



## Parent resources for early childhood vaccination: An online environmental scan



Shokoufeh Modanloo<sup>a,b,\*</sup>, Dawn Stacey<sup>a,c</sup>, Sandra Dunn<sup>a,b,d</sup>, Juliana Choueiry<sup>a,b</sup>, Denise Harrison<sup>a,b</sup>

<sup>a</sup> School of Nursing, University of Ottawa, Ottawa, Ontario, Canada

<sup>b</sup> Children's Hospital of Eastern Ontario (CHEO) Research Institute, Ottawa, Ontario, Canada

<sup>c</sup> Ottawa Hospital Research Institute, Ontario, Ottawa, Ontario, Canada

<sup>d</sup> Better Outcomes Registry & Network (BORN), Ottawa, Ontario, Canada

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### ABSTRACT

**Background:** Early childhood vaccination is one of the most important public health interventions. However, the injections are usually painful. Clinical practice guidelines recommend using pain management strategies for infants during vaccination. Public access to online health information has increased due to the advent of internet. Parents are likely to find thousands of websites, and online video platforms of variable quality. This study aims to identify and critically appraise the quality of online parent-targeted resources concerning early childhood vaccination and determine inclusion of recommended infant pain management strategies.

**Methods:** An environmental scan of two main internet sources was conducted: (a) Google, (b) Social Media networks. Resources including information relating to infant vaccination and available to Canadians were included. Characteristics of resources were collected. Resource quality was evaluated using the CDC Clear Communication Index. A CDC index score of 90% and above indicates the resource is as an acceptable public communication material. Means and standard deviations were used for normally distributed data; median and interquartile range (IQR) or numbers and proportions were used for data not normally distributed or presented in categorical format.

**Results:** We found 55 online resources in website format and 10 resources in video format. Overall, the mean score for the quality of resources was  $60\% \pm 0.19$ . Most resources were scored as moderate to low quality (33–87%). Only 5% of material scored as acceptable quality. In terms of content, 30 (46%) resources presented information about pain management strategies during vaccination, including breastfeeding (24, 37%), holding (27, 42%), and sweet solutions (22, 34%). The remaining 35 (54%) resources made no clear statement regarding any pain management strategies during vaccination.

**Conclusion:** Most publicly accessible online parent-targeted vaccination resources were of poor quality and did not contain information related to the use of recommended pain management strategies during vaccination.

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## 1. Introduction

Early childhood vaccination is the most important public health intervention to protect against life-threatening infectious diseases worldwide [1]. In the first year of life, the childhood vaccination schedule includes up to 24 vaccine injections [2]. These vaccinations, although necessary for public health, are associated with pain and distress at the time of administration. In addition, a fear of needles has been reported in up to 63% of children [3], poten-

tially leading to the child being uncooperative during future painful procedures, developing a fear of medical events and subsequently avoiding health care and immunization [4,5].

Clinical practice guidelines [4] and high-quality synthesized evidence show that breastfeeding [6], sucrose [7–9] and upright secure holding [4] effectively reduce pain during vaccination in infants [10]. The World Health Organization (WHO) has a position statement recommending the administration of sweet-tasting oral vaccinations before injections and use of breastfeeding during infant vaccinations [11]. Despite the evidence, these pain reduction strategies are not consistently used [4,12–14], highlighting an important gap in translating this knowledge into practice [4].

\* Corresponding author at: School of Nursing, University of Ottawa, Ottawa, Ontario, Canada.

E-mail address: [smoda044@uottawa.ca](mailto:smoda044@uottawa.ca) (S. Modanloo).

The inconsistent use of these evidence-based recommended pain management strategies during infants' vaccination might be due in part to lack of parental knowledge or confidence in providing comfort or in advocating for use of pain management in health care settings [15]. In fact, parents have expressed their dissatisfaction about their knowledge of pain care and have identified a knowledge gap in their education as the main barrier to comforting their infants during painful procedures. They also reported a desire to learn more about effective pain management during vaccinations [16]. Thus, it is crucial to educate parents as this can potentially increase the use of effective pain management strategies during vaccination [4]. In other words, including parent-targeted informational resources on accessible educational platforms may empower them to comfort their infants during vaccination [17].

