic prescription rates by state (Hicks & Taylor, 2013), and although there may be other reasons to target high-rate states, these rates did not create a problematic social environment that predicted different rates of parental stewardship. This finding suggests that there are some other reasons for state differences, such as provider norms, medical education, or institutional and state policies related to prescription practices.

The covariate analysis showed that health mavens were more likely to be Requesters and Non-Stewards, instead of Stewards. The reason to identify health mavens is because they can be possible agents of change or problematic counter-forces against interventions (Rogers, 2003). The finding that health mavens showed problematic parental stewardship has serious implications for campaign design. Health mavens like to be sources for health expertise and advice (Boster et al., 2011). As sources of advice, it may be critical to target health mavens first in order to prevent them spreading misinformation and encourage them to spread accurate messages. One subset of patients who may warrant particular attention are physicians self-prescribing antibiotics for themselves or their children (Gendel et al., 2012).

Last, while campaign designers may be immediately drawn to developing interventions to change Requesters and Non-Stewards, Stewards are also important targets for campaigns. People do not always follow through on their intentions. The integrated model of behavior (Fishbein & Yzer, 2003) outlines that while intentions are strong predictors of behavior, those intentions may not translate into action if people lack the skills to perform the behavior or face environmental constraints on their behavior. Furthermore, while Stewards intended to engage in parental stewardship, they may still benefit from understanding more as to why and how their actions slow down antibiotic resistance and protect their child. Evidence from large studies of pediatric caregivers shows that understanding, in general, is limited (Vaz et al., 2015). Strengthening the basis for the intentions can make them more resistant to counter-persuasion (Szabo & Pfau, 2002).

Limitations

While the participants were diverse in many respects, this sample did not represent the entire U.S. population. Studies with nationally representative samples are needed to assess how well these findings generalize to the U.S. population.

In addition, while self-reported intentions are useful for formative research and planning, intentions and behavior are strongly, but not perfectly related (e.g., Sheppard, Hartwick, & Warshaw, 1988). Within the context of doctor-parent interactions around antibiotics, a review of several previous studies shows that parents often do not ask providers about antibiotics, which may indicate that parents may not follow through on the intentions expressed in this survey (see Stivers, 2007 for a review). It would be useful to compare our

findings with observational studies of clinical encounters with self-reported intentions. Finally, this study used a cross-sectional design, which limits its utility for causal claims.

Although the behaviors considered in this study represented fundamental aspects of antibiotic stewardship (CDC, 2013), this study was not comprehensive. For example, a different concern associated with keeping unused antibiotics is related to their disposal. Antibiotics are present in the water supplies in the U.S. in part because the human body excretes unmetabolized drugs and people dispose of them in toilets (Mispagel & Gray, 2005). Furthermore, people can influence antibiotic stewardship when they purchase antibiotic-free animal products (Smith et al., 2014) and toiletries and cleaning products without antibiotics in them (Davies & Davies, 2010). It is important to consider variations of these behaviors in campaign planning and design, in order to fully identify typologies of antibiotic stewardship behavior. In addition, these considerations are important for campaign planning: systems must be in place to facilitate behavior, such as pill “take-back” programs through pharmacies to ensure proper disposal of antibiotics, before interventions are introduced. As noted earlier, environmental constraints can be an important reason why positive intentions do not translate into behavior (Fishbein & Yzer, 2003; Fishbein & Ajzen, 2010). In addition, this study, in alignment with the RPA (Rimal & Real, 2003), focused on personal risks. Future studies should also include risks for others, such as the risk to society or vulnerable populations, to assess whether other-oriented risks may be useful extensions to the RPA and to campaign planning.

Conclusion

Some health threats have complicated causality and require that people perform multiple behaviors to address them. Childhood is a time of frequent infections, and parents will need to engage in various prevention behaviors related to infection control as well as judicious antibiotic use. Through these actions, parents can protect children from the immediate harms of unnecessary antibiotic exposure and potential harm of contracting antibiotic-resistant infections. Twenty years ago, multiple scholars argued for a need to improve theory and methods of campaign planning, including audience segmentation. Indeed, Edgar and colleagues (Edgar, 2012; Edgar et al., 2009) have tried to educate life scientists and clinical scholars on how to use social marketing concepts, including segmentation and communication-based interventions, to change human behaviors and their antecedents (e.g., beliefs). Audience segmentation promises efficiency and efficacy: by revealing the cohesive, homogeneous subgroups within a population and theoretical predictors of their actions, we can make better decisions about with whom to intervene and how to do so well (Slater, 1996; Slater et al., 2006; Maibach et al., 1996; Maibach et al., 2011). This study provided insights into using novel methods for segmentation to research predictors of behavioral patterns and to provide practical advice on ways forward, as well as the theory developments needed in communication scholarship to make more informed decisions. The evolution of antibiotic resistance is outpacing the speed at which new antibiotics will reach the marketplace (Smith et al., 2014). Informed decisions on how to reach all of these audience segments is needed to ensure that future generations have access to effective drugs to treat bacterial infections.

