

WHO GUIDELINE

RECOMMENDATIONS ON DIGITAL INTERVENTIONS FOR HEALTH SYSTEM STRENGTHENING

WEB SUPPLEMENT 1

EVIDENCE-TO-DECISION FRAMEWORKS



World Health
Organization



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EVIDENCE-TO-DECISION FRAMEWORKS

The systematic reviews cited in these frameworks are available at www.who.int/reproductivehealth/publications/digital-interventions-health-system-strengthening/en/.

1.1 Evidence-to-decision framework for birth and death notification via mobile devices (see Recommendations 1 and 2)

POSITIVE AND NEGATIVE EFFECTS OF BIRTH AND DEATH NOTIFICATION VIA MOBILE DEVICES

Research evidence

A systematic review of the global evidence shows the following (see Web supplement 2E for more detail):

Note: No evidence on the effectiveness of death notification via mobile devices was identified.

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
COVERAGE OF BIRTH NOTIFICATION	Uncertain – the certainty of this evidence was assessed as very low	VERY LOW
TIMELINESS OF BIRTH NOTIFICATION	Uncertain – the certainty of this evidence was assessed as very low	VERY LOW
COVERAGE OF NEWBORN OR CHILD HEALTH CARE SERVICES	Uncertain – the certainty of this evidence was assessed as very low	VERY LOW
TIMELINESS OF NEWBORN OR CHILD HEALTH CARE SERVICES	Uncertain – the certainty of this evidence was assessed as very low	VERY LOW
RESOURCE USE	Uncertain – no studies were identified that reported this outcome	No evidence
UNINTENDED CONSEQUENCES	Uncertain – no studies were identified that reported on this outcome	No evidence



ACCEPTABILITY OF BIRTH AND DEATH NOTIFICATION VIA MOBILE DEVICES

Research evidence

A systematic review of the global evidence (Web supplement 2E) points to the following factors that are relevant to the acceptability of digital birth and death notification.

Acceptability to health workers

In general, health workers see the use of mobile phones for birth–death notification as **acceptable and as supportive of their responsibilities**. Some health workers report being **more proactive** in finding and reporting pregnancies as a result of reminders being sent to their phones. Some report earning more **trust and respect in their communities** due to the ability to communicate and coordinate emergency services with health care facilities. Others report **spending more time delivering services rather than reporting data**, especially when reports are submitted electronically rather than in person (*moderate confidence*, Web Supplement 2E).

Acceptability to clients

Within families, **several factors can prevent the timely notification of births and deaths**, although these factors are not specific to notification conducted via mobile devices. These factors include **sociocultural norms**, such as the extent to which stillbirths, births to unmarried mothers, or maternal deaths are acknowledged in communities (*low confidence*, Web Supplement 2E). For some families, **cost** may also be a barrier to completing registration (*low confidence*, Web Supplement 2E). Families may also **not see any advantage** to birth or death notification, and there may be a need for demand-generation activities, concurrent with the introduction of mobile phones for birth and death notification (*low confidence*, Web Supplement 2E).

FEASIBILITY OF BIRTH AND DEATH NOTIFICATION VIA MOBILE DEVICES

Research evidence

Systematic reviews of the global evidence point to a number of factors regarding the feasibility of digital health interventions in general, including problems with network connectivity, access to electricity, system integration and usability of the device, and concerns about data confidentiality (*high confidence, except moderate for data confidentiality*, Web supplement 2M).

With regard to digital birth and death notification specifically, the evidence (see Web Supplement 2E) points to the following issues.

In some settings, the timeliness of birth and death notification conducted via mobile devices is hampered by **geographic barriers** such as distance or seasonal impassability when trying to access families. For family members, **transportation problems** may also make it difficult to certify births and deaths or to access post-notification services after health workers have notified using mobile phones. Some study authors suggest that these problems can be reduced by using mobile devices



to facilitate issuance of birth certification at the site of notification, thereby precluding the need for trips to distant registration centres (*moderate confidence*, Web Supplement 2E).

Study authors underline the **need for adequate numbers of local staff** to conduct birth and death notification by digital device (*moderate confidence*, Web Supplement 2E). However, health workers' **competing priorities and lack of adequate incentives** may affect the successful adoption of these strategies (*moderate confidence*, Web Supplement 2E). Rigorous **training of health workers** is seen as critical. Approaches used to strengthen local capacity include "cascade training" and other training-of-trainers approaches (*low confidence*, Web Supplement 2E). Adequate and **continuous monitoring** is also considered critical for ensuring quality and timeliness of birth and death data collected via mobile devices. Some study authors suggest that self-reported data may be subject to under- or overreporting (*moderate confidence*, Web Supplement 2E). However, digital systems for birth and death notification may in themselves facilitate provider accountability as these systems can make it possible to track and monitor the quality and productivity of health workers (*low confidence*, Web Supplement 2E).

Inadequate attention is sometimes given to legal frameworks governing civil registration, and governments may need to modify these frameworks to allow the use of mobile devices when notifying births and deaths and to allow new types of health workers to carry out notifications and issue certificates (*low confidence*, Web Supplement 2E). Study authors also argue that strong underlying health and civil registration system **infrastructure**, resources and processes are necessary to achieve the impact of using mobile devices for birth and death notification (*low confidence*, Web Supplement 2E). In addition **to availability of health workers**, study authors also highlight strong political will and support from the national government as a key factor in the successful implementation of birth and death notification via mobile devices (*low confidence*, Web Supplement 2E).

GENDER, EQUITY AND HUMAN RIGHTS FOR BIRTH AND DEATH NOTIFICATION VIA MOBILE DEVICES

Research evidence

While birth and death notification via mobile devices is seen as a way to reach under-registered populations, study authors report inequities in the implementation of this strategy related to availability of supportive infrastructure (network coverage, roads, human resources), demographic factors (age, gender, literacy, poverty), and selective funding priorities of donors (*moderate confidence*, Web Supplement 2E).

Health workers based in **peripheral facilities and rural communities** may find digital interventions particularly helpful because they help overcome geographic barriers to linking to the wider health system.

However, health workers in these settings may also be more likely to experience poor network coverage and access to electricity; may have lower levels of training and technology literacy; and may have fewer resources, including poorer access to smartphones that may be needed for some programmes.



RESOURCES REQUIRED FOR BIRTH AND DEATH NOTIFICATION VIA MOBILE DEVICES

Research evidence

Research evidence on resource use was not identified in the effectiveness studies that were reviewed.

Additional considerations

The following information about the resources required to implement digital birth and death notification is based on an assessment of programme documents and discussions with implementers. All the resources listed below are based on costs to the health system.

The resource use considerations assume the following, which have therefore not been added to the list of cost categories:

- ▶ electricity is available;
- ▶ network connectivity is available; and
- ▶ health workers and civil registrars (including civil registration field officers) are available and remunerated.

Note: To highlight the major cost drivers within the intervention, the cost level is indicated by dollar signs – from \$ denoting lowest cost to \$\$\$\$ denoting highest (a 20-point scale was used).

IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
ONE-TIME START-UP COSTS	Content adaptation (\$)	<ul style="list-style-type: none"> ▶ User-centred design process to define requirements within appropriate context. This includes business process mapping, understanding the intended users, and documenting functional and non-functional requirements.
	Outreach and raising awareness of the intervention (\$\$)	<ul style="list-style-type: none"> ▶ Raising awareness in the community about the intervention and how to make notifications. This may be conducted by outreach through community health workers, pamphlets, billboards, mass messaging. ▶ Campaigns and community outreach programmes directly to communities and key informants.
	Equipment/hardware (\$)	<ul style="list-style-type: none"> ▶ Devices (e.g. mobile phones, tablets, computers) used by key informants for conducting birth notifications. ▶ Set-up of cloud hosting or physical server, which would require physical and virtual security and authentication.
	Initial training (\$)	<ul style="list-style-type: none"> ▶ Development/adaptation of training curriculum and standard operating procedures. This can include materials for training-of-trainers approaches. ▶ Training on standard operating procedures for the recipient of the birth/death notification (i.e. health workers and civil registrar personnel).









IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
RECURRING COSTS	Human resources (\$\$)	<ul style="list-style-type: none"> ▶ Personnel to oversee overall programme. ▶ Personnel for system set-up and user support. ▶ Personnel for partnership building and coordination meetings to align with stakeholders (e.g. ministry of health counterparts, other implementing partners, mobile network operators). ▶ Incentives for reporting birth and death notifications, particularly if relying on community members and key informants for the notification.
	Refresher training and workflow management (\$\$)	<ul style="list-style-type: none"> ▶ Refresher training or continued community outreach to facilitate uptake of notification processes. ▶ Periodic review meetings to discuss feedback on system performance and challenges.
	Communication/data exchanges (\$)	<ul style="list-style-type: none"> ▶ SMS text message/USSD voice call/data transmission charges based on volume of communication content and communication channel. ▶ Short code maintenance fee, which represents a simplified number for clients to use when registering for the service. ▶ Aggregator maintenance fees to enable communication across multiple network carriers.
	Technology maintenance (\$)	<ul style="list-style-type: none"> ▶ Data hosting (e.g. server maintenance or cloud-hosting fees). ▶ Software maintenance, licensing and upgrade fees. ▶ Hardware maintenance, including insurance and replacement of hardware.



IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
ADDITIONAL CONSIDERATIONS FOR INTEGRATION WITH BIRTH /DEATH REGISTRATION SYSTEMS	Content adaptation (\$\$)	<ul style="list-style-type: none"> ▶ Development/adaptation of content and requirements for registration system. For death registration, this may require mapping to processes for death certificates, death surveillance and ICD codes (http://www.who.int/classifications/icd), and requirements for linkages to insurance and social protection mechanisms. ▶ Design of technology architecture to link the notification with the birth registration system or with health record. In the case of death registration, this will require linkages to verbal autopsy systems. ▶ Review and incorporation of policies related to identity management and civil registration, including processes for obtaining unique identifiers.
	Technology adaptation (\$\$)	<ul style="list-style-type: none"> ▶ Software customization of digital system for completing birth registration information, including generation of unique identification. ▶ Embedding of security features, such as authorization for user access control and data encryption to ensure security of data. ▶ Definition of integration or interoperability requirements including data definition and message formats. ▶ Software linkage between birth registration application and health record, ideally using a unique identifier, such as a unique personal ID (e.g. social security number). ▶ User testing among targeted populations to ensure optimal user experience. ▶ Refinement of the intervention in response to feedback from user testing to ensure requirements and context are taken into account.
	Equipment/hardware (\$)	<ul style="list-style-type: none"> ▶ Devices (e.g. mobile phone, tablet, computer) used by health workers and/or civil registrar staff for birth registration.
	Outreach and raising awareness of the intervention (\$)	<ul style="list-style-type: none"> ▶ Additional awareness-raising in the community about the intervention and how to make notifications (e.g. personal contact through community health workers, pamphlets, billboards, outreach from health workers).
	Human resources (\$\$)	<ul style="list-style-type: none"> ▶ Additional personnel to ensure the ongoing maintenance of the integrated system and integration of data.
	Training and workflow management (\$\$\$)	<ul style="list-style-type: none"> ▶ Additional training for personnel interacting with the birth registration software system. ▶ Additional training for supervisory personnel on continuous monitoring of software system. ▶ Additional training for ICT support staff to provide end-user support, troubleshooting, backup and recovery. ▶ Periodic review meetings to discuss feedback on system performance and challenges.
	Communication/data exchanges (\$)	<ul style="list-style-type: none"> ▶ Additional data transmission charges for submitting digital registration forms.



SUMMARY OF JUDGEMENTS FOR BIRTH AND DEATH NOTIFICATION VIA MOBILE DEVICES¹

 BALANCE OF EFFECTS – BIRTH NOTIFICATION	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
 BALANCE OF EFFECTS – DEATH NOTIFICATION	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
 ACCEPTABILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 FEASIBILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 GENDER, EQUITY AND HUMAN RIGHTS	Don't know	Varies	Increased inequities	Probably increased inequities	Probably no impact	Probably reduced inequities	Reduced inequities
 RESOURCES REQUIRED	Don't know	Varies	Large resource requirements	Moderate resource requirements	Negligible resource requirements or savings	Moderate savings	Large savings

¹ Due to a technical problem, the final judgements of the guideline development group (GDG) from the meeting were not saved and the judgements for this specific intervention were therefore reconstructed after the GDG meeting.