The advent of the internet has increased public access to online health information. Statistics Canada reported that 70% of Canadians used the internet to search for medical or health related-information [18]. In addition, social media platforms (i.e., Facebook and Twitter) provide an influential platform for sharing health information and consumer-to-consumer knowledge exchange, particularly among young parents [19]. YouTube is also a popular website for video-sharing among parents and has been used in health education dissemination since 2005 [19]. Online information can empower individuals in health care decision making, self-care, and may improve health behaviour by increasing public understanding of medical conditions. In addition, online information can enable communication with health care providers [19,20]. While there are many benefits to access online information, there are also challenges. Parents of infants and children seeking information regarding vaccinations and related pain management strategies are likely to find thousands of websites, discussion forums, and video platforms of variable quality. Thus, identifying accurate or appropriate information can be difficult and overwhelming for parents [21]. As a result, parents might not feel confident in trusting these online information sources [20,22].

Little is known of the extent to which evidence-based pain management strategies for infants during vaccinations are included in parent-targeted online information. The degree of accessibility and user-friendliness of this information is also unknown. Therefore, this study aims to identify and critically appraise the quality of online parent-targeted resources concerning early childhood vaccination and determine the inclusion of recommended infant pain management strategies. The objectives of this study are to critically appraise: (a) the quality of the available online parent-targeted resources focusing on infant vaccination, and (b) the content relating to evidence-based pain management strategies of the available online parent-targeted resources

## 2. Methods

### 2.1. Study design

We conducted an environmental scan of publicly available resources accessible to parents searching for vaccination information. An environmental scan is a passive and unobtrusive strategy to analyze the phenomena externally. It aims to organize and collect information without interfering or changing the evidence [23].

### 2.2. Search strategy

The environmental scan was conducted using two main internet sources, Google searches and Social Media networks (Facebook, YouTube, and Twitter). The searches were conducted by one person (SM) in February 2018, using the most popular searched key-

words according to the Google Trend [24]. Google Trend allows the researcher to optimize their search results by selecting the most popular keywords used by the public when looking for online information. Multiple keywords were entered the search toolbar of Google Trend, the output graphs showed a worldwide trend which could be adjusted by time range and country. As a result, the following search terms were used independently: (a) Vaccine AND "Parent OR Mom OR Father" and (b) "Childhood immunization". Given the dynamic content of the internet information, the search results were scanned over 24 h in order to reduce the chance of changes in findings based on previous searches. A new account was used to search Facebook, YouTube, Twitter, and Google, to eliminate the interference of previous search history in new search results.

Results of each search term (2 different search terms) in each database (4 different platforms) were scanned. The process was discontinued when 20 sequential records achieved redundancy. Since this discontinuation process has not been validated [19], the next 50 records were also screened to make sure no related resources were missed. The search strategy is shown in PRISMA flowchart (Fig. 1). Each of the search engines of different social media platforms (i.e., Facebook, Twitter, and YouTube) were searched separately for eligible resources. Moreover, Google advanced search was then used to identify any further resources that may have been missed in direct searching of social media. While searching YouTube, if a video met the inclusion criteria, the first five videos shown on the suggested marginal column (right side of the screen) were screened further for eligibility. This study followed the discontinuation rule published by Sampson et al (2013) for screening YouTube videos [19]. This method allows researchers to have relevant-ranked results out of the dynamic and huge size of records [19].

### 2.3. Selection of eligible resources

The following criteria were applied to include resources, (a) accessible to Canadians, (b) containing information relating to infant vaccinations, (c) parent-targeted (aiming to disseminate information to parents) about vaccination for infants. Resources were excluded if there were duplicates, related to animal vaccination, not parent-targeted (i.e., targeting health care providers), news or commercial piece, focused on vaccination of children, adolescents or adults, related to anti- or pro-vaccination debates, not accessible to the public, or not informational (i.e., personal website, forums). There was no limit applied regarding the publication date. Two expert informants in the field of vaccination pain management in infants reviewed the final list of parent-targeted resources for completeness and suggested possible additional eligible resources if any. These experts included a professor with specialized knowledge in vaccination pain management and a nurse practitioner who advocates for the use of pain management strategies in childhood vaccination.

