Cochrane Effective Practice and Organisation of Care | NIPH Norwegian Institute of Public Health | Norad Norwegian Agency for Development Cooperation

Effects of digital interventions for promoting vaccination uptake
APPENDICES

APPENDIX 1: **About the systematic reviews underlying this briefing note**

REVIEW 1:
Targeted client communication via mobile devices for improving maternal, neonatal, and child health [1]

Review objective: to assess the effects of targeted client communication via mobile devices on health behaviour, service use, and health and well-being for maternal, new-born and child health

Types of	What the review authors searched for	What the review authors found
Study designs & Interventions	Randomised trials of targeted client communication delivered via mobile phones and other mobile devices, where the communication content was intended to improve maternal, newborn, and / or child health. Targeted client communication was defined as 'the transmission of targeted health content to a specified population or people within a predefined health or demographic group'	27 randomised trials of targeted client communication
Participants	(1) Pregnant and postpartum women up to six weeks after birth, including women living with HIV, and their partners or others who supported them (2) Parents and carers of children aged under five years	11 trials among pregnant and postpartum women; 3 trials among pregnant and postpartum women living with HIV; 13 trials among parents of children under the age of five years
Settings	Any setting	• Trials among pregnant and postpartum women: 4 in HICs, 6 in MICs and 1 in a LIC • Trials among pregnant and postpartum women living with HIV: 3 in a MIC • Trials among parents of children <5 years: 5 in HICs, 7 in MICs and 1 in a LIC
Outcomes	Primary outcomes were health behaviour change; service utilisation; health status and wellbeing; unintended consequences	The primary outcomes were assessed across all three participant groups, apart from health status and wellbeing which was not assessed in trials among parents <5 years and unintended consequences, which were not measured in any trials
Date of most recent search: July/August 2017		
Limitations: Minor – although an updated search was conducted in July 2019, these studies were not incorporated into the review		

REVIEW 2:

Patient reminder and recall interventions to improve immunization rates across all age groups [2]

Review objective: To evaluate and compare the effectiveness of various types of patient reminder and recall interventions to improve receipt of immunizations

Types of	What the review authors searched for	What the review authors found
Study designs & Interventions	Randomized trials, controlled before-after studies, and interrupted time series studies of patient reminder or recall interventions for patients of upcoming immunizations or immunization visits that were due (reminders) or overdue (recall). Reminders and recalls could be delivered by telephone, letter, mobile phone messaging, automatic electronic telephone calls (autodialer) or in person	75 studies: 5 CBAs, 70 randomised trials
Participants	Children (birth to 18 years) or adults who receive immunizations in any setting	Infants and children – routine immunizations (29 studies); children – influenza vaccination (5 studies); adolescents (12 studies); adults – routine immunizations (8 stuides); and adults – influenza vaccination (24 studies) [Note that some studies examined more than one category]
Settings	Academic or non-academic, and developed or developing countries. We excluded studies of patients who were hospitalized for the study duration	Diverse settings, including urban to rural and both publicly funded and privately funded institutions. Fifty-eight studies were performed in the USA, and the remainder were conducted in HICs (14 trials) and LICs (3 trials)
Outcomes	Primary: receipt of immunizations	Receipt of immunizations
Date of most recent search: January 2017		
Limitations: Minor – the searches are >1 year old. The review does not report whether the reminders in each study were targeted to specific individuals or untargeted.		

REVIEW 3:

Interventions aimed at communities to inform and / or educate about early childhood vaccination [3]

Review objective: To assess the effects of interventions aimed at communities to inform and/or educate people about vaccination in children six years and younger

Types of	What the review authors searched for	What the review authors found
Study designs & Interventions	Randomised and non-randomised trials, interrupted time series studies (ITS), and controlled before-after studies (CBA) of interventions aimed at communities or groups of people, with a broad audience and purpose and that were intended to inform and/or educate about vaccination in children six years and younger. Interventions aimed at communities were defined as those directed at a geographic area (neighbourhood, for example) and/or those interventions directed to groups of people who share at least one common social or cultural characteristic.	22 studies: 16 randomised trials, two non-randomised trials, two ITS and two CBA.
Participants	Interventions which targeted groups of people (the general public), including, for example, parents, community leaders and other influential community members. Some of these groups are the 'end' target group for vaccination communication interventions (such as parents) while other groups are 'intermediaries' (such as teachers) who are targeted because of their ability to convey information to the end target group.	Most of the interventions were aimed at parents, including first-time parents, expectant parents and, in some cases, specifically mothers.
Settings	Any setting	13 studies were conducted in high-income settings (6 in USA, 2 in Canada, 2 in UK and one each in Australia, Japan and New Zealand) and nine studies in low-and middle-income settings (Bangladesh, Ecuador, India, Liberia, Malawi, Nigeria, Pakistan, Zimbabwe). Nine studies were carried out in the community; ten were conducted in community child health clinics; and three studies in prenatal clinics.
Outcomes	Primary outcomes: (1) Psychosocial impact; and (2) Health impact – Immunisation status of child.	All studies assessed the immunisation status of included children
Date of most recent search: May 2018		
Limitations: Minor – searches are >1 year old		

REVIEW 4:
Improving vaccination uptake among adolescents [4]

Review objective: To evaluate the effects of interventions to improve vaccine uptake among adolescents