1.2 Evidence-to-decision framework for stock notification via mobile devices (see Recommendation 3)

POSITIVE AND NEGATIVE EFFECTS OF STOCK NOTIFICATION VIA MOBILE DEVICES

Research evidence

A systematic review of the global evidence shows the following for stock notification via mobile devices (see Web Supplement 2D for more detail):

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
AVAILABILITY OF COMMODITIES	Uncertain – the certainty of this evidence was assessed as very low	VERY LOW
QUALITY OF DATA/TIMELINESS OF STOCK MANAGEMENT	Uncertain – the certainty of this evidence was assessed as very low	VERY LOW
RESOURCE USE	Uncertain – no studies were identified that reported this outcome	No evidence
UNINTENDED CONSEQUENCES	Uncertain – no studies were identified that reported on this outcome	No evidence

ACCEPTABILITY OF STOCK NOTIFICATION VIA MOBILE DEVICES

Research evidence

Systematic reviews of the global evidence suggest that health workers often see digital health interventions in general as allowing them to offer more tasks and reach more people and work more efficiently (*moderate confidence*, Web Supplement 2M). They also see it as raising their social status (*moderate confidence*, Web Supplement 2M). However, they are concerned that it could increase their workload (*moderate confidence*, Web Supplement 2M) and in some cases may lead to personal expenses (*low confidence*, Web Supplement 2M). Health workers who struggle to use these technologies may view them negatively and be concerned about job security (*high confidence*, Web Supplement 2M).

Access to digital data on stock availability at all levels of the health system may be seen as useful and important by health care officials as it allows them to respond to anticipated stock shortages. However, staff at the district level may be concerned about data becoming available simultaneously at district and national levels, as this takes away their opportunity to contextualize the data or explain shortcomings (*low confidence*, Web Supplement 2D).

FEASIBILITY OF STOCK NOTIFICATION VIA MOBILE DEVICES

Research evidence

Systematic reviews of the global evidence point to several factors regarding the feasibility of digital health interventions in general, including problems with network connectivity, access to electricity, system integration, usability of the device and access to health worker training (*high confidence*, Web Supplement 2M); and concerns about data confidentiality and obtaining informed consent (*moderate confidence*, Web Supplement 2M).

The evidence on digital stock notification specifically highlights similar issues, including **problems uploading and transmitting data** and **loss of data** due to poor network as key barriers to implementation (*moderate confidence*, Web Supplement 2D); and the importance of systems that are **designed with user participation**, have **easy-to-use interfaces**, and are **aligned with the country's existing health information reporting systems** (*moderate confidence*, Web Supplement 2M). Other issues that are referred to include variations in health workers' familiarity with smartphones and **the importance of training** (*moderate confidence*, Web Supplement 2M); the importance of **supportive supervision** (*moderate confidence*, Web Supplement 2M); and the availability of **technical programming expertise**, both for initial development and for ongoing maintenance of the digital system (*low confidence*, Web Supplement 2M).

Even where these issues are addressed, there are concerns that digital stock notification systems cannot mitigate a number of broader health system problems, including an **underlying lack of stock at national or district level**, and a **mismatch between national ordering routines and local needs**. The use of digital systems that allow facility staff to assess stock levels and order new stock from district or national suppliers can potentially lead to a more efficient distribution of existing commodities and help prevent stock-outs. However, if there is no stock at the national or district level, actions taken to replenish stocks at facility level are likely to be pointless, which may again demotivate system users. In cases where stock levels are determined at global rather than national level, national digital systems may be particularly powerless (*low confidence*, Web Supplement 2M).

Where stock is available at district or national level, the evidence points to other health system problems that digital systems alone cannot address. For instance, in one study, authors reported a mismatch between the national medicine ordering system and local needs. Here, health care facility drug orders are made quarterly based on the patterns of the previous quarter. However, this does not account for the seasonality of diseases such as malaria (*low confidence*, Web supplement 2M).



GENDER, EQUITY AND HUMAN RIGHTS IN RELATION TO STOCK NOTIFICATION VIA MOBILE DEVICES

Research evidence

No direct evidence was identified. However, the following could be inferred from the available evidence: health workers based in **peripheral facilities and rural communities** may find digital interventions particularly helpful because they help overcome geographic barriers to linking to the wider health system, including when communicating about stock levels. However, health workers in these settings may also be more likely to experience poor network coverage and access to electricity; may have lower levels of training and technology literacy; and may have fewer resources, including poorer access to smartphones that may be needed for some programmes.

RESOURCES REQUIRED FOR STOCK NOTIFICATION VIA MOBILE DEVICES

Research evidence

Research evidence on resource use was not identified in the effectiveness studies that were reviewed.

Additional considerations

The following information about the resources required to implement digital stock notification is based on an assessment of programme documents and discussions with implementers. All the resources listed below are based on costs to the health system.

The resource use considerations assume the following, which have therefore not been added to the list of cost categories:

- ▶ electricity is available;
- ▶ network connectivity is available;
- ▶ health workers, including dispensaries, are available and remunerated to provide appropriate services; and
- ▶ commodities are available at national or central level.



Note: To highlight the major cost drivers within the intervention, the cost level is indicated by dollar signs – from \$ denoting lowest cost to \$\$\$\$ denoting highest (a 20-point scale was used).






IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
ONE-TIME START-UP COSTS	Content adaptation (\$)	<ul style="list-style-type: none"> ▶ Defining list of commodities to be monitored and mapping their identification codes to global standards. ▶ User-centred design process to define requirements within appropriate context. This includes business process mapping, understanding personas of intended users, and documenting functional and non-functional requirements. ▶ Development/adaptation of dashboards for monitoring data collected by the software system.
	Technology adaptation (\$\$)	<ul style="list-style-type: none"> ▶ Software customization to adapt the stock notification system to the commodities that need to be tracked and thresholds for notifying stock-outs (e.g. commodities for notification, logic of when to trigger a notification). ▶ Dashboards for monitoring the performance of the digital software system and visualizing aggregated data. ▶ User testing among targeted populations to ensure optimal user experience. ▶ Refinement of the intervention in response to feedback from user testing to ensure requirements and context are taken into account.
	Equipment/hardware (\$)	<ul style="list-style-type: none"> ▶ Devices (e.g. mobile phones, tablets) for operating the stock notification software system and used by the health workers tracking commodity levels. ▶ Server/cloud for storing data generated by the software system. This also includes ensuring a locked and air-conditioned physical space for a server. Some contexts may store data in a cloud, in which a physical server may not be required but would incur cloud-hosting fees. ▶ Computers at district and/or national level for monitoring system performance and viewing reporting dashboards.
	Initial training (\$\$\$)	<ul style="list-style-type: none"> ▶ Development/adaptation of training curriculum and standard operating procedures for using the system. ▶ Initial training for health workers interacting with the system. ▶ Training for supervisory staff on standard operating procedures and continuous monitoring.



IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
RECURRING COSTS	Human resources (\$\$\$)	<ul style="list-style-type: none"> ▶ Personnel to oversee overall programme. ▶ Personnel for system set-up and user support (e.g. monitoring stability of software and troubleshooting system failures). ▶ Personnel to monitor data generated by software system and provide feedback, corrective actions, etc. ▶ Personnel for partnership building and coordination meetings to align with stakeholders (e.g. ministry of health counterparts, other implementing partners, mobile network operators).
	Refresher training & workflow integration (\$\$\$)	<ul style="list-style-type: none"> ▶ Refresher training for health workers interacting with the system. ▶ Refresher training for supervisory staff on continuous monitoring and use of data emerging from system. ▶ Periodic review meetings to discuss feedback on system performance and challenges.
	Communication / data exchanges (\$)	<ul style="list-style-type: none"> ▶ Text messaging/SMS/voice call/data transmission charges for submitting data on stock levels.
	Technology maintenance (\$)	<ul style="list-style-type: none"> ▶ Software maintenance and licence fees. ▶ Hardware maintenance, including insurance and replacement of hardware.
ADDITIONAL CONSIDERATIONS FOR INTEGRATION WITH LOGISTICS MANAGEMENT INFORMATION SYSTEM (LMIS)	Technology adaptation (\$\$)	<ul style="list-style-type: none"> ▶ Design of technology architecture to link the notification with the broader LMIS software system. ▶ Software integration with broader LMIS.
	Human resources (\$\$)	<ul style="list-style-type: none"> ▶ Additional personnel to ensure the ongoing maintenance of the integrated system and integration of data. ▶ Personnel to oversee overall programme.
	Training and workflow management (\$\$\$)	<ul style="list-style-type: none"> ▶ Additional training for personnel interacting with the LMIS software system. ▶ Additional training for supervisory personnel on continuous monitoring of the LMIS software system. ▶ Additional training for ICT support staff to provide end-user support, troubleshooting, backup and recovery.



SUMMARY OF JUDGEMENTS FOR STOCK NOTIFICATION VIA MOBILE DEVICES²

 BALANCE OF EFFECTS	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
 ACCEPTABILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 FEASIBILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 GENDER, EQUITY AND HUMAN RIGHTS	Don't know	Varies	Increased inequities	Probably increased inequities	Probably no impact	Probably reduced inequities	Reduced inequities
 RESOURCES REQUIRED	Don't know	Varies	Large resource requirements	Moderate resource requirements	Negligible resource requirements or savings	Moderate savings	Large savings

² Due to a technical problem, the final GDG judgements for this specific intervention were not saved and these judgements were therefore reconstructed after the GDG meeting.



1.3 Evidence-to-decision framework for client-to-provider telemedicine (see Recommendation 4)

POSITIVE AND NEGATIVE EFFECTS OF CLIENT-TO-PROVIDER TELEMEDICINE

Research evidence

A systematic review of the global evidence shows the following (Web Supplement 2H).

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
UTILIZATION OF HEALTH SERVICES	client-to-provider telemedicine may: <ul style="list-style-type: none"> ▶ make little or no difference to the number of hospital admissions among individuals with heart-related conditions or older individuals receiving home care ▶ slightly reduce the number of hospital or clinic visits among individuals with chronic conditions and depression and among women who have given birth 	LOW
	Uncertain of the effect of client-to-provider telemedicine on: <ul style="list-style-type: none"> ▶ length of hospital stay among individuals with heart-related conditions, and ▶ the number of individuals that visit hospitals or clinics, because the certainty of the evidence is very low 	VERY LOW
HEALTH BEHAVIOUR, STATUS AND WELL-BEING	Client to health care provider telemedicine: <ul style="list-style-type: none"> ▶ probably makes little or no difference to diabetes control 	MODERATE
	Client to health care provider telemedicine: <ul style="list-style-type: none"> ▶ may reduce mortality among individuals with heart-related conditions ▶ may improve health-related quality of life, assessed 1–6 months after the intervention, but may make little or no difference to health-related quality of life assessed 6–18 months after the intervention ▶ may increase exclusive breastfeeding among postpartum women 	LOW
	Uncertain of the effect of client-to-provider telemedicine on depressive symptoms among adults with depressive disorders because the certainty of this evidence is very low	VERY LOW



OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
SATISFACTION AND ACCEPTABILITY	Client-to-provider telemedicine: <ul style="list-style-type: none"> ▶ may increase the number of individuals who are satisfied with care among people with chronic conditions and depression 	LOW
	Uncertain of the effect of client-to-provider telemedicine on: <ul style="list-style-type: none"> ▶ client acceptability / satisfaction with the intervention, and ▶ client acceptability / satisfaction with care, because the certainty of the evidence is very low 	VERY LOW
RESOURCE USE	Uncertain – the certainty of the evidence is very low	VERY LOW
UNINTENDED CONSEQUENCES	Client-to-provider telemedicine: <ul style="list-style-type: none"> ▶ may make little or no difference to the number of adverse clinical events 	LOW
	Uncertain of the effect of client-to-provider telemedicine on unintended consequences related to the intervention, as the certainty of this evidence is very low	VERY LOW

Additional considerations

Six of the 31 trials reported inclusion criteria that excluded potentially disadvantaged groups, including clients who did not own a mobile phone, did not speak English or did not have specific health coverage. Four trials reported that clients choosing not to participate or who dropped out were more likely to be older, female, disabled or have a lower educational level. In some of the trials, costs associated with the intervention were also an issue. Two trials specifically recruited low-income women from an ethnic minority group and living in a lower-middle-income group.

