ORIGINAL RESEARCH

REDUCING PRIMARY CARE ATTENDANCE INTENTIONS FOR PEDIATRIC RESPIRATORY TRACT INFECTIONS

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ABSTRACT

Purpose

The aim of this study was to evaluate a theory and evidence-based parent-targeted online intervention, combining microbiological local syndromic surveillance data, symptom information, and home-care advice, to reduce primary care attendance for self-limiting, low-risk pediatric respiratory tract infections (RTIs).

Methods

The effect of this novel intervention on primary care attendance intentions was evaluated in an online experimental study. A representative sample of mothers (N = 806) was randomized to be presented with the intervention material before (intervention) or after (control) answering questions concerning attendance intentions for an RTI illness scenario and mediating factors. Both groups provided feedback on the material. Group comparisons and linear regression and path analyses were conducted.

Results

Intervention participants reported lower attendance intentions compared to control participants (d = 0.69; CI = 0.55 to 0.83), an effect that remained when controlling for demographic and clinical characteristics (B = -1.62, CI = -1.97 to -1.30). The path model highlighted that the intervention effect (B = -0.33, CI = -0.40 to -0.26) was mostly indirect and mediated by infection and antibiotic knowledge, symptom severity concerns and social norm perceptions concerning attendance. Information on when to attend was rated 227x as the most important intervention component, followed by symptoms (186x). Information on circulating viruses was rated as least important (274x).

Conclusions

The intervention was effective in reducing primary care attendance intentions by increasing knowledge, lowering attendance motivation and reducing the need for additional resources. The contribution of individual intervention components and effects on behavioral outcomes requires further testing.

KEYWORDS

Antimicrobial resistance; Behavior change; Behavioral medicine; Primary care; Child health; Microbiological surveillance data; Experimental design; Intervention development; eHealth

ABBREVIATIONS

COM-B Model:	Capability, opportunity, motivation and behavior model
RTI:	Respiratory tract infection

INTRODUCTION

Respiratory tract infections (RTIs) are one of the main reasons for primary care consultation for children.[1] This contributes to primary care clinicians' increasing workload and costs the National Health Service £31.5M per year.[2,3] Primary care consultations for RTIs often lead to unnecessary antibiotic prescribing,[4,5] promoting antimicrobial resistance.[6-9] Providing parents with actionable information can reduce the number of unnecessary consultations by up to 40%,[10] have a significant positive impact on resources, and promote antimicrobial stewardship.[11,12]

When children have an RTI, parents want to know how to manage symptoms at home and which symptoms require medical attention.[13] Consulting for a child with an RTI is perceived to be the safest course of action and to be the socially acceptable norm if parents have any doubt about a medical threat to their child.[14] Qualitative research investigating the potential value of an intervention combining real-time, community-level information on locally prevalent RTIs with information about typical symptoms and normal durations found that while most parents thought such an intervention was useful and anticipated using the information to inform lay diagnoses, there were mixed views about whether it would influence decisions to consult primary care physicians.

The current research is an experimental evaluation of a novel online intervention informed by this research, following recommendations for evaluating complex digital behavior change interventions.[16,17] It aimed to investigate the intervention's effect on primary care attendance intentions and any mediating factors and parents' perception of the intervention material.

METHODS

Intervention description

The intervention material was developed based on a behavioral analysis of the target behavior: consulting with a primary care health professional. Using the COM-B (Capability, Opportunity, Motivation – Behavior) model,[18] potential pathways of influence were identified as the basis to develop the intervention material and predict mechanisms of action. The intervention material (Figure 1 and Supplement 1 – Intervention material) was designed to change parents' capability, opportunity and motivation to consult primary care for low risk, self-limiting RTIs in children, providing microbiological and locally enhanced syndromic surveillance data, symptom duration information, and home-care advice. The following behavior change techniques[19] were used in the intervention: providing information, instructions on how to perform home-care behaviors, encouraging social comparison, and referring to credible information sources.

Information included in the intervention was drawn from official influenza statistics,[20] the 'Caring for children with cough' website,[21] and national guidance.[22,23] To increase relevance, comprehension and recall, the intervention material contained information tailored to parents as target group, repeated key points, categorized information in a structured way, kept instructions brief, simple and specific, and used supporting visualizations.[24-27] To receive feedback from the target group,[28] a parent advisory group was involved in the intervention development (Supplement 2 - Public involvement).

