Accepters, fence sitters, or rejecters: Moral profiles of vaccination attitudes

Isabel Rossen, Mark J. Hurlstone, Patrick D. Dunlop, and Carmen Lawrence

University of Western Australia, Australia

Author Note

Isabel Rossen, Mark J. Hurlstone, Patrick D. Dunlop, and Carmen Lawrence: School of Psychological Science, University of Western Australia. The first two authors contributed equally to the work reported here. All data and analysis scripts can be accessed via the Open Science Framework: https://osf.io/kqu82/. Correspondence concerning this article should be addressed to Mark Hurlstone, School of Psychological Science, University of Western Australia, Crawley, WA 6009, Australia. Email: mark.hurlstone@uwa.edu.au. URL: http://mark-hurlstone.github.io

Abstract

Rationale: Childhood vaccination is a safe and effective way of reducing infectious diseases. Yet, public confidence in vaccination is waning, driven in part by the 'manufacture of doubt' by anti-vaccination activists and websites. However, there is little research examining the psychological underpinnings of anti-vaccination rhetoric among parents. **Objectives:** Here, we examined the structure and moral roots of anti-vaccination attitudes amongst Australian parents active on social media parenting sites. **Methods:** Participants (N = 296) completed questionnaires assessing their vaccination attitudes, behavioural intentions, and moral preferences. **Results:** Using Latent Profile Analysis, we identified three profiles (i.e., groups), interpretable as vaccine "accepters", "fence sitters", and "rejecters", each characterised by a distinct pattern of vaccination attitudes and moral preferences. Accepters exhibited positive vaccination attitudes and strong intentions to vaccinate; rejecters exhibited the opposite pattern of responses; whilst fence sitters exhibited an intermediate pattern of responses. Compared to accepters, rejecters and fence sitters exhibited a heightened moral preference for liberty (belief in the rights of the individual) and harm (concern about the wellbeing of others). Compared to acceptors and fence sitters, rejecters exhibited a heightened moral preference for purity (an abhorrence for impurity of body), and a diminished moral preference for authority (deference to those in positions of power). **Conclusion:** Given the sensitivity of fence sitters and rejecters to liberty-related moral concerns, our research cautions against the use of adversarial

approaches—e.g., No Jab, No Pay legislation—that promote vaccination uptake by restricting parental freedoms, as they may backfire amongst parents ambivalent toward vaccination.

Keywords: Vaccination · Vaccine hesitancy · Moral foundations theory · Moral profile · Liberty

Accepters, fence sitters, or rejecters: Moral profiles of vaccination attitudes

1. Introduction

Childhood vaccination is one of the most important public health achievements of the last century. However, in recent years many countries have faced growing problems with vaccine hesitancy: “the delay in acceptance or refusal of vaccination despite availability of vaccination services” (MacDonald, 2015). While there is generally a high rate of vaccination coverage in most western developed countries, clusters of under-vaccinated individuals have now contributed to outbreaks of diseases previously considered eradicated or controlled (Shetty, 2010). Furthermore, even among parents who do choose to vaccinate their children, there is a growing number who express doubts and concerns about vaccination (Kennedy et al., 2011).

While the reasons for the decline in public confidence surrounding vaccination are many, one major contributor is the communication of misinformation by a small yet vocal anti-vaccination movement (Betsch et al., 2010; Dubé et al., 2014). Amongst some sections of the general public, the impact of such misinformation has been to foster misperceptions about vaccine facts and risks, and the discounting of vaccine expertise (Benegal, 2018; Motta et al., 2018). Much work has analysed the specific arguments commonly employed by online anti-vaccination activists, demonstrating that opposition to childhood vaccination is situated in the following discourses: (1) vaccination is ineffective and unsafe, (2) vaccination is a governmental intrusion into parental autonomy, (3) vaccines are unnatural, and alternative, natural lifestyles

provide sufficient protection against infectious disease, and (4) the safety and effectiveness of vaccination is subject to sinister cover ups by the government and pharmaceutical companies (Kata, 2010, 2012). While the information that tends to be proffered on anti-vaccination websites is well understood, two important questions remain.