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References

- Baucher H, Pelton SI, Klein JO. Parents, physicians, and antibiotic use. *Pediatrics*. 1999; 103:395–401. DOI: 10.1542/peds.103.2.395 [PubMed: 9925831]
- Boster FJ, Kotowski MR, Andrews KR, Serota K. Identifying influence: Development and validation of the connectivity, persuasiveness, and maven scales. *Journal of Communication*. 2011; 61:178–196. DOI: 10.1111/j.1460-2466.2010.01531.x
- Cabral C, Horwood J, Hay AD, Lucas PJ. How communication affects prescription decisions in consultations for acute illness in children: A systematic review and meta-ethnography. *Biomed Central Family Practice*. 2014; 15:63–76. [PubMed: 24708839]
- Centers for Disease Control and Prevention. Antibiotics prescribing rates by state across the U.S. (2011/2012). 2012. Retrieved from <http://www.cdc.gov/media/dpk/2013/images/getsmart/dpk-antibiotics-week-prescribing-rate.html>
- Centers for Disease Control and Prevention. Antibiotic resistance threats in the United States, 2013. 2013. Retrieved from <http://www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf>
- Collins LM, Lanza ST. Latent class and latent transition analysis: With applications in the social, behavioral, and health sciences. New York, NY: Wiley; 2010.
- Davies J, Davies D. Origins and evolution of antibiotic resistance. *Microbiology and Molecular Biology Reviews*. 2010; 74:417–433. DOI: 10.1128/MMBR.00016-10 [PubMed: 20805405]
- Dethlefsen L, Relman DA. Incomplete recovery and individualized responses of the human distal gut microbiota to repeated antibiotic perturbation. *Proceedings of the National Academy of Science*. 2011; 108:4554–4561. DOI: 10.1073/pnas.1000087107
- Edgar T. Communication and behavior change challenges to limiting the development of antibiotic resistance. *Journal of General Internal Medicine*. 2012; 27:758–9. DOI: 10.1007/s11606-012-2000-1 [PubMed: 22302358]
- Edgar T, Boyd SD, Palamé MJ. Sustainability for behaviour change in the fight against antibiotic resistance: A social marketing framework. *The Journal of Antimicrobial Chemotherapy*. 2009; 63:230–7. DOI: 10.1093/jac/dkn508 [PubMed: 19095680]
- Fishbein M, Yzer MC. Using theory to design effective health behavior interventions. *Communication Theory*. 2003; 13:164–183.
- Fishbein M, Ajzen I. Predicting and changing behavior: The reasoned action approach. New York: Psychology Press; 2010.
- Fishman N. Antimicrobial stewardship. *American Journal of Infection Control*. 2006; 34:S55–S63. DOI: 10.1016/j.ajic.2006.05.237 [PubMed: 16813983]
- Fleming-Dutra KE, Shapiro DJ, Hicks LA, Gerber JS, Hersh AL. Race, otitis media, and antibiotic selection. *Pediatrics*. 2014; 134:1059–1066. [PubMed: 25404720]
- Gendel MH, Brooks E, Early SR, Gundersen DC, Dubovsky SL, Dilts SL, Shore JH. Self-prescribed and other informal care provided by physicians: Scope, correlations and implications. *Journal of Medical Ethics*. 2012; 38:294–298. [PubMed: 22313661]
- Harrington N, Norling GR, Witte FM, Taylor J, Andrews JE. The effects of communication skills training on pediatricians' and parents' communication during "sick child" visits. *Health Communication*. 2007; 21:105–114. [PubMed: 17523856]
- Heen MS, Lieberman JD, Miethe TD. Center for Crime and Justice Policy Research in Brief. Las Vegas, NV: University of Nevada, Las Vegas; 2014. A comparison of different online sampling approaches for generating national samples.