Study design and procedure

The study used an experimental design, randomly allocating participants in equal numbers to the intervention or control group. Research participants viewed the intervention and completed the survey online. They accessed the survey remotely via an online link and they were automatically randomized based on computer-generated sequences (Supplement 4 – Recruitment). Following an approach adopted by Godinho et al. and McGlone et al.,[29,30] participants were asked to imagine the scenario that their youngest child was experiencing symptoms consistent with a rhinovirus infection (Supplement 3 – Survey). The intervention

group were presented with the intervention material in a series of static images (Supplement 1 – Intervention material) prior to answering questions concerning primary care attendance intentions and factors influencing their decision (Table 1). Control participants completed the same questions before being shown the intervention material. All participants provided feedback on the material and information on demographic (parent and child age, child gender, parent employment, education, ethnicity, number of children) and clinical (primary care visits over the past 12 months, chronic health issues of the child) characteristics potentially associated with primary care attendance[21]. Participants were asked to view the intervention material as they would if their child was suffering from the described illness scenario to simulate real-life usage instead of examining all included information in-depth as a whole. Scales used to assess psychological processes involved in behavior change according to the COM-B model[18] and feedback on the intervention material were based on previous research and validated scales (Table 1, Supplement 3 – Survey). ~~and d~~Details of how the survey was amended to increase face validity following testing with a parent advisory group are presented elsewhere (Supplement 2 – Public involvement). The survey required an average reading level (Flesch Reading Ease = 60, Flesch-Kincaid Formula = 7.7, Fog Index = 9.7, SMOG Grading = 7.6).[45] Ethical approval was obtained from a university research ethics committee (Project ID Number: CEHP/2013/508). The study protocol is available on the Open Science framework.[46]

Participant recruitment

A representative sample in relation to age, socioeconomic status and geographic location of mothers living in England was recruited between 24th January and 9th February 2017 by a market research company online panel using a quota sample. The quota targets were relevant for mothers aged 18 to 65 years and based source data used for UK population studies, including participants until all quotas were filled (Supplement 4 - Recruitment). Participants did not receive a financial compensation but they were offered points by the market research company, which can be accrued over time to redeem for

vouchers or to enter prize draws. To maximize statistical power whilst minimizing recruitment costs, participation was limited to mothers as they are more likely than fathers to take the child to see a doctor.[21] To be eligible, mothers had to have at least one child aged three months to 12 years; children younger than 3 months with fever should be assessed in hospital and home-care is not appropriate. [22,23] A sample size of 800 participants was estimated to ensure 80% power to detect a statistically significant difference at $\alpha = 0.05$, assuming a small effect size of $d = 0.2$ for the main outcome, intention to attend primary care. Previous research by Godinho et al.[28] identified this size of effect for an intervention to increase vaccination intentions.

Analysis

The data were analyzed with the statistics program IBM SPSS Statistics 25 and its extension module AMOS, considering an alpha level of $P < 0.05$ for significance tests. Descriptive statistics were calculated for demographic and clinical sample characteristics. Following assignment of numerical scores of the opposite direction for reverse coded survey items, scales were computed by summing items as outlined in Table 1. Their reliability in the current sample was assessed with Cronbach's alpha and distributions examined with histograms and Shapiro-Wilk tests. Scales had high internal consistencies (Table 1) and the main outcome variable, attendance intentions, was left-skewed (S-W = 0.87, $P < 0.001$; skewness = -0.62, SE = 0.09). Bootstrapping was used for following statistical procedures, drawing multiple samples (n = 800+) randomly from the original sample, to allow for robust inferences despite the non-normality distribution.[47,48] Compared to normalizing transformations, bootstrapping has the advantage that measurement units remain unchanged, simplifying output interpretations.[49,50] Content analysis was used to develop coding frameworks for the open-ended questions, summarizing responses in quantifiable categories.[51] Two coders (AS, AU) with a background in health psychology and experience in infection research independently coded responses without knowing participants' experimental allocation, discussing discrepancies to reach agreement. Clinical collogues

were available for further discussion but as responses were typically short comments instead of in-depth, detailed elaborations (e.g. naming the “NHS website and telephone hotline” as further information resource, listing “asthma and neurodermatitis” as chronic health issue or stating “useful information” as intervention feedback), this was not required. Correspondingly, inter-rater reliabilities were high.

The effect size and confidence interval was calculated comparing intervention and control group. Following assumption tests (DW = 2.104) and dummy-coding categorical variables, linear regression analysis was used to test the intervention effect while controlling for demographic and clinical characteristics. The relationship between variables hypothesized based on prior research and theoretical assumptions concerning the intervention behavior change pathway were examined specifying a path model. The main a priori hypothesis was that the intervention would have an indirect effect (mediated through capability, opportunity and motivational factors) on intentions to visit primary care for the specified illness scenario.[18] The model specification ensured the pathway analysis preconditions of model linearity, causal closure, unitary of variables and a maximum of one curved arrow per path.[52] There were no missing data for model parameters and the sample size of 806 sufficed to calculate valid estimates. The model was assessed by the chi-square test statistic, the Comparative Fit Index (CFI) and the Root mean square error of approximation (RMSEA). Considering that a nonsignificant chi-square value, CFI > 0.90 and RMSEA < 0.06 indicate a good fit,[53] the model as specified according to assumed intervention behavior change pathway was not an acceptable fit for the data (Chi-square = 320.396, df = 12, P < 0.001; CFI = 0.785; RMSEA = 0.179). To identify a model that better represented the data, post hoc model fitting was carried out by examining the modification indexes that point to possible model misspecifications.[54] The model adjustment significantly improved its fit on both indices (CFI = 0.99, RMSEA = 0.02) and resulted in a significant chi-square test result (Chi-square = 6.445, df = 5, P = 0. 265).–To assess participants’ perception of the material, feedback scales and open-ended questions were examined and

drag and drop responses to the intervention component ratings sorted according to importance, generating a diverging stacked bar chart.