First, it is unclear the extent to which the specific arguments employed by online anti-vaccine activists are endorsed among a broader population of parents. It is commonly assumed that there exist multiple types of parents who differ in their vaccination beliefs and behaviours. Although many researchers argue for such a distinction, thus far, vaccine hesitancy has typically been plotted along a single continuum (Opel et al., 2011). Indeed, there is little quantitative research examining whether there exist distinct types of parents who differ in the extent to which they endorse anti-vaccination beliefs. Of the existing studies, most have uncovered at least three kinds of parents: (1) a small yet vocal group of outright vaccine rejecters who oppose the use of vaccines in all forms, and a potentially larger group of (2) fence sitters, characterised by uncertainty and a lack of confidence in vaccines, but who may still support vaccination in some respects, and (3) vaccine accepters who strongly endorse vaccination practices (Larson et al., 2014). Here, we examined the core attitudes and beliefs that comprise opposition to vaccination typically promoted by anti-vaccine activists online. We hypothesised that there would be at least three distinct profiles of parents representing strong, intermediate, and weak support of

anti-vaccination beliefs.

Second, there is little work examining the psychological variables that may underpin objection to vaccination. There is agreement in the literature that opposition to vaccination—particularly in its most extreme form—likely stems from strongly held ideological beliefs (Dubé et al., 2014; Leask, 2015) and conspiracist ideational tendencies (Lewandowsky et al., 2013). This can perhaps explain why attempts to correct vaccine misinformation can sometimes be counterproductive: although corrections reduce—but do not eliminate—belief in vaccine misinformation, paradoxically they can reduce intentions to vaccinate amongst certain groups (Nyhan et al., 2014; Nyhan & Reifler, 2015). Such "backfire effects" (cf. Rossen et al., 2016) are likely to materialise when the corrective information is at variance with the message recipient's cultural and moral values. For example, there is evidence that resistance to some vaccines is driven by a specific form of motivated reasoning (Kunda, 1990)—known as identity protective cognition—wherein beliefs that align with the moral values of one's cultural in-group are accepted, whereas those that clash are rejected (Kahan, 2013; Kahan et al., 2010). However, to date there has been no attempt to elucidate the nature of the moral values associated with vaccine hesitancy, which may be a necessary route to crafting persuasive communications that resonate with vaccine-hesitant parents.

To plug this theoretical gap, in the current paper we apply Moral Foundations Theory, which proposes six core moral domains upon which people differentially base

their morality. The foundations are: harm (concerned with violations to the safety and wellbeing of others), fairness (concerned with the pursuit of justice), in-group (favouring one's in-group first), authority (a preference for traditional societal structures and deference to those in positions of power), purity (an abhorrence for impurity of body or mind and 'unnatural' acts), and liberty (a preference for freedom and the rights of the individual) (Haidt and Joseph, 2004, 2008; Iyer et al., 2012). Multiple lines of evidence indicate that people's stances on a number of culturally divisive issues can be explained in part by their 'moral profile', as defined by their position along these six moral foundations (Feinberg and Willer, 2013; Koleva et al., 2012; Rossen et al., 2015)—although see Smith et al. (2017) for important methodological limitations of Moral Foundations Theory.

We suggest that individual differences in endorsement of the moral foundations may shed light on why some people are opposed to vaccination. We made some broad hypotheses about the moral foundations likely to be associated with opposition to vaccination. First, we hypothesised that support of the moral foundation harm may be an important driver of opposition to vaccination because the belief that vaccines are harmful and unsafe may stem from a heightened sensitivity toward harm violations. Liberty is likely implicated in the decision to not vaccinate a child, given the potential for vaccination to be viewed as government intrusion into parental autonomy through schemes such as No Jab, No Pay and No Jab, No Play (Beard et al., 2017). Purity is also likely relevant given the perception that vaccination is "unnatural". Finally, we suggest

that authority may be inversely associated with endorsement of anti-vaccination beliefs, given the perception that regulatory bodies conceal information about the safety and effectiveness of vaccination from the public.

In sum, it is currently unclear whether (1) there are distinct types of parents who vary in their support of anti-vaccination rhetoric, and (2) whether a unique pattern of moral values underpins these distinct types of parents. To investigate these questions, we constructed a novel 18-item measure to tap into the most common beliefs that are featured on anti-vaccination websites. We administered this novel inventory and the Moral Foundation Questionnaire, which measures the six moral foundations, to a self-selected sample of denizens of Australian online parenting forums within which both pro- and anti-vaccination sentiments existed. As anti-vaccination and vaccine-hesitant parents represent a small minority of the population, this opportunistic sample afforded us the chance to obtain relatively large numbers of these parents, so as to construct a more accurate picture of their underlying moral profiles.

