

Effects of digital interventions for promoting vaccination uptake

Background

Digital interventions such as mobile phone messaging and social media are being used increasingly to promote the uptake of vaccinations in all age groups, including in low- and middle-income countries (LMICs).

In the context of the COVID-19 pandemic, there is growing interest in how these interventions might be used to support the uptake of a future COVID-19 vaccine. Digital interventions can also be used to ensure that the uptake of other vaccines, including childhood and influenza vaccines, are not neglected in the context of COVID-19.

Purpose and objective

The purpose of this brief is to provide policy- and decision makers and operational staff with evidence to inform decisions on the use of **digital interventions to promote vaccine uptake** across all age groups.

The objective is to summarize evidence from four systematic reviews on this topic, including how much certainty we have in this evidence. This brief does not include evidence on the safety and efficacy of specific vaccines.

Key messages

- Evidence on the effects of digital interventions to promote uptake of vaccinations is fragmented and shows mixed results.
- Sending people vaccination reminders via mobile phone may encourage people to vaccinate; vaccination prompts for health care providers delivered by digital client health records probably make little or no difference to adolescent vaccination uptake; and we are uncertain about the effects of educational videos for parents or of vaccination reminders sent via online patient portal systems. The relevance of this evidence to LMICs may also vary (see Table on Relevance of the reviews).
- Before deciding whether to implement these digital interventions in a specific setting, evidence on the following should also be considered and discussed: the acceptability and feasibility of these interventions, equity impacts, and start-up and ongoing costs.
- Given the limitations of the available evidence, large scale implementations of digital interventions for vaccination uptake should be accompanied by evaluation of effectiveness, equity impacts and unintended consequences. Evaluation is needed particularly for interventions and target groups where evidence of effectiveness is currently sparse.

Decision makers and operational staff should also:

- Pay attention to context: Health systems arrangements and on-the-ground realities and constraints may affect the acceptability and feasibility of digital interventions. For example, internet-based vaccination information may not be a feasible option in poorer settings. Decision makers should therefore consider which type/s of digital interventions may be feasible and acceptable to stakeholders in their setting.

Who is this brief for?

Decision makers and operational staff working in or with low- and middle-income countries who are planning and implementing strategies to promote vaccination uptake.

Who commissioned this brief?

The brief was commissioned and funded by the Evaluation Department of the Norwegian Agency for Development Cooperation (Norad) and was prepared by the Norwegian Institute for Public Health.

Norad (the Norwegian Agency for Development Cooperation) is a participant to the COVID 19 Global Evaluation Coalition – a network of evaluation units of Evalnet member countries, United Nations organisations and other multilateral institutions. The overall purpose of the COVID-19 Global Evaluation Coalition is to foster collaboration to improve the speed and quality of evaluative analysis, and communication, in ways that provide useful, credible evidence to support a more effective response to the COVID-19 pandemic, and future crises.

This brief is based on the following systematic reviews:

Abdullahi 2020^[1]; Grobler 2020^[2]; Jacobson Vann 2018^[3]; Palmer 2020^[4] (see Appendices).

What is a systematic review?

A summary of studies addressing a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise the relevant research, and to collect and analyse data from the included studies.

Perspective

The authors of this brief are researchers at the Norwegian Institute of Public Health (NIPH) and at NIPH's Centre for Informed Health Choices. The perspective we have taken in this brief is that we support the individual's right to make his or her own healthcare decisions, including decisions about vaccination. We also believe that it is important for people to have easy access to evidence-based information about vaccination, including information about side effects, evidence gaps and uncertainties. However, we also have a public health perspective, and regard adherence to vaccines recommended by the WHO as an important public health measure.

- Consider the likely equity impacts of different interventions: Using digital interventions to promote vaccination uptake may widen inequities for people with poor access to electricity and/or network services; for people with poor access to devices such as mobile phones; and for people with low literacy or digital literacy skills. Health care providers and facilities without access to these services and resources may also be disadvantaged.
- Note that start-up costs for these interventions may be very substantial due to the technical infrastructure required, and that costing in the implementation setting will be needed.