### 2.4. Data collection

Data were extracted by one screener (SM) into spreadsheets on Excel 2016 (Microsoft, Redmond, WA). The characteristics of each resource were collected (i.e., name, record type, upload/update date, affiliation, the internet domain (.ca, .org, .com, etc.), and country of origin). Resources were screened further by same screener (SM) for information about pain management strategies during vaccination information, and the accuracy of information was assessed against current evidence from clinical practice guidelines and systematic reviews [4,6,8]. Each resource was reviewed to determine the presence of information relating to breastfeeding,

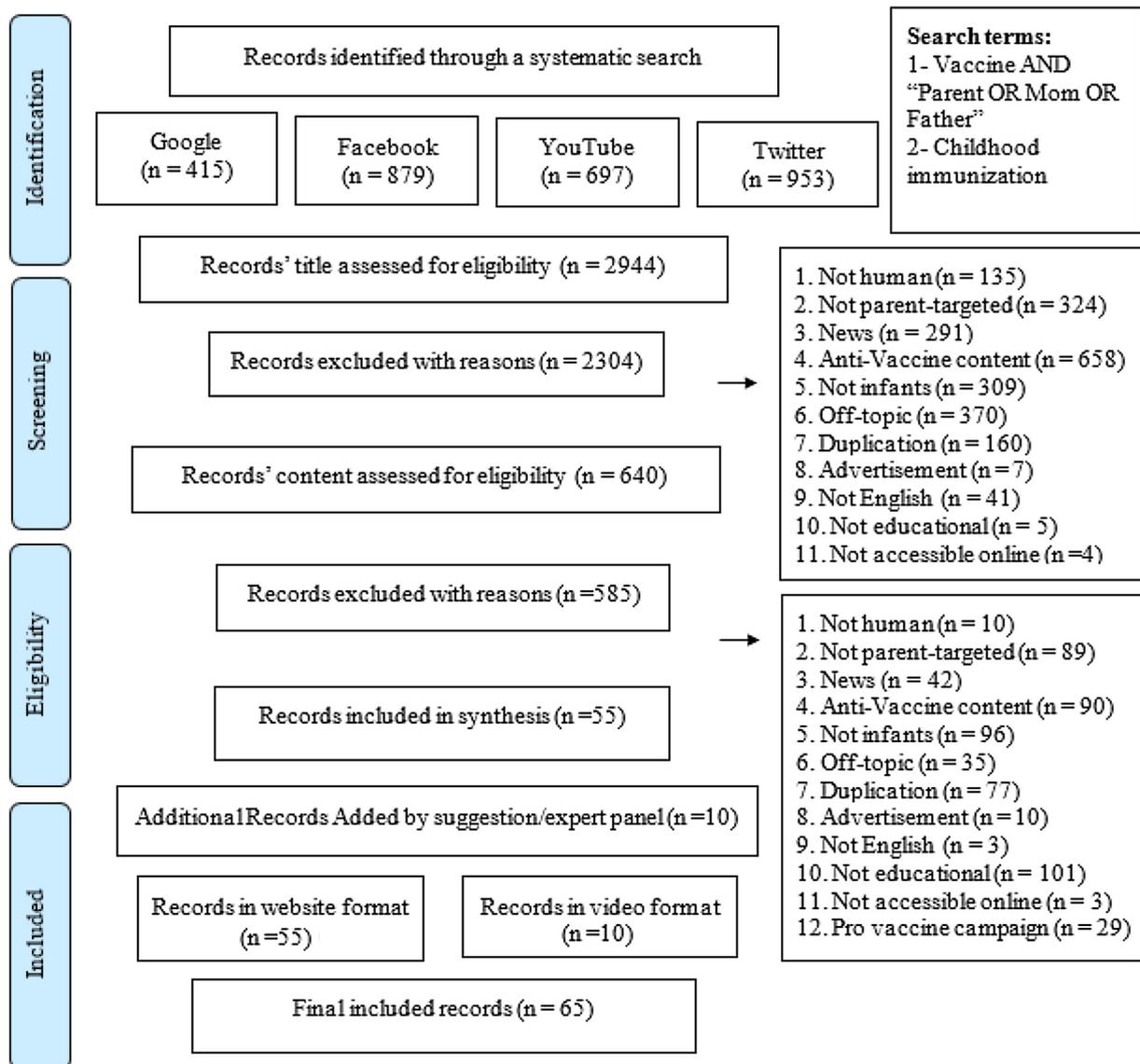


Fig. 1. PRISMA flow diagram.

sweet solutions, or secure holding and close contact by caregivers during vaccination.