2. Methods

Ethical approval to conduct the study was granted by the Human Research Ethics Office at the University of Western Australia (RA/4/1/6723).

Australian visitors to parenting websites who self-identified as a parent or guardian voluntarily completed an online questionnaire between May and December 2014 (N = 296; 85.4% female; mean age = 35.33, SD = 8.31). The survey link was posted on six parenting forums and Facebook pages on which community members

expressed a diverse range of attitudes on childhood vaccination. Participants read an information sheet and provided informed consent initially before completing several questionnaires.

Vaccine confidence was assessed using a novel inventory—the Vaccine Confidence Inventory—developed to tap into the rhetoric most commonly employed by anti-vaccination activists. We consulted work, which examines the content that most commonly appears on anti-vaccination websites (Kata, 2010, 2012). This resulted in the identification of five major concerns/beliefs: (1) vaccines are unsafe, (2) vaccines are ineffective, (3) malevolence of government and pharmaceutical companies, (4) vaccines are unnatural/alternative remedies or healthy lifestyle is sufficient, and (5) parents should retain the right to decide whether one's child is vaccinated. We formulated three to four items per theme, which yielded a total of 18 items that were constructed so they formed a combination of positively and negatively keyed declarative statements (we recoded the responses to the latter). Participants indicated their degree of agreement with each statement on a 5-point scale (1 = strongly disagree, 5 = strongly agree). Vaccination intention was measured using a novel scale—the Vaccine Behavioural Intentions Scale—with 12 items asking the likelihood that parents would vaccinate a future child against 12 different diseases, measured along a 6-point scale (1 = very unlikely, 6 = very likely).

Political ideology was assessed using two single-item measures. One asked participants to indicate the extent to which they self-identified as politically left-wing

or right-wing on a 7-point scale (1 = very left-wing, 7 = very right-wing), whilst the other asked participants to indicate the extent to which they self-identified as politically libertarian on a 4-point scale (1= do not identify at all, 4 = strongly identify). Finally, moral preferences were elicited using the Moral Foundations Questionnaire (Graham et al., 2009; Iyer et al., 2012), which measures the six moral foundations: harm, fairness, in-group, authority, purity, and liberty (divided into 'economic' liberty and 'lifestyle' liberty). The 39-item questionnaire is composed of two sub-scales, the first section asks questions of 'moral relevance' and the second asks questions of 'moral agreement'. The items are assessed on a 6-point scale, ranging from not at all relevant (1) to extremely relevant (6) in section one, and strongly disagree (1) to strongly agree (6) in section two.

Further information about the participant recruitment procedure and survey questionnaires can be found in supplemental materials.

3. Results

Our first aim was to investigate the emergence of profiles, or constellations of attitudes towards vaccination and, accordingly, we employed person-centred analytical methods. To this end, we undertook Latent Profile Analysis (LPA) with Mplus 7.3 using robust maximum likelihood estimation, specifying models with one, two, and finally, three profiles (see supplemental materials for technical details and model fits).

Overall, we found that the three-profile model offered substantially improved fit over the two-profile model and Figure 1 plots the mean responses to each of the vaccine confidence inventory items by profile. Profile 1, which was the largest (51.8%),

appears to represent very strong and universal positive attitudes towards vaccination with mean responses to all but one item falling below 2.

Profile 2 (23.5%) was more ambivalent towards vaccination with quite varied mean responses across the item set. Profile 2 appeared most concerned with the beliefs around the deprivation of liberty in relation to vaccination policy, with mean responses approaching 4.00 (i.e., the Agree point on the response scale) to four items which related to the self-determination of vaccination decision making (items 2, 7, 10, and 17). This profile was also characterised by a generally strong level of agreement that vaccination is effective (items 4, 9, 11, and 15), but they exhibited moderate concerns about the safety, naturalness (items 1, 3, 5, and 14), and necessity (items 6, 13, and 16) of vaccines, and the motives of vaccine service providers (items 8, 12, and 18).

Profile 3 (24.7%) expressed very strong negative attitudes towards vaccination. This profile was extremely concerned about the deprivation of liberty with respect to the choice to vaccinate (items 2, 7, 10, and 17). However, they also exhibited significant doubts about the effectiveness (items 4 and 15), safety, naturalness (items 1, 3, 5, and 14), and necessity of vaccines (items 6 and 16), along with a highly conspiratorial outlook on the institutions that provide vaccine services (items 8, 12, and 18). The only areas which appeared to be contentious for this profile were in relation to the extent to which vaccinations caused diseases they were meant to prevent (item 11), whether vaccinations were unnecessary given that the diseases being prevented were no longer a threat (item 9), and whether homeopathic treatments are an effective alternative to

conventional vaccines (item 13).