ACCEPTABILITY OF CLIENT-TO-PROVIDER TELEMEDICINE

Research evidence

Acceptability to health workers

Systematic reviews of the global evidence suggest that health workers often see digital health interventions in general as allowing them to offer more services and reach more people and work more efficiently (*moderate confidence*, Web Annex M). They also see it as raising their social status (*moderate confidence*, Web Supplement 2M). However, they are concerned that it could increase their workload (*moderate confidence*, Web Supplement 2M) and in some cases may lead to personal expenses (*low confidence*, Web Supplement 2M). Health workers who struggle to use these technologies may view them negatively and be concerned about job security (*high confidence*, Web Supplement 2M).



With regard to client-to-provider telemedicine specifically, the evidence (Web Supplements 2A and 2C) points to the following factors regarding acceptability among health workers: some health workers believe that two-way communication with clients through mobile devices **increases their ability to offer immediate care**, to follow up missing clients and offer informed care, advice and emotional support to clients, even when physical contact is not possible (*high confidence*, Web Supplement 2M).

However, health workers feel that some cases still warrant face-to-face contact (*high confidence*, Web Supplement 2A). Some health workers are also concerned that **loss of face-to-face communication will change the client-health worker relationship** and lead to poorer quality care (*moderate confidence*, Web Supplement 2F). For instance, some may feel that their focus on the mobile device could negatively impact on their interaction with clients, particularly when learning to use the device (*very low confidence*, Web Supplement 2A). Health workers may also find it difficult to communicate or explain information to the client that is provided to them via their mobile device when this information is **beyond their clinical capacity** or when the support needed to follow up on this information is absent (*low confidence*, Web Supplement 2A).

Health workers also have **mixed reactions to being contactable via mobile phone outside of working hours**. While some health workers feel that this is useful in emergency cases, some are ambivalent, and others are more negative and describe the need to set boundaries to protect themselves from being contacted outside of working hours (*moderate confidence*, Web Supplement 2A). Other issues referred to in the evidence include the need to clarify **liability issues** for health workers providing care through telemedicine systems (*low confidence*, Web Supplement 2F).

Acceptability to clients

Systematic reviews of the global evidence (Web Supplements 2A, 2C and 2F) point to the following factors regarding client acceptability of client-to-provider telemedicine.

Clients may **appreciate being able to communicate with health workers from their homes** (*low confidence*, Web Supplement 2F). Some clients may also see telemedicine services as **offering reassurance and a sense of safety** and appreciate the increased access and the consistency and continuity of care that it can offer (*low confidence*, Web Supplement 2F). Some clients may also feel that telemedicine services have increased their **independence and self-care**, although some health workers may be concerned about clients' ability to manage their own conditions (*low confidence*, Web Supplement 2F).

However, some clients may see **face-to-face contact as preferable** (*low confidence*, Web Supplement 2F), and **warmer and more familiar** (*very low confidence*, Web Supplement 2C). Clients believe there should be **little or no charge** tied to digital health programmes, such as joining the programme, downloading apps, and sending and receiving SMS/phone calls (*high confidence*, Web Supplement 2C).



FEASIBILITY OF CLIENT-TO-PROVIDER TELEMEDICINE

Research evidence

Systematic reviews of the global evidence point to a number of factors regarding the feasibility of digital health interventions in general, including problems with network connectivity, access to electricity, system integration, usability of the device and access to health worker training (*high confidence*), and concerns about data confidentiality and obtaining informed consent (moderate confidence, Web Supplement 2M).

GENDER, EQUITY AND HUMAN RIGHTS OF CLIENT-TO-PROVIDER TELEMEDICINE

Research evidence

Systematic reviews of the global evidence (Web Supplements 2A, 2C and 2F) point to the following factors as relevant for client-to-provider telemedicine services.

Positive effects

Telemedicine services can potentially increase access for some groups of clients who have poor access to health services:

- ▶ Telemedicine services can give **clients who speak minority languages** access to health workers who speak this language (*high confidence*, Web Supplement 2F).
- ▶ These services may also save time and money and reduce the burden of travel, particularly for **clients with caring or work responsibilities, clients living far from health care facilities and clients with few funds** (*low confidence*, Web Supplements 2C and 2F).

Negative effects

However, access to telemedicine services can be difficult for other client groups, including **clients with hearing impairments or poor computer literacy** (*high confidence*, Web Supplement 2A).

RESOURCES REQUIRED FOR CLIENT-TO-PROVIDER TELEMEDICINE

Research evidence

Research evidence on resource use was not identified in the effectiveness studies that were reviewed.

Additional considerations

The following information about the resources required to implement client-to-provider telemedicine is based on an assessment of programme documents and discussions with implementers. All the resources listed below are based on costs to the health system.



The resource use considerations assume the following, which have therefore not been added to the list of cost categories:

- ▶ electricity is available;
- ▶ network connectivity is available;
- ▶ physical space/facility is available for conducting the telemedicine consultations; and
- ▶ clients have access to mobile devices for contacting health workers, thus the health system is not required to procure new devices.

Note: To highlight the major cost drivers within the intervention, the cost level is indicated by dollar signs – from \$ denoting lowest cost to \$\$\$\$ denoting highest (a 20-point scale was used).






IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
ONE-TIME START-UP COSTS	Content adaptation	N/A (see first bullet under “Initial training” below)
	Outreach and raising awareness of the intervention (\$\$)	<ul style="list-style-type: none"> ▶ Development of materials on how to access this intervention (e.g. pamphlets and billboard with the number to dial). ▶ Raising awareness among clients about the intervention (e.g. messages sent to phone bank of numbers to communicate availability of the telemedicine service).
	Initial training (\$)	<ul style="list-style-type: none"> ▶ Development/adaptation of training protocols and standard operating procedures, including call intake, obtaining consent and referral processes. ▶ Initial training to health workers on how to use the telemedicine system.
	Equipment/hardware (\$)	<ul style="list-style-type: none"> ▶ Computer with dedicated software system for audio and/or video connections for health workers to conduct the consultation. ▶ Audio/videoconferencing equipment – this may include headsets and trunk lines, which are central lines that can direct voice calls/images/video to multiple lines and across different network operators.
	Technology adaptation (\$)	<ul style="list-style-type: none"> ▶ Software customization for communication and exchanging health content. The customization is based on the modalities/communication channels to be used for videoconferencing, transmission of data or images, setting up phone lines for voice calls, etc. ▶ Security features such as user-authentication schemes when recording callers’ demographic and health information.



IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
RECURRING COSTS	Human resources (\$\$)	<ul style="list-style-type: none"> ▶ Personnel to oversee overall programme. ▶ Clerical staff to answer and triage incoming calls. This may not be necessary if clinical staff can also do the call intake. ▶ Clinical staff to provide consultations or refer to a specialist if needed. This may be particularly expensive if the service needs to be available around the clock. ▶ Access to specialists, in cases requiring expertise that is not currently available among clinical staff (e.g. dermatology, radiology). ▶ Personnel for routine monitoring of system performance, including tracking of dropped calls and use of the service. ▶ Personnel for system set-up and user support. ▶ Personnel for partnership building and coordination meetings to align with stakeholders (e.g. ministry of health counterparts, other implementing partners, mobile network operators).
	Refresher training (\$)	<ul style="list-style-type: none"> ▶ Refresher training and continuous support to health workers on how to use the telemedicine system. ▶ Periodic review meetings to discuss system performance and workflow integration.
	Communication/ data exchanges (\$\$)	<ul style="list-style-type: none"> ▶ Airtime and/or transmission of data files, depending on the volume and modality of the client-to-provider communication. Modalities/ communication channels may include videoconferencing, transmission of data or images, web-based platforms, voice calls, interactive voice response (IVR). The caller may incur these costs unless there are provisions for the service to be "toll-free" and enable costs to be absorbed by the organization/facility providing the remote consultation. ▶ Support line for client experiences and feedback.
	Technology maintenance (\$)	<ul style="list-style-type: none"> ▶ Software maintenance and licence fees. ▶ Hardware maintenance, including insurance and replacement of hardware.



SUMMARY OF JUDGEMENTS FOR CLIENT-TO-PROVIDER TELEMEDICINE

 BALANCE OF EFFECTS	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
 ACCEPTABILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 FEASIBILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 GENDER, EQUITY AND HUMAN RIGHTS	Don't know	Varies	Increased inequities	Probably increased inequities	Probably no impact	Probably reduced inequities	Reduced inequities
 RESOURCES REQUIRED	Don't know	Varies	Large resource requirements	Moderate resource requirements	Negligible resource requirements or savings	Moderate savings	Large savings



1.4 Evidence-to-decision framework for provider-to-provider telemedicine (see Recommendation 5)

POSITIVE AND NEGATIVE EFFECTS OF PROVIDER-TO-PROVIDER TELEMEDICINE

Research evidence

A systematic review of the global evidence shows the following (see Web supplement 2I).

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
PROVIDER PERFORMANCE	Provider-to-provider telemedicine may: <ul style="list-style-type: none"> ▶ increase the number of individuals receiving clinical exams for diabetes eye management and the number of individuals presenting with symptoms requiring an ultrasound who had a successful follow-up appointment ▶ reduce time between clients presenting with a health issue and appropriate management or follow-up 	LOW
UTILIZATION OF HEALTH SERVICES	Provider-to-provider telemedicine may: <ul style="list-style-type: none"> ▶ have little or no effect on hospitalizations among older individuals treated with home enteral nutrition ▶ reduce length of stay among individuals visiting the emergency department 	LOW
	Uncertain of the effect of provider-to-provider telemedicine on: <ul style="list-style-type: none"> ▶ on the number of outpatient consultations among individuals living with diabetes, and ▶ the number of referrals to dermatologists among individuals presenting with skin-related symptoms or conditions, because the certainty of the evidence is very low	VERY LOW
HEALTH BEHAVIOUR, STATUS AND WELL-BEING	Provider-to-provider telemedicine may: <ul style="list-style-type: none"> ▶ lead to a small to moderate reduction in mortality among people living with HIV or diabetes. However, the range in which the actual effect may be indicates that the intervention may reduce or increase mortality ▶ lead to little or no difference in clinical improvement among individuals with skin conditions 	LOW
	Uncertain of the effect of provider-to-provider telemedicine on health-related quality of life because the certainty of this evidence is very low	VERY LOW



OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
SATISFACTION AND ACCEPTABILITY	Provider-to-provider telemedicine may: <ul style="list-style-type: none"> ▶ make little or no difference to satisfaction with care among individuals with diabetes or skin conditions 	LOW
	Uncertain of the effect of provider-to-provider telemedicine on acceptability/satisfaction among health workers because the certainty of the evidence is very low	VERY LOW
RESOURCE USE	Uncertain – the certainty of the evidence is very low	VERY LOW
UNINTENDED CONSEQUENCES	Uncertain – the certainty of the evidence is very low	VERY LOW

ACCEPTABILITY OF PROVIDER-TO-PROVIDER TELEMEDICINE

Research evidence

Systematic reviews of the global evidence suggest that health workers often see digital health interventions in general as allowing them to offer more tasks and reach more people and work more efficiently (*moderate confidence*, Web Supplement 2M). They also see it as raising their social status (*moderate confidence*, Web Supplement 2M). However, they are concerned that it could increase their workload (*moderate confidence*, Web Supplement 2M) and in some cases may lead to personal expenses (*low confidence*, Web Supplement 2M). Health workers who struggle to use these technologies may view them negatively and be concerned about job security (*high confidence*, Web Supplement 2M).

With regard to provider-to-provider telemedicine specifically, the evidence (Web Supplements 2A and 2F) points to the following factors regarding acceptability among health workers.

Health workers often appreciate the opportunity to communicate with other health workers through digital services (*moderate confidence*, Web Supplement 2F). This direct contact can reduce professional isolation (*moderate confidence*, Web Supplement 2F), break down hierarchies and improve relationships between health worker cadres (*moderate confidence*, Web Supplement 2A). Lower-level health workers in particular are likely to appreciate how telemedicine services allow them to access advice from higher-level health workers, which they see as improving the quality of care, health outcomes and client satisfaction (*moderate confidence*, Web Supplement 2A).

While some health workers may perceive provider-to-provider telemedicine as supportive, other health workers may not have the same experience, particularly when those assigned to offer clinical support are not responsive or when they respond in anger (*low confidence*, Web Supplement 2A). Some health workers may also feel the need for face-to-face meetings (*low confidence*, Web Supplement 2A). For some health workers, collaboration can be challenging or cause resistance because of a lack of trust, loss of control and power conflicts, disagreements



about roles, and cultural and linguistic differences (*moderate confidence*, Web Supplement 2F). Other issues referred to in the evidence include the need to clarify liability issues for health workers providing care through telemedicine systems (*low confidence*, Web Supplement 2F).