RESULTS

Of 2451 individuals responding to the survey invite, 806 were included in the final sample (32.9%). Excluded participants either belonged to a sampling quota that was already full (n = 911), dropped out before randomization (n = 341) or part way through (n = 363) or did not fulfill data quality requirements (n = 30) according to set algorithms identifying straight-liners (choosing only one answer option for each question, being twice as quick as the median amount of time spent answering the survey).[55] Exclusions were carried out by the market research company commissioned to recruit the representative sample not knowing the research aim and with no interest in the outcome before the study authors carried out the analysis according to the study protocol.[46] A detailed description of participant enrollment and inclusion is given in Supplement 4. Most participants (70%) were primary caregivers and had attended primary care with their youngest child at least once in the past year (76%). Ten percent reported that their child had chronic health issues, most commonly asthma (N = 13), allergies (N = 7) or eczema (N = 3). Table 2 provides an overview of sample demographics and clinical characteristics.

Intervention effects on primary care attendance intentions

Scores on the summed up two-item intention to attend primary care scale ranged from two to ten in the current sample (possible range 2 to 10). The mean intention to attend score was 7.29 (SD = 2.56), with intervention participants reporting lower attendance intentions (M = 6.45, SD = 2.57) than control participants (M = 8.12, SD = 2.28). The average difference of 1.67 between intervention and control group represents a medium-sized effect (d = 0.69; CI = 0.55 to 0.83). Divided by two to convert back to the original 5-point answer scale (strongly disagree to strongly agree) used to rate both intentions to attend items, the intervention was associated with an almost 1-point decrease (0.84) in attendance intentions.

Consistent with the this analysis, participants in the intervention group had lower attendance intentions than those in the control group when adjusting for demographic and clinical characteristic associated with attendance intentions (R^2 = 0.17, F(20, 785) = 8.175, p < 0.001; Table 3): Asian participants had higher intentions and black participants lower intentions than white participants; participants from the greater London area had higher intentions compared to Northern England; and participants with older children had lower intentions than those with younger children. The intervention effect was still significant (f^2 = 0.08) although small when adjusting for those characteristics, with a difference of 0.04 between the adjusted (B = -1.66, CI = -1.99 to -1.32) and the unadjusted intervention regression coefficient (B = -1.62, CI = -1.97 to -1.30).

Mediating effects of capabilities, motivation and opportunities on attendance intentions

The a priori hypothesis was that the intervention effect on primary care attendance would be indirect and completely mediated through assessed capability, opportunity and motivational factors. This model was not an acceptable fit for the data (X^2 = 320.396, df = 12, P < 0.001, CFI = 0.79, RMSEA = 0.18). Post hoc model fitting resulted in the adjusted model (X^2 = 6.445, df = 5, P = 0. 265, CFI = 0.99, RMSEA = 0.02) outlined in Figure 1, which accounted for 56.9 % of the variance in primary care attendance intentions. Most of the intervention's total effect on attendance intentions (B = -0.33, SE = 0.03, CI = -0.40 to -0.26) according to this model was still mediated by participants' capabilities, motivation and opportunities (B = -0.231, SE = 0.025; CI = -.279 to -.180). The intervention specifically increased infection and antibiotic knowledge, reduced concerns about symptom severity and counteracted the perception of attendance as accepted and expected social norm (Table 4). Those factors in turn were directly ~~all~~ associated with lower attendance intentions. Further direct effects included i) a small but significant negative effect of the intervention on attendance intentions and number of resources consulted, ii) a negative effect of information sufficiency on attendance seen as a social norm, iii) a negative effect of infection and

antibiotic knowledge on attendance seen as a social norm but a positive effect on number of mentioned resources, and iiii) a negative effect of confidence in home-care capabilities on worries. There was no direct intervention effect on perceived sufficiency of available information or on number or confidence in self-care capabilities.

Feedback on the intervention material

Overall, participants regarded the intervention positively in their open-ended comments, typically highlighting its information as valuable, useful and useable, e.g.: '*Excellent resource for parents. Really puts people's minds at rest of the signs and symptoms to look out for and in an easy format to find the exact information you are looking for*.' Ratings of intervention components (Figure 2) highlighted that information about primary care attendance and symptoms were perceived to be most important and information on locally circulating viruses least important.

