Changing attitudes towards polio vaccination: a randomized trial of an evidence-based presentation versus a presentation from a polio survivor

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Abstract

We compared the impact of epidemiological evidence and anecdotal evidence on changing vaccination attitudes amongst alternative medical students. Ninety-seven students were randomized to either an evidence-based lecture on the benefits of the polio vaccine on population health or a presentation from a visibly affected victim of polio. We compared change in responses to a survey measuring vaccination attitudes between the two groups. The follow-up rate was 73%. There was no statistically significant difference between the two groups in change in response to any of the survey questions. In a post hoc analysis we found that 25% of students were less likely to recommend the vaccine after being provided with evidence supporting vaccination. These findings suggest that confronting deeply held beliefs regarding vaccination may paradoxically strengthen these belief systems.

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1. Introduction

Concerns about pediatric vaccinations amongst some individuals remains a persistent challenge to public health officials interested in ensuring high vaccination rates [1]. Efforts to improve vaccination have largely centered on education programmes designed to inform the public of the benefits and safety of vaccines [2–4]. However, despite these efforts some individuals have remained highly skeptical about the safety and efficacy of vaccines. Public health officials have partially attributed this to the fact that the diseases being vaccinated against are no longer present, largely due to the success of the vaccine programmes [5]. The argument has been made that if these individuals had seen the illnesses these vaccines are designed to prevent they would not harbour such strong anti-vaccination views.

We sought to test the hypothesis that anecdotal evidence in the form of an individual with a vaccine preventable disease would be more effective than an evidence-based presentation in persuading populations of the benefits of vaccines [6]. We specifically tested this hypothesis as it related to the polio vaccine. Our belief that seeing a survivor of polio would be more effective than evidence in influencing attitudes was based on the “vividness hypothesis” [7]. According to this hypothesis vivid information, in the form of a well-described anecdote or a recent clinical experience, is more persuasive than pallid information, such as epidemiological data. This hypothesis, as it pertains to vaccination attitudes, was supported by a previous survey we conducted which identified a negative association between personal knowledge of a patient with an adverse vaccine reaction and willingness to advise vaccination [8].

To specifically test our hypothesis we conducted a trial in which we randomized alternative medicine students, who...
had previously been documented to harbour views less supportive of vaccination, to receive a primarily epidemiological lecture on the benefits of the polio vaccine or to hear the experiences of a polio survivor [8]. We examined the change in attitudes towards vaccination as measured by change in before-and-after survey responses in each of these two groups.

2. Methods

2.1. Study population

Our study population was the final year students at a large Canadian alternative medicine school. Students were informed at the beginning of class that a study was being conducted and they could choose to participate by completing a survey before and after having heard a presentation on vaccinations. Students had received an identical education over the previous three years in CAM modalities, philosophy and sciences. The school does not have a formal opinion on vaccines, however, vaccine efficacy and physiology have been formally taught in microbiology (2nd year). This study was approved by the IRB of the alternative medicine college.

2.2. Testing scale

A sixteen-question survey was developed by the authors and pre-tested on five students at the college. Pre-testing was conducted to determine if students understood the questions being asked and were clear about the instructions on the survey. The survey elicited information about patient age, sex, marital status, and parental status. Additionally, the survey utilized eleven Likert scales to evaluate beliefs regarding common childhood vaccinations and specifically examined beliefs related to the polio vaccine.

2.3. Intervention

Students were randomized into two groups, an evidence group or a polio survivor group, using simple, unrestricted randomization accomplished by coin-tossing [9]. The evidence group received a 40-min didactic lecture on the historical and current epidemiological evidence of polio and the efficacy of the oral polio vaccine (OPV) and inactivated polio vaccine (IPV). The lecture focused on the decline of polio since the introduction of polio vaccination programs in Canada. Additionally, the lecturer (K.W.) addressed epidemiological evidence about adverse effects of the polio vaccines; vaccine associated paralytic polio and how this condition had been eliminated with the use of inactive vaccines. The lecturer briefly spoke about the pathophysiological profile of the disease. Students were permitted to ask questions of clarification pertaining to epidemiological aspects of the disease and the vaccine. Anecdotal evidence was not discussed.