FEASIBILITY OF PROVIDER-TO-PROVIDER TELEMEDICINE

Research evidence

Systematic reviews of the global evidence point to a number of factors regarding the feasibility of digital health interventions in general, including problems with network connectivity, access to electricity, system integration, usability of the device and access to health worker training (*high confidence*), and concerns about data confidentiality and obtaining informed consent (*moderate confidence*, Web supplement 2M: Cross-cutting acceptability and feasibility issues).

GENDER, EQUITY AND HUMAN RIGHTS FOR PROVIDER-TO-PROVIDER TELEMEDICINE

Research evidence

Systematic reviews of the global evidence (Web Supplements 2A, 2C and 2F) point to the following factors as relevant for provider-to-provider telemedicine services.

Telemedicine services have the potential to increase access for clients who may have poor access to health services:

- ▶ Some health workers may see their own access to digital devices as particularly **beneficial to clients who are too poor to have such devices** as this enables them to access higher-level care on behalf of these clients (*very low confidence*, Web Supplement 2A).
- ▶ These services may also save time and money (*low confidence*, Web Supplement 2F) and reduce the burden of travel (*low confidence*, Web Supplement 2C), particularly for **clients with caring or work responsibilities, clients living far from health care facilities and clients with few funds**.

However, **poor access to mobile devices or personal expenses** associated with their use may exclude some health workers, and thereby their clients, from these services. In the review of effectiveness of provider-to-provider telemedicine (Web Supplement 2I), health workers in one trial were excluded from participating if they did not own a smartphone with the secure messaging service, while authors of another trial noted that the costs of the intervention could have been a limiting factor for health workers, as the monthly stipend given for mobile-phone credits was not always enough.



RESOURCES REQUIRED FOR PROVIDER-TO-PROVIDER TELEMEDICINE

Research evidence

Research evidence on resource use was not identified in the effectiveness studies that were reviewed.

Additional considerations

The following information about the resources required to implement provider-to-provider telemedicine is based on an assessment of programme documents and discussions with implementers. All the resources listed below are based on costs to the health system.

The resource use considerations assume the following, which have therefore not been added to the list of cost categories:

- ▶ electricity is available
- ▶ network connectivity is available
- ▶ physical space/facility is available for conducting the telemedicine consultations
- ▶ health workers are available and remunerated to provide the appropriate health services.








Note: To highlight the major cost drivers within the intervention, the cost level is indicated by dollar signs – from \$ denoting lowest cost to \$\$\$\$ denoting highest (a 20-point scale was used).

IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
ONE-TIME START-UP COSTS	Content adaptation	N/A (see first bullet under "Initial training" below).
	Outreach and raising awareness of the intervention (\$)	<ul style="list-style-type: none"> ▶ Raising awareness among health workers about the service.
	Equipment / hardware (\$)	<ul style="list-style-type: none"> ▶ Computer with dedicated software system for audio and/or video connections for health workers to conduct the consultation. ▶ Audio/videoconferencing equipment. This may include headsets and trunk lines, which are central lines that can direct voice calls/images/video to multiple lines and across different network operators). ▶ Database to log all incoming calls, audio, images. ▶ Server/cloud for storage of recorded calls, audio, images. This also includes ensuring a locked and air-conditioned physical space for the server. Some contexts may store data on the "cloud", for which cloud-hosting fees would be required.
	Technology adaptation (\$)	<ul style="list-style-type: none"> ▶ Software customization for communication and exchanging health content. The customization may be based on the modalities/communication channels to be used for videoconferencing, transmission of data or images, voice calls. ▶ Security features such as user-authentication schemes when relaying client's health information. ▶ User testing among health workers to ensure optimal user experience and alignment with workflows. ▶ Refinement in response to feedback from user testing to ensure requirements and context are taken in account.
	Initial training (\$)	<ul style="list-style-type: none"> ▶ Development/adaptation of training protocols and standard operating procedures, including referral processes. ▶ Initial training of health workers on how to use the telemedicine system.



IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
RECURRING COSTS	Human resources (\$\$\$)	<ul style="list-style-type: none"> ▶ Personnel to oversee overall programme. ▶ Health worker seeking assistance with clinical case. This may be particularly expensive if the service needs to be available around the clock. ▶ Referral health workers/specialists (e.g. dermatology, radiology) providing the consultations. ▶ Personnel for system set-up and user support. ▶ Personnel for partnership building and coordination meetings to align with stakeholders (e.g. ministry of health counterparts, other implementing partners, mobile network operators).
	Refresher training (\$)	<ul style="list-style-type: none"> ▶ Refresher training to health workers on how to use the telemedicine system. ▶ Periodic review meetings to discuss system performance and workflow integration.
	Communication/ data exchanges (\$\$)	<ul style="list-style-type: none"> ▶ Airtime and/or transmission of data files, depending on the volume and modality of the provider-to-provider communication.
	Technology maintenance (\$)	<ul style="list-style-type: none"> ▶ Software maintenance, updates and licence fees. ▶ Hardware maintenance, including insurance and replacement of hardware.

SUMMARY OF JUDGEMENTS FOR PROVIDER-TO-PROVIDER TELEMEDICINE

 BALANCE OF EFFECTS	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
 ACCEPTABILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 FEASIBILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 GENDER, EQUITY AND HUMAN RIGHTS	Don't know	Varies	Increased inequities	Probably increased inequities	Probably no impact	Probably reduced inequities	Reduced inequities
 RESOURCES REQUIRED	Don't know	Varies	Large resource requirements	Moderate resource requirements	Negligible resource requirements or savings	Moderate savings	Large savings



1.5 Evidence-to-decision framework for targeted client communication via mobile devices for SRMNCAH (see Recommendation 6)

POSITIVE AND NEGATIVE EFFECTS OF TARGETED CLIENT COMMUNICATION VIA MOBILE DEVICES

Research evidence

A systematic review of the global evidence shows the following ([Web Supplement 2G](#)).

The summary of findings tables below are available for comparisons listed in the literature as “standard practice”, as well as studies that explicitly stated a comparison of a non-digital mechanism for targeted communication (for example pamphlets). For some population groups (adolescents, adults and parents of children aged under 5 years), studies reported a variety of comparison groups that could be interpreted as standard practice.

PART 1. Targeted client communication (TCC) for adolescent sexual and reproductive health (SRH)

Two summaries of findings are available to account for two comparison groups (standard care and non-digital TCC).

DIGITAL, TARGETED CLIENT COMMUNICATION FOR ADOLESCENT SRH COMPARED WITH STANDARD CARE

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
UTILIZATION OF HEALTH SERVICES	Uncertain of the effect of targeted client communication (TCC) on clinic attendance for STI/HIV testing among adolescents because the certainty of the evidence is very low	VERY LOW
	Uncertain of the effect of TCC on the timeliness of information and services for adolescents because no direct evidence was identified	No evidence
HEALTH BEHAVIOUR, STATUS AND WELL-BEING	TCC: <ul style="list-style-type: none"> may increase oral contraception use at 6 months among adolescents (<i>low certainty</i>) 	LOW
	Uncertain of the effect of TCC for adolescents on: <ul style="list-style-type: none"> condom use, adherence to antiretroviral medication, and HIV treatment success (assessed using viral load suppression) because the certainty of the evidence is very low	VERY LOW
ACCEPTABILITY/ SATISFACTION	Uncertain – the certainty of the evidence is very low	VERY LOW



OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
KNOWLEDGE AND ATTITUDES	Uncertain – the certainty of the evidence is very low	VERY LOW
RESOURCE USE	Uncertain – no direct evidence was identified	No evidence
UNINTENDED CONSEQUENCES	Uncertain – no direct evidence was identified	No evidence

DIGITAL, TARGETED CLIENT COMMUNICATION FOR ADOLESCENT SRH COMPARED WITH NON-DIGITAL, TARGETED COMMUNICATION

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
UTILIZATION OF HEALTH SERVICES	Uncertain of the effect of targeted client communication (TCC) on whether adolescents accessed contraceptive services or care for STIs because the certainty of the evidence is very low	VERY LOW
	Uncertain of the effect of TCC on the timeliness of information and services for adolescents because no direct evidence was identified	No evidence
HEALTH BEHAVIOUR, STATUS AND WELL-BEING	Uncertain of the effect of TCC for adolescents on: <ul style="list-style-type: none"> ▶ condom use in the past 3 months, ▶ contraceptive use in the past 3 months, and ▶ number of pregnancies, because the certainty of the evidence is very low	VERY LOW
ACCEPTABILITY/ SATISFACTION	Uncertain – no direct evidence was identified	No evidence
KNOWLEDGE AND ATTITUDES	Uncertain – the certainty of the evidence is very low	VERY LOW
RESOURCE USE	Uncertain – the certainty of the evidence is very low	VERY LOW
UNINTENDED CONSEQUENCES	Uncertain – no direct evidence was identified	No evidence

Additional considerations

- ▶ Eleven of the 12 trials were conducted in high-income countries. Several of these trials focused on populations known to be vulnerable to poor sexual health outcomes. Eight of the trials recruited participants among young people already accessing health care services. This recruitment strategy could arguably miss important and potentially particularly disadvantaged segments of the population who are unable to access health care services.
- ▶ Two trials that were excluded from this review but which evaluated closely related interventions showed that women who received digital TCC on contraception may experience more physical violence. However, the range in which the actual effect may be indicates that the intervention may reduce or increase the number of women who experience physical violence.



PART 2. Targeted client communication (TCC) for adult SRH

Two summaries of findings are available to account for two comparison groups (standard care and non-digital targeted communication).

DIGITAL, TARGETED CLIENT COMMUNICATION FOR ADULT SRH COMPARED WITH STANDARD CARE

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
UTILIZATION OF HEALTH SERVICES	Targeted client communication (TCC): <ul style="list-style-type: none"> probably slightly increases clinic attendance following self-management of medical abortion. However, the range in which the actual effect may be indicates both little or no effect and a slight increase the number of women attending post-abortion care 	MODERATE
	TCC: <ul style="list-style-type: none"> may make little or no difference to the timeliness of men returning for postoperative visits following voluntary male medical circumcision 	LOW
	Uncertain of the effect of TCC on clinic attendance for: <ul style="list-style-type: none"> testing for sexually transmitted infections and/or HIV HIV treatment because the certainty of the evidence is very low	VERY LOW
HEALTH BEHAVIOUR, STATUS AND WELL-BEING	TCC: <ul style="list-style-type: none"> may increase modern contraception use among women at 4 and 12 months may increase adult antiretroviral adherence at 12 months may make little or no difference to health status among individuals living with HIV and AIDS, as assessed by CD4 count 	LOW
	Uncertain of the effect of TCC on: <ul style="list-style-type: none"> condom use, HIV treatment success (assessed using viral load suppression), physical well-being among people living with HIV and AIDS, and the number of repeat abortions among women who have had an abortion within the last 12 months, because the certainty of the evidence is very low	VERY LOW
ACCEPTABILITY/ SATISFACTION	Uncertain of the effect of targeted client communication on clients' acceptance and satisfaction with the intervention because the certainty of the evidence is very low	VERY LOW
RESOURCE USE	Uncertain of the effect of TCC on resource use because the certainty of the evidence is very low	VERY LOW



OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
UNINTENDED CONSEQUENCES	TCC: <ul style="list-style-type: none"> ▶ may increase the number of women who experience physical violence 	LOW
	Uncertain of the effect of TCC on other unintended consequences because the certainty of the evidence is very low	VERY LOW

DIGITAL, TARGETED CLIENT COMMUNICATION FOR ADULT SRH COMPARED WITH NON-DIGITAL, TARGETED COMMUNICATION

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
UTILIZATION OF HEALTH SERVICES	Uncertain of the effect of targeted client communication (TCC) on clinic attendance for: <ul style="list-style-type: none"> ▶ vaccination among adolescents and adults, and ▶ breast cancer and cervical screening, because the certainty of the evidence is very low	VERY LOW
HEALTH BEHAVIOUR, STATUS AND WELL-BEING	Uncertain – no direct evidence was identified	No evidence
ACCEPTABILITY/ SATISFACTION	Uncertain of the effect of TCC on clients' acceptance and satisfaction with the intervention because the certainty of the evidence is very low	VERY LOW
RESOURCE USE	Digital TCC: <ul style="list-style-type: none"> ▶ may use fewer resources than non-digital, targeted client communication 	LOW
UNINTENDED CONSEQUENCES	Uncertain – no direct evidence was identified	No evidence

Additional considerations

- ▶ The 27 trials were conducted in a range of low- to high-income countries. In two trials, people were excluded for participation because they were illiterate, had no phone or both. Furthermore, only one trial specifically stated that they provided mobile phones to participants, making it likely that the other trials excluded those who did not own a mobile phone. Authors of two trials suggested that participants had more education, higher levels of employment and/or were wealthier than the general population.
- ▶ The evidence from forthcoming trials on TCC also suggests the intervention has some unintended negative consequences, such as women experiencing physical violence in the context of receiving targeted communications for SRH services.



