Confidence in the safety of standard childhood vaccinations among New Zealand health professionals

Carol Lee, Isabelle Duck, Chris G Sibley

Scepticism about the safety of childhood vaccinations is an issue of pressing concern. Despite the abundance of comprehensive and reliable scientific evidence on the safety and effectiveness of standard vaccinations, many parents continue to express fear and mistrust of vaccinations. Such scepticism may be fostered or enabled by the increased accessibility of pseudo-scientific anti-vaccination information online and previous fraudulent studies on vaccinations. This includes Andrew Wakefield’s now retracted study on the unwarranted link between the measles, mumps and rubella vaccine (MMR) and autism. In order to maintain high vaccination coverage, it is essential to correct current misconceptions about vaccinations among the general public.

Health professionals have crucial impact on parental decisions regarding their children’s vaccinations. Numerous studies suggest that physician recommendation and positive communication with doctors are associated with an increased likelihood of vaccination uptake. Smith et al found that parents who express vaccine safety concerns were much more likely to vaccinate their child when their decisions were influenced by their health professional. Hence, it is essential to ensure that health professionals have strong vaccine confidence and accurate vaccine knowledge to positively influence parental vaccination decisions.

Vaccinations in the context of New Zealand

The New Zealand National Immunisation Schedule offers publicly funded vaccinations to all New Zealanders at various recommended ages. This includes the influenza and whooping cough vaccine for pregnant women, and rotavirus and diphtheria-tetanus-pertussis vaccine for babies six weeks after birth. As pregnancy is not officially defined as a category on the National Immunisation Register, it is difficult to quantify

ABSTRACT

AIMS: To investigate the level of confidence in the safety of standard childhood vaccinations among health professionals in New Zealand.

METHOD: Data from the 2013/14 New Zealand Attitudes and Values Study (NZAVS) was used to investigate the level of agreement that “it is safe to vaccinate children following the standard New Zealand immunisation schedule” among different classes of health professionals (N=1,032).

RESULTS: Most health professionals showed higher levels of vaccine confidence, with 96.7% of those describing their occupation as GP or simply ‘doctor’ (GPs/doctor) and 90.7% of pharmacists expressing strong vaccine confidence. However, there were important disparities between some other classes of health professionals, with only 65.1% of midwives and 13.6% of practitioners of alternative medicine expressing high vaccine confidence.

CONCLUSION: As health professionals are a highly trusted source of vaccine information, communicating the consensus of belief among GPs/doctors that vaccines are safe may help provide reassurance for parents who ask about vaccine safety. However, the lower level of vaccine confidence among midwives is a matter of concern that may have negative influence on parental perceptions of vaccinations.
accurate vaccination coverage rates among pregnant women. Immunisation coverage for children who turned one of the milestone ages during 2017 are relatively high (from 78.7% to 93.4%), but a small subset (around 4%) of parents continue to decline at least one vaccination every year.11 Somewhat in line with these coverage rates, a recent study using data from the 2013/14 NZAVS found that the majority of New Zealand adults (68.5%) strongly agree that standard vaccinations following the National Immunization Schedule are safe, but 26% express uncertainty and 5.5% are strongly opposed.12

Unsurprisingly, parents who receive discouraging information on vaccinations are less likely to immunise their children.13,14 The Growing Up in New Zealand Study14 found that information which encourages immunisations did not increase the likelihood of timely vaccination uptake, suggesting that exposure to negative information has a particularly salient impact on parental vaccination decisions. On the contrary, Wroe, Turner and Owens15 found that, in comparison to parents who received standard immunisation information, those who received more sophisticated decision-making aids showed a significantly higher likelihood of timely immunisations and decreased risk perceptions of vaccinations. This finding suggests that the comprehensiveness and adequacy of the way in which positive vaccination information is provided determines its impact on parental vaccination decisions.