The polio survivor group received a 40-min didactic lecture by a public speaker with The Ontario March of Dimes visibly afflicted by polio related paralysis in her left leg, and the survivor’s daughter, an educational outreach worker at The Ontario March of Dimes. The speakers delivered anecdotal information about their experiences living with the disease. Specifically, the polio survivor, who was born prior to the introduction of the vaccine, discussed her impressions of the benefit the vaccine could have had on her life as well as her medical experience of coping with the disease. Students were permitted to ask questions of clarifications and for further description of the experiences of the individuals. Epidemiological evidence was not discussed.

2.4. Evaluation

We issued the survey at the beginning of class and instructed the students that a trial was being conducted. Students were asked to complete the self-administered survey. They were asked to supply an identifier, such as a student number, to allow for matching and analysis of their before-and-after responses. The survey was again issued following the lectures.

2.5. Analysis

Assessors were blinded to the groups to which students had been allocated. Fisher’s exact tests were used to compare the two groups on the proportions who were male, who were single and who had children. Age was compared using a t-test. Our primary outcome was the pre-to-post intervention change in the Likert score for willingness to recommend the polio vaccine. Our secondary outcomes were changes in the Likert scores for willingness to recommend the MMR vaccine, willingness to vaccinate own child, and strength of belief that the risk of the polio vaccine outweighs the benefits. The other questions were examined in large groups as potential explanatory variables. Changes in the Likert scores in the two groups were compared using the Wilcoxon rank-sum test.

On a closer examination of the data we observed an unusual finding that important numbers in each group were less likely to vaccinate after being provided with the intervention. We conducted a post hoc analysis to see if there was any difference between the two groups on the direction in which their attitudes changed on the primary and secondary outcomes. We specifically determined if their responses became more supportive of vaccines, or less supportive of vaccines. We used the additional questions to see if a priori attitudes predicted direction of change. For each question, each subject was classified as having a more favourable, a less favourable or an equally favourable attitude towards vaccines and groups were then compared using the Wilcoxon rank sum test with this ordinal variable. Tests of statistical significance were carried out at the α = 0.05 level.
and 40% in the evidence group). The variable in which the risk of the polio vaccine outweighed the benefits (43% over-
supportive of vaccination was on the question of whether the
in which the highest percentage of individuals became more
ning been exposed to the intervention (Table 1). In our post hoc
analysis, we found that some students became more support-
ive of vaccination, some did not change their attitudes and
became less supportive, 2.4% in the polio survivor group and
6% recommending the polio vaccine and MMR vaccine,
respectively (Table 2).

There was no statistically significant difference between
the evidence group and the polio survivor group on any of
the primary or secondary outcomes (Table 3). In our post hoc
analysis, we found that some students became more support-
ive of vaccination, some did not change their attitudes and
others became less supportive of vaccinations (Fig. 1).

We found that, overall 19% of students were more likely to
recommend the polio vaccine (19% overall, 15% in the polio
survivor group and 25% in the evidence group) after hav-
ing been exposed to the intervention (Table 4). The variable
in which the highest percentage of individuals became more
supportive of vaccination was on the question of whether the
risk of the polio vaccine outweighed the benefits (43% over-
all were more supportive, 45% in the polio survivor group
and 40% in the evidence group). The variable in which the
lowest percentage of individuals became more supportive of
vaccination was on the question of whether homeopathy is
effective in reducing disease (10% overall were more support-
tive, 2.4% in the polio survivor group and 0% in the evidence
group).

Overall, 25% were less likely to recommend the polio
vaccine (23% in the polio survivor group and 29% in the ev-
idence group) after having been exposed to the intervention.
The variable in which the highest percentage of individuals
became less supportive of vaccination was on the question of
whether polio is a serious problem (38% overall were less
likely to think polio was a serious problem after hearing the
intervention, 22% in the polio survivor group and 60% in the
evidence group). This question was also the only ques-
tion in which there was a statistically significant difference
in change between the two groups, with more of the evidence
group moving towards a belief that polio is not as serious
as they had believed compared to the polio survivor group.
The variable in which the lowest percentage of individuals
became less supportive of vaccination was on the question of
whether they would vaccinate their own child (1.4% overall
became less supportive, 2.4% in the polio survivor group
and 0% in the evidence group).