PART 3. Targeted client communication (TCC) for pregnant women and postpartum women

DIGITAL, TARGETED CLIENT COMMUNICATION FOR PREGNANT AND POSTPARTUM WOMEN COMPARED WITH STANDARD CARE

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
UTILIZATION OF HEALTH SERVICES	<p>Targeted client communication:</p> <ul style="list-style-type: none"> ▶ probably increases the number of women attending more than four antenatal care appointments ▶ probably increases the number of women receiving skilled birth attendance in settings where many women do not use a skilled birth attendant, but probably makes little or no difference in settings where most women use a skilled birth attendant 	MODERATE
	<p>Uncertain of the effect of TCC among pregnant and postpartum women on:</p> <ul style="list-style-type: none"> ▶ women’s attendance for antenatal influenza vaccination, and ▶ women’s attendance for check-up of their neonates, because the certainty of the evidence is very low 	VERY LOW
	<p>Uncertain of the effect of TCC among pregnant and postpartum women on:</p> <ul style="list-style-type: none"> ▶ the timeliness of information and services for pregnant and postpartum women, because no direct evidence was identified 	No evidence
HEALTH BEHAVIOUR, STATUS AND WELL-BEING	<p>TCC:</p> <ul style="list-style-type: none"> ▶ probably increases the number of women taking iron and folate tablets 	MODERATE
	<p>TCC:</p> <ul style="list-style-type: none"> ▶ may make little or no difference to the number of pregnant women who do not smoke or consume alcohol during pregnancy ▶ may reduce neonatal mortality 	LOW
	<p>Uncertain of the effect of TCC among pregnant and postpartum women on:</p> <ul style="list-style-type: none"> ▶ women’s mortality, ▶ neonatal diarrhoea, and ▶ exclusive breastfeeding up to 3 months, because the certainty of the evidence is very low 	VERY LOW



OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
ACCEPTABILITY/ SATISFACTION	Uncertain of the effect of TCC on acceptance and satisfaction among pregnant and postpartum women because the certainty of the evidence is very low	VERY LOW
RESOURCE USE	Uncertain of the effect of TCC among pregnant and postpartum women on resource use because no direct evidence was identified	No evidence
UNINTENDED CONSEQUENCES	Uncertain of the effect of TCC among pregnant and postpartum women on unintended consequences because no direct evidence was identified	No evidence

Additional considerations

- ▶ The three trials concerned with breastfeeding were conducted in lower-middle- and upper-middle-income countries, two of which specifically highlighted their inclusion of low-income participants. The two trials concerned with smoking and alcohol consumption were conducted in high-income countries. The two trials concerned with antenatal influenza vaccination were also from high-income countries; one primarily included unmarried participants with low levels of education, while the other trial mostly included married or partnered women with higher levels of education (despite these apparent socioeconomic differences, the finding of no benefit was demonstrated across both studies).
- ▶ More than half of the 11 trials applied a language-based criterion in their inclusion/exclusion criteria. Given the nature of the intervention, it is likely that those trials not explicitly stating a language-based criterion will also have excluded those lacking fluency in a particular language. This raises the issue of exclusion of illiterate populations and recent migrants, who are known to be a particularly vulnerable population, but are unable to provide consent to take part in studies which rely on phone-based communications in a specific language.



PART 4. Targeted client communication (TCC) for pregnant and postpartum women living with HIV

DIGITAL, TARGETED CLIENT COMMUNICATION FOR PREGNANT AND POSTPARTUM WOMEN LIVING WITH HIV COMPARED WITH STANDARD CARE

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
UTILIZATION OF HEALTH SERVICES	<p>Targeted client communication (TCC):</p> <ul style="list-style-type: none"> ▶ may reduce the number of women living with HIV that give birth in a health care facility. However, the range in which the actual effect may be indicates that the intervention may reduce or may have little or no effect on the number of women giving birth in a health care facility ▶ may increase the number of women living with HIV who attend postpartum care appointments 	LOW
	<p>Uncertain of the effect of TCC on the timeliness of information and services for pregnant and postpartum women living with HIV because no direct evidence was identified</p>	No evidence
HEALTH BEHAVIOUR, STATUS AND WELL-BEING	<p>TCC:</p> <ul style="list-style-type: none"> ▶ probably makes little or no difference to the number of pregnant women adhering to prenatal antiretroviral medication 	MODERATE
	<p>TCC:</p> <ul style="list-style-type: none"> ▶ may reduce the number of women adhering to postnatal antiretroviral medication (<i>low certainty</i>). However, the range in which the actual effect may be indicates that the intervention may reduce or increase adherence ▶ may make little or no difference to the number of infants who receive an HIV test (<i>low certainty</i>) ▶ may lead to little or no difference to uptake of or adherence to antiretroviral prophylaxis medication among infants (<i>low certainty</i>) 	LOW
	<p>Uncertain of the effect of TCC among pregnant and postpartum women living with HIV on:</p> <ul style="list-style-type: none"> ▶ neonatal mortality, and ▶ the number of infants who test positive for HIV, <p>because the certainty of the evidence is very low</p>	VERY LOW
	<p>Uncertain of the effect of TCC among pregnant and postpartum women living with HIV on maternal mortality because no direct evidence was identified</p>	No evidence



OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
ACCEPTABILITY/ SATISFACTION	Uncertain of the effect of TCC on acceptance and satisfaction among pregnant and postpartum women living with HIV because no direct evidence was identified	No evidence
RESOURCE USE	Uncertain of the effect of TCC among pregnant and postpartum women living with HIV on resource use because no direct evidence was identified	No evidence
UNINTENDED CONSEQUENCES	Uncertain of the effect of TCC among pregnant and postpartum women living with HIV on unintended consequences because no direct evidence was identified	No evidence

Additional considerations

All three trials were conducted in a lower-middle-income country. One study specifically stated that it excluded women without a phone, who did not receive antenatal care, and who could not read or did not have someone to read for them, making it highly likely that particularly vulnerable women were unable to take part in this trial. The other two studies provided little information on exclusion criteria. However, all trials recruited from health care facilities, meaning that pregnant women living with HIV who were not accessing care will not have had the opportunity for inclusion.



PART 5. Targeted client communication (TCC) for parents and caregivers of children under 5 years of age

Two summaries of findings are available to account for two comparison groups (standard care and non-digital targeted communication).

DIGITAL, TARGETED CLIENT COMMUNICATION FOR PARENTS AND CAREGIVERS OF CHILDREN UNDER 5 YEARS OF AGE COMPARED WITH STANDARD CARE

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
UTILIZATION OF HEALTH SERVICES	<p>Targeted client communication (TCC):</p> <ul style="list-style-type: none"> ▶ probably increases the number of children receiving vaccinations at 2 months and may increase the number of children receiving vaccinations at 6 months ▶ probably increases the number of children receiving vaccines within a certain time period ▶ probably increases the number of children living with HIV and exposed to HIV who attend HIV medical appointments 	MODERATE
	<p>Uncertain of the effect of TCC among parents of children under 5 years on:</p> <ul style="list-style-type: none"> ▶ the number of children receiving vaccinations at 12 months, ▶ early intervention for developmental delay, and ▶ the number of infants that do not attend emergency room in the first 6 months, <p>because the certainty of the evidence is very low</p>	VERY LOW
HEALTH BEHAVIOUR, STATUS AND WELL-BEING	<p>Uncertain of the effect of TCC among parents of children under 5 years on child mortality because no direct evidence was identified</p>	No evidence
ACCEPTABILITY/ SATISFACTION	<p>Uncertain of the effect of TCC on acceptance and satisfaction among parents of children under 5 years because the certainty of the evidence is very low</p>	VERY LOW
RESOURCE USE	<p>Uncertain of the effect of TCC among parents of children under 5 years on resource use because the certainty of the evidence is very low</p>	VERY LOW
UNINTENDED CONSEQUENCES	<p>Uncertain of the effect of TCC among parents of children under 5 years on unintended consequences because no direct evidence was identified</p>	No evidence



DIGITAL, TARGETED CLIENT COMMUNICATION FOR PARENTS AND CAREGIVERS OF CHILDREN UNDER FIVE YEARS OF AGE COMPARED WITH NON-DIGITAL, TARGETED CLIENT COMMUNICATION

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
UTILIZATION OF HEALTH SERVICES	Uncertain of the effect of TCC among parents of children under 5 years on use of health services because no direct evidence was identified	No evidence
HEALTH BEHAVIOUR, STATUS AND WELL-BEING	TCC: <ul style="list-style-type: none"> ▶ may make little or no difference to oral health among children under 5 years 	LOW
	Uncertain of the effect of TCC among parents of children under 5 years on child mortality because no direct evidence was identified	No evidence
ACCEPTABILITY/ SATISFACTION	Uncertain of the effect of TCC on acceptance and satisfaction among parents of children under 5 years because no direct evidence was identified	No evidence
RESOURCE USE	Uncertain of the effect of TCC among parents of children under 5 years on resource use because no direct evidence was identified	No evidence
UNINTENDED CONSEQUENCES	Uncertain of the effect of TCC among parents of children under 5 years on unintended consequences because no direct evidence was identified	No evidence

Additional considerations

- ▶ The 14 trials targeting childhood immunizations were conducted in a range of high-, lower-middle- and low-income countries. Four studies specifically included low-income families or recruited from population groups identified as low-income and/or with high unemployment rates.
- ▶ One study, though not explicitly stating whether particular populations were excluded, incorporated strategies to accommodate users with low health literacy. These included plain language, visual reinforcement of key ideas, bullet points to summarize key information and providing specific action steps.



ACCEPTABILITY OF TARGETED CLIENT COMMUNICATION VIA MOBILE DEVICES

Research evidence

Systematic reviews of the global evidence (Web supplement 2C) point to the following factors that are relevant to the acceptability of *digital targeted client communication (TCC) specifically*:

Acceptability to clients

Some clients describe digital targeted client communication programmes as providing them with support and connectedness. The fact that someone is taking the time to send them messages can make clients feel like someone is interested in their situation, invested in their well-being and cares about them. Some clients describe this as leading to feelings of encouragement, increased self-confidence and self-worth, and describe the messages as providing support, guidance and information, giving a sense of direction, reassurance and motivation. Some clients also feel that the sense of caring and support that they receive from health workers through these types of programmes has a positive influence on their relationship with their health worker (*moderate confidence*, Web Supplement 2C). Clients also describe sharing messages with friends, family and community members (*moderate confidence*, Web Supplement 2C).

However, clients who are dealing with health conditions that are often stigmatized or very personal (e.g. HIV, family planning and abortion care) worry that their confidential health information will be disclosed or their identity traced due to their participation in these types of programmes; and their perceptions of different delivery channels is influenced by how confidential they feel these are (*high confidence*, Web Supplement 2C).

Some clients may feel that participating in a digital TCC programme has influenced their behaviour while others may not. Reasons that they give for potentially altering their behaviour included receiving new knowledge; receiving specific strategies for instance how to initiate discussion with a partner or health worker; being motivated or reassured by the programme; and being reminded for example to take medication or make an appointment. Some clients who believe that the intervention does not have any influence on their behaviour may find the programmes to not be relevant to their situation (*low confidence*, Web supplement 2C).



Clients' perceptions and experiences of digital TCC are influenced by characteristics of the content; the format; and the delivery mechanisms. For instance, clients want varied information that provides new knowledge and reminders, as well as explanations, solutions and suggestions about health issues (*moderate confidence*, Web Supplement 2C), and may also like elements that ask them for a response, such as quizzes or nutrition calculators (*low confidence*, Web Supplement 2C). Clients may also prefer short, concise, personalized, clear and direct messages (*low confidence*, Web Supplement 2C); and messages that are motivational, friendly and encouraging rather than messages that make them feel pressured, lectured or frightened (*low confidence*, Web Supplement 2C). Clients' acceptance is also influenced by their perceptions of the sender (*moderate confidence*, Web Supplement 2C). In addition, clients have preferences about how often messages are sent, the time of day, and the duration of programmes (*moderate confidence*, Web Supplement 2C); as well as preferences for different delivery channels (*moderate confidence*, Web Supplement 2C). Clients believe there should be little or no charge tied to these messages (*high confidence*, Web Supplement 2C).