Health professionals in New Zealand

Similar to past international research,6,7 earlier New Zealand studies suggest that characteristics or attitudes of health professionals influence parental decisions on childhood vaccinations.13,16,17 For instance, the belief that parental apathy is a barrier to immunisation among nurses has been associated with increased timeliness of vaccinations,13 and practices with doctors who were confident in their vaccination knowledge had higher vaccination coverage.17 As the way in which health professionals present pro-immunisation information is likely to determine its effectiveness, it is vital they have sufficient vaccine knowledge and can adequately communicate their confidence in vaccine safety to parents.

Previous studies indicate inconsistencies in perceptions of vaccinations across different classes of health professionals. A 2002 survey on health professionals in Rotorua (N=200) which assessed participants’ level of agreement to various statements about immunisations (1= strongly disagree, 5= strongly agree) found that most health professionals agreed that childhood immunisations should be recommended (95%).16 However, “41% of nurses (35/86), 45% (13/29) of midwives and 21% of doctors (16/76) were unsure whether the MMR vaccine was associated with autism or Crohn’s disease.”18 Moreover, while 80% of doctors and nurses disagreed or strongly disagreed that “immunisations have unacceptable dangers”, only 45% of midwives disagreed, with 28% being uncertain and 28% agreeing.18 In other studies, some GPs identified inaccurate vaccine information distributed by midwives as a barrier to childhood vaccination,19 and a higher proportion of pregnant women reported receiving vaccine discouraging information from midwives (11%) compared to GPs (3%).14 Yet, a greater number of mothers also reported receiving vaccine encouraging information from their midwife (62%) compared to GPs (36%).14

Extending on past research, the current study leverages data from the 2013/14 NZAVS to directly assess up-to-date differences in levels of confidence in the safety of standard immunisations across different classes of health professionals in New Zealand. We aim to identify which classes of health professionals exhibit strong vaccine confidence, and which classes may require greater access to training and resources about vaccine safety.

Methods

Sampling procedure

The NZAVS is a longitudinal panel study with a probability sample of New Zealand adults. This study has been approved by the University of Auckland Human Participants Ethics Committee. Time 1 (2009) wave of the NZAVS was initially sampled from the electoral roll (response rate: 16.6%), with various booster samples collected during
Time 3 (2011), 4 (2012) and 5 (2013) to increase representativeness of our sample.\textsuperscript{20} The current study uses data from the Time 5 sample (\(N=18,261\), 81\% retention rate from Time 4), specifically focusing on health professionals who completed the item assessing vaccine confidence (\(N=1,032\)).

Participants
As seen in Table 1, most health professionals in our sample were European (86.7\%) and female (84.1\%). The median age for all health professionals was 48 years (SD = 12). Doctors who listed a speciality other than GP ($150,000) and those describing their occupation as GP or simply ‘doctor’ ($120,000) had the highest median personal income, whereas midwives, physiotherapists ($50,000) and practitioners of alternative medicine ($52,000) had the lowest median income.

Measures
Occupation was assessed using the open-ended question “What is your occupation?” Health professionals were identified using the statistical standard provided by the Australian and New Zealand Standard Classification of Occupations.\textsuperscript{21} This measure was validated by matching participants’ self-reports against their occupation as listed in the original sample frame drawn from the electoral roll. We then created our own coding scheme within this Level 3 tier to classify health professionals into the 11 categories described in Table 1. Participants simply listing ‘doctor’ as their occupation were included in the GP category, as more specific information about their medical speciality was not available. Doctors listing a specific speciality other than GP (eg, anaesthetist, surgeon) were grouped into a category representing ‘other specialist doctors.’ Participants were also asked about their demographic characteristics.

Vaccine confidence was assessed using the likert item (1 = Strongly Disagree, 7 = Strongly Agree); “It is safe to vaccinate children following the standard NZ immunisation schedule”. This item was developed for the NZAVS in consultation with medical professionals.

Statistical analyses
A one-way ANOVA was conducted to assess mean differences in levels of vaccine confidence across different classes of health professionals. This was followed by an ANCOVA which included participants’ age, gender, ethnicity, parental and partner status, religiosity and region of residence as covariates. Lastly, a Chi-square test was conducted to investigate differences in proportions of strong vaccine confidence across the different classes of health professional. All analyses were conducted on SPSS.