We also attempted to determine if a priori attitudes influ-
enced the direction of change of vaccination attitudes and
found no statistically significant associations.

3. Results

In total 97 students chose to participate and filled out the
pre-presentation survey. Our final sample consisted of 71 stu-
dents who completed both the pre and post surveys, with 41
individuals in the polio survivor group and 30 individuals
in the evidence group. The follow-up rate was 73%. The
groups were similar demographically except that Group A
had a higher proportion of single students (Table 1). Our
baseline data confirmed our starting hypothesis that this pop-
ulation was generally non-supportive of vaccines with only 9
students who completed both the pre and post surveys, with 41
in the evidence group. This question was also the only ques-
tion in which there was a statistically significant difference
in change between the two groups, with more of the evidence
group moving towards a belief that polio is not as serious
as they had believed compared to the polio survivor group.

The variable in which the lowest percentage of individuals
became less supportive of vaccination was on the question of
whether they would vaccinate their own child (1.4% overall
became less supportive, 2.4% in the polio survivor group
and 0% in the evidence group).

4. Discussion

In this study of individuals randomized to an evidence-
based presentation or a presentation of anecdotal evidence to
influence their attitudes on the polio vaccine we found that,
as an aggregate, neither intervention had a statistically signif-
ificant effect on vaccination attitudes. However, when exam-
inig the results more closely we were surprised to observe
that some students were less supportive of polio vaccination
after being provided with pro-vaccination information.

There are several limitations to this study. These include
our small sample size and the important drop out rate. Our

Table 1
Baseline characteristics of the study participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>Polio survivor (n = 41)</th>
<th>Evidence (n = 30)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>29.2</td>
<td>28.9</td>
<td>0.71</td>
</tr>
<tr>
<td>Female</td>
<td>34 (83%)</td>
<td>21 (70%)</td>
<td>0.25</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>36 (86%)</td>
<td>19 (63%)</td>
<td>0.02</td>
</tr>
<tr>
<td>Married/divorced/separated</td>
<td>5 (12%)</td>
<td>11 (37%)</td>
<td></td>
</tr>
<tr>
<td>Have children</td>
<td>2 (5%)</td>
<td>2 (7%)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Table 2
Baseline responses of the study participants

<table>
<thead>
<tr>
<th>Attitude (number of responses)</th>
<th>No definitely</th>
<th>No probably</th>
<th>Not sure</th>
<th>Yes probably</th>
<th>Yes definitely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommend polio vaccine (67)</td>
<td>4 (6%)</td>
<td>25 (37.5%)</td>
<td>32 (47.8%)</td>
<td>6 (9.0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Recommend MMR vaccine (66)</td>
<td>12 (17.6%)</td>
<td>30 (44.1%)</td>
<td>22 (32.4%)</td>
<td>4 (5.9%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

Table 3
Recommendation of pediatric vaccines: a comparison of changes in Likert scores

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Polio survivor Δ</th>
<th>Evidence Δ</th>
<th>Difference (polio survivor-evidence [95% CI])</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willingness to recommend polio vaccine</td>
<td>-0.05</td>
<td>0.00</td>
<td>-0.05 [-0.4, 0.35]</td>
<td>0.79</td>
</tr>
<tr>
<td>Willingness to recommend MMR vaccine</td>
<td>-0.05</td>
<td>0.07</td>
<td>-0.12 [-0.4, 0.2]</td>
<td>0.43</td>
</tr>
<tr>
<td>Willingness to vaccinate own child</td>
<td>-0.22</td>
<td>0.10</td>
<td>0.11 [-0.1, 0.31]</td>
<td>0.29</td>
</tr>
<tr>
<td>Risk of polio vaccine outweighs the benefits</td>
<td>-0.28</td>
<td>-0.07</td>
<td>-0.21 [-1.1, 0.7]</td>
<td>0.65</td>
</tr>
</tbody>
</table>

* Likert scores are on a 7-point scale; change in Likert scores is on a –3 to +3 scale.