Acceptability to health workers

Health workers may regard interventions such as digital TCC programmes as impacting positively on clients' health behaviours, including improving their adherence to treatment (*low confidence*, Web Supplement 2C).

FEASIBILITY OF TARGETED CLIENT COMMUNICATION VIA MOBILE DEVICES

Research evidence

Systematic reviews of the global evidence point to a number of factors regarding the feasibility of digital health interventions in general, including problems with network connectivity, access to electricity, system integration and usability of the device (*high confidence*, Web Supplement 2M); and concerns about data confidentiality and obtaining informed consent (*moderate confidence*, Web supplement 2M).

With regard to digital targeted client communication specifically, health workers may experience challenges when attempting to communicate with clients via mobile device. These include clients who regularly change their phone numbers without informing the health worker or clients who have poor access to phones (*low confidence*, Web Supplement 2A).



GENDER, EQUITY, AND HUMAN RIGHTS OF TARGETED CLIENT COMMUNICATION VIA MOBILE DEVICES

Research evidence

Systematic reviews of the global evidence (Web Supplements 2A, 2C and 2F) suggest that access to health care services via digital devices may be particularly helpful to clients **with caring or work responsibilities, clients who live far from health facilities and clients with few funds** (*low confidence*, Web Supplements 2C and 2F).

However, access to and use of TCC services may be particularly difficult for certain groups of clients. These include:

- ▶ Clients with **poor access to network** services or **poor access to electricity** with which to charge their phones (*high confidence*, Web supplement 2C).
- ▶ Clients with **poor access to mobile phones**, for instance because they have no phone, access to their phone is controlled by others, they have lost or broken their phone, cannot afford airtime or have changed their number (*moderate confidence*, Web Supplements 2A and 2C). For people, particularly **women and adolescents**, who have to share or borrow a phone or who have their access to phones controlled by another person, it can be difficult to receive messages or to keep messages and conversations private (*moderate confidence*, Web Supplement 2).
- ▶ Clients who speak **minority languages** or who have **low literacy skills or low digital literacy skills** (*moderate confidence*, Web Supplement 2C).
- ▶ Clients dealing with **stigmatized health conditions**: People with these conditions may be particularly concerned about the confidentiality of digital health devices (*high confidence*, Web Supplement 2C).

RESOURCES REQUIRED FOR TARGETED CLIENT COMMUNICATION

Research evidence

Research evidence on resource use was not identified in the effectiveness studies that were reviewed.

Additional considerations

The following information about the resources required to implement TCC is based on an assessment of programme documents and discussions with implementers. All the resources listed below are based on costs to the health system.



The resource use considerations assume the following and therefore have not been added to the list of cost categories:

- ▶ Electricity is available;
- ▶ Network connectivity is available;
- ▶ Clients have access to mobile devices, thus the health system is not required to procure new devices;
- ▶ Health services referenced in the TCC (e.g. antenatal care, contraception, STI/HIV care, etc.) are available to clients.

Note: To highlight the major cost drivers within the intervention, the cost level is indicated by dollar signs – from \$ denoting lowest cost to \$\$\$\$ denoting highest (a 20-point scale was used).

IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
ONE-TIME START-UP COSTS	Content adaptation (\$)	<ul style="list-style-type: none"> ▶ Development/adaptation of health content to be communicated with clients. This may be developed by reviewing existing clinical guidelines to ensure that the health content is validated and from a trusted source. The adaptation process may require translating the content to the different health literacy levels and languages spoken among the targeted population, as well as ensuring optimal format and mode of delivery. ▶ Adaption to the appropriate communication channel(s). This may include additional adaptations to the different communication channels, such as text-based communication (SMS, WhatsApp), audio communication, which can vary by dialect; or the use of visual aids (pictures, interactive features, videos) for less literate populations.
	Technology adaptation (\$)	<ul style="list-style-type: none"> ▶ Software customization for transmitting the communication content. The customization can include the frequency and logic of when communication content should be transmitted. ▶ Short code set-up, which represents a simplified number for clients to use when registering for the service. ▶ Database to log incoming/outgoing communication exchanges. ▶ User testing among targeted populations to ensure optimal user experience. ▶ Refinement of the intervention in response to feedback from user testing to ensure requirements and context is taken in account.
	Equipment/ Hardware (\$)	<ul style="list-style-type: none"> ▶ Computers for monitoring system performance and uptake. ▶ Server/Cloud for storage of recorded calls, audio, images.
	Outreach and raising awareness of the intervention (\$\$)	<ul style="list-style-type: none"> ▶ Registration of clients to enrol for the service. This could be done by creating a number by which clients can register/subscribe themselves to receive messages or through recruitment by health workers or other health organization staff. ▶ Raising awareness among clients about the service and how to subscribe (e.g. pamphlets, billboards, SMS blasts).



IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
RECURRING COSTS	Human resources (\$\$)	<ul style="list-style-type: none"> ▶ Personnel to oversee overall programme ▶ Personnel for partnership building and coordination meetings to align with stakeholders (e.g. ministry of health counterparts, other implementing partners, mobile network operators). ▶ Personnel for routine system performance and delivery of communication content (e.g. monitoring read receipts, failures). ▶ Personnel to review incoming messages/calls, if bidirectional communication.
	Communication/ data exchanges (\$\$)	<ul style="list-style-type: none"> ▶ SMS, USSD, voice call, data transmission charges based on volume of communication content and communication channel.
	Technology maintenance (\$)	<ul style="list-style-type: none"> ▶ Software maintenance, updates, and license fees ▶ Short code maintenance fees
ADDITIONAL CONSIDERATIONS FOR SCALE-UP AND INTEGRATION WITH NATIONAL SYSTEMS	Content adaptation (\$)	<ul style="list-style-type: none"> ▶ Content adaptation to include clinical referral. End-users receiving clinical content should have access to formal health care resources for follow-up and interpretation of information given through the intervention.
	Technology adaptation (\$\$)	<ul style="list-style-type: none"> ▶ Integration of client identification. Unique client identification, ideally by means of a unique personal identifier, needs to be built into the system design and registration process to ensure the fidelity of message delivery. In some cases, a proxy identifier, such as a mobile phone number is used where it can be ascertained that it is valid and consented. ▶ Integration and interoperability standards, profiles and application program interfaces (APIs) to enable data integration and interoperability with other systems, such as client health records and call centres.
	Human resources (\$\$)	<ul style="list-style-type: none"> ▶ Personnel to implement system and data integrations to enable interoperability between communication systems and other national systems, such as medical records. ▶ Personnel to monitor system and data integration to ensure the merging of data between systems. ▶ Personnel to ensure the ongoing maintenance of the integrated system and integration of data. ▶ Personnel for increased coordination with partners to follow-up on software integrations and governance for unique identifiers. ▶ Personnel for monitoring intervention coverage, particularly for hard to reach populations.



SUMMARY OF JUDGMENTS FOR TARGETED CLIENT COMMUNICATION

 BALANCE OF EFFECTS – ADOLESCENTS AND YOUTH	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
 BALANCE OF EFFECTS – ADULTS	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
 BALANCE OF EFFECTS – PREGNANT AND POSTPARTUM WOMEN	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
 BALANCE OF EFFECTS – HIV+ PREGNANT AND POSTPARTUM WOMEN	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
 BALANCE OF EFFECTS – PARENTS	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
 ACCEPTABILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 FEASIBILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 GENDER, EQUITY AND HUMAN RIGHTS	Don't know	Varies	Increased inequities	Probably increased inequities	Probably no impact	Probably reduced inequities	Reduced inequities
 RESOURCES REQUIRED	Don't know	Varies	Large resource requirements	Moderate resource requirements	Negligible resource requirements or savings	Moderate savings	Large savings



1.6 Evidence-to-decision framework for health worker decision support via mobile devices (see Recommendation 7)

POSITIVE AND NEGATIVE EFFECTS FOR HEALTH WORKER DECISION SUPPORT VIA MOBILE DEVICES

Research evidence

A systematic review of the global evidence shows the following (see Web Supplement 2) for more detail).

OUTCOME CATEGORIES	WHAT HAPPENS WHEN MOBILE DECISION SUPPORT SYSTEMS ARE USED?	CERTAINTY OF THE EVIDENCE
PROVIDER PERFORMANCE	Uncertain – the certainty of the evidence is very low	VERY LOW
UTILIZATION OF HEALTH SERVICES	Uncertain – no direct evidence was identified	No evidence
HEALTH BEHAVIOUR	Probably makes little or no difference to the numbers of smokers among individuals with high cardiovascular disease risk	MODERATE
	Probably increases the number of individuals taking their antihypertensive medication	MODERATE
	May increase the number of individuals with high cardiovascular disease risk taking prescribed aspirin but may make little or no difference to medication adherence among individuals with poorly controlled diabetes	LOW
HEALTH STATUS AND WELL-BEING	Probably makes little or no difference to systolic blood pressure level among individuals with high cardiovascular disease risk or to the number of individuals with hyperlipidaemia reaching LDL cholesterol goals	MODERATE
	May make little or no difference to HbA1c levels among individuals with poorly controlled diabetes	LOW



OUTCOME CATEGORIES	WHAT HAPPENS WHEN MOBILE DECISION SUPPORT SYSTEMS ARE USED?	CERTAINTY OF THE EVIDENCE
ACCEPTABILITY / SATISFACTION	May make little or no difference to satisfaction with the clarity or helpfulness of medication information among individuals with poorly controlled diabetes	LOW
	Uncertain of the effect on acceptability/satisfaction among health workers	VERY LOW
QUALITY OF DATA ABOUT SERVICES PROVIDED	Uncertain - no direct evidence was identified	No evidence
RESOURCE USE	Uncertain - no direct evidence was identified	No evidence
UNINTENDED CONSEQUENCES	Uncertain - no direct evidence was identified	No evidence

ACCEPTABILITY OF HEALTH WORKER DECISION SUPPORT VIA MOBILE DEVICES

Research evidence

Acceptability to health workers

Systematic reviews of the global evidence (See Web Supplement 2M: Cross-cutting acceptability and feasibility issues) suggests that health workers often see digital health interventions in general as allowing them to offer more tasks and reach more people and work more efficiently (*moderate confidence*, Web Supplement 2M). They also see it as raising their social status (*moderate confidence*, Web Supplement 2M). However, they are concerned that it could increase their workload (*moderate confidence*, Web Supplement 2M) and in some cases may lead to personal expenses (*low confidence*, Web Supplement 2M). Health workers who struggle to use these technologies may view them negatively and be concerned about job security (*high confidence*, Web supplement 2M).

In addition, the evidence (Web Supplement 2A) points to the following factors that are relevant to acceptability among health workers of digital decision support tools specifically:

Health workers often find treatment algorithms on digital devices **useful and reassuring** because they guide and simplify deliver care. However, some health workers perceive algorithms as **too prescriptive**, and are concerned that they may lose their clinical competencies by blindly following treatment algorithms (*moderate confidence*, Web Supplement 2A).

Some health workers may use their mobile devices to search for information and advice online. They may find this **quick access to such information useful**, in particular when they are with clients and need more information about a particular condition and its treatment (*very low confidence*, Web Supplement 2A).



Some health workers may feel that their **focus on the mobile device can negatively impact on their interaction** with clients, particularly when learning to use the device (*very low confidence*, Web Supplement 2A).

Acceptability to clients

Systematic reviews of the global evidence suggest that clients see digital health services as offering **increased support and connectedness** and **improving the quality of care** (*moderate confidence*, Web Supplement 2M).

Some health workers describe how clients believe that digital devices improve the quality of care by **making the health worker more thorough**, for instance because the health worker asks many questions, and is given the answers through the digital device (*moderate confidence*, Web Supplement 2A).

FEASIBILITY OF HEALTH WORKER DECISION SUPPORT VIA MOBILE DEVICES

Research evidence

Systematic reviews of the global evidence point to a number of factors regarding the feasibility of digital health interventions in general, including problems with network connectivity, access to electricity, system integration, usability of the device, and access to health worker training (*high confidence*, Web Supplement 2M); and concerns about data confidentiality and obtaining informed consent (*moderate confidence*, Web Supplement 2M).