Results
Analysis of mean differences
The ANOVA assessing differences in agreement with the Likert item “It is safe to vaccinate children following the standard NZ immunisation schedule” across the 11 classes of health practitioners was significant (\(F_{(10,1021)}=18.64, p<.001\), partial eta squared = .154). Observed power for the F-ratio was >.99. Mean levels of vaccine confidence for each class of health professionals are presented in Figure 1.

GPs/doctors expressed the highest level of agreement that vaccinations following the standard schedule were safe (\(M=6.84\)). Bonferroni post-hoc tests indicated that midwives expressed significantly lower levels of belief in the safety of vaccinations relative to GPs/doctors (\(p<.001\)), pharmacists (\(p<.001\)), nurses (\(p=.001\)), dentists (\(p<.001\)), physiotherapists (\(p<.001\)) and other specialist doctors (\(p=.025\)). Midwives’ mean level of belief in the safety of vaccinations following the standard schedule (\(M=5.30\)) was marginally lower than that of the general population (\(M=5.72\)). However, this was not a significant difference.

Practitioners of alternative medicine (eg, homeopathy and osteopathy) expressed the lowest level of vaccine confidence (\(M=3.18\)). Bonferroni post-hoc tests indicated that they showed significantly lower agreement that vaccinations are safe relative to all other classes of health professionals (\(p<.001\)).

The ANCOVA assessing differences in levels of vaccine confidence across health professionals was significant (\(F_{(10,995)}=16.57, p<.001\), partial eta squared = .147). Observed power for the overall F-ratio was >.99. Age, gender, ethnicity (Māori, Asian, Pacific or European), parental and partner status, religiosity and region of residence were included as covariates. GPs continued to show the highest mean level of vaccine
safety ($M=6.78$), while midwives ($M=5.53$) and practitioners of alternative medicine ($M=3.13$) showed the lowest level of agreement. Bonferroni post-hoc tests indicated that midwives expressed significantly lower vaccine confidence relative to GPs/doctors ($p<.001$) and pharmacists ($p=.008$). However, practitioners of alternative medicine continued to show significantly lower levels of vaccine confidence compared to all other health professionals ($p<.001$).

**Strong vaccine confidence**

The number of participants who selected each rating on our measure of vaccine confidence is presented in Table 2. The distribution of confidence in vaccine safety tended to be skewed towards strong agreement for most classes of health professionals. Following the coding scheme proposed by Lee et al., ratings of 6 or 7 on the vaccination item were described as **strong vaccine confidence**. A chi-square test indicated that there were reliable differences across the classes of health professional in strong support for vaccinations ($\chi^2(10; N=1032)=107.73$, $p<.001$). As shown in Figure 2, GPs/doctors exhibited the highest proportion of strong vaccine confidence (96.7%), while practitioners of alternative medicine (13.6%) and midwives (65.1%) showed the lowest proportions.

**Discussion**

The current study used data from the 2013/14 NZAVS to investigate the level of confidence in the safety of standard childhood vaccinations among different classes of health professionals. We found that GPs/doctors (96.7%), pharmacists (90.7%) and dentists (86.2%) exhibited the highest levels of strong vaccine confidence, while midwives (65.1%) and practitioners of alternative medicine (13.6%) exhibited the lowest level of strong confidence. As reported by Lee et al., the 2013/14 NZAVS data suggests that the majority of New Zealanders believe in the safety of vaccinations (68.5%). Although most health professionals exhibit considerably higher levels of vaccine confidence compared to the general public, practitioners of alternative medicine show substantially lower and midwives show marginally lower levels of strong confidence.