### 2.5. Quality appraisal

The final list of included resources was appraised independently by two reviewers (SM and JC) for quality assessment, using the Control and Prevention (CDC) Clear Communication Index (<https://www.cdc.gov/ccindex/index.html>). The CDC tool presents the criteria used to evaluate consumer health-related information. This includes evaluation of accuracy and appropriateness of resources (based on resource audience) and detection of misleading or poor-quality information [25]. The tool was designed to identify communication features of public resources that increase the understanding and the clarity of the information, regardless of the format or distribution channel. It has four sections consisting of four open-ended questions and 20 scored items. Evaluation of the resources is based on the following seven categories; main message and call to action, language, information design, and state of the science, behavioral recommendations, numbers, and risk. The four sections include these: Part A: Main message and call to

action, literacy level, information design, state of the science, Part B: Behavioral recommendations, Part C: Numbers (Presenting the numbers that are necessary to support the main message in common terms for public) and, Part D: Risk (Explaining benefits and actual risk of behaviors, treatments, and preventive measures to non-expert audiences to make informed decisions) [26].

**Scoring.** CDC Clear Communication Index Score Sheet (<https://www.cdc.gov/healthcommunication/pdf/clearcommunicationindex/fillableformmay2013.pdf>) was used for Website records. The result obtained is based on 20 scored items. The scores were added up according to the Yes = 1, or No = 0 answers. Question 1–11 in Part A, 11 scores, and questions 12–20 in Parts B (3 scores), C (3 scores), and D (3 scores) that may not apply to all resources. For calculation, the total score according to the instruction, the total point that each record earned (numerator) was divided by and multiplied by 100 (Note: Online tool does the required math). If the total score was 90 or above, it was addressed most of the required items that make the record easier to understand and use. If the total score was 89 or below, means the record needed revision and improvement. CDC index was chosen over similar quality appraisal tools introduced in literature [32,35,36] since it has been identified as a

comprehensive tool for appraisal of health information in different formats (print and web, Facebook, written scripts, Tweets, infographics). However, CDC index has not been used or validated for video format resources. In fact, there was no standardized tool or guideline for evaluating the quality of online information in video format [27]. However, CDC published a social media guideline and best practice on the process of preparing videos for CDC YouTube channels. This includes a list of recommendations for high-quality consumer-friendly video resources [28]. Therefore, in addition to the CDC Clear Communication tool, the guideline was also used to appraise the quality of video format resources in this study. The guideline evaluates video records in some further domains including videos' content, authorities, length, date, reference, title, description, keywords, category, playlist. The total scoring added up similar to websites score (20 points).

Two independent evaluators (SM and JC) participated in a training session (calibration exercise) for CDC index scoring of resources. Their scores were gathered and compared to resolve the differences. Where there was disagreement, the resource was revisited and discussed. If disagreements remained, a third reviewer (DH) was consulted to reach a consensus.

## 2.6. Data analysis

Summary statistics and descriptive analysis were used to synthesize data regarding the characteristics of online resources. If data were normally distributed, mean and standard deviations, minimum, and maximum were used, if data were not normally distributed or presented in a categorical format, median and interquartile range (IQR) or numbers and proportions were used.

## 3. Results

### 3.1. Search strategies

The search yielded 2944 links, of which 2304 records were excluded after screening. From the remaining 640 records, 585 records were excluded for reasons relating to animal vaccination, not parent-targeted, anti-/ pro-vaccine debates, not childhood immunization, and duplicates (Fig. 1). Fifty-five records were identified for inclusion. In addition, 4 records were added to the final list based on the expert informants' suggestions and 6 records were added while browsing the original records. Consequently, 65 records were included and appraised for quality, 55 in website format and 10 in video format.