Participants positively assessed the intervention's content and presentation, rating the intervention materials to be generally clear (Mdn = 30, min = 5, max = 35, IQR = 9, x_{25} = 25, x_{75} = 34), credible (Mdn = 17, min = 3, max = 21, IQR = 7, x_{25} = 13, x_{75} = 20), cognitively challenging and stimulating (Mdn = 25, min = 5, max = 35, IQR = 8, x_{25} = 21, x_{75} = 29), novel (Mdn = 12, min = 3, max = 21, IQR = 3, x_{25} = 11, x_{75} = 14) and emotionally arousing (Mdn = 33, min = 7, max = 49, IQR = 10, x_{25} = 28, x_{75} = 38). Two participants voiced concerns for the child's safety if not seen by a doctor and thought the intervention was 'irresponsible' for deterring attendance.

DISCUSSION

The parent-targeted online intervention, combining real-time information on locally circulating RTIs with symptom information and advice, was associated with lower intentions to attend primary care for a child with a hypothetical RTI. The intervention effect on intentions was mostly indirect and mediated by increased infection and antibiotic knowledge and reduced symptom severity concerns and perceived social pressure to attend. The

intervention material was generally well received, particularly information on when to attend primary care and symptoms.

Strengths and limitations

The current research was a theory-informed experimental evaluation of a novel, evidence-based intervention. Such initial intervention tests and agile development approaches are important when developing eHealth interventions, in particular for complex interventions promising considerable improvements of current practice, but requiring substantial financial investments.[56,28] Considering behavioral science theory for the intervention development, as well as the research design, further advances the growing field of internet-based behavior change interventions, which often lack sound theoretical grounding.[57]

Using intentions as a proxy-measure of behavior and a hypothetical illness scenario instead of examining responses to real illness episodes is a potential limitation and should be considered when interpreting the findings. Evidence from a meta-analysis suggests that intentions are likely to be good predictors for single action, specific, non-habitual behaviors, such as primary care attendance.[58] Outcomes in response to real-life illnesses instead of hypothetical scenarios may, however, show different results.

The survey itself was extensive to assess all constructs hypothesized to affect attendance intentions. Ease of readability was average and the survey was tested prior to data collection with a parent advisory group for understandability and burdensomeness. It cannot, however, be ruled out that some participants would find it too lengthy or struggle to understand the intervention material or survey questions, especially those with different socio-demographic profiles than the mostly white and educated parent advisory group members. Furthermore, by limiting the current research to English mothers, we are unable to say if the intervention would be as effective for reducing intentions to attend primary care among fathers or in other countries. The quota sampling approach ensured a representative

but non-random sample of English mothers. The re-specification of the original path model remained exploratory in nature.[52]

Relation to prior research

The intervention had an effect on factors that have been shown to be important influences on parents' decisions to consult primary care for pediatric RTIs,[13,14,59,60] and with that reduced primary care attendance intentions. The intervention increased for example knowledge of infections and antibiotics usage, which is important as wide-spread misperceptions about antibiotic use still exist.[21,61] The observed attendance intention patterns correspond to research on parents' RTI consolation behavior that found non-white ethnicities to consult more often.[62] The evidence is not conclusive but it could be due to a combination of different cultural practices and higher anxiety levels, e.g. from operating in a second langue and unfamiliar contexts in case of migrant communities. Parents who are part of minority or discriminated against groups may also feel more pressure to consult to avoid accusations of failing to attend when required and consequently accusations of neglect.[14,63]

As a whole, the intervention was well received and the information provided was rated as credible, cognitively stimulating and emotionally engaging. This is an important finding, given that eHealth research has found that ease of use and understanding, credibility, and visual appeal are important factors in encouraging intervention engagement.[64-66] Current positive assessments of the intervention's usefulness is supported by prior qualitative research suggesting that parents were interested in accessing information on locally prevalent RTIs and on symptoms and home-care strategies online prior to primary care consultations to inform lay diagnoses and consolation decisions.[15] The information would be particularly helpful for first-time parents and parents of young children. Some parents were interested in regularly checking the website to monitor circulating viruses. The intervention could therefore also be used in an effort to prevent infections by heightening awareness of circulating viruses and increasing the promotion of hand hygiene and other infection

prevention techniques. Accessing the information with primary care clinicians during consultations was also seen as acceptable and could help publicize the intervention.

A key finding was that the novel intervention component, providing information on locally circulating viruses, was seen as less important by participants than symptom and home-care information. It might be useful to add further details on how to interpret and use the dynamic surveillance information, especially for consultation decision-making. The static information components preferred by participants addressed more directly factors previously identified to influence consultation behavior[14] and the current research provides evidence that interventions including such information can change primary care attendance intentions. Ultimately, what users like about an eHealth intervention and what they engage with is not necessarily linked to the effectiveness of those intervention components in changing behaviors.[67] The effects of individual intervention components and their interactions remain to be determined.