About the certainty of the evidence (GRADE)

The “certainty of the evidence” is an assessment of how good an indication the research provides of the likely effect; i.e. the likelihood that the effect will be substantially different from what the research found. By “substantially different” we mean a large enough difference that it might affect a decision. These judgements are made using the GRADE system, and are provided for each outcome. The judgements are based on the study design (randomised trials versus observational studies), factors that reduce the certainty (risk of bias, inconsistency, indirectness, imprecision, and publication bias) and factors that increase the certainty (a large effect, a dose response relationship, and plausible confounding). For each outcome, the certainty of the evidence is rated as high, moderate, low or very low using the definitions below:

⊕⊕⊕⊕ High: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different is low.

⊕⊕⊕○ Moderate: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different is moderate.

⊕⊕○○ Low: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different is high.

⊕○○○ Very low: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different is very high.

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- The sending of health information to targeted or specific groups of people, for example based on their demographics or place of residence [6].
- The same health information content is sent to large groups of people, regardless of their demographics or place of residence [6].
- The sending of health information to targeted or specific groups of people, for example based on their demographics or place of residence [6].

Key findings from the included reviews

Reminder or recall messages via analogue telephone, mobile phone messaging or autodialers:

- probably improve vaccine uptake among people of all ages, when compared to no intervention or interventions other than reminders (moderate certainty evidence: ⊕⊕⊕○) [3].

Targeted messages^a via mobile phone:

- may lead to more parents taking their children to healthcare services such as vaccination appointments, when compared to parents who get *no messages* (low certainty evidence: ⊕⊕○○) and may lead to fewer parents taking their children to vaccination appointments, when compared to parents who get *untargeted mobile phone messages^b*, but this evidence is mixed (low certainty evidence: ⊕⊕○○) [4].

Vaccine information for parents via a website, with or without a bidirectional social media component

- may slightly improve children’s vaccination status, when compared to usual practice (low certainty evidence: ⊕⊕○○) [2].

Multi-component interventions that include digital components directed to parents and/or providers:

- may improve HPV vaccination uptake among adolescents, when compared to usual practice (low certainty evidence: ⊕⊕○○) [1].

Vaccination prompts for health care providers delivered by digital client health records:

- probably makes little or no difference to the number of adolescents who receive tetanus–diphtheria–pertussis, meningococcal, HPV, or influenza vaccination, when compared to usual practice (moderate certainty evidence: ⊕⊕⊕○) [1].

Targeted messages^c via mobile phone:

- may make little or no difference to whether women get influenza vaccines during their pregnancy, compared to women who get *untargeted mobile phone messages* (low certainty evidence: ⊕⊕○○) [4].

Reminder or recall messages via secure digital online patient portal systems:

- we are uncertain whether these are effective as no evidence was identified [3].

Educational videos for parents:

- we are uncertain whether these improve parents’ vaccine knowledge, when compared with oral presentation of information or information pamphlets, because the certainty of the evidence is very low (⊕○○○) [2].



We identified a number of limitations of the available evidence base:

- The systematic reviews we identified on the effects of digital interventions for vaccination show that current research in this field is fragmented. Studies differ in relation to the type of people included, the type and purpose of the digital interventions, what these interventions have been compared to and the outcomes that have been measured. It is therefore challenging to obtain an overall picture of the available evidence.
- We also identified a lack of up to date, well-conducted systematic reviews for interventions targeting adults, including older adults.

More detailed findings are available in Appendix* 2, Appendix 3, Appendix 4 and Appendix 5.

Implementing digital interventions for promoting vaccination uptake

Implementers should:

- Consider the recent WHO guideline on Digital Interventions for Health Systems Strengthening which recommends digital targeted client communication for maternal, newborn, and child health under the condition that potential concerns about sensitive content and data privacy can be addressed. This guideline also includes a number of key implementation considerations relevant to the use of these interventions to promote vaccination uptake ([5] page 81).
- See the accompanying Norad brief note on “Communicating with people about vaccines?”, which has implications for some kinds of digital interventions [7].
- Consider the issues raised in the relevance table above regarding applicability, equity and economic considerations and monitoring and evaluation.

