BE HE@LTHY
BE MOBILE

A handbook on how to implement **mHypertension**

World Health Organization

ITU

BE HE@LTHY BE MOBILE

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mHypertension

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Executive Summary

WHO and the International Telecommunication Union (ITU) have formed a partnership to use mobile technology to help combat noncommunicable diseases. As part of this Be He@lthy, Be Mobile initiative, WHO and ITU aim to assemble evidence-based and operational guidance to assist countries and governments to implement mHealth programmes for noncommunicable diseases. Mobile health, or mHealth, is defined as "medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices" *(1)*. The Be He@lthy, Be Mobile initiative generally uses basic technologies common in most mobile phones. The handbooks specific to the mHealth programme act as aids to policy-makers and implementers of national, or large-scale, mHealth programmes.

This handbook provides guidance for developing and implementing an mHealth programme to support people with hypertension in achieving better control of their condition and improving their quality of life. It describes how an mHypertension programme can be used to supplement and augment existing national hypertension control programmes, and illustrates the steps required for successful implementation. The example text message library provided in the handbook uses evidence-based behaviour change techniques to support healthy behaviour changes and hence better hypertension control. This document and programme content are informed by a relevant evidence base and were developed following standardized processes. These mHealth interventions have shown promise for the behaviour change necessary to reduce the risk of developing or exacerbating hypertension, and WHO considers that the proper application of this handbook can be a critical factor in success in achieving behaviour change.

The handbook provides guidance on the following components of an mHypertension programme:

Content development and adaptation

2

Technology specifications

4

1

Operations management

3

Promotion and recruitment

5

Monitoring and evaluation
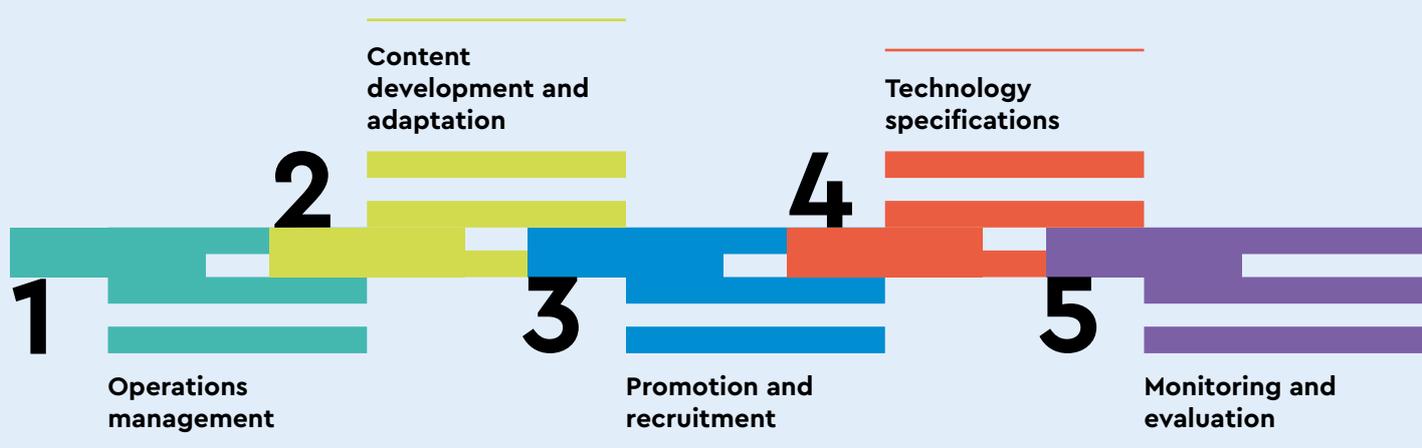
Background

Hypertension, or blood pressure equal to or greater than 140/90 mmHg *(2)* is the leading risk factor for premature mortality globally and is estimated to cause 9.4 million deaths every year, which equates to more than half the approximately 17 million deaths due to cardiovascular disease *(3)*. Blood pressure level is directly associated with cardiovascular risk and overall morbidity and mortality risk; lowering the blood pressure reduces these risks. Evidence suggests that even modest reductions in blood pressure are important and linked with risk reduction.

Lifestyle-related noncommunicable diseases are chronic diseases that take years or decades to manifest; preventing or even delaying the onset of these diseases could improve lives and result in substantial cost savings *(4)*. Addressing behavioural risk factors such as an unhealthy diet, physical inactivity, tobacco use and harmful use of alcohol can help to prevent hypertension at a population level. Figure 1 below shows the main factors that contribute to the development of hypertension *(2)*.

FIGURE 1. MAIN FACTORS THAT CONTRIBUTE TO THE DEVELOPMENT OF HIGH BLOOD PRESSURE AND ITS COMPLICATIONS

Social determinants and drivers

- Globalization
- Urbanization
- Ageing
- Income
- Education
- Housing

Behavioural risk factors

- Unhealthly diet
- Tobacco use
- Physical inactivity
- Harmful use of alcohol

Metabolic risk factors

- High blood pressure
- Obesity
- Diabetes
- Raised blood lipids

Cardiovascular disease

- Heart attacks
- Strokes
- Heart failure
- Kidney disease
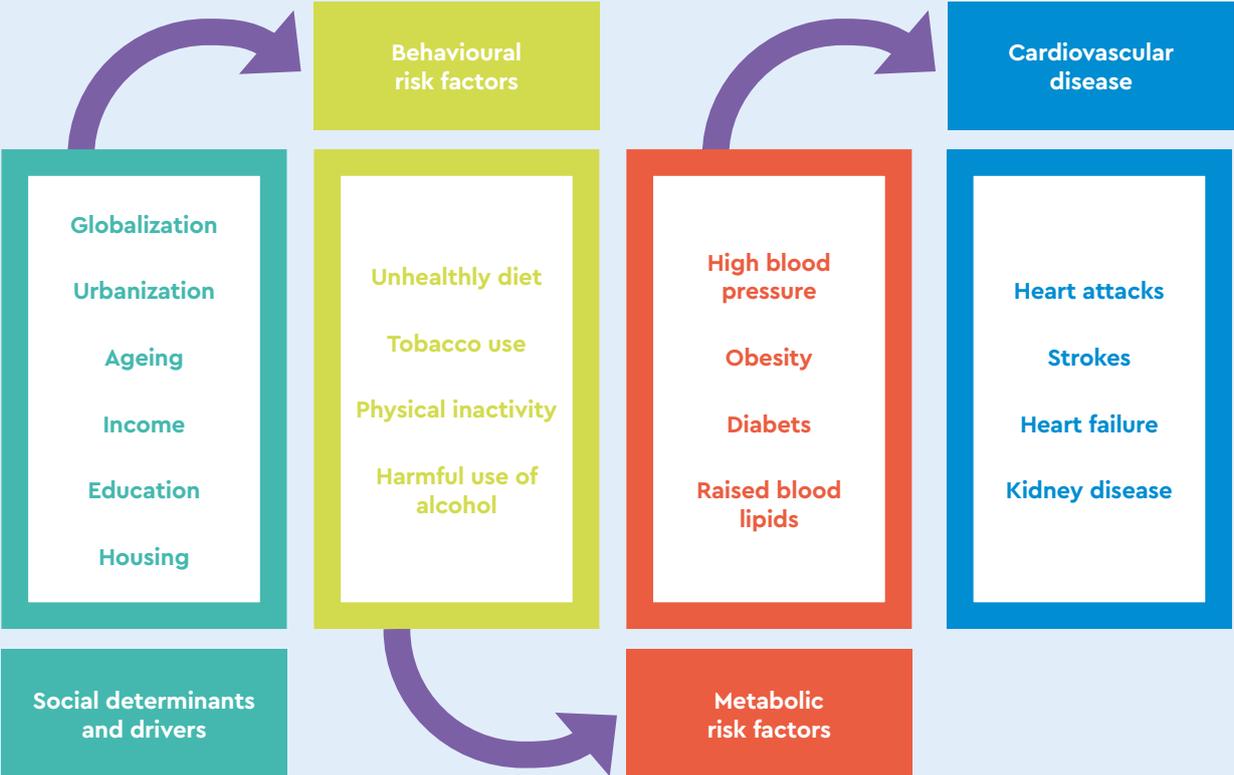
Source: (2).