A full list of included resources in both website and video format with their characteristics is provided in Table 1. Most records were categorized as educational resources posted by health care organizations (36, 55%) or professional associations (22, 34%). The remaining records were posted by an academic institute (2, 3%), were web pages hosted by individuals (2, 3%), online encyclopedias (2, 3%), or had no identified affiliation (1, 2%). Although no location restriction was applied to the search strategy, most resources (52, 80%) were produced in North America (25 in Canada, 27 in the USA) and the remaining resources were produced in Australia, UK, New Zealand, South Africa, Switzerland, and Norway (9, 14%) or unknown (4, 6%). Thirty-seven resources (57%) had been updated or uploaded in the last 7 years (earliest May 2012 to latest January 2019) and no date was provided for 28 resources (43%). Assessing the internet domain of the 55 websites, most records had a country code (24, 44%) (i.e., .ca, .au.), or had generic domains used for general purposes such as commercial or non-profit organizations (i.e., .com, .org) (23, 42%). Eight records (14%) had a sponsored domain, used by businesses or industries (i.e., .edu, .gov).

Table 1. Characteristics of included resources

"Regarding the 10 video resources, the earliest video was uploaded in May 2012 and the most recent was uploaded in March 2017. The median number of the videos' statistics are as follows, number of views 13,123 (IQR 66,661.25, Min 203, Max 132,654), number of "likes" 30 (IQR 2.75, Min 0, Max 80), number of "dislikes" 2 (IQR 2.75, Min 0, Max 25), and number of comments 0 (IQR 11.75, Min 0, Max 25), length 114 s (IQR 134.5, Min 81, Max 788). The following theme was emerged after reviewing the content of 10 included videos: benefits of childhood vaccination, understanding the routine childhood vaccination schedule and reminders tools, risks of not getting a child vaccinated, pain management strategies to reduce the needle pain. More information about videos' uploaded date, affiliation, and country of origin, CDC Clear Communication score and inclusion of pain management information are shown in Table 1."

### 3.2. Quality appraisal

The overall mean CDC Clear Communication Index score of the website resources was  $60\% \pm 0.19$  (Min 14% and Max 93%) with a range of 33–87%. Results of the website resources in the four domains were, Part A (main message and call to action, language, information design, state of the science), mean scores of  $66\% \pm 0.24$ , Part B (behavioral recommendations),  $70\% \pm 0.28$ , Part C (numbers),  $69\% \pm 0.14$ , and part D (risks),  $60\% \pm 0.28$ . Out of all eligible websites and videos, only three resources (5%) met the CDC guideline score of at least 90%, considered as acceptable quality to be published online. The large majority of resources (62, 95%) scored below 89% [29]. The list of scores for each resource is provided in Table 1.

### 3.3. Pain management strategies

Of the 65 resources, 30 (46%) included information about pain management strategies during vaccination, including breastfeeding (24, 37%), skin to skin care (4, 6%), holding (27, 41%), sweet solutions (22, 34%), distraction (i.e., watching videos, blowing bubbles, singing, toys) (27, 41%), non-nutritive sucking (6, 9%), nutritive sucking i.e., bottle feeding (2, 3%), stroking (6, 9%), swaddling (2, 3%), topical anesthetic (EMLA or Ametop) (16, 25%), talking (23, 35%) (Fig. 2).

Of the 35 (54%) resources that did not include information about pain management strategies, 14 resources referred to other websites providing pain management information via embedded links. However, these links were not clearly identified in the original resource and were not assessed. As a side note, even when resources did include information about pain management, it was not easy to navigate them on the websites according to the time required for an author to locate them (~5–10 min). However, evaluating the navigation trail of resources was not the aim of this study and requires further analysis.

## 4. Discussion

This environmental scan demonstrated that the internet and social media platforms are sources of information about infant vaccination for parents. However, only 5% met the CDC rating for quality and less than half included information about recommended pain management strategies to use during vaccination. When resources did include pain management information, it was not easily identifiable on the websites as it was frequently buried under other health information or vaccine safety information. Evaluating the ease of access to these resources was not the focus of this study. While the quality and accuracy of online information