Types of	What the review authors searched for	What the review authors found
Study designs & Interventions	Randomised trials, non-randomised trials, interrupted time series studies, and controlled before-after studies of interventions to improve vaccine uptake among adolescents	• 16 studies: 12 randomised trials; 3 non-randomised trials; and 1 controlled before-after study
		• Interventions: health education (7 studies) plus financial incentives (1 study); multi-component directed at providers (1 study) plus parents (2 studies); provider education with performance feedback extracted from a digital client health record (1 study); financial incentives (1 study); provider prompts via a digital client health record (1 study); mandatory school entry vaccination (1 study); class-based vaccination (1 study)
		• 3 of the included studies evaluated digital interventions: provider prompts via a digital client health record (1 study); multicomponent provider and parent intervention including digital elements (1 study); Online provider education with a digital client health record-generated performance feedback (1 study)
Participants	Girls or boys (or both) aged 10 to 19 years eligible for WHO recommended vaccines and their parents or healthcare providers	The interventions targeted adolescent boys or girls or both (7 studies), parents (4 studies), and providers (2 studies). Five studies included a range of participants
Settings	Any	Australia (1 study); Sweden (1 study); Tanzania (1 study); UK (1 study); USA (12 studies)
Outcomes	• Primary outcome: Adolescent vaccination coverage (% adolescents who have received the recommended dose(s) of the vaccine(s) studied)	Outcomes assessed: uptake of human papillomavirus (HPV) (11 studies); hepatitis B (three studies); and tetanus-diphtheria-acellular-pertussis (Tdap), meningococcal, HPV, and influenza (three studies) vaccines
	• Secondary outcomes: % adolescents completing the schedule; equitable uptake of immunisation; knowledge, attitudes, and beliefs; adverse effects; costs; incidence of vaccine preventable diseases	
Date of most recent search: October 2018		
Limitations: Minor – the searches are >1 year old. One study awaiting assessment evaluates a digital intervention for increasing vaccination coverage.		

APPENDIX 2: **Summaries of findings – Palmer 2020** [1]

Digital targeted client communication using mobile phone messaging, compared to digital non-targeted client communication (pregnant and postpartum women) for improving maternal, neonatal, and child health

Patient or population: pregnant and postpartum women
Setting: community and healthcare settings
Intervention: digital targeted client communication via mobile phones
Comparison: digital non-targeted client communication

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)**	Results in words
	Risk with digital non-targeted communication	Risk with digital targeted client communication				
Service utilisation – attendance antenatal care appointments (attendance for antenatal influenza vaccination)	310 per 1000	326 per 100 (220 to 490)	**RR 1.05** (0.71 to 1.58)	204 (1 RCT)	⊕⊕⊖⊖ **Low**[a,b]	The intervention may make little or no difference to attendance for antenatal influenza vaccination, but the confidence interval includes both an increase and a decrease in attendance.

***The risk in the intervention group** (and its 95% confidence interval) is based on the **assumed risk** in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: confidence interval; **RCT:** randomised controlled trial; **RR:** risk ratio.

****GRADE Working Group grades of evidence**:
High certainty: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different[1] is low.
Moderate certainty: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different[1] is moderate.
Low certainty: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high.
Very low certainty: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high.

1. *Substantially different = a large enough difference that it might affect a decision.*

a. Downgraded one level for imprecision: 95% confidence intervals that encompass a potential harmful effect and a potential beneficial effect of the intervention.
b. Downgraded one level for risk of bias: trial at unclear risk of bias for several domains.

Digital targeted client communication using mobile phone messaging compared to standard care or no intervention (parents of children aged < 5 years) for improving maternal, neonatal, and child health

Patient or population: parents of children aged < 5 years
Setting: community and healthcare settings
Intervention: digital targeted client communication via mobile phones
Comparison: standard care or no intervention

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)**	Results in words
	Risk with standard care	Risk with digital targeted client communication				
Service utilisation – attendance for necessary healthcare (attendance for vaccinations at 6–12 months, attendance at HIV medical appointments) Follow-up: up to 12 months	642 per 1000	777 per 1000 (693 to 860)	**RR 1.21** (1.08 to 1.34)	5660 (10 RCTs)	⨁⨁◯◯ **Low**[a, b]	The intervention may increase attendance for necessary healthcare. However, the result varied considerably according to whether the healthcare attendance was for vaccinations at 6 months, vaccinations at 12 months, or an HIV medical appointment, and between studies within each of these outcome categories.

***The risk in the intervention group** (and its 95% confidence interval) is based on the **assumed risk** in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: confidence interval; **RCT:** randomised controlled trial; **RR:** risk ratio.

****GRADE Working Group grades of evidence**:
High certainty: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different[1] is low.
Moderate certainty: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different[1] is moderate.
Low certainty: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high.
Very low certainty: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high.

1. *Substantially different = a large enough difference that it might affect a decision.*

a. Downgraded one level for risk of bias: most studies at unclear risk of bias for allocation concealment.
b. Downgraded one level for inconsistency: high statistical heterogeneity (I2 > 90%).

Digital targeted client communication using mobile phone messaging compared to non-digital targeted client communication (parents of children aged < 5 years) for improving maternal, neonatal, and child health

Patient or population: parents of children aged < 5 years
Setting: community and healthcare settings
Intervention: digital targeted client communication via mobile phones
Comparison: non-digital targeted client communication

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)**	Results in words
	Risk with non-digital targeted client communication	Risk with digital targeted client communication				
Service utilisation – attendance for necessary healthcare (attendance for vaccinations at 14 weeks)	839 per 1000	948 per 1000 (839 to 1000)	**RR 1.13** (1.00 to 1.28)	744 (1 RCT)	⨁⨁◯◯ **Low**[a]	The intervention may slightly increase attendance for vaccinations. However, the confidence interval includes both no increase and a large increase in attendance.