WHO and the United States Centers for Disease Control and Prevention have launched the Global HEARTS initiative to strengthen prevention of cardiovascular disease globally *(5)*. The HEARTS technical package includes recommendations to countries for preventing and managing hypertension, a major risk factor for cardiovascular disease. Early detection of hypertension is key to minimizing the chance of heart attack, heart failure, stroke and kidney failure. The HEARTS technical package provides information on the four main behavioural risk factors for cardiovascular disease *(5)*:

Unhealthy Diet   **Insufficient physical activity**   **Tobacco use**   **Harmful use of alcohol**
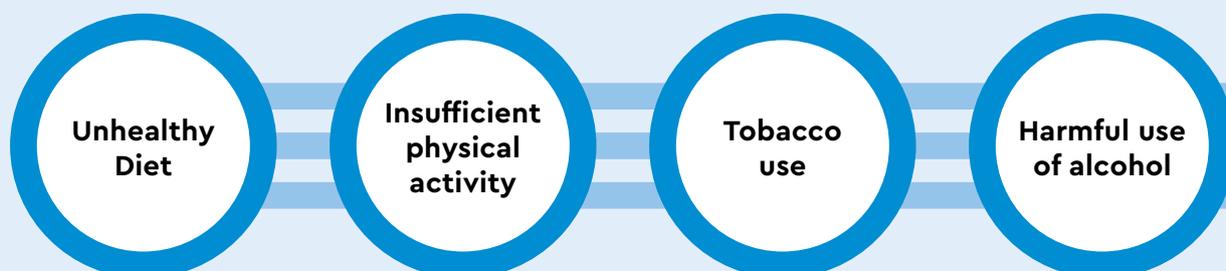
Control of hypertension can be achieved by a healthy lifestyle and safe and effective medications, when needed. However, to do so demands multistakeholder collaboration, involving governments, civil society, academia, and the private sector. mHealth presents one tool which supports the implementation efforts for hypertension control aligned as part of the implementation of HEARTS.

RATIONALE FOR mHYPERTENSION

In 2016, ITU reported that, in countries with available data, 85% of the population aged 25-75 years owned a mobile phone *(6)*. This worldwide mobile phone usage makes mHealth a widespread modality for providing public heath interventions. While mHealth research has mainly taken place in high-income countries, the explosion of mobile technologies in lower-income countries means that it is now being explored as an approach to support the development and strengthening of health systems.

Much of the human and social impact caused each year by morbidity and mortality related to noncommunicable diseases could be averted through population level interventions that are well understood, cost-effective and feasible *(7)*. Results from recent systematic reviews have been quite promising in respect of the use of mHealth to manage chronic conditions, such as coronary heart disease *(8, 9)* and its risk factor, hypertension *(10, 11)*. mHealth interventions have also shown promise for the behaviour change necessary to reduce the risk of developing or exacerbating hypertension, such as engaging in regular physical activity *(12, 13)*. Deploying mHealth at the population level can be an effective way to achieve behaviour change, especially in lower and middle-income countries where mobile phone penetration is growing exponentially and risk of cardiovascular disease is high *(2)*.

What is an mHypertension programme?

There are many ways mobile technology can be used to prevent or control hypertension. Annex 1 provides further details on mHealth programme ideas at the individual or health system level. This handbook focuses on the individual level, to provide basic education, behaviour change strategies (see Annex 2) and medication adherence prompts to support people with hypertension in achieving better control.

A comprehensive mHypertension programme operating over a wide geographical area should aim to address the spectrum of disease of hypertension, the use of appropriate technologies and the needs and cultural norms of the population. The interventions should be embedded in the continuum of prevention and care, since mHealth can support services at all levels (see Figure 2).

FIGURE 2. THE mHYPERTENSION CONTINUUM OF PREVENTION AND CARE
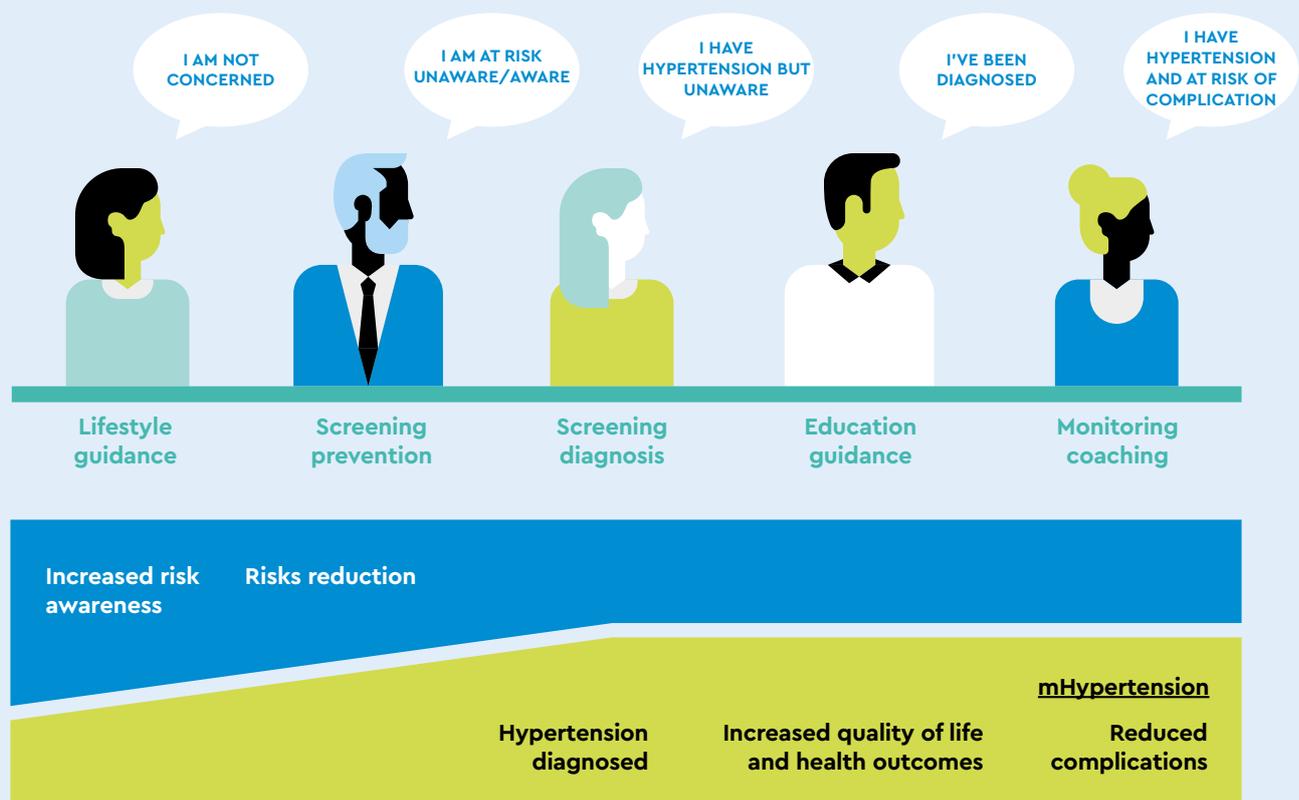
Previous mHealth hypertension interventions have delivered education and supportive strategies to make healthy lifestyle changes and/or adhere to guidance using text messaging, mobile applications and telemonitoring *(10, 11, 14, 15)*. However, the present handbook describes a standard mHypertension programme for the individual using the simplest form of mHealth technology: text messaging. A recent review found mHealth interventions to be effective for prevention and management of cardiovascular disease, and suggested that text message interventions were more effective than smartphone interventions. However, using multiple modalities should be considered for maximum outreach *(16)*. The mHypertension message library and programme algorithms found in Annexes 3 and 4 have been developed for text messaging. Countries or groups can choose to adapt the programme algorithm, message content and technology they use based on the capacity, interests and needs of their respective populations.

The goal of the mHypertension programme is to help people with hypertension to improve their blood pressure control through healthy behaviours and self-management.

To achieve this goal, the focus of the messages is on education and supporting behaviour change, namely adherence to prescribed medication and monitoring of blood pressure, eating a diet low in salt and high in fruit and vegetables, starting or maintaining regular participation in physical activity, stopping smoking and limiting alcohol consumption. Text message content is based on the recommendations from the HEARTS technical package *(5)* and the WHO global brief on hypertension *(2)*. Each mHypertension user will receive three modules (adherence, healthy eating and physical activity), with the option of adding modules on tobacco cessation and/or harmful use of alcohol if the user is a smoker or consumes an unhealthy amount of alcohol. Details on the content for each stream can be found in Section 2 of the handbook. Each stream will also have slightly different evaluation outcomes, which can be found in Section 5 of the handbook.