Given the characteristics of the profiles described above, we labelled Profile 1 as "vaccine accepters", Profile 2 as "fence sitters", and Profile 3 as "vaccine rejecters". We next examined the three profiles' standing on the intention to vaccinate and Moral Foundations measures. We undertook this analysis using the auxiliary variable approach in Mplus 7.3, which is appropriate when examining latent profiles' standing on other descriptive variables; results are displayed in Figure 2. Starting with vaccination intentions, Profile 1 (vaccine accepters) exhibited extremely strong intentions to vaccinate. Interestingly, Profile 2 (fence sitters) also appears to be very likely to vaccinate their children. Profile 3 (vaccine rejecters) is clearly substantially more reluctant to vaccinate their children.

Next, we turned our attention to the specific pattern of moral foundations endorsement for each profile. First, it merits comment that all three profiles shared a similar pattern of endorsing harm and fairness to a relatively greater extent than in-group, authority, and purity. We examined the difference between the foundations for each of the profiles (see Table S3 of supplemental materials for p values and Hedges's g effect sizes). In line with expectations, rejecters were significantly higher than accepters on the harm foundation, and fence sitters were significantly higher than accepters, indicating that, for both fence sitters and rejecters, harm is a particularly important moral concern that may drive rejection of, and hesitancy about, vaccines. Unexpectedly, there was a significant difference between accepters and fence sitters,

and also between fence sitters and rejecters, on the fairness foundation. This may be attributable to rejecters and fence sitters heightened sensitivity to the liberty foundation (see below)—for these parents, parental freedom to choose to vaccinate their children may be closely tied to notions of fairness. Both fence sitters and accepters were significantly higher than rejecters on endorsement of the foundation authority. This shows that rejection of traditional societal structures and hierarchies characterises vaccine rejecters, when compared to fence sitters and accepters. Rejecters were also significantly higher than accepters on endorsement of the purity foundation, demonstrating a greater moral importance placed on the sanctity of mind and body. Perhaps most importantly, however, examination of the economic and lifestyle liberty foundations demonstrated substantial and significant differences between all three groups, with rejecters demonstrating the highest endorsement of both facets of liberty, followed by fence sitters, with the lowest endorsement by accepters. Finally, we found no association between anti-vaccination attitudes and liberal, conservative, or libertarian political ideologies within the three profiles.

4. Discussion

4.1 Summary of results

The research reported here contributes the first quantitative psychological investigation of the structure of endorsement of anti-vaccination rhetoric among parents—specifically, Australian parents active on social media parenting sites. We make two important contributions. First, we constructed an inventory specifically

designed to tap into the most common beliefs that form the basis of the anti-vaccination movement. Second, we used this inventory to examine whether there are distinct types of parents who differ in their support of the core beliefs that comprise opposition to vaccination. The emergent profiles were consistent with past speculation about the structure of vaccine hesitancy—three groups of parents emerged that were interpretable as accepters, fence sitters, and rejecters. Vaccine accepters showed strong disagreement with all anti-vaccination rhetoric items and very high intention to vaccinate. Therefore, this group seems to be very confident in the safety and necessity of vaccines, and this confidence translates into strong intentions to vaccinate their children. It seems that this group of parents is entirely unaffected by anti-vaccination arguments. The group of parents termed rejecters were strongly opposed to vaccination in all forms. They showed high endorsement of all anti-vaccination items, particularly the items pertaining to the right to decide whether or not to vaccinate. The rejecters also demonstrated low intention to vaccinate, showing that strong endorsement of anti-vaccination rhetoric also translates into behaviour. Finally, the fence-sitters were below the mid-point on most of the anti-vaccination items, revealing that they mostly supported vaccination, but not as strongly as the accepters. The main exception to this was the items pertaining to the right to decide whether parents vaccinate their children, which they tended to agree with. Importantly, this group seems to believe that although vaccines are effective and beneficial for society, it is important to allow individuals to make their own decisions about vaccines.