* A positive Δ means subjects are more pro-vaccine after the intervention than before.
Table 4
Direction of change in vaccination attitudes per group

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Change in attitude</th>
<th>Polio survivor group</th>
<th>Evidence group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommend polio vaccine</td>
<td>More supportive</td>
<td>6/39 (15%)</td>
<td>7/28 (25%)</td>
</tr>
<tr>
<td></td>
<td>Less supportive</td>
<td>9/39 (23%)</td>
<td>8/28 (29%)</td>
</tr>
<tr>
<td>Recommend MMR vaccine</td>
<td>More supportive</td>
<td>6/40 (15%)</td>
<td>5/28 (18%)</td>
</tr>
<tr>
<td></td>
<td>Less supportive</td>
<td>9/40 (23%)</td>
<td>3/28 (11%)</td>
</tr>
<tr>
<td>Would vaccinate own child</td>
<td>More supportive</td>
<td>9/41 (22%)</td>
<td>3/29 (10%)</td>
</tr>
<tr>
<td></td>
<td>Less supportive</td>
<td>14/41 (35%)</td>
<td>0/29 (0%)</td>
</tr>
<tr>
<td>Think risk of polio vaccine outweighs benefits</td>
<td>More supportive</td>
<td>18/40 (45%)</td>
<td>12/30 (40%)</td>
</tr>
<tr>
<td></td>
<td>Less supportive</td>
<td>9/40 (23%)</td>
<td>9/30 (30%)</td>
</tr>
<tr>
<td>Think polio is a serious problem</td>
<td>More supportive</td>
<td>15/41 (37%)</td>
<td>4/30 (13%)</td>
</tr>
<tr>
<td></td>
<td>Less supportive</td>
<td>9/41 (22%)</td>
<td>18/30 (60%)</td>
</tr>
<tr>
<td>Think vaccines are beneficial</td>
<td>More supportive</td>
<td>7/40 (18%)</td>
<td>7/29 (24%)</td>
</tr>
<tr>
<td></td>
<td>Less supportive</td>
<td>3/40 (8%)</td>
<td>5/29 (17%)</td>
</tr>
<tr>
<td>Think vaccines prevent serious infectious diseases</td>
<td>More supportive</td>
<td>16/41 (39%)</td>
<td>10/29 (34%)</td>
</tr>
<tr>
<td></td>
<td>Less supportive</td>
<td>6/41 (15%)</td>
<td>6/29 (21%)</td>
</tr>
<tr>
<td>Think vaccines reduce infectious diseases</td>
<td>More supportive</td>
<td>16/41 (44%)</td>
<td>8/29 (28%)</td>
</tr>
<tr>
<td></td>
<td>Less supportive</td>
<td>6/41 (15%)</td>
<td>8/29 (28%)</td>
</tr>
<tr>
<td>Think vaccines are given at too young an age</td>
<td>More supportive</td>
<td>12/41 (29%)</td>
<td>5/28 (18%)</td>
</tr>
<tr>
<td></td>
<td>Less supportive</td>
<td>9/41 (22%)</td>
<td>12/28 (43%)</td>
</tr>
<tr>
<td>Think homeopathy is effective in reducing disease</td>
<td>More supportive</td>
<td>5/41 (12%)</td>
<td>2/29 (7%)</td>
</tr>
<tr>
<td></td>
<td>Less supportive</td>
<td>2/41 (5%)</td>
<td>5/29 (17%)</td>
</tr>
<tr>
<td>Think parents can reduce the risk of infectious</td>
<td>More supportive</td>
<td>12/41 (29%)</td>
<td>4/29 (14%)</td>
</tr>
<tr>
<td>diseases</td>
<td>Less supportive</td>
<td>9/41 (22%)</td>
<td>10/29 (34%)</td>
</tr>
</tbody>
</table>