- Hersh AL, Shapiro DJ, Pavia AT, Shah SS. Antibiotic prescribing in ambulatory pediatrics in the United States. *Pediatrics*. 2011; 128:1053–1061. [PubMed: 22065263]
- Hicks LA, Taylor TH. U.S. outpatient antibiotic prescribing, 2010. *New England Journal of Medicine*. 2013; 368:1461–1462. DOI: 10.1056/NEJMc1212055 [PubMed: 23574140]
- Holbert RL, Stephenson MT. Structural equation modeling in the communication sciences, 1995–2000. *Communication Research*. 2002; 30:332–354. DOI: 10.1111/j.1468-2958.2002.tb00822.x
- Jackson S, Mathews KH, Pulanic D, Falconer R, Rudan I, Campbell H, Nair H. Risk factors for severe acute lower respiratory infections in children – a systematic review and meta-analysis. *Croatian Medicine Journal*. 2013; 54:110–121. DOI: 10.3325/cmj.2013.54.110
- Jules A, Grijalva CG, Zhu Y, Talbot HK, Williams JV, Poehling KA, Griffin MR. Influenza-related hospitalizations and ED visits in children less than 5 years: 2000–2011. *Pediatrics*. 2015; 135:e66–e74. DOI: 10.1542/peds.2014-1168 [PubMed: 25489015]
- Kardas P, Devine S, Golembesky A, Roberts C. A systematic review and meta-analysis of misuse of antibiotic therapies in the community. *International Journal of Antimicrobial Agents*. 2005; 26:106–113. DOI: 10.1016/j.ijantimicag.2005.04.017 [PubMed: 16009535]
- Lanza ST, Collins LM, Lemmon DR, Schafer JL. PROC LCA: ASAS procedure for latent class analysis. *Structural Equation Modeling*. 2007; 14:671–694. [PubMed: 19953201]
- Laxminarayan R, Duse A, Wattal C, Zaidi AKM, Wertheim HFL, Sumpradit N, Vlieghe E, Cars O. Antibiotic resistance—the need for global solutions. *The Lancet Infectious Diseases*. 2013; 13:1057–1098. DOI: 10.1016/S1473-3099(13)70318-9 [PubMed: 24252483]
- Lederberg J. Infectious history. *Science*. 2000; 288:287–293. DOI: 10.1126/science.288.5464.287 [PubMed: 10777411]
- Levy S. The challenge of antibiotic resistance. *Scientific American*. 1998; 278:46–53. [PubMed: 9487702]
- Maibach E, Leiserowitz A, Roser-Renouf C, Mertz CK. Identifying like-minded audiences for global warming public engagement campaigns: An audience segmentation analysis and tool development. *PLOS One*. 2011; 6:1–9. DOI: 10.1371/journal.pone.0017571
- Maibach E, Maxfield A, Ladin K, Slater M. Translating Health psychology into effective health communication: The American health styles audience segmentation project. *Journal of Health Psychology*. 1996; 1:261–277. DOI: 10.1177/135910539600100302 [PubMed: 22011991]
- Mangione-Smith R, Zhou C, Robinson JD, Taylor JA, Elliott MN, Heritage J. Communication practices and antibiotic use for acute respiratory tract infections in children. *The Annals of Family Medicine*. 2015; 13:221–227. [PubMed: 25964399]
- Misapagel H, Gray JT. Antibiotic resistance from wastewater oxidation ponds. *Water Environment Federation*. 2005; 77:2996–3002. DOI: 10.2175/106143005x73875
- Moran MB, Sussman S. Translating the link between social identity and health behavior into effective health communication strategies: An experimental application using antismoking advertisements. *Health Communication*. 2014; 29:1057–1066. [PubMed: 24447056]
- Nerby JM, Gorwitz R, Leshner L, Juni B, Jawahir S, Lynfield R, Harriman K. Risk factors for household transmission of community-associated Methicillin-resistant *Staphylococcus aureus*. *Pediatric Infectious Disease Journal*. 2011; 30:927–932. DOI: 10.1097/INF.0b013e31822256c3 [PubMed: 21617572]
- Neuzil KM, Mellen BG, Wright PF, Mitchel EF, Griffin MR. The effect of influenza on hospitalizations, outpatient visits, and courses of antibiotics in children. *The New England Journal of Medicine*. 2000; 342:225–231. DOI: 10.1056/NEJM200001273420401 [PubMed: 10648763]
- Noar SM, Harrington NG, Aldrich RS. The role of message tailoring in the development of persuasive health communication messages. *Communication Yearbook*. 2009; 33:73–133.
- Obama BH. Executive order 13676 - combating antibiotic-resistant bacteria. The American President Project. 2014. Retrieved from <http://www.presidency.ucsb.edu/ws/index.php?pid=107546&st=antibiotic&st1=>
- Pechère JC. Patients' interviews and misuse of antibiotics. *Clinical Infectious Diseases*. 2001; 33:170–173. DOI: 10.1086/321844
- Rimal RN, Real K. Perceived risk and efficacy beliefs as motivators of change. *Human Communication Research*. 2003; 29:370–399. DOI: 10.1111/j.1468-2958.2003.tb00844.x