Using denizens of social media parenting sites, this study is the first to show the moral profiles of parents who are hesitant about and reject vaccination. Each profile of parents demonstrated a unique pattern of moral foundation endorsement that can help to understand why they may have come to hold their vaccination views. A core finding to emerge was that rejecters were most sensitive to the restriction of liberty, followed by fence sitters and accepters. This manifested in two ways. First, both fence sitters and rejecters exhibited a high level of endorsement of the attitudinal items pertaining to a parent's right to choose whether or not to vaccinate their children, and second both profiles exhibited higher levels of endorsement of the economic and lifestyle liberty foundations than acceptors did. The moral preferences of the three profiles diverged in other ways. Specifically, rejecters were significantly lower than the other profiles of parents on authority, and significantly higher than both other profiles on purity. The relatively low endorsement of authority helps explain the tendency to express a lack of trust in the authorities that provide vaccination services. The relatively high endorsement of purity helps understand the commonly expressed concern about harmful and unnatural toxins entering a child's body. The fence sitters were less likely to concern themselves with purity violations, or the role of authority in society, but they exhibited a heightened sensitivity to harm violations compared to vaccine acceptors.

4.2 Potential limitations

Our data are based on a self-selected sample of visitors of Australian online parenting websites. Accordingly, one potential limitation of our results is that they may

not generalise to the broader population of Australian parents. We acknowledge that our sample is self-selected and therefore unlikely to be representative of the population as a whole. However, as noted at the outset, we deliberately opted to pursue this sampling strategy to increase the likelihood that we would obtain appreciable numbers of anti-vaccination and vaccine-hesitant parents to facilitate our moral profile analysis (bearing in mind that such parents constitute a relatively small portion of the general population compared to pro-vaccination parents). This potential objection does not undermine the importance of our results because such parents are important contributors to the debate about childhood vaccination within society, and social media is an important medium through which views about childhood vaccination are expressed. Nevertheless, we acknowledge that an important avenue for future work will be to determine if our results generalise to the Australian population at large.

4.3 Conclusions

If the results reported here can indeed be shown to generalise to the broader population of Australian parents, such results will have important implications for policy and communication strategies designed to increase vaccination uptake. It is widely acknowledged that shifting the attitudes of vaccine rejecters is a difficult, if not impossible task (Leask, 2011). Our findings further attest to this notion. Given that rejecters demonstrate a low endorsement of authority, and strong endorsement of liberty, they are unlikely to be swayed by persuasive appeals from health authorities, and punitive sanctions—such as No Jab, No Pay and No Jab, No Play legislation (Beard

et al., 2017)—run the risk of triggering moral outrage amongst this group. The moral profile of fence sitters is also of practical interest. We show that among those parents who express some reservations surrounding vaccination, they are not moderate about one thing, their right to decide whether they vaccinate their children. The fence sitters in our study reported a very high intention to vaccinate their children. However, the introduction of restrictive policy such as excluding un-vaccinated children from child-care, or withholding essential goods and services from parents who do not vaccinate, may reduce perceived personal liberty, and undermine trust among this group of parents, thereby potentially pushing fence-sitters toward vaccine rejection.

One obvious question raised by our work is whether knowledge of the moral profiles of different groups of parents can be used to improve vaccination communication strategies. Several studies have shown that persuasive appeals that are congruent with the moral foundations endorsed by a particular audience can shift attitudes on a range of polarising cultural issues (Feinberg and Willer, 2013, Day et al., 2014, Kidwell et al., 2013). This raises the tantalising prospect that it may be possible to craft persuasive moral appeals that can increase vaccination attitudes and intentions amongst fence sitters to bring them more closely in line with those of vaccine accepters. For example, it may be possible to capitalise on fence sitters apparent moral preference for liberty—and moderate attitudes toward vaccination, which render them more amenable to moral suasion than rejecters—by framing vaccination as an opportunity to keep their child's immune system fit and healthy, enabling it to live a life

free and unrestricted by disease, or as an opportunity to protect the liberty of other children who are unable to be vaccinated by contributing to the provision of herd immunity.

References

Beard, F., Leask, J., McIntyre, P. B., 2017. No Jab, No Pay and vaccine refusal in Australia: The jury is out. MJA 206(9), 381–383.

Benegal, S., 2018. Overconfidence and the discounting of expertise: A commentary. Soc. Sci. Med. 213, 95–97.

Betsch, C., Renkewitz, F., Betsch, T., Ulshöfer, C., 2010. The influence of vaccine-critical websites on perceiving vaccination risks. J. Health. Psychol. 15(3), 446–455.