***The risk in the intervention group** (and its 95% confidence interval) is based on the **assumed risk** in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: confidence interval; MD: mean difference; **RCT:** randomised controlled trial; **RR:** risk ratio.

****GRADE Working Group grades of evidence**:
High certainty: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different[1] is low.
Moderate certainty: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different[1] is moderate.
Low certainty: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high.
Very low certainty: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high.

1. *Substantially different = a large enough difference that it might affect a decision.*

a. Downgraded two levels for risk of bias: study at unclear or high risk of bias across all but one domain.

Digital targeted client communication using mobile phone messaging compared to digital non-targeted client communication (parents of children aged < 5 years) for improving maternal, neonatal, and child health

Patient or population: parents of children aged < 5 years
Setting: community and healthcare settings
Intervention: digital targeted client communication via mobile phones
Comparison: digital non-targeted client communication

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)**	Results in words
	Risk with digital non-targeted client communication	Risk with digital targeted client communication				
Service utilisation – attendance for necessary healthcare – attendance for vaccinations at 6 months Follow-up: 6 months	652 per 1000	411 per 1000 (215 to 782)	**RR 0.63** (0.33 to 1.20)	40 (1 RCT)	⊕⊕⊖⊖ **Low**[a,b]	The intervention may reduce attendance for vaccinations, but the confidence interval includes both an increase and a decrease in attendance.

***The risk in the intervention group** (and its 95% confidence interval) is based on the **assumed risk** in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: confidence interval; **RCT:** randomised controlled trial; **RR:** risk ratio.

****GRADE Working Group grades of evidence**:
High certainty: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different[1] is low.
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Low certainty: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high.
Very low certainty: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high.
1. *Substantially different = a large enough difference that it might affect a decision.*

a. Downgraded one level for risk of bias: unclear risk of bias for allocation concealment, high risk of bias for incomplete outcome reporting and other bias.
b. Downgraded one level for imprecision: small number of events and confidence interval encompassing potential harmful effect and potential beneficial effect of the intervention.

APPENDIX 3: **Summaries of findings – Jacobson Vann 2018** [2]

Patient reminder or recall interventions compared with no patient reminder or recall for receipt of immunizations

Patient or population: children, adolescents, and adults with a need for routine immunizations, excluding travel immunizations.
Settings: patient telephone reminder or recall interventions are typically received in the home; the interventions originate from outpatient departments of hospitals, community-based clinical settings, local and state public health departments, and other clinical settings.
Intervention: patient reminder or recall interventions
Comparison: no-intervention control groups, standard practice activities that did not include immunization-focused patient reminder or recall interventions, media-based activities aimed at promoting immunizations, and simple practice-based immunization awareness campaigns.

Intervention typeh	Outcome: received immunizations					
	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Certainty of the evidence (GRADE)**	Results in words
	Risk without intervention	Risk with patient reminder / recall interventions				
All patient reminder or recall interventions combined (digital and non-digital)	290 per 1000	371 per 1000 (357 to 392)	RR 1.28[a] (1.23 to 1.35)	138,625 -55	⊕⊕⊕⊖ Moderate[b]	Reminder or recall interventions probably improve uptake of immunizations
Patient telephone reminder or recall (digital and non-digital)	164 per 1000	287 per 1000 (197 to 417)	RR 1.75 (1.20 to 2.54)	9120 -7	⊕⊕⊕⊖ Moderate[c]	Patient telephone reminder or recall interventions probably improve uptake of immunizations
Patient letter reminder or recall	320 per 1000	412 per 1000 (387 to 442)	RR 1.29 (1.21 to 1.38)	81,1 -27	⊕⊕⊕⊖ Moderate[d]	Patient letter reminder or recall interventions probably improve uptake of immunizations
Patient postcard reminder or recall	327 per 1000	386 per 1000 (353 to 425)	RR 1.18 (1.08 to 1.30)	27,734 -8	⊕⊕⊕⊕ High[e]	Patient postcard reminder or recall interventions improve uptake of immunizations
Patient mobile phone message reminder or recall	161 per 1000	208 per 1000 (185 to 232)	RR 1.29 (1.15 to 1.44)	7772 -6	⊕⊕⊕⊕ High	Patient mobile phone message reminder or recall interventions improve uptake of immunizations
Patient autodialer message reminder or recall	365 per 1000	427 per 1000 (376 to 482)	RR 1.17 (1.03 to 1.32)	11,947 -5	⊕⊕⊕⊕ High	Patient autodialer message reminder or recall interventions improve uptake of immunizations
Combination of patient mail and telephone reminder or recall	277 per 1000	354 per 1000 (316 to 402)	RR 1.28 (1.14 to 1.45)	6506 -8	⊕⊕⊕⊖ Moderate[f]	Combined patient mail and telephone reminder or recall interventions probably improve uptake of immunizations

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Patient reminder or recall interventions compared with no patient reminder or recall for receipt of immunizations						
Combination of patient reminder or recall with outreach intervention	360 per 1000	439 per 1000 (396 to 486)	RR 1.22 (1.10 to 1.35)	2701 -3	⊕⊕⊕⊕ High	Combined patient reminder or recall and outreach interventions improve uptake of immunizations
Combination of patient reminder or recall with provider reminder intervention	202 per 1000	588 per 1000 (540 to 644)	RR 2.91 (2.67 to 3.19)	4120 -2	⊕⊕⊕⊖ Moderate[g]	Patient reminder or recall interventions combined with provider reminder systems may improve uptake of immunizations

*****The basis for the **assumed risk**, e.g. the median control group risk across studies, is provided in footnotes. The **corresponding risk**, and its 95% confidence interval, is based on the **assumed risk** in the comparison group and the **relative effect** of the intervention, and its 95% CI.
CI: confidence interval; **RR:** risk ratio