Developing an mHypertension programme

FIVE AREAS OF THE mHYPERTENSION PROGRAMME

BE
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MOBILE

1
Operations
management

2
Content
development and
adaptation

3
Promotion and
recruitment

4
Technology
specifications

5
Monitoring and
evaluation
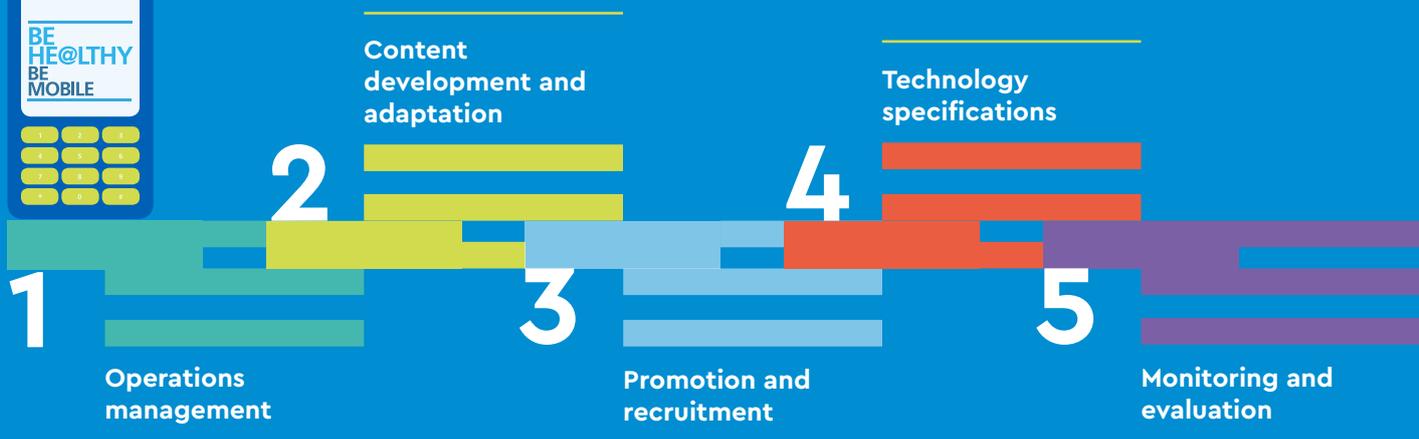
OPERATIONS MANAGEMENT

1.1 mHEALTH NEEDS ASSESSMENT

A thorough mHealth needs assessment, including a readiness assessment, is a crucial step in developing an mHypertension programme. As with any large-scale intervention, it is essential to understand the context in which the intervention will be delivered. For the mHypertension programme to be effective, text messages need to be consistent with users' needs, their capabilities and impairments and their motivations. Messages can support self-management by incorporating relevant and effective behaviour change techniques, which provide strategies and encouragement to overcome barriers. Supporting a person diagnosed with hypertension to self-manage their condition may increase their understanding of hypertension and how it increases their risk of cardiovascular disease. It may also encourage the person to be an active participant in decision-making about their health and motivate them to engage in healthy behaviours *(17)*. A needs assessment will help determine the relevant barriers and facilitators of behaviour change for people diagnosed with hypertension in each participating country's context.

A needs assessment also provides a vehicle for consolidating information for planning, identifying gaps in knowledge and helping with decision-making. Conducting a needs assessment will provide an understanding of the setting for the operations management teams. The needs assessment will involve visiting, observing and interviewing key informants and stakeholders and documenting existing resources. The results of the needs assessment will be useful in the development and implementation of a national mHypertension programme, and act as a baseline measure from which the programme can be monitored and evaluated.

The following information describes questions related to the goals and content of an mHypertension intervention that should be considered as part of a needs assessment.

Which behaviours contribute to hypertension?
Which behaviours can control diagnosed hypertension?

Based on the HEARTS technical package *(5)*, the four main behavioural risk factors for cardiovascular disease are the following:

Unhealthy Diet　　**Physical inactivity**　　**Tobacco use**　　**Harmful use of alcohol**
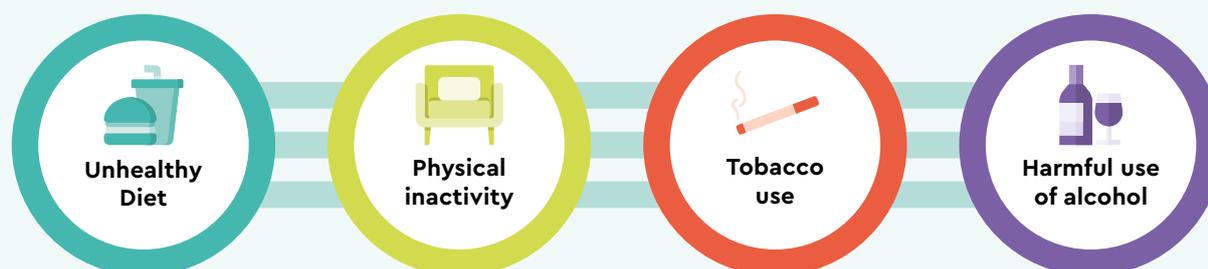
Other considerations for the population include taking blood pressure medication as prescribed and receiving health-care service reminders, such as attending appointments with health workers and regular monitoring of blood pressure. Individuals should know their own blood pressure, especially if a close relative had or has hypertension, as this is another risk factor *(2)*.

A good understanding of the most prevalent unhealthy behaviours in each country's specific context will help decision-making about the emphasis and frequency of the text messages in the mHypertension programme. Identification of these behaviours can be completed as part of the literature review during the needs assessment.

What factors are going to help/hinder behaviour change?

Once the most prevalent and influential behaviours have been identified among the population, it will be important to understand key barriers and facilitators of change in these behaviours. This needs to be explored primarily from the mHypertension participants' perspectives, using a person-centred approach.

INTERNAL INFLUENCES

- ☐ Knowledge level
- ☐ Low risk perception
- ☐ Perceived stigma (e.g. overweight/ obese; ageism)
- ☐ Traditional care-seeking practices
- ☐ Myths and misconceptions
- ☐ Physical and psychological addiction
- ☐ Self-efficacy

EXTERNAL INFLUENCES

- ☐ Socioeconomic conditions
- ☐ Sociocultural norms
- ☐ Social stigma (e.g. overweight/ obesity; ageism)
- ☐ Access to quality and affordable health services

A needs assessment will be able to identify the extent to which and intensity with which these barriers influence behaviour change in the given context. A literature search should identify existing local studies and an exploratory qualitative study can identify such barriers and facilitators. Such a study would include conducting a set of interviews and/or focus group discussions with people with hypertension. It may also be useful to interview or conduct focus groups with family members and support people of those with hypertension. The sampling strategy for such a study would need to take account of age, gender, and whether they were diagnosed with hypertension.

What are the end users' digital literacy and habits?

As the "digital divide" has declined between different social groupings across the world, there may still be a considerable "digital use divide". This often reflects an underlying gap in digital literacy and digital engagement. Special consideration should be given to creating an inclusive programme which allows users with functional limitations, such as vision, hearing, or motor impairment, or those with low levels of digital literacy and engagement, to take part *(18)*.

Several tools are now available that can be used on a representative sample to appraise digital literacy and practices across a range of domains including operational, navigation, social, creative and mobile. For instance, the eHealth Literary Scale has been found to be a reliable and valid instrument for use in older populations *(19)*. Countries should consider validating such instruments in their own populations as part of the needs assessment.

The digital media needs assessment is critical to programme algorithm planning, as it will help to determine the number of messages sent, whether two-way messaging is used and whether voice messaging needs to be employed.

Table 1 lists additional considerations relating to the operation and implementation of an mHypertension programme that should be included in the needs assessment.

TABLE 1. CONSIDERATIONS FOR mHYPERTENSION NEEDS ASSESSMENT

THEME	CONSIDERATIONS
Current situation of hypertension	• Prevalence of hypertension • Demographic data on number and percentage of people diagnosed with hypertension, including age, gender and location (e.g. urban or rural) • What are the priority populations and population segments?
State of national programmes for hypertension control	• mHypertension programme objectives, constraints, institutional and human resources, funding • Approaches and algorithms for identifying people in need of support, treatment and enhancing adherence • Existing or planned synergies with other chronic condition programmes (e.g. cardiovascular disease, diabetes) • Campaigns and health promotion strategies for hypertension • Involvement of nongovernmental, community and patient organizations • Relevant priorities of the government and the health system • Use of clinical management guidelines • Gaps in medication supply, laboratory facilities, diagnostics, medical equipment, etc., and any additional supplies needed to support mHypertension
Target group	• Target populations • Challenges and opportunities within the population • Literacy and language considerations • Mobile technology and other digital literacy considerations • Functional ability issues in the use of mobile phones (e.g. dexterity, visual impairment) • Knowledge levels, cultural attitudes, perception of risk, current behaviour and behavioural trends relating to hypertension and chronic conditions
State of mobile communications	• Statistics on use of mobile phones and text messaging; costs to consumers of text messaging, data and calls • Penetration and use of smartphones and mobile internet access • Description of the mobile network environment (e.g. the number of network providers and whether they provide "value-added services", including any related to health) • Whether unsolicited text messaging (spam) by companies is allowed and/or occurs • Whether health services use text messaging or smartphone apps • Cultural issues in the use of mobile phones • The projected evolution of the mobile phone market in the near future, particularly with respect to increased penetration of smart- or semi-smartphones • Regulatory issues such as spam, consent to receive programmes, cost of message transmission, restrictions on the number of messages that can be sent each day • Existing mHealth programmes that could incorporate mHypertension messages

Contextual, geographical, cultural and behavioural influences	• Individual and cultural attitudes to health care and self-management • Determinants and risk factors of hypertension • Cultural and social factors that may influence individuals from adopting a healthier lifestyle • Community dynamics and actors that would support successful mHypertension outcomes • Motivation and incentives for individuals to participate in an mHypertension programme • People who can be considered champions, "trusted advisors" and how to leverage them • Expected interactions of target populations with potential channels in health interventions: SMS (text message), web, app, phone call, interactive voice response, brochure, face-to-face coaching or consultation • Convenience for the population • Cost (who will pay: the population or the government?)