Day, M. V., Fiske, S. T., Downing, E. L., Trail, T. E., 2014. Shifting liberal and conservative attitudes using moral foundations theory. Pers. Soc. Psychol. B. 40, 1559–1573.

Dubé, E., Vivion, M., MacDonald, N. E., 2014. Vaccine hesitancy, vaccine refusal and the anti-vaccine movement: influence, impact and implications. Expert. Rev. Vaccines. 14(1), 99–117.

Feinberg, M., Willer, R., 2013. The moral roots of environmental attitudes. Psychol. Sci. 24(1), 56–62.

Graham, J., Haidt, J., Nosek, B. A., 2009. Liberals and conservatives rely on different sets of moral foundations. J. Pers. Soc. Psychol. 96(5), 1029–1046.

Haidt, J., Joseph, C., 2004. Intuitive ethics: How innately prepared intuitions generate culturally variable virtues. Daedalus 133(4), 55–66.

Haidt, J., Joseph, C., 2008. The moral mind: How five sets of innate intuitions guide the development of many culture-specific virtues, and perhaps even modules. In P. Carruthers, S. Laurence, S. Stitch (Eds.), The innate mind (Vol. 3, pp. 367–391). New York: Oxford University Press.

Iyer, R., Koleva, S., Graham, J., Ditto, P., Haidt, J., 2012. Understanding libertarian morality: The psychological dispositions of self-identified libertarians. PLoS One 7(8): e42366.

Kahan, D., Braman, D., Cohen, G. L., Gastil, J., 2010. Who fears the HPV vaccine, who doesn't, and why? An experimental study of the mechanisms of cultural cognition. Law. Human. Behav. 34(6), 501–516.

Kahan, D., 2013. A risky science communication environment for vaccines. Science 342, 53–54.

Kata, A., 2010. A postmodern Pandora's box: Anti-vaccination misinformation on the Internet. Vaccine 28(7), 1709–1716.

Kata, A., 2012. Anti-vaccine activists, Web 2.0, and the postmodern paradigm–An overview of tactics and tropes used online by the anti-vaccination movement. Vaccine 30(25), 3778–3789.

Kennedy, A., LaVail K., Nowak, G., Basket, M., Landry, S., 2011. Confidence about vaccines in the United States: understanding parents' perceptions. Health Aff (Millwood) 30(6): 1151–1159.

Kidwell, B., Farmer, A., Hardesty, D. M., 2013. Getting liberals and conservatives to go

green: Political ideology and congruent appeals. J. Consum. Res. 40(2), 350–367.

Koleva, S. P., Graham, J., Iyer, R., Ditto, P. H., Haidt, J., 2012. Tracing the threads: How five moral concerns (especially Purity) help explain culture war attitudes. J. Res. Pers. 46(2), 184–194.

Kunda, Z., 1990. The case for motivated reasoning. Psychol. Bull. 108(3), 480–498.

Larson, H. J., Jarrett, C., Eckersberger, E., Smith, D. M., Paterson, P., 2014. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: A systematic review of published literature, 2007–2012. Vaccine 32(19), 2150–2159.

Leask, J., 2011. Target the fence-sitters. Nature 473(7348), 443–445.

Leask, J., 2015. Should we do battle with antivaccination activists? Public. Health. Res. Pract. 25(2), e2521515.

MacDonald N. E., 2015. Vaccine hesitancy: Definition, scope and determinants. Vaccine 32(34), 4161–4164.

Motta, M., Callaghan, T., Sylvester, S., 2018. Knowing less but presuming more: Dunning-Kruger effects and the endorsement of anti-vaccine policy attitudes. Soc. Sci. Med. 211, 274–281.

Nyhan, B., Reifler, J., Richey, S., Freed, G. L., 2014. Effective messages in vaccine promotion: A Randomized Trial. Pediatrics 133(4), e835–e842.

Nyhan, B., Reifler, J., 2015. Does correcting myths about the flu vaccine work? An experimental evaluation of the effects of corrective information. Vaccine 33(3),

459–464.

Opel, D. J., Mangione-Smith, R., Taylor, J. A., Korfiatis, C., Wiese, C., Catz, S., Martin, D. P., 2011. Development of a survey to identify vaccine-hesitant parents: the parent attitudes about childhood vaccines survey. Hum. Vaccines. 7(4), 419-425.

Rossen, I. L., Dunlop, P. D., Lawrence, C. M., 2015. The desire to maintain the social order and the right to economic freedom: Two distinct moral pathways to climate change scepticism. J. Environ. Psychol. 42(1), 42–47.