****GRADE Working Group grades of evidence**:
High certainty: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different[1] is low.
Moderate certainty: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different[1] is moderate.
Low certainty: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high.
Very low certainty: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high.
1. *Substantially different = a large enough difference that it might affect a decision.*

a. It is important to note that this review is the third update of the initial review that was published in 2002; the results for each update have been relatively stable and consistent with the original review.
b. We downgraded the certainty of the evidence by 1 point. GRADE was reduced by 0.5 points because of a small degree of inconsistency in outcomes. Generally, most included studies reported relatively small positive risk ratios, with several negative outliers and several with stronger positive effects; the patient reminder recall interventions also varied. We downgraded precision slightly (-0.5) because the confidence intervals were wide for several included studies.
c. We downgraded the certainty of the evidence by 1 point. GRADE was reduced by 0.5 points because of a small degree of inconsistency in outcomes; the interventions were relatively homogeneous. We downgraded precision slightly (-0.5) because the confidence intervals were wide for a few included studies.
d. We downgraded the certainty of the evidence by 1 point because of a small degree of inconsistency in outcomes (0.5 point); the interventions were relatively homogeneous. We downgraded precision slightly (-0.5) because the confidence intervals were wide for several included studies.
e. We downgraded the certainty of the evidence by 0.5 points because of a high risk of bias for one or two of eight criteria for 15 studies.
f. We downgraded the certainty of the evidence by 1 point. GRADE was reduced by 0.5 points because of a small degree of inconsistency in outcomes, with one outlier; the interventions were more varied than the single intervention types. We downgraded precision slightly (-0.5) because the confidence interval was wide for one outlier.
g. We downgraded the certainty of the evidence by 1.5 points. GRADE was reduced by 0.5 points because of a moderate risk of bias in one of three comparisons within two studies. We downgraded precision by 1 point because of two wide confidence intervals in three comparisons.
h. Some single component reminder or recall interventions used repeated contacts.

Patient reminder or recall interventions for receipt of immunization, by type of immunization (including digital and non-digital interventions)

Patient or population: children, adolescents, and adults with a need for routine immunizations, excluding travel immunizations
Settings: patient reminder or recall interventions are typically received in the home; the interventions originate from outpatient departments of hospitals, community-based clinical settings, local and state public health departments, and other clinical settings
Interventions: patient reminder or recall interventions, including digital (telephone calls, autodialer calls, mobile phone messaging) and non-digital (letters, postcards); as well as combinations of mail or telephone, and patient reminder or recall with outreach: These summary measures exclude patient reminder or recall interventions combined with provider reminders
Comparison: no-intervention control groups, standard practice activities that did not include immunization-focused patient reminder or recall interventions, media-based activities aimed at promoting immunizations, and simple practice-based immunization awareness campaigns

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Certainty of the evidence (GRADE)**	Results in words
	Risk without intervention	Risk patient reminder / recall interventions				
Childhood immunizations	333 per 1000	406 per 1000 (383 to 430)	RR 1.22 (1.15 to 1.29)	31,099 -23	⊕⊕⊕⊕ High[a]	Reminder or recall interventions increase uptake of childhood immunizations
Childhood influenza immunizations	431 per 1000	651 per 1000 (491 to 857)	RR 1.51 (1.14 to 1.99)	9265 -5	⊕⊕⊕⊖ Moderate[b]	Reminder or recall interventions probably increase uptake of childhood influenza immunizations
Adult immunizations – other than influenza or travel ('Other adult')	109 per 1000	227 per 1000 (99 to 521)	RR 2.08 (0.91 to 4.78)	8065 -4	⊕⊕⊖⊖ Low[c]	Reminder or recall interventions may increase the uptake of adult vaccinations other than influenza or travel, but the confidence interval also includes no impact
Adult influenza immunizations	292 per 1000	376 per 1000 (342 to 418)	RR 1.29 (1.17 to 1.43)	59,328 -15	⊕⊕⊕⊖ Moderate[d]	Reminder or recall interventions probably increase the uptake of adult influenza immunizations
Adolescent immunizations	244 per 1000	314 per 1000 (285 to 346)	RR 1.29 (1.17 to 1.42)	30,868 -10	⊕⊕⊕⊕ High[e]	Reminder or recall interventions increase the uptake of adolescent immunizations

***The basis for the **assumed risk**, e.g. the median control group risk across studies, is provided in footnotes. The **corresponding risk**, and its 95% confidence interval, is based on the **assumed risk** in the comparison group and the **relative effect** of the intervention, and its 95% CI.
CI: confidence interval; **RR:** risk ratio

****GRADE Working Group grades of evidence**:
High certainty: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different[1] is low.
Moderate certainty: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different[1] is moderate.
Low certainty: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high.
Very low certainty: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high.

1. *Substantially different = a large enough difference that it might affect a decision.*

a. We did not downgrade the certainty of the evidence: no serious risk of bias, serious inconsistency, serious indirectness, or serious imprecision was identified among the 23 studies; however, one study was an outlier (RR 5.33).

b. We downgraded the certainty of the evidence by 1.5 points because of some imprecision (-1) and inconsistency (-0.5). One of five studies had a wide confidence interval and effect sizes ranged from 1.08 to 4.6.

c. We downgraded the certainty of the evidence by 2 points because of lack of agreement between studies (-1) and some imprecision (-1). Effect sizes ranged from 1.08 to 3.61 and two of five studies had wide confidence intervals.

d. We downgraded the certainty of the evidence by 1.5 points because of some inconsistency in results (-0.5) and some imprecision (-1). Effect sizes ranged from 0.91 to 3.11 and one of 15 studies had a wide confidence interval.

e. We did not downgrade the certainty of the evidence: no serious risk of bias, serious inconsistency, serious indirectness, or serious imprecision was identified among the 10 studies.