* Difference between groups significant (P < 0.05).
study likely was not adequately powered to identify smaller but potentially important levels of change in attitudes. The students that chose not to fill out the second survey may have also differed systematically from the other students and failure to include their response could bias the findings. Nevertheless, despite these limitations the results of our study are difficult to explain. While it is understandable, why our interventions may have had little effect on attitudes due to the statistical power of the study or the design of the intervention, the movement towards a position less supportive of vaccination is surprising. Some of the changes we observed could be a result of inherent variability in responses to the questionnaire, however, we have not evaluated test–retest reliability of the questionnaire, and so, we cannot quantify this. Nonetheless, it is a distinct possibility that decisions to change attitudes were conscious ones. The movement towards a more anti-vaccine position could be due to a process of resolving cognitive dissonance [10]. Cognitive dissonance is a discomfort that is felt by an individual when there is inconsistency between new information that is received and existing beliefs. The belief system that contributed to the students pre-existing concerns about vaccination could be considered to be “deep core” [11]. This form of belief system is a fundamental view on how the world should be, analogous to a religious belief, and is difficult to change. When confronted with views that challenge these belief systems individuals can become more entrenched in their existing beliefs. We tried to test for this empirically by identifying if a priori beliefs were associated with the direction of change. We found no effects although we had low statistical power to detect all but the strongest associations. Write-in comments from the students and comments made to the polio survivor and her daughter, however, support the cognitive dissonance resolution explanation. In these comments, students expressed anger over the study, suggesting that pharmaceutical companies were involved in this study. They also asserted that, to be balanced, we should have relied on sources of information written by those concerned about vaccines to obtain a more objective view on vaccine risks and benefits and that we should have included an individual with a vaccine-induced impairment as part of the study. Overall the impression amongst some of the students was that this was a manipulative exercise.

An alternative explanation for the somewhat paradoxical effect of our interventions is that the evidence we provided might have actually demonstrated to the students that polio was not as serious a condition as they may have thought. This is supported by the fact that the greatest change towards attitudes less supportive of vaccination occurred on the question of the severity of polio (38% overall, 22% in the polio survivor group and 80% in the evidence group). The students may have had an image of polio that was worse than what they saw in the patient, which could have been reinforced by our necessary use of an adult polio survivor as opposed to a child afflicted with the condition. Additionally, students in the evidence group may have come away with the impression that polio had been eradicated and was not a serious threat.

This hypothesis is also consistent with theories of knowledge uptake, which assert that uptake is selective based on a priori beliefs systems [12]. Importantly, we cannot necessarily infer from this study what impact the re-emergence of vaccine preventable diseases, that results from decreased vaccine coverage may have on vaccination rates [13]. If this scenario were to occur it may provide a much more compelling evidence to the general public, of a causal association between failure to vaccinate and development of vaccine preventable diseases. Additionally, while we have identified that some students exposed to our interventions moved to a position less supportive of vaccination, it is also important to recognize that 19% of students were more likely to recommend the polio vaccine after hearing the interventions. It therefore, appears that characteristics of the participants may govern their receptiveness to the message being provided. Some individuals may have a priori beliefs that are susceptible to change. Others, however, may have pre-existing belief systems that will reject new contradictory information.

Important messages arise from this study for those interested in maintaining confidence in vaccination programs. One recommendation would be that public health officials should consider a form of targeted messaging, tailoring their approach to the strength of belief system they are confronting. For some individuals concerns about vaccination may be due to simple misunderstanding of technical information and may easily be addressed. For those in whom this belief system is more strongly held, and which is part of an overall view of the world, a different approach may be required. Challenging views in this population could be seen as threatening, analogous to directly confronting a religious belief. Directly confronting these belief systems may create further animosity and distrust of public health professionals. The issue of trust appears to be central to identifying mechanisms in which to communicate with these individuals. We have previously demonstrated how trust in conventional medicine is lower in students in later years of an alternative medicine program compared to earlier years and how this deterioration in trust is negatively correlated with willingness to recommend vaccines [8]. To establish trust amongst individuals with strongly held belief systems not supportive of vaccination, approaches that are respectful to the views of this audience should be encouraged. Public health professionals must be prepared to non-judgmentally listen to the concerns of these groups and determine if there are effective ways to address these concerns. However, it is important to also recognize that changing views amongst some individuals concerned about vaccinations may not be possible.

5. Conclusion

Changing vaccination attitudes amongst those who have strongly held belief systems is a challenging process. Simple delivery of evidence, either in the format of a vivid example or...
as an evidence-based presentation may, in some individuals, reinforce their concerns about vaccination. We recommend further exploration of alternative approaches to addressing this issue that are more respectful and less threatening to belief systems. These approaches will likely involve mechanisms to improve trust and promote open communication.

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References