Rossen, I. L., Hurlstone, M. H., Lawrence, C. M., 2016. Going with the grain of cognition: Applying insights from psychology to build support for childhood vaccination. Front. Psychol. 7, 1483.

Shetty, P., 2010. Experts concerned about vaccination backlash. Lancet 375(9719), 970–971.

Smith, K. B., Alford, J. R., Hibbing, J. R., Martin, N. G., Hatemi, P. K., 2017. Intuitive ethics and political orientations: Testing moral foundations as a theory of political ideology. Am. J. Polit. Sci. 61(2), 424–437.

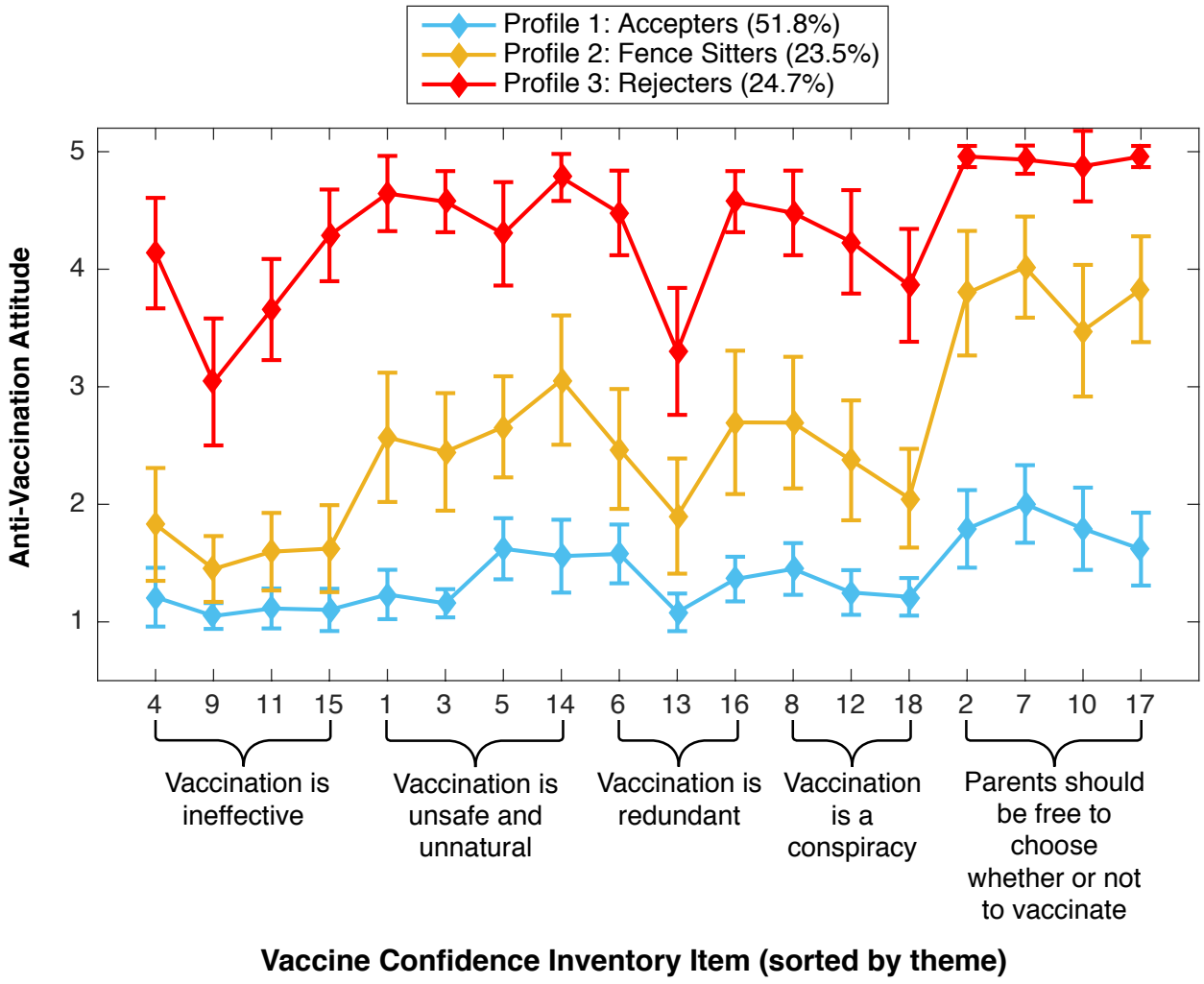

Figure 1. Average responses to each of the 18 items of the Vaccine Confidence Inventory for the three different profiles of parents. To facilitate interpretation, items have been arranged on the x-axis according to theme (the items can be viewed in supplemental materials). Error bars represent 95% confidence intervals.