APPENDIX 4: **Summaries of findings – Grobler, unpublished** [3]

Interventions aimed at communities to inform and/or educate about early childhood vaccination versus routine immunisation practices in primary and community care						
People: community members **Settings:** primary and community care settings in the USA and Zimbabwe **Intervention:** mobile phone messaging to inform and/or educate members of the community about early childhood vaccination **Comparison:** routine immunisation practices / written reminders						
Outcomes	**Impact**				**Number of participants (studies)**	**Certainty of the evidence (GRADE)****
	Anticipated absolute effects*		**Estimated effects (95%CI)**	**Results in words**		
	Without mobile phone messaging	**With mobile phone messaging to inform and or educate**				
Parents' knowledge of vaccine or vaccine-preventable disease				No studies measured this outcome		
Parents' knowledge of vaccine service delivery				No studies measured this outcome		
Improvements in children's vaccination status (Influenza vaccine) Measured in children 6 to 59 months	36 per 100 children vaccinated	38 per 100 children vaccinated (35 to 42 children)	RR 1.04 (0.95 to 1.14)[a]	Compared to usual care, educational mobile phone messages probably lead to little or no difference in children's influenza vaccination status	6869 (2)[b]	⊕⊕⊕⊖ moderate[c]
Improvements in children's vaccination status (influenza vaccine 2nd dose) Measured in children 6 to 59 months	65 per 100 children vaccinated	81 per 100 children vaccinated (60 to 100 children)	RR 1.24 (0.91 to 1.69)	Compared to usual care, educational mobile phone messages may improve children's uptake of 2nd influenza vaccination	361 (1)[d]	⊕⊕⊕⊖ low[e]
Improvements in children's vaccination status (Polio, diphtheria, tetanus, whooping cough, hepatitis B, Haemophilus influenzae type B, Streptococcus pneumonia) Measured in children 6 to 14 weeks old[f]	75 per 100 children vaccinated	95 per 100 children vaccinated (86 to 100 children)	RR 1.26 (1.14 to 1.39)[g]	Compared to usual care, educational mobile phone messages may improve children's receipt of scheduled vaccines between the ages of 6 -14 weeks	304 (1)[h]	⊕⊕⊕⊖ low[i]
Parents' intention to vaccinate their children				No studies measured this outcome		
Parents' anxiety regarding vaccination				No studies measured this outcome		
Parents' involvement in decision-making regarding vaccination				No studies measured this outcome		
Parents' confidence in the decision made regarding vaccination				No studies measured this outcome		
Unintended or adverse effects				No studies measured this outcome		

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Interventions aimed at communities to inform and/or educate about early childhood vaccination versus routine immunisation practices in primary and community care			
Resource use or cost of the intervention	A total of 1368 short messages were sent to study participants in the intervention group and 42 messages were sent to the researcher indicating those that are due for follow up. Messages to the study participants cost US$57.46, and the cost of messages to the researcher was US$1.76, giving a total cost of US$59.22 for all the messages that were send for the study. Capturing of data before sending short message reminders required about 5 minutes and this will translate to US$0.33 per message for the human resource needed.	304 (1)[h]	

*****The absolute effect WITHOUT the intervention is based on data from the trial control group. The corresponding absolute effect WITH the intervention is based on the estimated effect of the intervention relative to the control group.
CI: confidence interval; **RR:** risk ratio

****GRADE Working Group grades of evidence**:
High certainty: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different[1] is low.
Moderate certainty: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different[1] is moderate.
Low certainty: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high.
Very low certainty: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high.
1. *Substantially different = a large enough difference that it might affect a decision.*

a. For ages 6-23 months: RR 0.98 (95% CI 0.74 to 1.31); for ages 24 to 59 months: RR 1.07 (0.99 to 1.15).
b. Stockwell 2012; Hofstetter 2015.
c. Downgraded by 1 for unexplained heterogeneity between the combined studies (I2 = 61%).
d. Stockwell 2015.
e. Downgraded by 1 for imprecision as the CI includes both a small benefit and a very large benefit and a relatively small number of events. gowngraded by 1 for indirectness as it is likely that the relative effect may be different in settings with different health systems arrangements.
f. Bangure 2015: Both groups received routine health education, which involved sharing information on the importance of having the child immunized. This is done every time the mother or the guardian visits the health facility for routine immunization.
g. Bangure 2015: Immunization coverage (OPV3, Penta3 and PCV3) at 14 weeks; Immunisation coverage (OPV1, Penta1 and PCV1) at 6 weeks: RR 1.18 (95% CI 1.09 to 1.28; Immunization coverage for OPV2, Penta2 and PCV2 at 10 weeks: RR 1.2 (95%CI 1.1 to 1.3).
h. Bangure 2015.
i. Downgraded to moderate due to some risk of bias issues (unclear if outcomes comparable at baseline and if allocation concealed) and small numbers of events (imprecision). Downgraded by 1 for indirectness as it is likely that the relative effect may be different in settings with different health systems arrangements.