Impact and future research

Increasing smartphone use means that web-based resources are accessible to more and more people from all socio-economic backgrounds and they are particularly suited for interventions including dynamic elements that require frequent updates. Paper-based versions of such interventions would be less practical. Even a small size effect of the intervention on parents' attendance behavior would be impactful if the intervention was rolled out widely, as pediatric RTIs are one of the main reasons for primary care consultations with children.[1] Future research should evaluate intervention effects on observed behavioral outcomes in real-world settings and examine long-term effects and cost-effectiveness. As the current online study was limited to participants with internet access, the impact of internet use proficiency should be examined.[28] Factorial experimental design studies could help to further disentangle the observed complex network of relationships between different intervention components, mediating factors and primary care attendance to further refine the

intervention.[68,69] Since the intervention was effective in increasing knowledge and reducing concerns in mothers, similar interventions aimed at other audiences such as school personnel and clinicians could also be developed to improve the care of pediatric RTIs. Expanding the application of the intervention to other contexts, target groups and countries requires a careful analysis of the specific setting, appropriate adaptions and further testing as effective behavior change is highly context and target group specific.[18]

Conclusion

The theory and evidence-based online intervention was effective at reducing primary care attendance intentions for self-limiting, pediatric RTIs. Information on locally circulating viruses, a novel intervention component, was rated as being less important compared to information on when to attend primary care and on symptoms and their management. The effectiveness of individual intervention components in changing parents' behavior requires further research.

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CONFLICT OF INTEREST STATEMENT

None declared.

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TABLES

Table 1: Survey details listing scales that assess the target constructs in order of their appearance in the survey.

Target construct / scale[a]	Items	Answer format	Reliability (Cronbach α)
Main outcome:			
Intentions - Primary care attendance intentions[29,31-35]	▪ I want to visit a GP today.[b] ▪ I intend to visit a GP today.[b]	5-point scale	α = 0.94
Potential mediating factors:			
Social influences - Social norms concerning primary care attendance[31,32,35]	▪ People around me think I need to visit a GP today / approve of me visiting a GP today / think I do not need to visit a GP today.[b]	5-point scale	α = 0.81
Emotions - worry / perceived severity of a health threat[36]	▪ Would you say that your child's symptoms as described in the illness scenario suggest that the illness is severe / serious / significant/ worrying / normal (given where I live and time of year)[b]?	5-point scale	α = 0.84
Knowledge - information sufficiency[37,38]	▪ How much do you think you currently know about the illness as described in the scenario? ▪ How much knowledge would you need to care adequately for your child showing the described symptoms? You might feel you need the same, more, or possibility even less, information about the topic. ▪ What additional information would you need to adequate care for your child showing the described symptoms? Please describe.	Scale of 0 to 100 Open-ended question	N/A N/A
Knowledge / skills / resources – viral illness knowledge and home-care test[29]	▪ Thinking about the illness scenario, do you think the cause of your child's symptoms would is a viral infection / bacterial infection? ▪ Approximately how long do you think the illness symptoms of your child could last, from start to finish without any antibiotics? Fever/high temperature / sore throat / cough ▪ How would you care for your child at home? Strategies and further resources?	True / False / I don't know Estimation in days Open-ended question	N/A N/A N/A
Reflective motivation – Beliefs about home-care capabilities[39]	▪ When my child shows the symptoms described in the scenario, I feel confident about looking after them at home / taking their temperature /	5-point scale	α = 0.81

	seeing if they need more fluids / checking for a rash / seeking advice from online resources / seeking advice or help from family and friends / seeking advice or help from healthcare professionals.		
Knowledge / beliefs – antibiotic use[40-42]	▪ Are most cold, cough, and flu illnesses caused by bacteria or viruses? ▪ Are antibiotics helpful in treating bacterial infections, viral infection, or both? ▪ How often are antibiotics needed for cough or bronchitis / sore throat / fever/ ear ache / tiredness and aching / vomiting? ▪ If my child does not receive an antibiotic for cold, cough, and flu symptoms, he/she will be sick for a longer time.	Multiple choice 5-point scale	N/A
Intervention material feedback:			
Clarity[43]	▪ Not at all understandable / very understandable. ▪ Not at all comprehensible / very comprehensible. ▪ Does not make sense / makes sense. ▪ Confusing arguments / clear arguments. ▪ Unclear information presented / clear information presented.	7-point scale	α = 0.93
Credibility[43]	▪ Credible information presented / information presented not credible.[b] ▪ Valid claims / invalid claims.[b] ▪ Presented accurate information / did not present accurate information.[b]	7-point scale	α = 0. 85
Cognitive challenge[43]	▪ Not intellectually stimulating / intellectually stimulating. ▪ Not intellectually engaging / intellectually engaging. ▪ Would make people think / would not make people think.[b] ▪ Not at all thought-provoking / thought-provoking. ▪ Did not really make me think / really made me think.	7-point scale	α = 0.70
Emotional arousal[44]	▪ Powerful impact / weak impact.[b] ▪ Emotional / unemotional.[b] ▪ Involving / uninvolving.[b] ▪ Boring / exciting. ▪ Arousing / not arousing.[b] ▪ Stimulating / not stimulating.[b] ▪ Strong visuals / weak visuals.[b]	7-point scale	α = 0.87
Novelty[44]	▪ Unique / common.[b] ▪ Novel / ordinary.[b] ▪ Unusual / usual.[b]	7-point scale	α = 0.72

[a]References to measures survey scales were based on. [b]reverse coded item.