Stakeholders	• Relevant agencies, organizations, donors, companies, experts and their potential interest in supporting an mHypertension programme, including:
	
	  1. national and subnational/regional levels of public health experts
	  2. funders of public health services
	  3. ministry of health and other relevant government departments and agencies
	  4. private and other health-care workers who work in hypertension
	  5. government agencies responsible for telecommunications (telecoms) and data protection
	  6. telecoms companies, mobile network providers and industry bodies or associations
	  7. any local mobile phone service providers or companies that provide mHealth services
	  8. patient associations; community advisory groups
	  9. health insurance companies; other private sector supporters
	  10. academic researchers (public health, hypertension, cardiovascular disease, behaviour change, social marketing, mHealth)

Promotion	• What channel will be used to promote the mHypertension programme • How people will be registered on the programme • What recruitment strategies will be used • Incentives for participation • Access to and availability of health-care services and resources
Further research	• Other areas in which further research is required to facilitate a successful pilot or "soft" launch and implementation; operational research.

1.2 PLANNING FOR INTEGRATION OF mHYPERTENSION WITHIN HEALTH-CARE SETTINGS

Integrating mHypertension within health-care settings offers an mHealth delivery mode to support hypertension control strategies for people diagnosed with hypertension. It requires buy-in from health-care providers who will likely be involved in promotion and recruitment of the mHypertension programme.

The key is to determine how mHypertension can best be integrated into the existing or future operations and how it could improve outcomes for all involved. The mHypertension programme should supplement, not replace, self-management advice and instruction from health-care providers. To facilitate uptake, it may be useful to consider the five characteristics that have been demonstrated to influence the likelihood of adoption of a technological innovation, outlined below in Table 2 *(20)*.

TABLE 2. FACILITATING IMPLEMENTATION AND UPTAKE OF THE mHYPERTENSION INNOVATION WITHIN TRADITIONAL HEALTH-CARE SETTINGS

Compatibility	Have we adapted mHypertension to fit well with our goals, objectives, operations, approaches? And those of our communities?
Relative advantage	Will mHypertension help us to do things better, such as making it easier to contact patients with results, support, reminders, etc.? Will it help us to make faster progress towards the goal of better hypertension control?
Level of complexity	Have we made mHypertension easy to understand and use? Have we made good arrangements for training, support, troubleshooting, project management and oversight?
Observability of results	How easily and quickly will mHypertension produce results that can be shared with users and countries? Have the results been organized in a format that different groups will understand and relate to?
Triability	Have we organized it so that everyone can comfortably try out mHypertension before having to decide about adopting it? Has enough time and consultation among all stakeholders been allowed for the pilots?

The mHypertension package will need to be customized so that it is aligned with the needs assessment, existing strategies, procedures, human resources and activities. For example, text messages that refer people to their health-care worker will need to provide correct information about where to go, what to do and whom to speak to. All those involved in the care or patient pathway should be trained and/or briefed prior to the pilot launch, and staff should be trained how to use and integrate the programme and refer and support their patients in the programme.

1.3 PROGRAMME LEADERSHIP AND PARTNERSHIPS

To facilitate planning, implementation and monitoring and evaluation of the mHypertension programme, a management team should be established, with clear responsibilities and accountability for the programme (see Figure 3):

- an international technical advisory group of experts to advise and support the in-country project team;

- a national steering committee for overall direction and agreement;

- a national technical advisory group of in-country leaders to manage operations, content development and adaptation, promotion and recruitment, technology specifications and monitoring and evaluation.

FIGURE 3. PROPOSED STRUCTURE OF AN mHYPERTENSION MANAGEMENT TEAM

WHO, ITU, and the Informal Expert Group

of public health and mHealth experts to assist in drafting the handbook and advising on implementation

International mHypertension Steering Committee

with representatives from the ministries of health and telecommunications and national and international representatives of WHO and ITU, to decide on overall direction and agreement

National technical advisory group

Government sectors (including health, telecommunications, business, media, treasury and planning) to set up the legal, technical and financial framework for a sustainable programme. This group will maintain links with a large group of potential partners such as the telecoms and software industry, local telecoms and mobile network providers, nongovernmental organizations, health professionals, academic and research organizations, health insurance groups, health service providers, civil society groups, opinion leaders, the media and others as appropriate

Operations

Management of overall programme operations, including needs assessment, work-plan, budget and legal aspects

Content

Development and adaptation of programme content

Promotion

Management of recruitment, communications, marketing and dissemination programme

Technology

Management of technical aspects of programme development and implementation

Monitoring and evaluation

Management of the development and implementation of monitoring and evaluation plans

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WHO, ITU, AND THE INFORMAL EXPERT GROUP

The international experts that assisted in drafting the country handbook also have experience in programme implementation and will be available to advise on technical aspects, legal issues, choice of platforms for scaling-up, and feasibility. Experts from international information technology organizations, health economists and business development experts can also be invited to advise on models for programme sustainability.

INTERNATIONAL mHYPERTENSION STEERING COMMITTEE

A steering committee should be responsible for presenting the mHypertension programme to governments and international agencies

to disseminate activities, share lessons and engage the population and policy-makers. Representatives from all government sectors involved in the programme should be part of the steering committee. In addition, representatives from WHO and ITU headquarters should also be members, contributing to decisions that maintain the coherence with the Be He@lthy, Be Mobile initiative and sharing lessons between countries.

NATIONAL TECHNICAL ADVISORY GROUP

The technical advisory group should support, inform and advise the programme throughout its inception, development, implementation and evaluation. It should include the people necessary to make decisions related to funding and planning, those who will be involved in implementing, promoting and evaluating the programme, those who can contribute to the long-term sustainability of the programme, and someone who understands or represents the mobile network environment in the country. Regular meetings should be held for information-sharing and updates on progress. The technical advisory group will assign roles and responsibilities to various organizations in the different phases of development, adaptation, implementation, evaluation and continuing service provision. They should encourage discussion on overall programme ownership, funding and contracts or agreements on dealing with technical and other

issues. The technical advisory group will assist the national operational team in making decisions about the target population, type of programme, programme objectives and design, promotion of the programme and the evaluation plan.

PROJECT LEADERS FOR NATIONAL OPERATIONS, CONTENT, PROMOTION, TECHNOLOGY AND MONITORING AND EVALUATION

These groups include the people who will develop or adapt the programme for cultural relevance and technical accuracy, promote the programme, operationalize and maintain it, integrate it into the health system and health promotion services and evaluate it. They may include hypertension and public health specialists, evaluators and statistical experts, health promoters, behaviour change and communications experts (including linguists) and consumer groups. These teams will report to, or be a subset of, the technical advisory group.

1.4 WORKPLAN DEVELOPMENT

This section provides a checklist or template for developing a project workplan for use and adaptation by any country intending to implement an mHypertension programme (Table 3). Each section of the workplan is described in detail throughout the handbook.

TABLE 3. CONTENT CHECKLIST OF A WORKPLAN FOR AN mHYPERTENSION PROGRAMME

CONTENT CHECKLIST
Background and context
In this section, information from the needs assessment that applies to decisions on the implementation strategy is used. ☐ Problem statement: a description of the problem of preventing and controlling hypertension ☐ Present situation or context of hypertension treatment and care in the country ☐ National or government commitment to this project ☐ Process used in project identification or formulation, the information used and the stakeholders involved ☐ Relation to previous and current programmes or activities in hypertension care

Operations management

In this section, planning decisions are made, a description of the programme to be implemented is created, and an operations management plan is developed that includes identifying who will be responsible for implementing the project and for ensuring provision of services.

- Overall project objective: for example, "to adapt the mHypertension programme for the population of X, particularly targeting Y people, and to implement it as a free national service"
- How the programme fits into national or regional strategies
- Strategy for operationalizing and promoting the programme
- How the initiative will evolve with progress in technology; become integrated into a comprehensive mHypertension and noncommunicable disease model
- Roles and responsibilities in the project: project team members, responsibilities for main activities; assign a project team leader
- Overall description of project management
- Management committee (if applicable, terms of reference)
- Accountability for project implementation

Public-private partnership

In this section, every partner has a unique role and all are motivated by the desire to improve health by using technology. Some important underlying principles to be considered include the following.

- A "win–win" philosophy, particularly for a long-term strategy, driven by the government, with the private sector and nongovernmental organizations involved in implementation
- A service free of charge to consumers to maximize public health impact (enrolment is very low when consumers have to pay)
- Consideration of the environmental effects of mobile networks
- Appropriate contractual arrangements with the best providers
- Assurance that service provision is sustainable in the long term

Content development and adaptation

In this section, a research driven message refinement process should be implemented.

- Review of existing programme content and rules of implementation
- Refinement of content through focus groups and consumer pre-testing, translation, changing the wording, removing and adding new messages, reframing messages, changing the rules in the system, and designing the registration, opt-in/opt-out and administration functions of the new programme
- Plan for updating messages

Promotion and recruitment

In this section, decisions should be made about marketing of and enrolment in the programme.

- Promotion and recruitment and retention plan (launch, short-term, mid-term and long-term strategy)
- Recruitment methods (by SMS, web, missed calls, third parties)
- Promotion strategy (media, health workforce training, civil society outreach, etc.) adapted for various client groups (by demographics, e.g. urban, rural, age, gender, income)

Technology

In this section, decisions are made about the considerations necessary for the infrastructure and rules of the programme.

- ☐ The type of mHealth technology and channels to be used (SMS, MMS, voice, apps, etc.)
- ☐ Availability of technology options within the public sector and/or private sector
- ☐ Process for procurement and adaptation of technology
- ☐ Dashboard development and access
- ☐ Procurement of a short code
- ☐ Negotiation with telecoms regulators, aggregators and operators for pricing
- ☐ Data security
- ☐ Technology pre-testing and scale-up plans

Monitoring and evaluation

In this section, decisions should be made about what will be measured by the programme, by whom and with what frequency.