Relevance of the reviews for low- and middle-income countries (LMICs)

FINDINGS	INTERPRETATION**
Applicability	
<ul style="list-style-type: none"> ■ All of the reviews were global in scope, but two included large numbers of studies from USA and few studies from LMICs ■ Some of the interventions require supporting infrastructure and may require integration into a Routine Health Information System 	<ul style="list-style-type: none"> ■ Differences in health systems arrangements, including how vaccination services are financed, organised and delivered, may mean that these interventions will not work in the same ways in some LMIC settings. ■ Differences in on-the-ground realities and constraints may alter the acceptability, feasibility and sustainability of these interventions. For example, internet-based vaccination information may not be a feasible option in poorer settings and people's trust in information from the health services will vary across settings. ■ Baseline vaccination rates vary across settings, age groups and other socio-economic variables. Where baseline vaccination rates are lower or higher than in the included studies, the absolute effects of these interventions may be different. ■ WHO has recommended several of these interventions to complement other delivery mechanisms where data privacy and traceability can be monitored; concerns about sensitive content addressed; and where the health system can support implementation in an integrated way [5].
Equity	
<ul style="list-style-type: none"> ■ The reviews did not provide data regarding the differential effects of the intervention for disadvantaged populations 	<ul style="list-style-type: none"> ■ Digital interventions may be useful to service users with caring or work responsibilities, those who live far from health facilities and people with few funds. These interventions may also facilitate better support of health care workers in remote settings, and help overcome geographic barriers between remote facilities and the wider health system [5]. ■ These interventions may widen inequities for people and health facilities with poor access to electricity and/or network services; for people and facilities with poor access to devices such as mobile phones and tablets; and for people with low literacy or digital literacy skills [5]. ■ Local assessments of implications for equity and human rights should be planned to support decisions on implementation, and should consider literacy levels, access to electricity and devices, and other locally relevant factors. Frameworks are available to support these assessments [6].

** Judgements were made by the authors of this brief, and are not necessarily those of the review authors.



Economic considerations

■ The included reviews identified little data on the costs of these interventions or their cost-effectiveness

- Costs that need to be considered include one-time start-up costs such as content adaptation; technology adaptation (for example, to ensure compatibility with existing Routine Health Information Systems); equipment and hardware; development of standard operating procedures for software support and upgrading; and initial training. Recurring costs include human resources; fresher in-service training; data exchange via wireless or 3G/4G connections; and maintenance of hardware, servers and software.
- The start-up costs for these interventions may be very substantial, particularly where substantial technology and content adaptation are needed. At a minimum, local costing studies should be considered prior to implementing any of these interventions and consideration should be given to the societal distribution of costs and benefits.

Monitoring & evaluation

■ Much of the available evidence is low to moderate certainty, and for some digital interventions little or no evidence on their effects is available

- As this is a particularly rapidly developing field, consideration should be given to evaluating the effects, cost-effectiveness, local acceptability and feasibility and equity impacts of these interventions, particularly newer digital interventions for vaccination uptake.
- Robust evaluation would be facilitated by greater use of WHO standards for describing digital interventions for health, better intervention description and by the development and use of core outcome sets in this area.

■ For some interventions, there is currently little evidence from LMICs or from specific age groups such as adults and older adults

- Evaluations should assess unintended consequences for health service users, the public, health workers and the health system and could also explore the characteristics of the most effective communication channels and content.
- Implementation of some digital interventions may help to improve the data collected by routine health information systems.

About the topic of this brief

- According to the World Health Organization (WHO), a digital health intervention can be defined as 'a discrete functionality of digital technology that is applied to achieve health objectives and is implemented within digital health applications and information and communications technology systems, including communication channels such as text messages' ([5] page xi).
- Digital interventions for health can be directed at health service users and the public; health workers; and health system managers. For each of these groups, there are a wide range of interventions relevant to increasing vaccination uptake including targeted client communication and health worker communication via mobile phone messaging; health worker decision support via digital devices; and supply chain management using digital devices [8].
- WHO recently made a number of global recommendations regarding digital interventions for health systems strengthening [5]. Although not focused on vaccination specifically, the WHO recommends using targeted digital communications on maternal, newborn, and child health, as long as potential concerns about sensitive content and data privacy can be addressed.