- Rogers EM. Diffusion of preventive innovations. *Addictive Behaviors*. 2002; 27:989–993. [PubMed: 12369480]
- Rogers EM. Diffusion of innovations. New York, NY: Simon & Schuster; 2003.
- Rosoff H, Siko R, John R, Burns WJ. Should I stay or should I go? An experimental study of health and economic government policies following a severe biological agent release. *Environment Systems & Decisions*. 2013; 33:121–137.
- Schulfer A, Blaser MJ. Risks of antibiotic exposures early in life on the developing microbiome. *PLOS Pathogens*. 2015; 11:31004903.doi: 10.1371/journal.ppat.1004903
- Sheppard BH, Hartwick J, Warshaw PR. The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of Consumer Research*. 1988; 15:325–343. DOI: 10.1086/209170
- Shi T, McLean K, Campbell H, Nair H. Aetiological role of common respiratory viruses in acute lower respiratory infections in children under five years: A systematic review and meta-analysis. *Journal of Global Health*. 2015; 5:1–10. DOI: 10.7189/jogh.05.010408
- Simon AK, Hollander GA, McMichael A. Evolution of the immune system in humans from infancy to old age. *Proceedings of the Royal Society B: Biological Sciences*. 2015; 282:1–9. doi: 0.1098/rspb.2014.3085.
- Slater M. Theory and method in health audience segmentation. *Journal of Health Communication: International Perspectives*. 1996; 1:267–284. DOI: 10.1080/108107396128059
- Slater M. Specification and misspecification of theoretical foundations and logic models for health communication campaigns. *Health Communication*. 2006; 20:149–157. [PubMed: 16965252]
- Slater MD, Flora JA. Health lifestyles: Audience segmentation analysis for public health interventions. *Health Education & Behavior*. 1991; 18:221–233.
- Slater MD, Kelly KJ, Thackeray R. Segmentation on a shoestring: Health audience segmentation in limited-budget and local social marketing interventions. *Health promotion practice*. 2006; 7:170–173. DOI: 10.1177/1524839906286616 [PubMed: 16637125]
- Smith RA, M'ikanatha NM, Read AF. Antibiotic resistance: A primer and call to action. *Health Communication*. 2015; 30:309–314. DOI: 10.1080/10410236.2014.943634 [PubMed: 25121990]
- Smith RA, Quesnell M, Glick L, Hackman N, M'ikanatha NM. Preparing for antibiotic resistance campaigns: A person-centered approach to audience segmentation. *Journal of Health Communication*. 2015; 20:1433–1440. DOI: 10.1080/10810730.2015.1018652 [PubMed: 26181623]
- So J. A further extension of the extended parallel processing model (E-EPPM): Implications of cognitive appraisal theory of emotions and dispositional coping style. *Health Communication*. 2013; 28:72–83. DOI: 10.1080/10410236.2012.708633 [PubMed: 23330860]
- So J, Kuang K, Cho H. Reexamining fear appeal models from cognitive appraisal theory and functional emotion theory perspectives. *Communication Monographs*. 2016; 83:120–144. DOI: 10.1080/03637751.2015.1044257
- Stivers T. Presenting the problem in pediatric encounters: "Symptoms only" versus "candidate diagnosis" presentations. *Health Communication*. 2002; 14:299–338. DOI: 10.1207/s15327027hc1403_2 [PubMed: 12186491]
- Stivers T. Parent resistance to physicians' treatment recommendations: One resource for initiating a negotiation of the treatment decision. *Health Communication*. 2005; 18:41–74. [PubMed: 15918790]
- Stivers T. Prescribing under pressure: Parent-physician conversations and antibiotics. Oxford, UK: Oxford University Press; 2007.
- Stivers T, Mangione-Smith R, Elliott MN, McDonald L, Heritage J. Why do physicians think parents expect antibiotics? What parents report vs what physicians believe. *Journal of Family Practice*. 2003; 52:140–147. [PubMed: 12585992]
- Storey JD, Saffitz GB, Rimón JG. Social marketing. In: Glanz K, Rimer BK, Viswanath K, editors *Health behavior and health education: Theory, research, and practice*. San Francisco, CA: Jossey-Bass; 2008. 435–446.
- Szabo EA, Pfau M. Nuances in inoculation: Theory and applications. In: Dillard JP, Pfau M, editors *The persuasion handbook: Theory and practice*. Thousand Oaks, CA: Sage; 2002. 233–258.