- ☐ Monitoring and evaluation plan based on the mHealth monitoring and evaluation framework
- ☐ Short-term, mid-term and long-term plans
- ☐ Reports and dissemination plans for evaluation, refinement, improvement and service provision

Estimated time frames

Planning: 3–4 months

- ☐ Needs assessment: assuming the information is readily accessible and local researchers are available to inform the technical advisory group
- ☐ Formation and planning of the technical advisory group: engaging the right partners, agreeing on the implementation plan, the promotional plan and the evaluation plan; working groups formed; project leader assigned
- ☐ Content development team formed
- ☐ Selection of programme and text message content or preparation of new text messages
- ☐ Agreement on programme and technical and transmission specifications

Content adaptation: 4–6 weeks

- ☐ Expert group consultation to review and culturally adapt content
- ☐ Consumer testing of messages before use in focus groups, online surveys, telephone interviews, etc.
- ☐ Modification of messages based on consumer feedback
- ☐ Translation (and back-translation to check for translation accuracy)

Technology adaptation: 4–6 weeks

Development of promotion and recruitment strategy and material: 4–6 weeks

Programme implementation: within six months of beginning the planning

Monitoring and evaluation

- ☐ Monitoring: should be done in real time, from the start of programme planning until the end of programme implementation, using agreed indicators
- ☐ Evaluation: beginning, at least, with a six-month follow-up of the initial cohort

CONTENT DEVELOPMENT AND ADAPTATION

The development and pre-testing of the mHypertension programme should:

(a) be informed by the existing evidence on effective mHealth interventions;

(b) be informed by the findings of a needs assessment; and

(c) follow steps recommended for the development of communication interventions for health behaviour change.

Recently, a consensus has emerged on these steps *(21)* which have been adapted for mHypertension (see Figure 4).

FIGURE 4. DESIGNING A TEXT MESSAGING PROGRAMME

Step 1
- **Conduct formative research for insights into target audience and target health behaviours**

Step 2
- **Design the text message programme**
- Choose the behaviour change goals
- Choose the communication objectives (e.g. beliefs, attitudes, knowledge) and behavioural techniques (e.g. actions)
- Design the framework or algorithm for the programme (timing and frequency of messages)
- Write the message library

Step 3
- **Pre-test the text messaging programme concept and messages**

Step 4
- **Revise the text message programme**

Table 4 lists key decisions for consideration by the content development team. Each decision contains recommendations based on previous mHealth and hypertension research and is further described in detail below with supporting evidence. This mHypertension handbook provides recommendations for programme content and delivery; however, it is up to each country to determine how it wishes to develop their programme on the basis of its needs assessment. The full message library and programme algorithm can be found in Annexes 3 and 4.

TABLE 4. DECISIONS AND SUGGESTED ACTIONS FOR mHYPERTENSION PROGRAMME CONTENT DEVELOPMENT

DECISION	ACTIONS
Target audience	Target people with hypertension, as informed by a health provider.
Goals of the programme	Help people with hypertension to improve their blood pressure through healthy behaviour and self-management.
Select behaviour change techniques	Target: information, reminders, instruction and self-management techniques (see full list of behaviour change techniques in Annex 2).

DECISION	ACTIONS
Design the framework of the programme (duration, message frequency, order, repetition, time, directionality, framing)	▌ The programme should last at least six months (see Section 2.3). ▌ Messages should start at a high dose for the first few weeks and then gradually decrease in frequency over time. ▌ Start with general informative messages, moving to self-management with specific behaviour change techniques, and then to maintenance of behaviour change in the later phase of the programme. ▌ We recommend grouping messages into modules, with each module targeting a specific behaviour. ▌ Allow users to choose when they receive messages, if possible. ▌ Offer two-way messaging. ▌ Messages should be clear and direct, offering practical and relevant. advice for older adults in simple language. Messages should emphasize the benefits of action (positive framing) over the consequences of inaction (negative framing).
Message components	Messages target the lifestyle advice from the HEARTS technical package. To encourage behaviour change, messages incorporate relevant behaviour change techniques.
Pre-testing, piloting, refining messages	Once a first draft of messages and the programme algorithm has been developed, pre-test the messages with the end user. Refine messages after pre-testing, then conduct a pilot programme. Refine messages and algorithm after the pilot programme prior to national scale-up of programme.

2.1 TARGET AUDIENCE AND GOALS OF THE PROGRAMME

Intervening at an early stage is essential because the early detection of hypertension can significantly minimize the risk of developing cardiovascular disease. The mHypertension programme will target those who have been diagnosed with hypertension by a health provider to achieve better control of their hypertension through healthy lifestyle change and self-management strategies. The programme may additionally target the general population and health workers.

2.2 SELECT BEHAVIOUR CHANGE TECHNIQUES

As part of the needs assessment, the steering committee should have agreed on a set of target behaviours and specific determinants (barriers and facilitators) to behaviour change, through relevant literature reviews and consulting with experts. The next task is to agree on the behaviour change techniques required to modify these behaviours and make healthy lifestyle changes. As highlighted in Figure 5, a behaviour change technique that is likely to modify a particular behaviour has to influence its determinant.

FIGURE 5. BEHAVIOUR CHANGE PROCESSES WITH EXAMPLE OF EXERCISE FOR HYPERTENSION CONTROL

Behaviour change techniques	Behavioural determinants	Behaviour	Physiological & biochemical processes	Outcome
Graded tasks	Increased self-efficacy	Regular aerobic exercise	Postexercise hypotension	Better controlled BP

Source: *(23)*. BP: blood pressure.

For example (see Figure 5), if the desired outcome is to control blood pressure, one behaviour that helps is to engage in regular aerobic exercise, which has the benefit of lowering blood pressure below pre-exercise levels for 2–3 hours post-exercise *(23)*. To encourage this behaviour, the self-efficacy or self-confidence to do regular aerobic exercise may be required. A behaviour change technique that can increase self-efficacy is to provide graded tasks, where easy-to-perform tasks are prescribed first, followed by increasingly difficult, but achievable, incremental tasks. An example message targeting graded tasks that is ultimately aimed at improved mobility is shown below.

Try to walk or do other exercise for 30 minutes each day to stay healthy. If you are new to exercise, start at a slow pace and try to add a minute each day.

Annex 2 provides a list and description of behaviour change techniques that may be relevant based on the taxonomy of Michie et al. *(24)*. The list was compiled from reviews of techniques used in mHealth intervention to improve clinical outcomes and behaviour change in cardiovascular disease *(8, 25)*. **The most commonly used behaviour change techniques for secondary prevention of cardiovascular disease included the following:**

▌ information about health consequences

▌ goal-setting (behaviour)

▌ self-monitoring of behaviour

▌ social support (practical)

▌ prompts/cues.

Messages in the message library (Annex 3) have been paired with a corresponding behaviour change technique to ensure the mHypertension programme has a theoretical framework. Internet- and mobile-based interventions with a theoretical underpinning have been shown to be more effective than those not based on theory *(26, 27)*. The combination of theory and the HEARTS technical package recommendations creates a usable framework to underpin an mHypertension programme.

2.3 DESIGN THE FRAMEWORK OF THE PROGRAMME

DURATION OF THE PROGRAMME

Recent reviews of mHealth interventions have found no clear conclusions on the optimal length of programmes, because of the low number of randomized controlled trials and heterogeneity of mHealth interventions *(8, 28)*. Research shows it can take six months of engaging in a new behaviour to move into the maintenance stage of behaviour change *(29, 30).* Two mHealth trials delivering text message-based interventions to adults (mean age ~60 years old, N=294) with coronary heart disease found most participants thought 24-weeks was the right length for a programme *(31, 32)*.

SUGGESTION 1

The programme should last at least six months.

TIMING AND FREQUENCY OF MESSAGES

As with the duration of mHealth programmes, few systematic reviews drew strong conclusions on effective message algorithms *(28)*. Despite this, a few reviews have made recommendations on the number and frequency of messages, although all agree that the area needs further investigation. Evans et al. reported that a higher dose of messages resulted in greater behaviour change but gave no indication on the optimal number of messages per week *(33)*. One review found message frequency that is customizable or declines in frequency over time were more effective than fixed frequency (a low or high number of fixed messages) *(34)*. Another systematic review found that at least one message every three days appeared effective in changing behaviours *(8)*. Park et al. conducted a review on mHealth interventions to prevent and manage cardiovascular disease, finding that studies with the highest frequency of messages

(i.e. at least once daily) had the strongest effect on adherence to medication and behaviour outcomes *(16)*.

SUGGESTION 2

Messages should start at a high rate for the first few weeks, e.g. once per day, and then gradually decrease in frequency over time, with at least one message every three days for the duration of the programme.