About the systematic reviews underlying this brief

This brief provides findings from four systematic reviews. The table below summarises the characteristics of each review. Further detail for each review is provided in Appendix* 1.

Types of	REVIEW 1 [4]	REVIEW 2 [3]	REVIEW 3 [2]	REVIEW 4 [1]
Study designs	Randomised trials	Randomized trials, controlled before-after studies, and interrupted time series studies	Randomised and non-randomised trials, interrupted time series studies, and controlled before-after studies	Randomised and non-randomised trials, interrupted time series studies, and controlled before-after studies
Interventions	Messaging via mobile phones and other mobile devices	Patient vaccination reminder or recall interventions delivered through any channel	Interventions aimed at communities or groups to inform about child vaccination, and delivered via any channel	Any intervention to improve vaccine uptake among adolescents
Participants	1) Pregnant and postpartum women; 2) Parents and carers of children aged <five years	Children or adults who receive immunizations	Groups of people including parents and community leaders	Girls or boys (or both) aged 10 to 19 years
Settings	Any	Any	Any	Any
Outcomes	Primary: health behaviour change; service utilisation; health status and wellbeing; unintended consequences	Primary: receipt of immunizations	Primary: psychosocial impact; health impact - Immunisation status of child	Primary: adolescent vaccination coverage
Date of most recent search	July / August 2017	January 2017	May 2018	October 2018
Limitations	Minor	Minor	Minor	Minor

One further Cochrane review on childhood immunisation [9] did not include any digital interventions in the 2018 version. The review is being updated currently, and several studies of digital interventions for improving coverage of childhood immunisation have been identified. The updated findings should be available in early 2021.

How this brief was prepared

We selected four systematic reviews that synthesised evidence on the effects of interventions to increase vaccination uptake, across different age groups and using different mechanisms. Time limitations prevented us from carrying out a systematic search for systematic reviews. Instead, we made a pragmatic decision to select reviews with which we were already familiar, with the aim of informing further discussion on priorities for evidence in this area and possibly further systematic reviews, or overviews of reviews.

To ensure that none of the selected reviews had important methodological limitations, we assessed each review using an adapted version of the AMSTAR 2 tool [10]. We assessed a review to have important methodological limitations if it had one or more major methodological limitations or if the number of minor methodological limitations was sufficient to undermine the reliability of the review findings. A review was categorized as having a major limitation if it did not use a comprehensive literature search strategy, if it did not use a satisfactory technique for assessing the methodological limitations for individual studies included in the review, or if it did not account for methodological limitations in individual

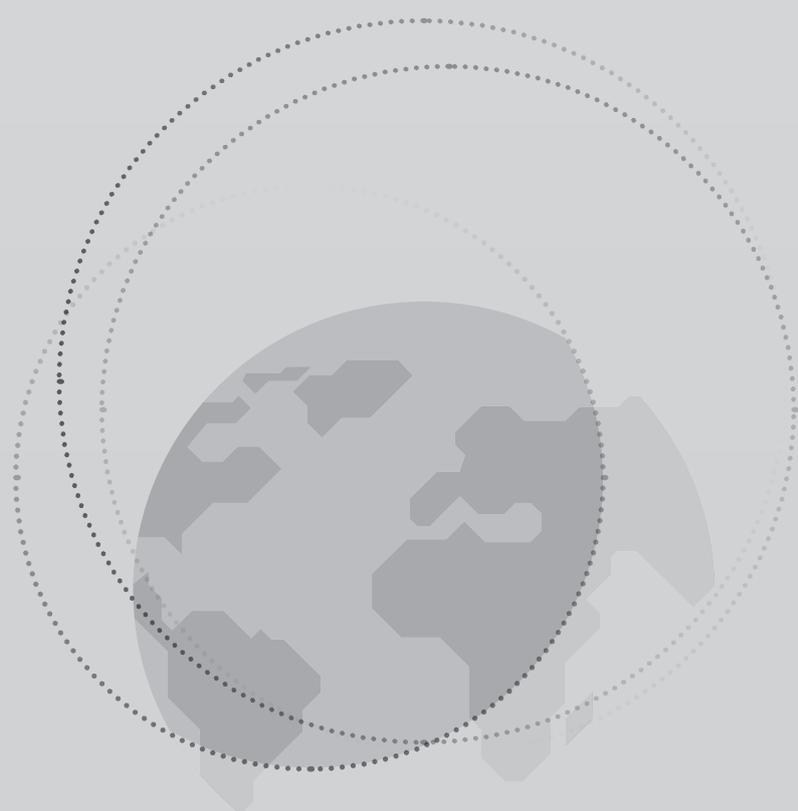
studies when interpreting the results of the review. All other concerns were described as minor limitations.