**Table 1**  
Characteristics of resources.

Resource name and URL	Record type	CDC Score (%)	Affiliation	Country of origin	Updated/ uploaded Date	Pain Management addressed
Children's Minnesota	Website	93	HCO*	USA	N.R**	Y
Colorado Children's Immunization Coalition (CCIC)	Website	90	Associations	USA	N.R	N
NSW government health	Website	90	HCO	Australia	N.R	N
CAN IMMUNIZE	Website	87	HCO	Canada	12.2018	Y
Vaccinate Oklahoma	Website	86	Associations	USA	N.R	Y
Government of Canada	Website	85	HCO	Canada	11.2018	Y
The vaccine mom	Website	85	blogs	N.R	N.R	N
Minnesota Childhood Immunization Coalition	Website	85	Associations	USA	N.R	N
Reduce the pain of vaccination in babies	VIDEO	85	HCO	Canada	3.2015	Y
The Vaccine Schedule   Parents	VIDEO	80	Associations	USA	10.2013	N
Children's Hospital of Philadelphia	Website	80	Academic institute	USA	5.2017	N
Childhood immunisations – what to expect	VIDEO	80	HCO	Australia	5.2014	N
I VACCINATE	Website	78	Associations	USA	N.R	Y
Breastfeed to minimize vaccination pain – 2 months	VIDEO	76	HCO	Canada	10.2016	Y
Breastfeed to minimize vaccination pain – 6 months	VIDEO	76	HCO	Canada	2.2017	Y
Give sweet solutions to minimize vaccination pain	VIDEO	76	HCO	Canada	3.2017	Y
The Hospital for Sick Children	Website	75	HCO	Canada	7.2018	N
It's Ok to ask	Website	75	HCO	USA	N.R	N
Healthed, helping newzealander stay healthy	Website	75	HCO	New Zealand	2.2018	N
Protecting Your Child: Understanding Childhood Immunisation	VIDEO	75	HCO	Australia	12.2014	N
Government of Ontario	Website	73	HCO	Canada	8.2018	Y
The California Immunization Coalition	Website	73	Associations	USA	N.R	Y
HELPinKids&Adults	Website	71	HCO	Canada	N.R	Y
Australian Government, department of health	Website	70	HCO	Australia	8.2018	N
Immunizenevada	Website	70	Associations	USA	N.R	Y
Voices for vaccines	Website	68	Associations	USA	12.2016	N
the Colorado Children's Immunization Coalition	Website	68	Associations	USA	N.R	N
Immuizealberta	Website	65	HCO	Canada	N.R	Y
The Centre for Pediatric Pain Research	Website	63	HCO	Canada	N.R	Y
PATH's Vaccine Resource Library (VRL)	Website	63	Encyclopaedias	N.R	2.2018	Y
Vaccines.gov	Website	63	HCO	USA	7.2018	Y
Immunization Action Coalition	Website	60	Associations	USA	1.2019	N
Parenting in Ottawa	Website	57	Associations	Canada	1.2019	Y
American Academy of pediatrics	Website	57	Associations	USA	3.2014	Y
Vaccinate your family	Website	56	Associations	USA	12.2018	N
Immunize Canada	Website	55	Associations	Canada	5.2018	Y
Immunizebc	Website	55	HCO	Canada	5.2018	Y
Centers for disease control and prevention	Website	55	HCO	USA	4.2016	Y
Government of Newfoundland and Labrador	Website	55	HCO	Canada	12.2018	N
Vaccines For Children	VIDEO	53	HCO	USA	5.2012	N
Arizona Partnership for Immunization	Website	52	Associations	USA	N.R	Y
Childhood Immunizations	VIDEO	50	HCO	Canada	2.2016	N
Norwegian Institute of Public Health	Website	50	HCO	Norway	11.2018	N
Porcupine Health Unit	Website	50	HCO	Canada	N.R	N
NHS Choices	Website	50	HCO	UK	7.2016	N
parents of kids with infectious diseases	Website	50	Associations	Canada	N.R	N
Haldimand-Norfolk Health Unit	Website	47	Associations	Canada	N.R	N
Vaccines for Africa	Website	46	Academic institute	South Africa	3.2017	Y
Kansas Immunization Program	Website	45	HCO	USA	N.R	N
Saskatchewan Health Authority	Website	45	HCO	Canada	N.R	N
BC Pediatric Society	Website	43	Associations	Canada	N.R	N
Maine Immunization Program	Website	42	Associations	USA	N.R	N
Caring for kids	Website	40	Associations	Canada	5.2018	Y
Vaccine information you need	Website	40	HCO	USA	5.2018	Y
DTP vaccination	VIDEO	40	N.A	N.R	7.2014	N
Childhood immunizations in the United States	Website	37	Encyclopedias	USA	12.2018	N
World Immunization Week	Website	37	HCO	Geneva	9.2015	Y
Emedicine health	Website	37	Associations	USA	N.R	N
California vaccine for children	Website	36	HCO	USA	N.R	N
interior health	Website	35	HCO	Canada	N.R	N
Vaccine Awareness and Research (CVAR)	Website	33	HCO	USA	N.R	N
Canadian Paediatric Society	Website	31	Associations	Canada	5.2018	Y
MedlinePlus	Website	25	HCO	USA	10.2017	Y
The scientific parent	Website	25	blogs	N.R	N.R	N
Government of Nunavut	Website	14	HCO	Canada	N.A	Y