ORDER OF MESSAGES

There was little evidence in the literature specifying the order of messages. Maar et al. recommended placing positive content before negative content, which may be more relevant for individual message framing *(35)*. Other behaviour change and exercise prescription programmes began with more introductory/general messages first which then become more specific *(31, 32)*. For instance, the messages could be more informational for the first few weeks, followed by specific instruction and self-management techniques. Specific behaviour change goals should start slow and offer gradual progression as the programme continues. The final half of the programme can incorporate messages that focus on maintenance of these newly adopted behaviours and reinforce the long-term benefits.

SUGGESTION 3

Start with general informative messages, moving to self-management with specific behaviour change techniques, and then to maintenance in the later phase of the programme.

REPETITION OF MESSAGES

Multiple behaviour change is under-studied; however, a growing body of evidence points to the effectiveness of changing multiple rather than single behaviours *(36, 37)*. There have been few studies examining the effectiveness of changing multiple behaviours sequentially as opposed to simultaneously, but one review suggests that both sequential and simultaneous multiple health behaviour change is effective *(36)*.

SUGGESTION 4

We recommend grouping messages into modules, with each module targeting a specific behaviour. Please see Table 5 below and the message library (Annex 3) for further clarification. To avoid repetition and participant boredom all messages should be unique. Part of the content development phase is to determine if users would rather receive modules simultaneously or sequentially.

TIME OF DAY MESSAGES ARE DELIVERED

One systematic review suggested that interventions were most successful when the time of day messages are delivered was customizable (34). Allowing user choices for delivery was also important to the participants in mHealth studies for self-management of cardiovascular disease; however, most participants chose to receive messages in the time slot 9 a.m.–12 noon *(31, 32)*.

SUGGESTION 5

Allow users to choose when to receive messages if possible. If tailored programmes are too costly, deliver messages at a time of day when participants are most receptive (e.g. midday: not too late or too early).

DIRECTIONALITY OF MESSAGES

Two reviews have found two-way messaging was more effective than one-way *(16, 34)*. However, many one-way mHealth interventions have been effective in changing behaviours *(38, 39)*.

SUGGESTION 6

Encourage two-way messaging if feasible.

Many studies on message framing have shown that positive framing is more effective and acceptable. Positive messages are benefit-oriented rather than consequence-oriented *(40)*. In one study, positively framed messages resulted in greater behaviour change, as older adults preferred and remembered positive messages better compared with negatively framed messages *(35, 41)*. It is important to note that message framing preferences can vary by population and should be tested in the pre-testing/piloting phase to determine if the population is more motivated by the potential benefits of behaviours ("regular exercise can control your blood pressure") or by reducing the consequences of inaction ("if you continue to smoke you increase your risk of heart attack or stroke").

In message framing:

Do use *(35, 40)*:	Do not use:
✓ **positive and encouraging tone** ✓ **reminders** ✓ **cultural practices** ✓ **one idea per message** ✓ **correct spelling and grammar** ✓ **direct, simple and concise language**	✗ **authoritarian and stern tones** ✗ **immediate commands** ✗ **over-simplification** ✗ **very informal "textese"** ("ur", "l8r", "b4")

Advice should be clear, practical, and realistic for the intended user (35). Specific content should be targeted to what people with or at risk of hypertension find relevant (42) and what behaviours they need to change, as tailored and targeted messages are more effective at changing behaviour (16, 34). To ensure that the language is at an appropriate level, literary testing of messages in the language concerned is recommended (e.g. Google web corpus or Lexile Analyzer®) (42). Muench et al. (40) found that individuals with less education were more likely to prefer the inclusion of an emoticon than those with more education. There were no preferences in terms of punctuation, such as the number of exclamation points or capital letters compared with messages with no visible emphasis.

SUGGESTION 7

Messages should emphasize the benefits of action (positive framing) over the consequences of inaction (negative framing). Messages should also be clear and direct, offering practical and relevant advice for older adults in simple language. It is suggested that message content and tone should be pre-tested with end users as part of the pre-testing and piloting phase.

2.4 MESSAGE CONTENT

This section describes some key topics that the mHypertension message library could address. The topics are based on recommendations from the HEARTS technical package *(5)* and the WHO global brief on hypertension *(2)*. As mentioned, it is recommended tailoring messages to people diagnosed with hypertension. There are five streams recommended for the programme; Table 5 outlines the content for each stream.

The design of the programme, including the number of messages and behaviour change techniques selected, may vary depending on which streams are implemented. A detailed library of the text messages for all five streams is provided in Annex 3. The text library will need to be customized to a country or group's needs, culture and language.

TABLE 5. CONTENT OF mHYPERTENSION PROGRAMME

MODULE	DESCRIPTION	EXAMPLE MESSAGE
Adherence	**Medication** • Take your blood pressure medications exactly as prescribed. • Often medication is needed to control blood pressure. • You may need to take more than one type of medicine. A fixed-dose combination medication, where two medicines are in a single pill, can ease logistics and reduces pill burden. • Even if you do not feel unwell, it is extremely important to keep taking your blood pressure medicines as prescribed. • Know the generic name and side-effects of your drugs. • Consult your doctor if you have any side-effects from the medication. • Take your medication as prescribed, every day, regularly. • Don't stop or change your medication without consulting your doctor. • Talk to your doctor before taking a new drug. • Adherence to treatment is critical for blood pressure control. • Practising a healthy lifestyle should be combined with taking medicines. • Hypertension is manageable and controllable, but not curable. • Know the red flag signs for hypertensive emergency: severe headache and loss of consciousness, chest pain, nausea and vomiting, dizziness, visual disturbance, racing heartbeat. • Do not miss appointments with your health worker. • If you feel unwell, do not delay – call or visit your health worker. • In case of emergency, do not delay calling the local emergency number and going to the hospital. **Monitoring/screening** • Do not miss appointments with your health worker. • If you feel unwell, do not delay – call or visit your health worker. • Have your blood pressure checked at every visit. People with raised blood pressure may monitor their own blood pressure if an appropriate device is available and affordable. • Have your blood sugar checked once a year. For people with diabetes, refer them to the mDiabetes programme. • Ask for your family's help to live a heart-healthy life. • Individuals can choose to live a healthy life through making healthy diet choices, increasing physical activity levels, avoiding tobacco use and avoiding harmful use of alcohol. • Keep a healthy weight. If you are overweight, losing weight can help to lower your blood pressure.	It is important to take your medication as prescribed. This means taking it at the right times and not missing any doses. Keep on top of regular blood pressure screening. Your blood pressure should be less than 140/90. If it is high, see your doctor.

MODULE	DESCRIPTION	EXAMPLE MESSAGE

Healthy eating	• Eat a heart-healthy diet. An unhealthy diet increases your risk of overweight and obesity and of heart attack, stroke, high blood pressure, diabetes, cancer and other diseases.
	• Eat less than 1 level teaspoon (5 g or less) of salt per day:
	  □ eating too much salt is a major cause of high blood pressure;
	  □ reduce or limit salt when eating or cooking but, better yet, eliminate any extra salt when eating or cooking;
	  □ limit flavourings that contain a lot of salt (for example, soy sauce, fish sauce, bouillon, or stock cubes);
	  □ limit salty foods such as salty fish or meat, salty cheese, pickles, salty snacks;
	  □ many canned foods and bread contain salt, so limit the amount of them that you eat.
	• Eat at least 5 portions of vegetables and fruits per day:
	  □ 1 portion is equal to, for example, 1 orange, apple, mango or banana, or 3 tablespoons of cooked vegetables;
	  □ starchy vegetables do not count as one of your portions (these include potatoes, sweet potatoes, cassava and other starchy root vegetables).
	• Eat fewer fatty or oily foods:
	  □ eat less fatty meat, processed meat, fried food and baked goods;
	  □ when cooking, use healthier vegetable oils such as olive, sunflower, safflower, soya or corn oil, instead of animal fat or palm or coconut oil;
	  □ boil, steam or bake rather than fry;
	  □ remove the fatty part of meat, including chicken skin, before cooking;
	  □ eat white meat (for example, chicken) and fish; limit red meat to once or twice a week at most.
	• Eat nuts, legumes, whole grains and foods rich in potassium.
	• Eat fish or other food rich in omega-3 fatty acids (e.g. flax seeds) at least twice a week.
	• Avoid added sugar:
	  □ choose fresh fruit and raw vegetables as snacks instead of sugary snacks such as cookies, cakes, candy and chocolate;
	  □ drink fewer soft drinks or soda and other drinks that are high in sugar (e.g. fruit juices, cordials and syrups, flavoured milks and yogurt drinks); drink water instead;
	  □ reduce sugar in your tea and coffee.
	• When buying food in the store, check food labels for sodium (salt), sugar, fat and calorie content.
		Prepare food using only a little bit of salt to help you and your family maintain normal blood pressure. Keep the salt shaker off the table!