Irrespective of whether we controlled for key demographic factors, practitioners of alternative medicine showed a significantly lower mean level of vaccine confidence compared to all other health professionals. Moreover, midwives showed a significantly lower level of confidence compared to most other health professionals and continued to

<table>
<thead>
<tr>
<th>Table 1: Demographic details of participants within each class of health professionals and the full sample.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Female</strong></td>
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<tr>
<td>------------</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>GPs/doctors</td>
</tr>
<tr>
<td>Pharmacists</td>
</tr>
<tr>
<td>Dentists/dental surgeons</td>
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<tr>
<td>Doctors - other specialists</td>
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<tr>
<td>Physiotherapists</td>
</tr>
<tr>
<td>Nurses</td>
</tr>
<tr>
<td>Radiographers</td>
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<tr>
<td>Health professionals - other</td>
</tr>
<tr>
<td>Occupational therapists</td>
</tr>
<tr>
<td>Midwives</td>
</tr>
<tr>
<td>Practitioners of alt. medicine</td>
</tr>
<tr>
<td>Total - health professionals</td>
</tr>
<tr>
<td>Total - full sample</td>
</tr>
</tbody>
</table>

Notes: ‘N’ and ‘%’ refer to the number of people classified within each demographic category for the different classes of health professionals. The median age and median personal income for people within each class of health professionals, all health professionals together and the full sample of the 2013/14 NZAVS (including health professionals) are also reported.
Table 2: Mean ratings of agreement with the item on vaccine safety and percentage of respondents expressing strong vaccine confidence.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Lower 95% CI</th>
<th>Upper 95% CI</th>
<th>N</th>
<th>Percent strong</th>
<th>Frequency count of Likert scale ratings (1 = Strongly Disagree, 7 = Strongly Agree)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>GPs/doctors</td>
<td>6.84</td>
<td>0.49</td>
<td>6.74</td>
<td>6.92</td>
<td>122</td>
<td>96.7%</td>
<td>0 0 0 1 3 11 107</td>
</tr>
<tr>
<td>Pharmacists</td>
<td>6.65</td>
<td>0.72</td>
<td>6.41</td>
<td>6.85</td>
<td>43</td>
<td>90.7%</td>
<td>0 0 0 1 3 6 33</td>
</tr>
<tr>
<td>Dentists/dental surgeons</td>
<td>6.48</td>
<td>1.15</td>
<td>5.96</td>
<td>6.86</td>
<td>29</td>
<td>86.2%</td>
<td>1 0 0 1 2 3 22</td>
</tr>
<tr>
<td>Doctors - other specialists</td>
<td>6.38</td>
<td>1.41</td>
<td>5.77</td>
<td>6.84</td>
<td>32</td>
<td>87.5%</td>
<td>1 0 1 2 0 4 24</td>
</tr>
<tr>
<td>Physiotherapists</td>
<td>6.33</td>
<td>1.05</td>
<td>6.04</td>
<td>6.60</td>
<td>60</td>
<td>85.0%</td>
<td>0 0 3 1 5 15 36</td>
</tr>
<tr>
<td>Nurses</td>
<td>6.22</td>
<td>1.34</td>
<td>6.10</td>
<td>6.34</td>
<td>524</td>
<td>83.6%</td>
<td>9 11 13 23 30 119 319</td>
</tr>
<tr>
<td>Radiographers</td>
<td>6.19</td>
<td>1.24</td>
<td>5.66</td>
<td>6.64</td>
<td>27</td>
<td>77.8%</td>
<td>0 0 2 1 3 5 16</td>
</tr>
<tr>
<td>Health professionals - other</td>
<td>5.83</td>
<td>1.60</td>
<td>5.52</td>
<td>6.13</td>
<td>109</td>
<td>72.5%</td>
<td>3 4 5 8 10 25 54</td>
</tr>
<tr>
<td>Occupational therapists</td>
<td>5.62</td>
<td>1.91</td>
<td>4.63</td>
<td>6.40</td>
<td>21</td>
<td>81.0%</td>
<td>2 0 2 0 0 9 8</td>
</tr>
<tr>
<td>Midwives</td>
<td>5.30</td>
<td>1.77</td>
<td>4.74</td>
<td>5.81</td>
<td>43</td>
<td>65.1%</td>
<td>2 3 3 3 4 17 11</td>
</tr>
<tr>
<td>Practitioners of alt. medicine</td>
<td>3.18</td>
<td>1.89</td>
<td>2.41</td>
<td>4.00</td>
<td>22</td>
<td>13.6%</td>
<td>6 3 4 3 3 2 1</td>
</tr>
<tr>
<td>Population estimate</td>
<td>5.71</td>
<td>1.54</td>
<td>5.69</td>
<td>5.73</td>
<td>18,154</td>
<td>68.5%</td>
<td>543 455 664 2,054 2,010 4,885 7,543</td>
</tr>
</tbody>
</table>