Interventions aimed at communities to inform and/or educate about early childhood vaccination versus routine immunisation practices in primary and community care

People: community members
Settings: primary and community care settings in the USA
Intervention: Bidirectional mobile phone messaging to inform and /or educate members of the community about early childhood vaccination
Comparison: Usual care

Outcomes	Impact				Number of participants (studies)	Certainty of the evidence (GRADE)**
	Anticipated absolute effects*		Estimated effects	Results in words		
	Educational mobile phone messages with bidirectional component	Usual care				
Parents' knowledge of vaccine or vaccine-preventable disease				No studies measured this outcome		
Parents' knowledge of vaccine service delivery				No studies measured this outcome		
Improvements in children's vaccination status (influenza vaccine) Measured in children 6 to 59 months	45 per 100 children vaccinated (41 to 50 children)	41 per 100 children vaccinated	RR 1.10 (0.99 to 1.23)[d]	Compared to usual care, educational bidirectional mobile messages may slightly improve children's influenza vaccination status[a]	1716 (1)[b]	⨁⨁◯◯ **low**[c]
Parents' intention to vaccinate their children				No studies measured this outcome		
Parents' anxiety regarding vaccination				No studies measured this outcome		
Parents' involvement in decision-making regarding vaccination				No studies measured this outcome		
Parents' confidence in the decision made regarding vaccination				No studies measured this outcome		
Unintended or adverse effects				No studies measured this outcome		
Resource use or cost of the intervention				No studies measured this outcome		

***The absolute effect WITHOUT the intervention is based on data from the trial control group. The corresponding absolute effect WITH the intervention is based on the estimated effect of the intervention relative to the control group.
CI: confidence interval; **RR:** risk ratio

****GRADE Working Group grades of evidence**:
High certainty: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different[1] is low.
Moderate certainty: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different[1] is moderate.
Low certainty: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high.
Very low certainty: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high.

1. *Substantially different = a large enough difference that it might affect a decision.*

a. All of the groups received reminders of the child's vaccination due date.
b. Hofstetter 2015.
c. Downgraded due to imprecision – CI crosses the line of no effect – and due to indirectness as it is likely that the relative effect may be different in settings with different health systems arrangements.
d. For ages 6-23 months RR 1.04 (95% CI 0.87 to 1.25); for ages 24-59 months RR 1.14 (95% CI 0.99 to 1.30).

Interventions aimed at communities to inform and/or educate about early childhood vaccination versus routine immunisation practices in primary and community care

People: community members
Settings: primary and community care settings in the USA
Intervention: Bidirectional mobile phone messaging to inform and /or educate
Comparison: Mobile phone messaging to inform and/or educate members of the community about early childhood vaccination

Outcomes	Impact				Number of participants (studies)	Certainty of the evidence (GRADE)**
	Anticipated absolute effects*		Estimated effects	Results in words		
	Educational mobile phone messages without bidirectional component	Educational mobile phone messages with bidirectional component				
Parents' knowledge of vaccine or vaccine-preventable disease				No studies measured this outcome		
Parents' knowledge of vaccine service delivery				No studies measured this outcome		
Improvements in children's vaccination status (influenza vaccine) Measured in children 6 to 59 months	39 per 100 children vaccinated	46 per 100 children vaccinated (41 to 51 children)	RR 1.17 (1.05 to 1.31)[d]	Compared to educational mobile messages, educational bidirectional mobile messages probably improve children's influenza vaccination status[a]	1713 (1)[b]	⊕⊕⊕⊖ **Moderate**[c]
Parents' intention to vaccinate their children				No studies measured this outcome		
Parents' anxiety regarding vaccination				No studies measured this outcome		
Parents' involvement in decision-making regarding vaccination				No studies measured this outcome		
Parents' confidence in the decision made regarding vaccination				No studies measured this outcome		
Unintended or adverse effects				No studies measured this outcome		
Resource use or cost of the intervention				No studies measured this outcome		

***The absolute effect WITHOUT the intervention is based on data from the trial control group. The corresponding absolute effect WITH the intervention is based on the estimated effect of the intervention relative to the control group.
CI: confidence interval; **RR:** risk ratio

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Low certainty: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high.
Very low certainty: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high.

1. *Substantially different = a large enough difference that it might affect a decision.*

a. All of the groups received reminders of the child's vaccination due date.
b. Hofstetter 2015.
c. Downgraded due to indirectness as it is likely that the relative effect may be different in settings with different health systems arrangements.
d. For ages 6-23 months RR 1.25 (95% CI 1.02 to 1.53); for ages 24-59 months RR 1.14 (95% CI 0.99 to 1.30).

Interventions aimed at communities to inform and/or educate about early childhood vaccination versus routine immunisation practices in primary and community care

People: community members
Settings: people's homes in the USA
Intervention: Web-based vaccine information to inform and/or educate members of the community about early childhood vaccination
Comparison: Routine immunisation practices / web-based control message

Outcomes	Impact				Number of participants (studies)	Certainty of the evidence (GRADE)**
	Anticipated absolute effects*		Estimated effects (95%CI)	Results in words		
	Without web-based vaccine information	With web-based vaccine information				
Parents' knowledge of vaccine or vaccine-preventable disease				No studies measured this outcome		
Parents' knowledge of vaccine service delivery				No studies measured this outcome		
Improvements in children's vaccination status[a] Measured in infants from birth to 200 days	86 per 100 infants vaccinated	92 per 100 infants vaccinated (from 86 to 98 infants)	RR 1.06 (0.99 to 1.13)[b]	Compared with routine immunisation practices, a web site with vaccine information, with or without a bidirectional social media component, may slightly improve children's vaccination status[a]	888 (1)[c]	⊕⊕⊖⊖ **low**[d]
Parents' anxiety regarding vaccination				No studies measured this outcome		
Parents' involvement in decision-making regarding vaccination				No studies measured this outcome		
Parents' confidence in the decision made regarding vaccination				No studies measured this outcome		
Unintended or adverse effects				No studies measured this outcome		
Resource use or cost of the intervention				No studies measured this outcome		

***The absolute effect WITHOUT the intervention is based on data from the trial control group. The corresponding absolute effect WITH the intervention is based on the estimated effect of the intervention relative to the control group.
CI: confidence interval; **RR:** risk ratio

****GRADE Working Group grades of evidence**:
High certainty: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different[1] is low.
Moderate certainty: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different[1] is moderate.
Low certainty: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high.
Very low certainty: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high.