Table 2: Demographic and clinical characteristics of the sample of English mothers (N = 806) collected in January and February 2017.

Characteristics		Proportion of sample (N = 806)	Proportion of intervention group (N = 403)	Proportion of control group (N = 403)
Mother	Age			
	18-29	145 (18.0%)	74 (18.4%)	71 (17.6%)
	30-39	412 (51.1%)	208 (51.6%)	204 (50.6%)
	40-65	249 (30.9%)	121 (30.0%)	128 (31.8%)
	Region			
	Northern England	235 (29.2%)	123 (30.5%)	112 (27.8%)
	Southern England	223 (27.7%)	115 (28.5%)	108 (26.8%)
	Midlands	139 (17.2%)	75 (18.6%)	64 (15.9%)
	Greater London	135 (16.7%)	56 (13.9%)	79 (19.6%)
	East of England	74 (9.2%)	34 (8.4%)	40 (9.9%)
	Employment status			
	Employed	578 (71.7%)	285 (70.7%)	293 (72.7%)
	Full-time parent / homemaker	182 (22.6%)	93 (23.1%)	89 (22.1%)
	Unemployed	36 (4.5%)	22 (5.5%)	14 (3.5%)
	Student / Pupil	8 (1.0%)	1 (0.2%)	7 (1.7%)
	Retired	2 (0.2%)	2 (0.5%)	0
	Education			
	No official qualification	15 (1.9%)	6 (1.5%)	9 (2.2%)
	School-leaving qualification	387 (48%)	205 (50.9%)	182 (45.2%)
	University qualification	404 (50.1%)	192 (47.6%)	212 (52.6%)
	Ethnicity			
	White	681 (84.5%)	347 (86.1%)	334 (82.9%)
	Asian	67 (8.3%)	31 (7.7%)	36 (8.9%)
	Black	27 (3.3%)	11 (2.7%)	16 (4.0%)
	Mixed	5 (0.6%)	10 (2.5%)	12 (3.0%)
	Rather not answer	5 (0.6%)	2 (0.5%)	3 (0.7%)
	Other group	4 (0.5)	2 (0.5%)	2 (0.5%)
	Caregiving role for youngest child			
	Primary caregiver	566 (70.2%)	282 (70.0%)	284 (70.5%)
	Shared caregiving role	240 (29.8%)	121 (30.0%)	119 (29.5%)
Youngest child	Gender			
	Boy	388 (48.1%)	191 (47.4%)	197 (48.9%)
	Girl	418 (51.9%)	212 (52.6%)	206 (51.1%)
	Age			
	0.25-4 years	282 (35.0%)	140 (34.7%)	142 (35.2%)
	5-8 years	276 (34.2%)	148 (36.7%)	128 (31.8%)

9-12 years	248 (30.8%)	115 (28.5%)	133 (33.0%)
Primary care visits in past year			
0	191 (23.7%)	94 (23.3%)	97 (24.1%)
1	250 (31.0%)	136 (33.7%)	114 (28.3%)
2	185 (23.0%)	89 (22.1%)	96 (23.8%)
>3	180 (22.3%)	84 (20.8%)	96 (23.8%)
Chronic health issues			
No	724 (89.8%)	366 (90.8%)	358 (88.8%)
Yes	82 (10.2%)	37 (9.2%)	45 (11.2%)

Table 3: Bootstrapped multiple regression model summary predicting primary care attendance intentions.

Parameter	B (95% CI)	SE	P
Intercept	9.21 (7.23 to 11.11)	1.05	0.001***
Intervention	-1.62 (-1.97 to -1.30)	0.18	0.001***
Demographics			
Age	-0.01 (-0.04 to 0.02)	0.01	0.408
Region			
Northern England	referent		
Southern England	0.09 (-0.34 to 0.53)	0.23	0.711
Midlands	-0.27 (-0.82 to 0.24)	0.27	0.310
Greater London	0.66 (0.17 to 1.10)	0.24	0.001***
East of England	0.07 (-0.58 to 0.71)	0.32	0.858
Employment status			
Employed	referent		
Full-time parent / homemaker	-0.09 (-0.53 to 0.32)	0.22	0.663
Unemployed	0.57 (-0.20 to 1.27)	0.40	0.150
Student / Pupil	0.52 (-0.49 to 1.55)	0.54	0.32
Retired	0.29 (-0.88 to 1.43)	0.57	0.628
Education			
No official qualification	referent		
School-leaving qualification	-0.32 (-1.74 to 1.10)	0.71	0.636
University qualification	-0.38 (-1.78 to 1.04)	0.72	0.581
Ethnicity			
White	referent		
Asian	0.85 (0.30 to 1.32)	0.24	0.002**
Black	-1.98 (-2.80 to -1.09)	0.41	0.001***
Mixed	-0.64 (-1.76 to 0.50)	0.59	0.273
Caregiver role	0.30 (-0.11 to 0.72)	0.19	0.117
Gender of youngest child	0.03 (-0.30 to 0.38)	0.17	0.864
Age of youngest child	-0.08 (-0.14 to -0.02)	0.03	0.011*
Clinical characteristics			
GP visits with youngest child in past year	0.10 (0.01 to 0.23)	0.06	0.083
Chronic health issues of youngest child	-0.20 (-0.75 to 0.37)	0.28	0.471