We assessed that none of the selected reviews were assessed as having important methodological limitations. We extracted the following information from each review: the criteria for considering studies for the review; the characteristics of the included studies; the relevant summaries of findings; the key messages from these findings; and key practice and research implications. Using an approach developed for another project (see: supportsummaries.org), we developed a summary of key considerations about the relevance of each review for LMICs. This includes judgements about possible differences between where the research was done and its application in LMICs; potential impacts on equity; economic consequences; and the need for monitoring and evaluation.

We sent the brief note to a selection of stakeholders from different settings, including planners, implementers such as heads of hospital departments, and researchers in the field, to gather their feedback about the relevance and completeness of the evidence presented. Their feedback was incorporated into the final version of this brief.

References cited in this brief

1. Abdullahi LH, Kagina BM, Ndze VN, Hussey GD, Wiysonge CS: **Improving vaccination uptake among adolescents.** *Cochrane Database Syst Rev* 2020, **1**:CD011895.
2. Grobler L, Oldervoll A, Yunpeng D, Glenton C, Lewin S: **Interventions aimed at communities to inform and/or educate about early childhood vaccination. Unpublished.** *Cochrane Database of Systematic Reviews* 2020, **Unpublished**.
3. Jacobson Vann JC, Jacobson RM, Coyne-Beasley T, Asafu-Adjei JK, Szilagyi PG: **Patient reminder and recall interventions to improve immunization rates.** *Cochrane Database Syst Rev* 2018, **1**:CD003941.
4. Palmer MJ, Henschke N, Bergman H, Villanueva G, Maayan N, Tamrat T, Mehl GL, Glenton C, Lewin S, Fonhus MS, Free C: **Targeted client communication via mobile devices for improving maternal, neonatal, and child health.** *Cochrane Database Syst Rev* 2020, **8**:CD013679.
5. WHO: **WHO guideline: recommendations on digital interventions for health system strengthening.** Geneva, Switzerland: *World Health Organization*; 2019.
6. Ismail SJ, Hardy K, Tunis MC, Young K, Sicard N, Quach C: **A framework for the systematic consideration of ethics, equity, feasibility, and acceptability in vaccine program recommendations.** *Vaccine* 2020, **38**:5861-5876.
7. Glenton C, Lewin S: **What do implementers need to consider when communicating with people about vaccines? Briefing note prepared for Norad.** Oslo: Norwegian Institute of Public Health. Version 1; August 2020.
8. WHO: **Classification of digital health interventions v1. 0: a shared language to describe the uses of digital technology for health.** Geneva: World Health Organization; 2018.
9. Oyo-Ita A, Wiysonge CS, Oringanje C, Nwachukwu CE, Oduwole O, Meremikwu MM: **Interventions for improving coverage of childhood immunisation in low- and middle-income countries.** *Cochrane Database Syst Rev* 2016, **7**:CD008145.
10. Foss H, Oldervoll A, Fretheim A, Glenton C, Lewin S: **Communication around HPV vaccination for adolescents in low- and middle-income countries: a systematic scoping overview of systematic reviews.** *Systematic Reviews* 2019, **8**.





Disclaimer

The opinions expressed and arguments employed herein are solely those of the authors and do not necessarily reflect the official views of the OECD, its member countries, the Norad Evaluation Department, or other participants in the COVID-19 Global Evaluation Coalition.

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* Appendices 1-5 provide information about the systematic reviews underlying the brief. These can be accessed on the Coalition website: www.covid19-evaluation-coalition.org/