\* Health Care Organization.

\*\* Not Recorded.

need significant attention, being easy to locate and navigate to relevant information is important as well.

In comparison with similar studies, Dol et al. (2018) evaluated the quality of online resources available to parents of preterm

infants requiring neonatal intensive care. They included 197 websites and reported that the most common topics covered were the experience of being a parent of a preterm infant, health concerns, skin-to-skin care, and breastfeeding and feeding problems. How-

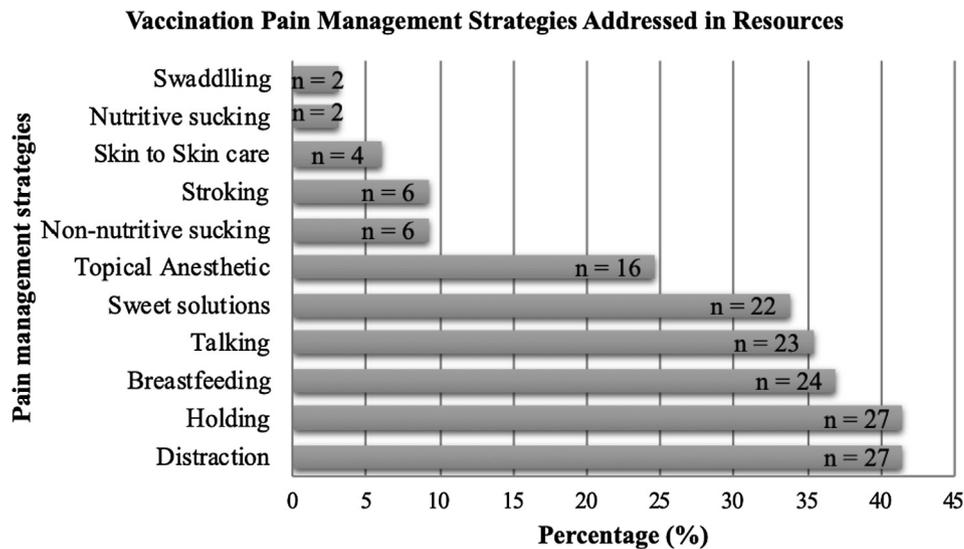


Fig. 2. Vaccination pain management strategies addressed in resources (N = 65).

ever, the issue of neonatal pain was discussed in only 10 (5%), whereas in our study it was discussed in 30 (46%) resources. In addition, recent systematic reviews of YouTube videos determining the use of recommended pain management strategies during the needle-related painful procedure in infants and children [21,30,31] reported sub-optimal use of recommended pain management strategies. Thus, our findings continue to highlight that infant pain management is rarely included on publicly available online parent-targeted resources.

In terms of the health information quality, the results of this study showed that only 5% included resources considered as acceptable quality resources based on the CDC Clear Communication Index. In fact, most resources scored as poor to moderate quality. Consistent with these results, assessment of 75 publicly accessible vaccination resources for Australian parents with a researcher-made 43-item quality appraisal tool in six domains (disclosure of ownership, transparency of sponsorship, mission of site, quality of information, accountability to users, and quantity of information) resulted in a mean quality score of 55% ([32].