Notes: The estimate of ‘percent strong’ represents the percentage of people rating a ‘6’ or ‘7’ (i.e., strong agreement) with the Likert scale item “It is safe to vaccinate children following the standard NZ immunisation schedule”. 95% confidence intervals of the mean were obtained using 5,000 bootstrap resamples. After applying the standard NZAVS post-stratification sample weighting adjustment the population estimate (using the total sample) was 5.72 and associated 95% confidence interval was 5.70, 5.74 (These estimates are different to values presented in table as bootstrapping was not possible in conjunction with weighting).

Figure 1: Mean level of agreement with the Likert item “It is safe to vaccinate children following the standard NZ immunisation schedule” for different classes of health professionals.

Note. Error bars represent 95% confidence interval of the mean using 5,000 bootstrap resamples. The bold horizontal line represents the estimated population mean level of vaccine confidence using the full sample (N=18,153) and applying NZAVS post-stratification sample weighting adjustment.
exhibit lower confidence than GPs/doctors and pharmacists after controlling for demographic factors. This finding is consistent with previous studies in which a greater proportion of midwives were found to exhibit vaccine safety concerns or distribute negative vaccine information.\textsuperscript{14, 18} The large effect size observed in our ANOVA of differences across occupation (partial eta squared = .154) suggest that the type of occupation held by a health professional has important influence on their level of vaccine confidence. Future studies should investigate how more specific factors, such as differences in vaccination education or working environments, may be driving these disparities in confidence.

Strong vaccine confidence among GPs/doctors

According to Freed et al,\textsuperscript{22} most parents tend to view their children’s doctors as a highly trusted source of vaccine information. Parents are more likely to vaccinate their children when their doctor is confident in their vaccine knowledge or take their vaccine concerns seriously.\textsuperscript{5, 17} Hence, the consensus of belief in the safety of immunisations among New Zealand GPs/doctors is an encouraging finding that is likely to have a positive impact on parental vaccination decisions. If GPs/doctors can adequately communicate their confidence in vaccine safety, they may be able to encourage sceptical parents to immunise their children.

Simply distributing information about vaccine safety may not be the best strategy to promote vaccinations.\textsuperscript{23, 24} To sufficiently influence parental vaccination attitudes, Wroe et al\textsuperscript{25} suggest that it is important to address omission bias; the tendency of people to exhibit greater fear regarding the harm resulting from action (ie, immunising) than from inaction (ie, not immunising). Accordingly, providing parents with a comprehensive information aid that addressed omission bias, and enabled more accurate comparisons between the risks of adverse immunisation side effects versus serious illnesses was found to increase positive perceptions of vaccinations and the likelihood of timely vaccinations.\textsuperscript{15} Thus, it may be useful to inform and train health professionals on how to effectively communicate vaccine confidence to parents.
professionals about how to effectively convey their confidence in vaccine safety and emphasise the risks of not immunising.

Additionally, explicitly stating to parents the statistic that “96.7% of GPs/doctors agree that standard childhood vaccinations are safe” may help provide further reassurance to parents. In the context of climate change belief, the presentation of statistics citing the near-universal consensus in the published literature that “climate change is happening and caused by humans” has been employed as a strategy to reduce scepticism towards this issue. In a similar way, the fact that the view of GPs/doctors, a highly trusted source of vaccine information, are consistent with the large body of high-quality scientific research showing that standard vaccinations are safe may help alleviate vaccine safety concerns among some parents.