- Vaz LE, Kleinman KP, Raebel MA, Nordin JD, Lakoma MD, Dutta-Linn MM, Finkelstein JA. Recent trends in outpatient antibiotic use in children. *Pediatrics*. 2014; 133:375–385. [PubMed: 24488744]
- Vaz LE, Kleinman KP, Lakoma MD, Dutta-Linn MM, Nahill C, Hellinger J, Finkelstein JA. Prevalence of parental misconceptions about antibiotic use. *Pediatrics*. 2015; 136:2015-0883.doi: 10.1542/peds.2015-0883
- Witte K. Fear control and danger control: A test of the extended parallel process model. *Communication Monographs*. 1994; 61:113–134.
- Witte K, Meyer G, Martell D. *Effective health risk messages*. Thousand Oaks, CA: Sage; 2001.
- Yzer MC. Reasoned action theory. In: Dillard JP, Shen L, editors *The Sage handbook of persuasion: Developments in theory and practice*. 2. Thousand Oaks: Sage; 2013. 120–136.
- Zhang Y, Xu M, Zhang J, Zeng L, Wang Y, Zheng QY. Risk factors for chronic and recurrent otitis media—a meta-analysis. *PLOS One*. 2014; 9:e86397.doi: 10.1371/journal.pone.0086397 [PubMed: 24466073]

Table 1

Future Intentions: Indicators for Latent Class Analysis (N = 193)

Indicators	Code	Label	<i>n</i>	%
Ask for antibiotic for sick child	1	No	231	44.8
	2	Yes or Unsure	285	55.2
Persuade providers for child's prescription	1	No	378	73.3
	2	Yes or Unsure	138	26.7
Store child's antibiotics for future illness	1	No	380	73.6
	2	Yes or Unsure	136	26.4
Share child's leftover antibiotics	1	No	421	81.6
	2	Yes or Unsure	95	18.4
Get child recommended vaccinations	1	No or Unsure	36	7.0
	2	Yes	480	93.0
Sanitize environment	1	No or Unsure	65	12.6
	2	Yes	451	87.4

Table 2

Model Fit Information for Comparison of Latent Class Models

Number of classes	G ²	AIC	BIC	df
2	183.53	209.53	264.73	50
3	93.58	103.04	217.69	43
4	49.04	104.45	220.51	36
5	29.44	109.52	241.81	29
6	22.45	113.63	278.54	22
7	17.63	133.58	317.45	15

Note. Boldface type indicates the selected model. AIC=Akaike's information criterion; BIC=Bayesian information criterion; *df*=degrees of freedom.

Table 3

Item-Response Probabilities for Three-Class Model Given Latent Class Membership

	Stewards	Requesters	Non-Stewards
	40%	40%	20%
Ask for antibiotic when sick	0.00	0.97	0.84
Persuade providers for prescription	0.00	0.33	0.68
Store antibiotics for future illness	0.06	0.15	0.89
Share leftover antibiotics (e.g., sick sibling)	0.00	0.00	0.91
Get recommended vaccinations	0.94	0.94	0.90
Sanitize environment	0.86	0.90	0.85

Note. Percentages reflect the number of participants likely to be in each profile. Cells contain the likelihood of agreeing with the concept. Likelihoods over 50% appear in bold.

Table 4

Covariate Analysis with Stewards as the Referent Class

	Non-Stewards		Requesters		
	OR	B	OR	B	LL ²
Severity of ARI	0.57	-0.57	0.49	-0.72	13.92 [*]
Worry about child getting an ARI	0.64	-0.44	0.77	-0.26	11.86 [*]
Child harmed from unnecessary antibiotic	0.74	-0.30	0.81	-0.21	4.39
Antibiotic efficacy misattributions	2.41	0.88	1.44	0.37	38.14 [*]
Health mavenism	1.74	0.56	1.72	0.54	9.94 [*]
White, Non-Hispanic	0.75	-0.29	0.98	0.01	1.25
Female	0.62	-0.48	0.88	-0.12	2.28
Unemployed	0.42	-0.87	0.96	-0.04	9.51 [*]
Higher income	1.10	0.09	0.85	-0.16	9.07 [*]
Resident of Level 5 or 4 States	0.84	-0.18	0.70	-0.35	2.24

Note. OR = Odds ratio; B = beta estimate. ARI = antibiotic resistant infection. Level 5 and 4 states have the highest and second highest levels of antibiotic prescription rates (CDC, 2012).

* $p < .05$