MODULE	DESCRIPTION	EXAMPLE MESSAGE
Physical activity	• Physical activity protects your health and can help you feel better and happier. Insufficient physical activity increases your risk of having a heart attack, stroke, cancer and other diseases. • Increase to 150 minutes of moderate physical activity per week, equivalent to brisk walking, spread throughout the week. • Moderate physical activity should make you breathe slightly faster and make your heart beat slightly faster. • Start slowly. You can engage in physical activity for as little as 10 minutes at a time, adding these up to reach 30 minutes a day or 150 minutes spread over the week. • People can do moderate physical activity at any age – do as much as you can manage.	Walk to work, walk to the shops, take the stairs, play with the kids or take the dog for a walk. It all adds up – build physical activity into your day.
Tobacco cessation (add-on)	• Using tobacco increases your risk of having a heart attack, stroke, cancer and other diseases. • Do not start smoking. • If you smoke, remember that quitting tobacco is the most important thing you can do to protect your health. • Ask your health worker to help you quit smoking. • Do not allow smoking in your home: second-hand smoke damages the health of your family and other people around you. • Smokers could also be referred to an mTobaccoCessation programme, if implemented, for extra support.	Do not be fooled! There is no such thing as a safe cigarette. Quitting is the only way to protect yourself from the health risks of smoking.

Harmful use of alcohol (add-on)	• Drinking alcohol can increase your risk of having a heart attack, stroke, cancer and other diseases.
	• Overall, the best way to avoid the health risks of alcohol is to abstain. If you do drink alcohol, keep in mind that less is better.
	• Avoid having more than two drinks on any one day and do not drink any alcohol on at least two days per week.
	• Do not drink alcohol for "health" reasons.
	• Do not use alcohol when you are:
	  ☐ driving;
	  ☐ operating machinery;
	  ☐ pregnant or breast feeding;
	  ☐ taking medications that interact with alcohol;
	  ☐ living with a medical condition that is made worse by alcohol;
	  ☐ having difficulty in controlling your drinking.
		Think of supportive people you trust, like friends, family, or your partner. Ask them to help you cut back on alcohol.

SPECIAL CONSIDERATIONS FOR SALT/ SODIUM

The HEARTS technical package, specifically the H module, has dietary advice that includes reducing salt, increasing fruit and vegetable consumption and limiting unhealthy fats and sugar. For an mHypertension programme, special consideration (or emphasis) should be given to decreasing salt/sodium intake, as this is a commonly-cited prevention strategy to reduce the burden of hypertension *(7)*. Data from around the world suggest that the average sodium consumption is well above the minimal physiological needs, and in many countries, it is above the value recommended by the 2002 Joint WHO/Food and Agriculture Organization of the United Nations Expert Consultation of 2 g sodium/ day (equivalent to 5 g salt/day) *(43)*. The high prevalence of hypertension in adult populations globally, and the clear benefit of reduced sodium in individuals with high blood pressure, means that reducing sodium intake is likely to be broadly beneficial to populations around the world. For example, modelling the impact of decreasing salt intake from the estimated global level of 9-12 g per day (g/day) to the recommended WHO maximum target of 5 g/day has demonstrated the potential to reduce the global stroke rate by 23% and the global cardiovascular disease rate by 17%. This would prevent about 2.5 million deaths every year *(44, 45)*.

2.5 PRE-TESTING, PILOTING AND REFINING THE MESSAGES

Once a good plan for the mHypertension programme has been developed, it should go through iterative stages of pre-testing, pilot and refinement.

PRE-TESTING THE TEXT MESSAGES

The draft text messages should be pre-tested by conducting interviews or focus group discussions with potential users. It is important that such interactions should include representatives from various subgroups within the target audience. During these interactions, the facilitator/ interviewer should explain the purpose and content of mHypertension to the participants and provide them with the message library, asking them to rate the messages on content,

clarity and persuasiveness. Testing should assess message comprehension, language, message framing and tone. It is important to consider the literacy levels of the target population, including health literacy. Messages that are unclear or inappropriate for the target group should be rewritten, either by or with the participants.

PILOT (ALL VERSIONS OF THE PROGRAMME IF POSSIBLE)

Once the messages are pre-tested and refined, the mHypertension pilot programme should be launched. Such a pilot could last for approximately 2-4 weeks and involve 25–50 users. This pilot should be evaluated using two sets of data: users' self-reported experience and their real-time engagement with the programme. Users' experience can be collected either through face-to-face/phone-based interaction or via web-based/internet-based surveys. The key questions to ask include the user's experience of taking part in the mHypertension programme; clarity, quantity, timing and frequency of messages; what was good about the programme and what was not; completion/non-completion of the programme; and any effect on their attitude or target behaviour(s). Users' real-time engagement can be evaluated using records from mobile phone companies (if available) of messages delivered and opened. Depending on the complexity of the programme, these data can provide information on the extent of clients' engagement. Measures used in the monitoring and evaluation phase of the mHypertension programme can also be tested during the pilot stage.

REFINE AND OPTIMIZE THE PROGRAMME

Once mHypertension is pre-tested and piloted, it should go through a refinement process addressing all key issues highlighted during the pilot, before its final launch. Messages may need to be reviewed and updated several times. The programme plan should identify a person responsible for maintaining and updating the message library. Having some degree of flexibility and keeping the programme fresh may help to keep the audience engaged. Once the programme is launched, someone on the team should also be receiving the messages in real-time and monitoring them closely to ensure that the correct messages are being sent on schedule.

PROMOTION AND RECRUITMENT

A nationwide or population-specific strategy to promote outreach and recruitment to the programme should be considered early in the planning stages, taking account of the following considerations.

▌ Target audience and access to media/promotional strategies.

▌ Who the public considers to be the "owner" of the programme and the data, as the operational model is likely to direct the promotional campaign.

▌ Existing health programme promotion strategies and synergies: which organizations/notable personalities are currently involved in mass media campaigns for hypertension prevention and/or self-management services and can those campaigns be linked or leveraged? Which mHealth programmes have previously been implemented in the area? Can lessons be learned about which promotional techniques are effective?

▌ How people will register with or sign up to the programme: directly by text message, online, by telephone, in person or through a third party (e.g. health-care provider).

▌ The amount of data to be collected at baseline to allow tailoring of the materials and ensure follow-up.

▌ The local mobile network environment: e.g. whether sending unsolicited text messages is allowed (this violates network codes of conduct in some countries). This may also be an important consideration in the potential effectiveness of or engagement in the programme, i.e. whether a population that has been desensitized to receiving unsolicited health-related text messages will be likely to read mHypertension text messages.

▌ Use of incentives to encourage participation.

▌ Effectiveness of mobile messaging (MMS) for outreach and promotion, leveraging the marketing and promotional campaigns of the stakeholder agencies, including technical partners, such as telecoms companies. This can enable campaigns where consumers can self-issue health messaging around this topic, i.e. a health promotion and/or or social marketing programme with posters and radio advertisements, through community settings, places where people meet or through social media, where mobile numbers are available for texting and automated health information can be sent to anyone who requests it.

▌ Timing of the campaign: consider a soft launch prior to starting the promotional campaign to ensure that all processes are working well before the official start date for registration.

▌ Cost of radio and TV advertising. This advertising can be an important method of promoting the programme but, in many countries, it can be very expensive. Initial underestimation of promotional costs is common and can be difficult to remedy later.
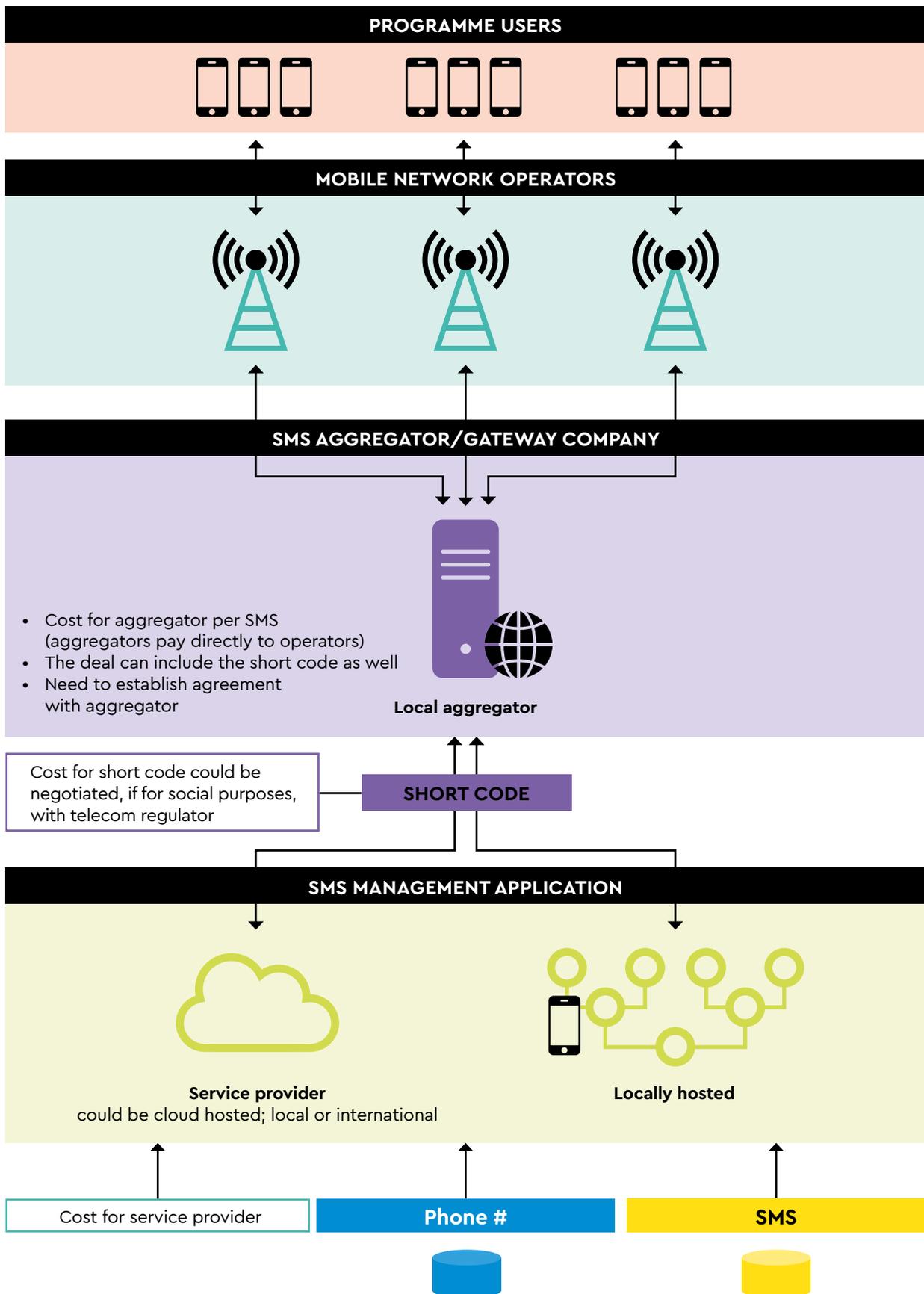
TECHNOLOGY SPECIFICATIONS