Lower vaccine confidence among midwives

In contrast to GPs/doctors, only two in three midwives showed strong vaccine confidence in our study. The 2002 survey in Rotorua had also found that midwives show a wide spectrum of beliefs regarding the dangers of vaccinations, suggesting that a fair proportion of midwives persistently exhibit uncertainty about vaccine safety. Perhaps due to this uncertainty, some midwives are hesitant about recommending vaccinations to mothers. A midwife interviewed by Litmus stated believing that it is up to parents to make immunisation decisions, with another stating that they preferred not to be involved in such a controversial issue and desired more vaccination information. From the perspective of parents, while some reported having informed conversations with their midwife, others felt that their midwife did not sufficiently explain the benefits of vaccinations and therefore were not motivated to vaccinate their child.

Midwives are chosen by most New Zealand women to be their lead maternity carer and are most directly involved with parents in the lead up to birth. As most parents make immunisation decisions during pregnancy, this is an important time to educate parents-to-be about the benefits of vaccinations. Hence, the relatively low level of vaccine confidence among midwives may have important implications for understanding the resistance to change of anti-vaccination attitudes in the population. Previously, Lee et al found that vaccine scepticism tends to be higher among Māori individuals, those living in rural areas, with lower education and income, and those with higher subjective health and Openness to Experience. In addition to these factors, the lack of vaccine confidence among midwives may also be contributing to the persistence of vaccine scepticism in New Zealand.

Over the years, there has been a substantial improvement in vaccination coverage rates, and currently there are numerous immunisation training courses available for health professionals. However, the lower level of vaccine confidence among midwives suggests there is a need to provide increased resources for this particular group. Further research on the specific concerns of midwives and the impact that their vaccination attitudes have on parental vaccination decisions is crucial. Such findings will inform the development of interventions and training protocols that aim to increase vaccine confidence among midwives and the general public.

Limitations

As the current study used cross-sectional data and a single-item measure to assess vaccine confidence, we were unable to track changes in attitudes of health professionals over time or identify the reasons why they expressed high or low confidence. There may also have been disparities in the way health professionals interpreted the term ‘safety’. Midwives may not regard vaccinations as entirely safe as they are concerned about any sort of harm caused by vaccinations, including minor side effects. Conversely, doctors may view transitory side effects of vaccinations as insignificant when compared to more serious health issues such as heart attacks or broken bones.

As noted by Robertson and Sibley, people with different demographic characteristics (eg, gender, occupation) are not equally likely to respond to the NZAVS. For instance, women and those with professional occupations tend to show higher response rates. This suggests that there may be some degree of response bias in our study, and certain groups may have been over-represented or more heavily determined the types of
occupations held by those in our sample of health professionals. On the other hand, as the NZAVS does not solely focus on health-related issues or specifically target health professionals, health professionals are less likely to have made participation decisions based on their health beliefs or consciously answered questions in a way deemed appropriate for someone in their profession.

Concluding comments

Using data from the 2013/14 NZAVS, the present study investigated the level of confidence in standard childhood immunisations among New Zealand health professionals. Most health professionals, especially GPs/doctors (96.7%) and pharmacists (90.7%), showed high levels of strong vaccine confidence, but midwives (65.1%) and practitioners of alternative medicine (13.6%) exhibited relatively lower levels of strong confidence. The consensus of belief in the safety of vaccinations among GPs/doctors is an encouraging finding and could be used to provide reassurance to vaccine sceptical parents. However, the low level of confidence among midwives is a major concern and may be contributing to the persistence of vaccine scepticism among the general public. Further research is warranted to identify the most effective ways GPs/doctors can convey their vaccine confidence to parents, as well as how to increase vaccine confidence among midwives.

Competing interests:
Nil.

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REFERENCES:
5. Deer B. How the case against the MMR vaccine was fixed. BMJ. 2011; 342:c3347.