In addition, other studies examining online information available to parents with a child affected by a different health problem such as preterm newborns [22], clubfoot [33], and epilepsy [34] demonstrated similar results to this study with poor-to moderate quality. In contrast to our study, websites included in those studies were evaluated by the DISCERN tool (a standard tool for quality appraisal of written health information on treatment choices) [35]. Furthermore, a systematic review of 79 studies, evaluating 5941 publicly accessible websites and 1329 web pages about consumer health information, demonstrated that 70% of the online information was of poor quality [36].

Screening for the eligible resources in this current environmental scan identified a large number of anti-vaccination websites. In fact, as shown in Fig. 1, 748 resources were excluded for this reason. Most of the websites promoting anti-vaccination information were found on social media sites, nor were they owned by reputable healthcare or academic organizations or foundations. In addition, in a systematic review of 87 YouTube videos about vaccination, more than two-thirds of videos (65.5%) promoted anti-vaccination messages [37]. Although the assessment of the anti-vaccination movement was not the aim of this study, it was evident that huge amounts of time and resources were spent on anti- or pro-vaccination campaigns.

There is a need to improve online parent-targeted resources pertaining to pain management during vaccinations. Several informative resources aiming to improve pain management during early childhood vaccinations were produced by reputable sources in video and website formats. For example, the Canadian Institutes of Health Research (CIHR)-funded HELPinKIDS team posted a 13:08-minute video on YouTube explaining different pharmacological and psychological strategies useful for parents to use during their babies' vaccination (<https://www.youtube.com/watch?v=5Oqa1Fag5eQ>) [38,39]. Another example is the Be Sweet to Babies video series developed professionally at the Children's Hospital of Eastern Ontario (CHEO) showing parents and nurses how to use breastfeeding and small amounts of sweet solutions as pain management strategies during vaccination [40,41] in three separate brief videos showing: (a) breastfeeding during 2-month vaccination (<https://www.youtube.com/watch?v=FrKmAth4ZGc&list=PLIZczt8t4Ac8cW3pbuRKJAEs3SoC5y8MB&index=9>), (b) breastfeeding during 6-month vaccination (<https://www.youtube.com/watch?v=55tejVjzzwE&list=PLIZczt8t4Ac8cW3pbuRKJAEs3SoC5y8MB&index=12>) and (c) sucrose in infants less than 12 months of age during vaccination (<https://www.youtube.com/watch?v=7NDJ463j2il&list=PLIZczt8t4Ac8cW3pbuRKJAEs3SoC5y8MB&index=16>).

Although the focus of this study was not the evaluation of online information-seeking behaviour among parents, the amount of poor-quality and misleading information is concerning". It is important for health care providers and health agencies to be aware of the online parent-targeted content relating to childhood vaccinations in order to ensure that accurate and high-quality information is available. In fact, poor quality or inaccurate information can have negative effects on health behaviours and uptake of recommended public health interventions [37].

## 5. Strengths and limitations

To our knowledge, this is the first study to critically appraised available online parent-targeted information regarding pain management during infant vaccinations. Having two reviewers independently appraise the quality of resources adds to the study's strengths. However, this study had some limitations. Given the dynamic status of online information and to reduce interference

with previous search results, attempts were made to reduce the change in the search results by screening all output in the span of one day. However, publicly accessible online information needs frequent monitoring to keep up with the myriad of resources posted. In this study, the popular search engines Google, Twitter, Facebook, and YouTube were screened for publicly accessible parent-targeted childhood vaccination resources. However, there are other search engines that exist such as Bing, Yahoo, or Ask.com that parents might be using to access health information. In addition, although the most common search terms suggested by Google Trend were used in this study, it is possible that parents may use different search terms and therefore, may obtain different search results. Moreover, if parents look further there is a chance that they might find relevant information in the records that were excluded in this study.

## 6. Conclusion

This environmental scan of online parent-targeted resources relating to infants vaccination included 65 resources, most of which lacked accurate and easy to find information about effective pain management strategies. This highlights the need to develop accurate, trustworthy high-quality parent-targeted resources and disseminate through knowledge translation interventions aimed at improving pain care of infant during vaccination. Further research is required to evaluate the effectiveness of such interventions to change parental behaviours and its impact on their engagement to use recommended pain management strategies during infant vaccinations is required.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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