B = Regression Coefficient, CI = Confidence Interval, SE = Standard Error,

P = Significance, *** P ≤ 0.001; ** P ≤ 0.01; * P ≤ 0.05.

Table 4: Bootstrapped effects of the intervention on mediating factors and primary care attendance intentions.

Intervention effects	**B (95% CI)**	**SE**	**P**
Direct effects			
Infection and antibiotic knowledge	0.18 (0.12 to 0.24)	0.03	0.002**
Worry / perceived severity	-0.14 (-0.20 to -0.08)	0.03	0.002**
Social norms concerning primary care attendance	-0.23 (-0.30 to -0.17)	0.03	0.002**
Number of mentioned resources	-0.13 (-0.19 to -0.06)	0.03	0.002**
Primary care attendance intentions	-0.09 (-0.14 to -0.04)	0.03	0.003**
Indirect effects			
Confidence in home-care capabilities	0.04(0.01 to 0.07)	0.02	0.008**
Worry / perceived severity	-0.15(-0.19 to -0.11)	0.02	0.002**
Social norms concerning primary care attendance	-0.02 (-0.04 to -0.01)	0.01	0.003**
Number of mentioned resources	0.03 (0.02 to 0.05)	0.01	0.001***
Primary care attendance intentions	-0.23 (-0.28 to -0.18)	0.03	0.002**

B = Regression Coefficient, CI = Confidence Interval, SE = Standard Error,

P = Significance, *** P ≤ 0.001; ** P ≤ 0.01; * P ≤ 0.05.