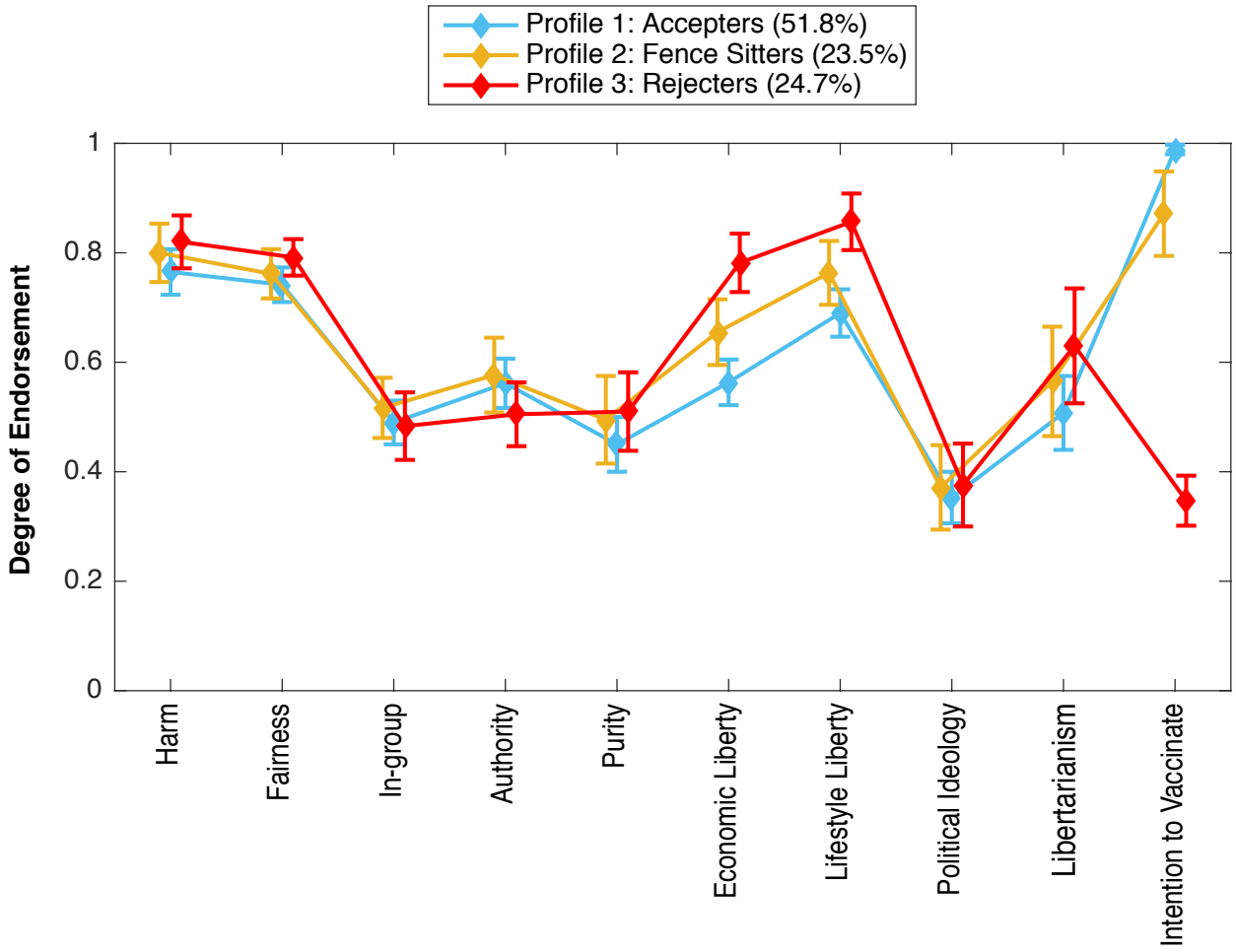

Figure 2. Average responses on the moral foundations, political ideology, and intention to vaccinate measures for the three different profiles of parents (scale scores have been standardised to a 0–1 metric). Error bars represent 95% confidence intervals.