1. *Substantially different = a large enough difference that it might affect a decision.*

a. Glanz 2017: the outcome assessed was the proportion of infants with up-to-date vaccinations (6 vaccines: hepatitis B; rotavirus; diphtheria-tetanus-acellular pertussis; Haemophilus influenzae type b; pneumococcal conjugate vaccine; and polio) at 200 days after birth (yes or no).

b. As the two comparisons showed very similar effects (comparison 1: web-based vaccine information with bidirectional social media component versus routine practice, RR 1.08 (95% CI 0.98 to 1.2); comparison 2: web-based vaccine information versus routine practice, RR 1.04 (95% CI 0.95 to 1.14), we decided to combine the data from the two arms and compare these two arms combined with usual care.

c. Glanz 2017.

d. Downgraded by 1 for serious risk of bias – high risk of attrition bias; and by 1 for indirectness as it is likely that the relative effect may be different in settings with different health systems arrangements.

Interventions aimed at communities to inform and/or educate about early childhood vaccination versus routine immunisation practices in primary and community care

People: community members
Settings: primary and community care settings in Canada and the USA
Intervention: video messaging to inform and /or educate members of the community about early childhood vaccination
Comparison: oral presentation or informational pamphlet

Outcomes	Impact		Number of participants (studies)	Certainty of the evidence (GRADE)**	Results in words
	Anticipated absolute effects*	Estimated effects			
Parents' knowledge of vaccine or vaccine-preventable disease[a]	Not possible to estimate absolute effects	One study showed that parents who watched the educational video had 3.3% more correct responses to knowledge questions (95% CI: -15.3 to 22.0; P value: 0.724, Bjornson 1997), compared to parents who received an oral presentation from a nurse and taking into account scores prior to the intervention.[a] A second study reported that the improvement in knowledge following the intervention was significantly larger in the group that received a video presentation and informational pamphlet, compared with the group that received an informational pamphlet only (Dunn 1998 p. 3)[b]	514 (2)[c]	⊕⊖⊖⊖ **very low**[d]	We are uncertain whether an educational video improves parents' vaccine knowledge, compared with either oral presentation or informational pamphlets because the certainty of the evidence is very low
Parents' knowledge of vaccine service delivery	No studies measured this outcome				
Improvements in children's vaccination status	No studies measured this outcome				
Parents' intention to vaccinate their children	No studies measured this outcome				
Parents' anxiety regarding vaccination	No studies measured this outcome				
Parents' involvement in decision-making regarding vaccination	No studies measured this outcome				
Parents' confidence in the decision made regarding vaccination	No studies measured this outcome				
Unintended or adverse effects	No studies measured this outcome				
Resource use or cost of the intervention	No studies measured this outcome				

***The absolute effect WITHOUT the intervention is based on data from the trial control group. The corresponding absolute effect WITH the intervention is based on the estimated effect of the intervention relative to the control group.
CI: confidence interval; **RR:** risk ratio

****GRADE Working Group grades of evidence**:
High certainty: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different[1] is low.
Moderate certainty: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different[1] is moderate.
Low certainty: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high.
Very low certainty: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high.

1. *Substantially different = a large enough difference that it might affect a decision.*

Interventions aimed at communities to inform and/or educate about early childhood vaccination versus routine immunisation practices in primary and community care

a. Bjornson 1997 compared the effectiveness of an eight-minute educational video with that of an oral presentation by a trained nurse on parental knowledge of diphtheria, pertussis, tetanus, polio and haemophilus influenza type B diseases and vaccines. Knowledge was assessed using a 16 question (14 true/false questions and two open-ended questions) questionnaire. The available data were re-analysed using a difference-in-difference approach. Dunn 1998 compared the effectiveness of a 15-minute educational video (one-on-one) plus vaccine information schedule (VIS) leaflet with VIS leaflet alone on parent's knowledge of polio, polio vaccines and vaccine schedules. Knowledge was assessed using a questionnaire with 6 true/false and multiple choice questions regarding polio disease, vaccine and vaccine schedule.

b. The study authors do not provide the mean and standard deviation for the posttest knowledge scores per experimental group. Instead they report the pre and post intervention test scores by clinic type, participant race/ethnicity and participant education level, but not that of the group as a whole. We were therefore not able to calculate an overall estimate of effect.

c. Bjornson 1997; Dunn 1998.

d. Downgraded by 1 for serious risk of bias (high risk of performance and detection bias); downgraded by 2 for very serious imprecision (small number of events and wide confidence intervals).