GENDER, EQUITY AND HUMAN RIGHTS OF HEALTH WORKER DECISION SUPPORT VIA MOBILE DEVICES

Research evidence

Issues hypothesized from the evidence

Health workers based in **peripheral facilities and rural communities** may find digital interventions particularly helpful because they help overcome geographic barriers to linking to the wider health system, including access to decision support programmes.

However, health workers in these settings may also be more likely to experience poor network coverage and access to electricity; may have lower levels of training and digital literacy; and may have fewer resources, including poorer access to smartphones that may be needed for some programmes.



RESOURCES REQUIRED OF HEALTH WORKER DECISION SUPPORT VIA MOBILE DEVICES

Research evidence

Research evidence on resource use was not identified in the effectiveness studies that were reviewed.

Additional considerations

The following information about the resources required to implement digital decision support is based on an assessment of programme documents and discussions with implementers. All the resources listed below are based on costs to the health system.

The resource use considerations assume the following and therefore have not been added to the list of cost categories:

- ▶ electricity is available;
- ▶ network connectivity is available; and
- ▶ health workers are available and remunerated to provide the appropriate health services.







Note: To highlight the major cost drivers within the intervention, the cost level is indicated by dollar signs – from \$ denoting lowest cost to \$\$\$\$ denoting highest (a 20-point scale was used).

IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
ONE-TIME START-UP COSTS	Content adaptation (\$\$)	<ul style="list-style-type: none"> ▶ Development/adaptation of decision-support pathways/algorithms based on clinical guidelines. This can include the adaptation into an online/web-based system, and accessible through mobile devices. ▶ Validation of algorithms and decision-support logic to be embedded into the decision-support software system.
	Technology adaptation (\$\$)	<ul style="list-style-type: none"> ▶ Software customization adapted to the validated decision-support logic. ▶ User testing among targeted populations to ensure optimal user experience. ▶ Refinement of the intervention in response to feedback from user testing to ensure requirements and context is taken in account.
	Equipment/ Hardware (\$)	<ul style="list-style-type: none"> ▶ Devices (e.g. mobile phones, tablets) for operating the decision-support software system used by the health workers. ▶ Computers for monitoring system performance.
	Initial training (\$\$)	<ul style="list-style-type: none"> ▶ Development/adaptation of training curriculum and standard operating procedures for using the decision-support system ▶ Initial training for health workers interacting with the decision-support system.



IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
RECURRING COSTS	Human resources (\$)	<ul style="list-style-type: none"> ▶ Personnel to oversee overall programme ▶ Personnel for system set-up and user support (e.g. monitoring stability of software, appropriate functioning of the algorithms, and troubleshooting system failures).
	Refresher training and workflow integration (\$)	<ul style="list-style-type: none"> ▶ Refresher training for health workers interacting with the decision-support system. ▶ Periodic review meetings to discuss feedback on system performance and challenges.
	Technology maintenance (\$)	<ul style="list-style-type: none"> ▶ Software maintenance and license fees ▶ Hardware maintenance, including insurance and replacement of hardware. ▶ Ongoing adaptation and update of decision-support logic as new clinical practices or recommendations emerge.

SUMMARY OF JUDGEMENTS FOR DECISION SUPPORT VIA MOBILE DEVICES

	BALANCE OF EFFECTS – COMMUNITY HEALTH WORKERS	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
	BALANCE OF EFFECTS – CLINICAL HEALTH WORKERS	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
	ACCEPTABILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
	FEASIBILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
	GENDER, EQUITY AND HUMAN RIGHTS	Don't know	Varies	Increased inequities	Probably increased inequities	Probably no impact	Probably reduced inequities	Reduced inequities
	RESOURCES REQUIRED	Don't know	Varies	Large resource requirements	Moderate resource requirements	Negligible resource requirements or savings	Moderate savings	Large savings



1.7 Evidence-to-decision framework for digital tracking of clients' health status and services (see Recommendations 8 and 9)

POSITIVE AND NEGATIVE EFFECTS OF DIGITAL TRACKING AND DECISION SUPPORT VIA MOBILE DEVICES

Research evidence

Digital tracking with decision support compared with standard care in primary health care settings

A systematic review of the global evidence shows the following (Web Supplement 2L).

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
PROVIDER PERFORMANCE	Uncertain – no direct evidence was identified	No evidence
UTILIZATION OF HEALTH SERVICES	Probably makes little or no difference to:	MODERATE
	<ul style="list-style-type: none"> ▶ the number of children under 5 who are vaccinated ▶ the number of women who give birth in a facility ▶ the number of women who receive at least 2 tetanus injections 	
	Probably increases:	MODERATE
	<ul style="list-style-type: none"> ▶ the number of pregnant women attending at least 3 antenatal care visits 	
HEALTH BEHAVIOUR, STATUS AND WELL-BEING	Probably slightly increases:	
	<ul style="list-style-type: none"> ▶ the number of children under 5 who receive a third dose of polio vaccine 	
	Uncertain about the effect of tracking with decision support on:	VERY LOW
	<ul style="list-style-type: none"> ▶ emergency visits and hospitalization among children under 5 ▶ timeliness of receiving health care services <p>because the certainty of this evidence was assessed as very low or no studies were identified that reported these outcomes</p>	
HEALTH BEHAVIOUR, STATUS AND WELL-BEING	Probably increases the number of pregnant women taking at least 90 iron tablets during pregnancy	MODERATE
	Probably increases the number of women immediately breastfeeding but probably makes little or no difference to the number of women exclusively breastfeeding for 6 months	
	Probably increases the number of women using contraception 6 months or later after giving birth	
	May make little or no difference to the number of women using contraception within 6 months after birth	LOW



OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
HEALTH WORKERS'/ PATIENTS' SATISFACTION/ ACCEPTABILITY	Uncertain – no studies were identified that reported this outcome	No evidence
QUALITY OF DATA ABOUT SERVICES PROVIDED	Uncertain – no studies were identified that reported this outcome	No evidence
RESOURCE USE	Uncertain – no direct evidence was identified	No evidence
UNINTENDED CONSEQUENCES	Uncertain – no direct evidence was identified	No evidence

Digital tracking with decision support and targeted client communication compared with standard care in primary health care settings

A systematic review of the global evidence shows the following (Web supplement 2L).

OUTCOME CATEGORIES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
PROVIDER PERFORMANCE	Uncertain – no studies were identified that reported on this outcome	No evidence
USE OF HEALTH SERVICES	Uncertain – the certainty of this evidence was assessed as very low	VERY LOW
DEATH	Uncertain – no studies were identified that reported on this outcome	No evidence
HEALTH WORKERS'/ PATIENTS' ACCEPTABILITY/ SATISFACTION	Uncertain – no studies were identified that reported on this outcome	No evidence
QUALITY OF DATA ABOUT SERVICES PROVIDED	Uncertain – no studies were identified that reported on this outcome	No evidence
RESOURCE USE	Uncertain – no studies were identified that reported on this outcome	No evidence
UNINTENDED CONSEQUENCES	Uncertain – no studies were identified that reported on this outcome	No evidence



ACCEPTABILITY OF DIGITAL TRACKING VIA MOBILE DEVICES

Research evidence

Systematic reviews of the global evidence (Web Supplement 2M) suggests that health workers often see digital health interventions in general as allowing them to offer more tasks and reach more people and work more efficiently (*moderate confidence*, Web Supplement 2M). They also see it as raising their social status (*moderate confidence*, Web Supplement 2M). However, they are concerned that it could increase their workload (*moderate confidence*, Web Supplement 2M) and in some cases may lead to personal expenses (*low confidence*, Web Supplement 2M). Health workers who struggle to use these technologies may view them negatively and be concerned about job security (*high confidence*, Web Supplement 2M).

In addition, the evidence (Web Supplement 2A) points to a number of issues relevant for acceptability of digital tracking among health workers.

- ▶ Most health workers see a number of advantages to digital technologies compared with paper-based systems. These include quicker recording of their work, easier access to client data, easy correction of recording mistakes, and not having to carry paper registers. However, some health workers prefer paper, seeing it as more trustworthy and harder to lose; and some health workers complain when they have to maintain both a digital and paper-based system (*moderate confidence*, Web Supplement 2A).
- ▶ When digital health interventions require the registration of clients onto the system, some health care professionals may perceive this as a menial task that is not appropriate for their job level. This may lead to dissatisfaction and the perception that the mobile health intervention is adding to their workload (*very low confidence*, Web Supplement 2A).

For information about the acceptability of TCC and decision support, see the evidence-to-decision frameworks for these specific recommendations (sections 1.5 and 1.6, respectively, of this Web supplement).

FEASIBILITY OF DIGITAL TRACKING VIA MOBILE DEVICES

Research evidence

Systematic reviews of the global evidence point to a number of factors regarding the feasibility of digital health interventions in general, including problems with network connectivity, access to electricity, system integration, usability of the device and access to health worker training (*high confidence*, Web Supplement 2M).



GENDER, EQUITY AND HUMAN RIGHTS FOR DIGITAL TRACKING VIA MOBILE DEVICES

Research evidence

Systematic reviews of the global evidence (Web Supplements 2C and 2F) suggest that access to health care services via digital devices may be particularly helpful to clients **with family or work responsibilities, clients who live far from health care facilities and clients with few funds** (*low confidence*, Web Supplements 2B and 2F).

However, access to and use of TCC services may be particularly difficult for certain groups of clients. These include clients with **poor access to network** services or **poor access to electricity** with which to charge their phones (*high confidence*, Web Supplement 2B); clients with **poor access to mobile phones**; clients who speak **minority languages** or who have **low literacy skills or low digital literacy skills** (*moderate confidence*, Web Supplement 2B); and clients dealing with **stigmatized health conditions** (people with these conditions may be particularly concerned about the confidentiality of digital health devices) (*high confidence*, Web Supplement 2B).

RESOURCES REQUIRED FOR DIGITAL TRACKING VIA MOBILE DEVICES

Research evidence

Research evidence on resource use was not identified in the effectiveness studies that were reviewed.

Additional considerations

The following information about the resources required to implement digital tracking with decision support is based on an assessment of programme documents and discussions with implementers. All the resources listed below are based on costs to the health system.

The resource use considerations assume the following, which have therefore not been added to the list of cost categories:

- ▶ electricity is available;
- ▶ network connectivity is available; and
- ▶ health workers are available and remunerated to provide appropriate services.

For the resource use considerations when adding targeted client communication, see Section 1.6 of this document.



Note: To highlight the major cost drivers within the intervention, the cost level is indicated by dollar signs – from \$ denoting lowest cost to \$\$\$\$ denoting highest (a 20-point scale was used).







IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
ONE-TIME START-UP COSTS	Content adaptation (\$\$\$)	<ul style="list-style-type: none"> ▶ Mapping of health care cadres workflows and responsibilities across the different levels of the health system. This information will be used to determine the data and content to be included in the software system. ▶ Development/adaptation of digital forms for recording client health information in the software system. This may also include aligning the data collection form with global data coding standards, such as the <i>International Classification of Diseases (ICD)</i>. ▶ Development/adaptation of decision-support algorithms from clinical guideline recommendations. ▶ Validation of algorithms and decision-support logic to be embedded into the digital software system.
	Technology adaptation (\$\$\$)	<ul style="list-style-type: none"> ▶ Software customization to adapt to the data collection and decision-support needs. ▶ Integrations with external software systems, such as DHIS2 for aggregate-level reporting. These integrations are most commonly done through an “application programming interface” (API), which details the rules and protocols for communicating between different software systems. ▶ Dashboards for monitoring the performance of the digital software system and visualizing aggregated data. ▶ User testing among targeted populations to ensure optimal user experience. ▶ Refinement of the intervention in response to feedback from user testing to ensure requirements and context is taken in account.
	Equipment/hardware (\$)	<ul style="list-style-type: none"> ▶ Devices (e.g. mobile phones, tablets) for operating the decision-support software system used by the health workers. ▶ Security features such as user-authentication schemes, passwords and data encryption for recording and sharing client health information. ▶ Computers for monitoring system performance and viewing reporting dashboards.
	Initial training (\$\$\$)	<ul style="list-style-type: none"> ▶ Development/adaptation of training curriculum and standard operating procedures for using the system. ▶ Initial training for health workers interacting with the system. ▶ Training for supervisory staff on standard operating procedures and continuous monitoring.



IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
RECURRING COSTS	Human resources (\$\$\$)	<ul style="list-style-type: none"> ▶ Personnel to oversee overall programme. ▶ Personnel for system set-up and user support (e.g. monitoring stability of software and troubleshooting system failures). ▶ Personnel to monitor data generated by software system and provide feedback, corrective actions, etc. ▶ Personnel for partnership building and coordination meetings to align with stakeholders (e.g. ministry of health counterparts, other implementing partners, mobile network operators).
	Refresher training & workflow integration (\$\$\$)	<ul style="list-style-type: none"> ▶ Refresher training for health workers interacting with the system. ▶ Refresher training for supervisory staff on continuous monitoring, use of data emerging from system. ▶ Periodic review meetings to discuss feedback on system performance and challenges.
	Communication/ data exchanges (\$\$)	<ul style="list-style-type: none"> ▶ Data (e.g. 3G connection) or wireless connection for submitting data collection forms.
	Technology maintenance (\$\$)	<ul style="list-style-type: none"> ▶ Server/Cloud for storing data generated by the software system. This also includes ensuring a locked and air-conditioned physical space for the server. Some contexts may store data on the "cloud" for which cloud-hosting fees would be required. ▶ Software maintenance and licence fees. ▶ Hardware maintenance, including insurance and replacement of hardware. ▶ Ongoing adaptation and update of decision-support logic as new clinical recommendations emerge.



SUMMARY OF JUDGEMENTS FOR TRACKING OF CLIENTS' HEALTH STATUS AND SERVICES VIA MOBILE DEVICES

 BALANCE OF EFFECTS – TRACKING + DECISION SUPPORT	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
 BALANCE OF EFFECTS – TRACKING + DECISION SUPPORT + TARGETED CLIENT COMMUNICATION	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
 ACCEPTABILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 FEASIBILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 GENDER, EQUITY AND HUMAN RIGHTS	Don't know	Varies	Increased inequities	Probably increased inequities	Probably no impact	Probably reduced inequities	Reduced inequities
 RESOURCES REQUIRED	Don't know	Varies	Large resource requirements	Moderate resource requirements	Negligible resource requirements or savings	Moderate savings	Large savings



1.8 Evidence-to-decision framework for digital provision of educational and training content to health workers via mobile devices/ mLearning (see Recommendation 10)

POSITIVE AND NEGATIVE EFFECTS OF MLEARNING

Research evidence

A systematic review of the global evidence shows the following results when comparing mLearning (alone or blended) with traditional learning for post-registration health workers (Web Supplement 2K).

OUTCOMES	WHAT HAPPENS?	CERTAINTY OF THE EVIDENCE
KNOWLEDGE	mLearning (alone or blended) may increase health care professionals' knowledge regarding the management of health issues	LOW
PROVIDER PERFORMANCE	Uncertain – no direct evidence was identified	No evidence
UTILIZATION OF HEALTH SERVICES	Uncertain – no direct evidence was identified	No evidence
HEALTH BEHAVIOUR, STATUS AND WELL-BEING	Uncertain – no direct evidence was identified	No evidence
HEALTH WORKERS' SATISFACTION AND ACCEPTABILITY	Uncertain – the certainty of the evidence is very low	VERY LOW
HEALTH WORKERS' SKILLS AND ATTITUDES	Uncertain – the certainty of the evidence is very low	VERY LOW
UNINTENDED CONSEQUENCES	Uncertain – no direct evidence was identified	No evidence



ACCEPTABILITY OF MLEARNING

Research evidence

Systematic reviews of the global evidence (Web Supplement 2M) suggests that health workers often see digital health interventions in general as allowing them to offer more tasks and reach more people and work more efficiently (*moderate confidence*). They also see it as raising their social status (*moderate confidence*). However, they are concerned that it could increase their workload (*moderate confidence*) and in some cases may lead to personal expenses (*low confidence*). Health workers who struggle to use these technologies may view them negatively and be concerned about job security (*high confidence*).

In addition, we identified several findings from a systematic review of mLearning specifically that explored factors influencing implementation of mLearning among both pre- and post-qualified health workers (Web Supplement 2B) (no assessment of confidence in the findings from this review was carried out). However, the studies only included medical and nursing education; and most of the studies only included pre-qualified students, were from high-income countries only, and evaluated pilot mLearning interventions. These factors may lessen the relevance of this evidence for our recommendation.³

Factors that may increase acceptability of mLearning

mLearning students may appreciate mLearning tools because they **allow them to reflect on and guide their own clinical practice**. Students report how they view medical literature and clinical guidelines via the digital tools to prepare for or problem-solve during clinical encounters (Web Supplement 2B). In these clinical settings, students may value being able to reduce their reliance on memory and address gaps in knowledge (Web Supplement 2B). This type of content is seen by students as supporting their clinical practice, especially in the absence of more senior advisors (Web Supplement 2B).

Students may also value the opportunity to instantly **contact their supervisors** remotely through text and chat, although some clinicians may prefer to use alternative means than smartphones for their teaching work, including personal computers for assessments, or paper (Web Supplement 2B). Some students may also feel more able to generate discussion with senior colleagues because of easier access to information and some tutors describe a process of learning alongside their students (Web Supplement 2B). Students may also perceive the use of mobile devices as **strengthening their professional identity** or see others as competent if they use devices to retrieve information (Web Supplement 2B).

³ The existing qualitative review was focused on nursing and medical students. The technical team extrapolated findings from this review that would be relevant for health workers.



Students may appreciate access to different types of cooperative learning via digital devices. For instance, students may value participating in online, social-media facilitated study groups and other groups that **give them the opportunity to discuss cases, post and respond to clinical questions, and immediately resolve complex cases** (Web supplement 2B). Students may also value cooperative peer assessment approaches. These approaches allow them to work together on case studies in real time; and also give them the opportunity to form social groups and the feeling of connection with others when on clinical assignments (Web supplement 2B).

Characteristics of mLearning programmes that students may appreciate include the **speed with which reference material can be retrieved**; the **ability to rapidly store material** such as text and images for later use; and the ability to **personalize the learning content or programme layout** to suit their own needs (Web supplement 2B). Students may also prefer mLearning approaches to 'cumbersome' text books, and may appreciate the **portability of the device**, as it allows them to use blocks of time, for instance between patients or when waiting for senior staff, as opportunities for learning activities (Web supplement 2B). Despite costs, some students may also **prefer to use their own devices** because this provides opportunities to engage with technology in an informal manner, or at times that suit them (Web supplement 2B).

Factors that may decrease acceptability of mLearning

Some students and tutors note that the use of digital devices can potentially strengthen communication between clinicians and patients. However, they may also have concerns about possible **negative effects on patient interactions**. For instance, these devices may be seen as interfering with activities at the bedside, specifically with medical consultations, clinical observations and teamwork. Some may feel that the use of these devices in front of patients is rude or awkward, or may feel discomfort due to a lack of technological skills. They may also feel that not being able to maintain good eye contact with patients is causing difficulties with conversation (Web Supplement 2B). Some students may fear they will be **viewed as unprofessional** by either patients or colleagues who perceive devices as being purely for leisure (Web Supplement 2B). Students may also experience disapproval for device use among supervising staff in clinical settings, resulting in students being hesitant to use the device openly (Web Supplement 2B).

Students and tutors may be **concerned about the content of the information** distributed through mLearning apps or websites. Some students and tutors report uncertainties about the trustworthiness or reliability of the information (Web Supplement 2B), poor timing of content, or content that is not congruent with the rest of students' curriculum or reflective of their practice (Web Supplement 2B).



Some students and lecturers express frustration and impatience in the process of **learning how to use a device**. Students, including technologically more competent users, report the need for support and repeat training to gain sufficient device familiarity, although students may become more comfortable with mobile devices over time (Web Supplement 2B). Some report that their clinical instructors also lack device knowledge (Web Supplement 2B).

Some students report that they are **too busy to incorporate devices into their learning activities** during practice. Some students may be reluctant to invest time integrating a mobile device into their daily schedule (Web Supplement 2B), and some students report receiving little guidance on how to integrate mobile devices into learning activities (Web Supplement 2B).

Some students may **prefer traditional pedagogical approaches**, with paper-based learning and face-to-face communication (Web Supplement 2B). Some students may be concerned about developing an **overdependency on their device**, for instance because of concerns about technology failure or that their loss of recall ability will be problematic during exams (Web Supplement 2B).

FEASIBILITY OF MLEARNING

Research evidence

Systematic reviews of the global evidence point to a number of factors regarding the feasibility of digital health interventions in general, including problems with network connectivity, access to electricity, system integration, usability of the device and access to health worker training (*high confidence*, Web Supplement 2M).

GENDER, EQUITY AND HUMAN RIGHTS FOR MLEARNING

Research evidence

Issues hypothesized from the evidence:

- ▶ Health workers based in **peripheral facilities and rural communities** may find digital interventions particularly helpful because they help overcome geographic barriers to linking to the wider health system, including access to mLearning programmes.
- ▶ However, health workers in these settings may also be more likely to experience poor network coverage and access to electricity; may have lower levels of training and digital literacy; and may have fewer resources, including poorer access to smartphones that may be needed for some programmes.



RESOURCES REQUIRED FOR MLEARNING

Research evidence

Research evidence on resource use was not identified in the effectiveness studies that were reviewed.

Additional considerations

The following information about the resources required to implement mLearning is based on an assessment of programme documents and discussions with implementers. All the resources listed below are based on costs to the health system.

The resource use considerations assume the following, which have therefore not been added to the list of cost categories:

- ▶ electricity and network connectivity are available
- ▶ health workers have received preregistration training
- ▶ health workers are available and remunerated to provide the appropriate health services.






Note: To highlight the major cost drivers within the intervention, the cost level is indicated by dollar signs – from \$ denoting lowest cost to \$\$\$\$ denoting highest (a 20-point scale was used).

IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
ONE-TIME START-UP COSTS	Content adaptation (\$\$\$)	<ul style="list-style-type: none"> ▶ Development/adaptation of training content in a digital format, such as videos and other forms of multimedia. This may be developed by adapting existing digital training modules or creating new modules based on validated health content or clinical guidelines. This may include customization from global repositories of digital training materials. The adaptation process may also require translating the content to the different languages or skill levels of targeted health workers.
	Technology adaptation (\$\$)	<ul style="list-style-type: none"> ▶ Software customization to incorporate the adapted training content to be transmitted. ▶ Software integration with accreditation databases held by health care professional councils or registration bodies. ▶ Software integration with human resource information systems/human resource registries. ▶ User testing among health workers to ensure optimal user experience and alignment with workflows. ▶ Refinement in response to feedback from user testing to ensure requirements and context are taken in account.
	Equipment/hardware (\$)	<ul style="list-style-type: none"> ▶ Devices (e.g. mobile phones, tablets) used by the health worker (if not already using their own device). ▶ Computers at district and/or national level for monitoring system performance.
	Initial training (\$\$\$)	<ul style="list-style-type: none"> ▶ Initial training for health workers interacting with the system.



IMPLEMENTATION PHASE	COST CATEGORY	DESCRIPTION
RECURRING COSTS	Human resources (\$\$\$)	<ul style="list-style-type: none"> ▶ Personnel for system set-up and user support (e.g. monitoring stability of software and troubleshooting system failures). ▶ Personnel to provide technical support related to exams and feedback on assignments.
	Refresher training (\$\$\$)	▶ Refresher training for health workers interacting with the system.
	Communication/ data exchanges (\$\$\$)	▶ Data transmission charges if the training content is not stored on the device.
	Technology maintenance (\$\$)	<ul style="list-style-type: none"> ▶ Software maintenance and licence fees. ▶ Ongoing adaptation and update of new training content. ▶ Hardware maintenance, including insurance and replacement of hardware.

SUMMARY OF JUDGEMENTS FOR MLEARNING

 BALANCE OF EFFECTS	Don't know	Varies	Favours the comparison	Probably favours the comparison	Does not favour either the option or the comparison	Probably favours the option	Favours the option
 ACCEPTABILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 FEASIBILITY	Don't know	Varies	No	Probably No	—	Probably Yes	Yes
 GENDER, EQUITY AND HUMAN RIGHTS	Don't know	Varies	Increased inequities	Probably increased inequities	Probably no impact	Probably reduced inequities	Reduced inequities
 RESOURCES REQUIRED	Don't know	Varies	Large resource requirements	Moderate resource requirements	Negligible resource requirements or savings	Moderate savings	Large savings



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