FIGURES

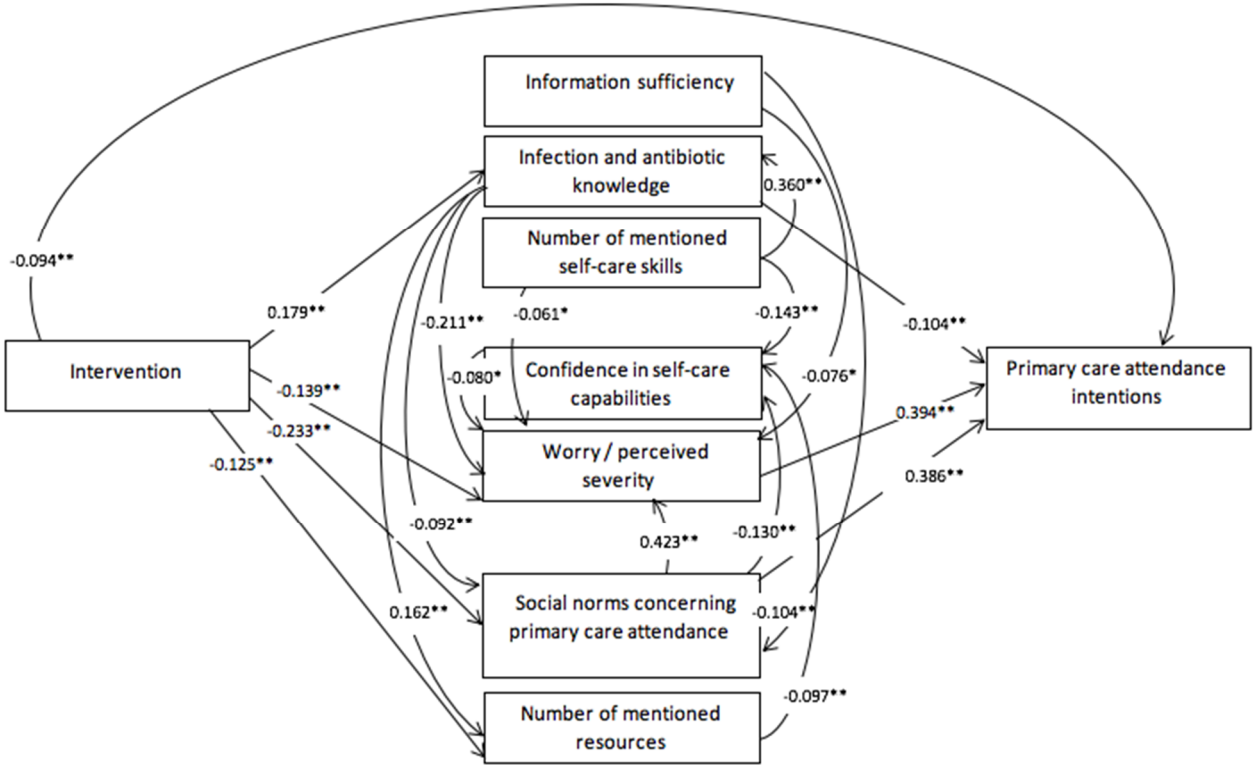

Figure 1: Standardized estimates for the adjusted intervention path model.
*P < 0.05, **P < 0.01. Not statistically significant effects and residual error terms are omitted for ease of interpretation

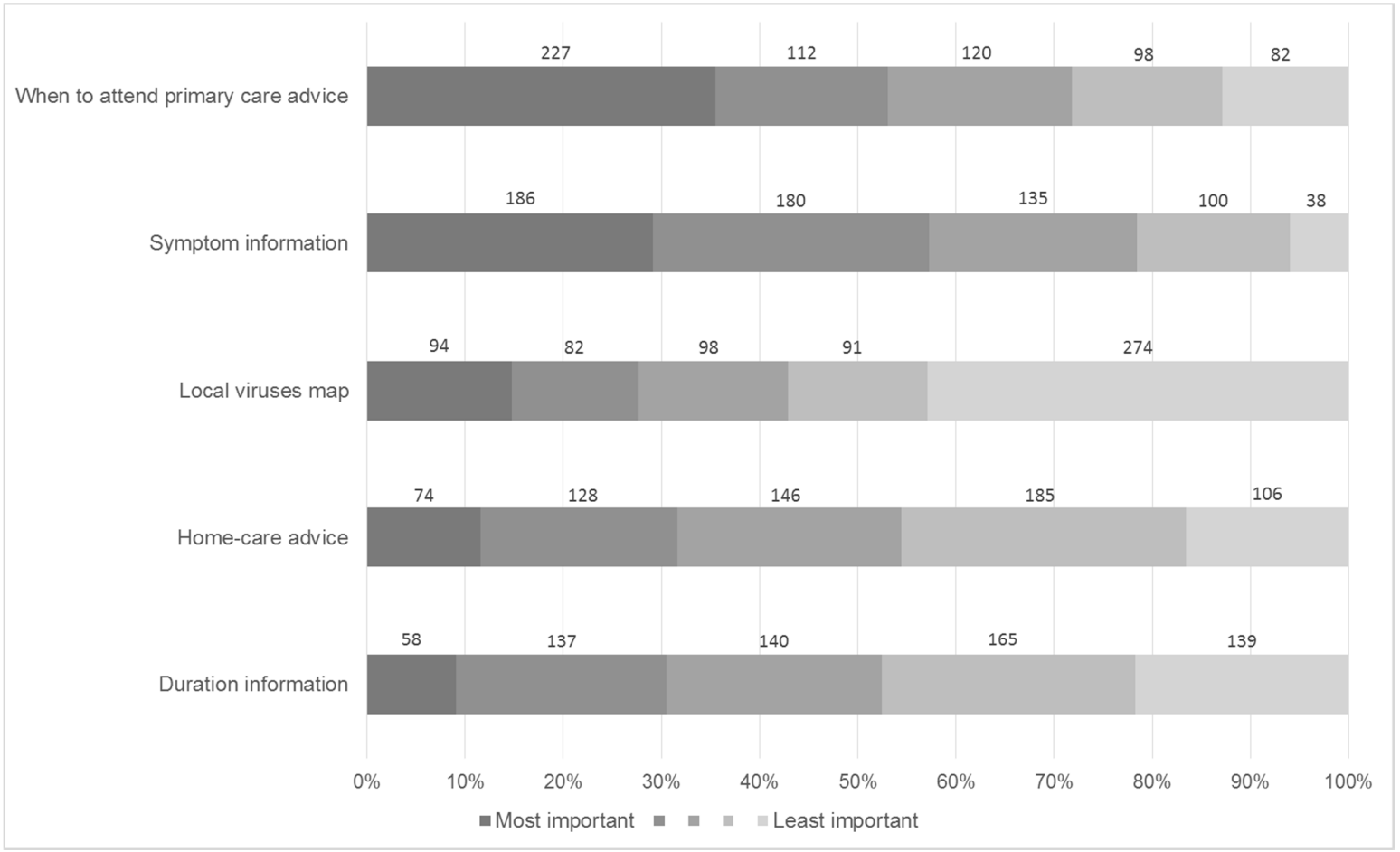

Figure 2: Information components included in the intervention rated by perceived importance.

APPENDICES

Supplement 1 – Intervention material

Supplement 2 - Public involvement

Supplement 3 – Survey

Supplement 4 – Recruitment