APPENDIX 5: **Summaries of findings – Abdullahi 2020** [4]

Provider prompts via a digital client health record compared to usual practice				
Population: healthcare workers **Setting:** USA **Intervention:** provider prompts via a digital client health record[a] **Comparison:** usual practice				
Outcomes	**Relative effect (95% CI)**	**№ of participants (studies)**	**Certainty of the evidence (GRADE)***	**Results in words**
Uptake of HPV vaccine[b]	aOR 0.99 (0.55 to 1.81)[e]	859 (2)[c]	⊕⊕⊕⊖ **Moderate**[d]	Provider prompts via a digital client health record probably make little or no difference to uptake of 3 doses of HPV vaccine among adolescents compared to usual practice.
Uptake of Tdap vaccine[b]	aOR 1.28 (0.59 to 2.80)	3296 (2)[c]	⊕⊕⊕⊖ **Moderate**[d]	Provider prompts via a digital client health record probably make little or no difference to uptake of Tdap vaccine among adolescents compared to usual practice.
Uptake of meningococcal conjugate vaccine[b]	aOR 1.09 ,(0.67 to 1.79)	3219 (2)[c]	⊕⊕⊕⊖ **Moderate**[d]	Provider prompts via a digital client health record probably make little or no difference to uptake of the meningococcal conjugate vaccine among adolescents compared to usual practice.
Uptake of seasonal influenza vaccine[b]	aOR 0.91 (0.61 to 1.34)	1439 (2)[c]	⊕⊕⊕⊖ **Moderate**[d]	Provider prompts via a digital client health record probably make little or no difference to uptake of the seasonal influenza vaccine among adolescents compared to usual practice.
CI: confidence interval; HPV: human papillomavirus; aOR: adjusted odds ratio; Tdap: tetanus–diphtheria–acellular–pertussis.				
***GRADE Working Group grades of evidence**: **High certainty:** this research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different[1] is low. **Moderate certainty:** this research provides a good indication of the likely effect. The likelihood that the effect will be substantially different[1] is moderate. **Low certainty:** this research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high. **Very low certainty:** this research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high. 1. *Substantially different = a large enough difference that it might affect a decision.*				

a. When a healthcare provider opened a client's digital health record, there was a screen display of the list of vaccines that were due at that visit. At the beginning of the study, a 1-2 hour educational session was given to the providers to inform them about the digital client health record-based prompts.

b.The lag-time between delivery of the intervention and assessment of outcomes was 12 months.

c. Szilagyi 2015 conducted two separate randomised trials, one in a local and one in a national network, and then reported these in one paper.

d. Downgraded one level for imprecision of findings.

e. All odds ratios were adjusted based on a multilevel mixed-effect logistic regression model with covariates for pair assignment, study time period, group assignment, and an interaction between time and group assignment.

Multi-component provider and parent intervention, including digital elements, compared to usual practice

Population: healthcare workers and parents
Setting: USA
Intervention: (1) distribution of HPV vaccination posters and brochures with the risk-related message to health departments and healthcare providers; (2) two radio public service announcements designed to raise awareness about HPV vaccine for boys among parents of preteen boys; (3) an online continuing medical education training with video demonstrating communication among providers, parents, and preteen boys available to enrolled health providers; (4) one-page tip sheet for providers to discuss HPV vaccination with parents and boys; and (5) a website with links to credible information sources useful for both parents and providers.
Comparison: usual practice

Outcomes	Impact			№ of participants (studies)	Certainty of the evidence (GRADE)**	Results in words
	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)			
	With usual practice	With multi-component intervention				
HPV vaccine uptake at 6 months	52 per 1,000	73 per 1000 (65 to 83)	RR 1.41 (1.25 to 1.59)	25,869 (1)[a]	⨁⨁◯◯ Low[b]	A multi-component intervention involving healthcare providers and parents may improve uptake of the HPV vaccine compared to usual practice

CI: confidence interval; HPV: human papillomavirus; **RR:** risk ratio.
***The risk in the intervention group** (and its 95% CI) is based on the likelihood of being vaccinated in the usual practice group and the **relative effect** of the intervention (and its 95% CI).

****GRADE Working Group grades of evidence**:
High certainty: this research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different[1] is low.
Moderate certainty: this research provides a good indication of the likely effect. The likelihood that the effect will be substantially different[1] is moderate.
Low certainty: this research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high.
Very low certainty: this research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high.

1. *Substantially different = a large enough difference that it might affect a decision.*

a. Cates 2014 (non-randomised trial).
b. Downgraded by two levels for non-randomised study design (Cates 2014).

Online provider education with digital client health record-generated performance feedback compared to usual practice			
Population: paediatricians and nurse practitioners **Setting:** USA **Intervention:** Online provider education with digital client health record-generated performance feedback **Comparison:** usual practice			
Outcomes	**Impact**	**№ of participants (studies)**	**Certainty of the evidence (GRADE)***
Uptake of HPV vaccination[a]	Online provider education with digital client health record-generated performance feedback may increase the proportion of adolescents who are offered and accept HPV vaccination by clinicians, compared to usual practice. Compared to adolescents visiting non-participating clinicians (in the usual practice group), the adolescents visiting clinicians in the intervention group may be more likely to receive the first dose of HPV during preventive visits (5.7 percentage points increase) and during acute visits (0.7 percentage points for the first and 5.6 percentage points for the second doses of HPV).	> 200,000 children (1)[b]	⨁⨁⨀⨀ **Low**[c]
HPV: human papillomavirus; CBA: controlled before-after study			

***GRADE Working Group grades of evidence**:
High certainty: this research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different[1] is low.
Moderate certainty: this research provides a good indication of the likely effect. The likelihood that the effect will be substantially different[1] is moderate.
Low certainty: this research provides some indication of the likely effect. However, the likelihood that it will be substantially different[1] is high.
Very low certainty: this research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different[1] is very high.

1. *Substantially different = a large enough difference that it might affect a decision.*

a. There was no lag-time between delivery of the intervention and assessment of outcomes. The intervention period ran from 01 January to 30 November 2013. Outcomes were assessed throughout this period, starting from day 1.

b. Fiks 2016 (controlled before-after study).

c. This is a non-randomised study.

COVID-19 GLOBAL Evaluation Coalition

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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