The following technical aspects of an mHealth programme must be considered by the technical advisory group from the start, in collaboration with local partners:

▌ type of mHealth technology and channels to be used (SMS, MMS, voiceover internet, apps (e.g. messaging apps), etc.);

  ▢ platforms that allow video could be particularly useful for demonstrating content in action, such as exercise content or skill-building, video messages demonstrating correct strength training techniques or how to cook;

▌ availability of technology options within the public and/or private sector;

▌ process for procurement and adaptation of technology;

▌ dashboard development and access;

▌ procurement of a short code (the 5- or 6-digit unique number used to send and receive SMS to and from mobile phones, "send a message to 123123 to enrol in the programme");

▌ negotiation with telecoms regulators, aggregators and operators for pricing;

▌ data security;

▌ plans for technology pre-testing and scale-up.

It is important to note that mobile communications network environments differ from country to country. The specificities should be considered in the planning stage by including in the technical advisory group technical experts (such as representatives of telecoms companies, operators, telecoms regulatory authorities, government departments responsible for information, communication and technology) or individuals knowledgeable about the communications network in the country. Network operators, telecoms companies or industry organizations can provide help in setting up the programme and advising on its sustainability.

Some providers may consider supporting such a programme as good publicity or a useful addition to the services they offer. In the absence of such support, the programme can be delivered through a contractual arrangement with an "aggregator" or "gateway" company that has established relations with all telecoms companies and networks (see Figure 6). This can be a cost-effective way to deliver messages to many participants, regardless of their mobile carrier or location, without establishing these interfaces individually. Although the aggregator adds a further cost, this cost decreases as the scale of the programme increases; using an aggregator can therefore be more cost-effective than attempting these activities "in-house", unless the necessary capacity and infrastructure already exist.

FIGURE 6. TWO-WAY SMS SYSTEM WITH AGGREGATOR AND SHORT CODE

PROGRAMME USERS

MOBILE NETWORK OPERATORS

SMS AGGREGATOR/GATEWAY COMPANY

- Cost for aggregator per SMS (aggregators pay directly to operators)
- The deal can include the short code as well
- Need to establish agreement with aggregator

Local aggregator

Cost for short code could be negotiated, if for social purposes, with telecom regulator

SHORT CODE

SMS MANAGEMENT APPLICATION

Service provider
could be cloud hosted; local or international

Locally hosted

Cost for service provider

Phone #

SMS

When thinking about the technical aspects of an mHealth programme, the technical advisory group may also consider the following questions.

▌ **Partnerships (see Table 6)**: what sort of arrangement with telecoms companies and/ or the aggregator will best suit long-term implementation of the programme?

▌ **Communicating messages (see Table 7)**: should voice messages, video messages, interactive messaging or interactive voice response systems be used? What are the capacity, cost-effectiveness and reach of the available technologies in the country?

▌ **Free access**: how can we ensure that the programme is free and available to all consumers regardless of their carrier, network or location?

▌ **Market research**: which telecoms system is most appropriate in the country, based on reach (subscribers), coverage, costs, security and sustainability? Who owns the data? What are the privacy regulations and how will data be protected and kept secure? Is there good interoperability with health systems? What are the considerations for data protection and how should a central database best be maintained?

▌ **Sustainability:** what are the operating costs of the programme, such as the cost per message, and how will these affect the scale of the programme?

▌ **Contracts**: in establishing contractual arrangements with partners, what are the considerations regarding intellectual property, security and privacy of mobile phone numbers, testing, expectations of involvement in monitoring and evaluation and service agreements? Who will manage the contractual arrangements, and what support will be given for maintenance and any other problems?

The technical advisory group should also consider logistics and the functional plan and finalize the functional specifications in collaboration with technical partners who will build the appropriate systems and interfaces and test internal and user acceptance. Table 6 provides an overview of the roles of the various stakeholders to be considered when planning the technological aspects of an mHealth programme.

TABLE 6. ROLES OF STAKEHOLDERS IN SETTING UP mHEALTH TECHNOLOGY

STAKEHOLDER	ROLE
Ministry of Health	▌ Official owner and custodian of the programme, part of the governance body ▌ Assess and identify needs, develop and validate content ▌ Contract service providers or build in-house infrastructure/platform ▌ Sign cooperation agreements with all operators and/or service provider ▌ Fund or partially fund the programme ▌ Can host the mHealth platform/database and own the short code ▌ Manage the promotion and marketing campaigns
Telecommunications ministry eGovernment (e-Gov) entity (if applicable)	▌ Policy-making to enable m-services in terms of regulations and policies ▌ (Partially) fund the programme, participate in the governing body ▌ Provide technical expertise to the ministry of health ▌ Possibly host the platform ▌ Facilitate dialogue between ministry of health and stakeholders in information and communications technology (ICT) ▌ Support the negotiation of preferential prices for m-services
Telecommunications regulatory authority	▌ Verify eligibility for short-code acquisition ▌ Allocate short code ▌ Facilitate dialogue between ministry of health and ICT stakeholders ▌ Fund or partially fund the programme
mHealth service providers (if ministry of health or eGov does not have a platform)	▌ Provide SMS management application/platform ▌ Manage the platform and run SMS campaigns ▌ Provide 24/7 technical support ▌ Deal with telecoms operators, potentially manage the short code
Telecoms operators	▌ Deliver SMS to end users ▌ Set the cost of SMS and agree on special tariffs with ministry of health, if possible ▌ Facilitate interfacing with service providers and/or local aggregator ▌ Support the promotion of the service
Local aggregator	▌ Provide interface with all operators and manage relationship and invoicing process ▌ Provide reporting on services delivered/failed ▌ (Potentially) own and manage the short code
Data privacy commission	▌ Set the rules for data protection ▌ Enforce the application of data protection regulations ▌ Authorize mHealth services, providing they respect data privacy ▌ Authorize data storage outside the country, if necessary
WHO and ITU	▌ Provide technical expertise and share knowledge from other countries ▌ Help to convene stakeholders

TABLE 7. EXAMPLES OF TECHNOLOGY OPTIONS FOR HEALTH PROMOTION

CHANNEL	STRENGTHS	WEAKNESSES
Interactive voice response (IVR)	▮ Voice- and phone-enabled access ▮ Fast time to market ▮ Supports natural language ▮ Ease of integration	▮ Limited capability and development tools ▮ Inability to pause, resume, fast-forward or rewind
SMS	▮ Simple, easy and convenient ▮ Cost-effective ▮ Private communication ▮ Fast communication	▮ Some security vulnerabilities ▮ Fake SMS (spoofing)
Unstructured supplementary service data (USSD)	▮ Simple and logical ▮ Real-time, fast and responsive ▮ Inexpensive ▮ Interactive navigation	▮ Session-based timeouts ▮ Codes more difficult to remember than common short codes
MMS	▮ Direct and personal ▮ Messages can be stored and forwarded ▮ Interactivity through multimedia	▮ Not compatible with basic phones ▮ More expensive than SMS ▮ Content adaptation limited by variations in screen size and resolution ▮ Read and response rates lower than SMS
Data applications	▮ Self-contained experience ▮ Graphics and user-generated content ▮ Automatic updates and content readable offline ▮ Leverages device-native capabilities (camera, global positioning system) ▮ Strong paid model	▮ Fragmentation, need to build for multiple platforms, with time and costs ▮ Managing multiple releases ▮ Client-side changes ▮ Need to submit app to some stores for approval
Mobile web	▮ More economical than mobile apps ▮ Mobile phones and smartphones supported ▮ Mobility for content and services ▮ Videos and photos	▮ Less functionality, unable to use advanced phone features such as camera, global positioning system ▮ Small display size ▮ Low text input and low bandwidth

MONITORING AND EVALUATION

Monitoring is the routine tracking of an intervention's performance using data collected on a regular and ongoing basis on specified indicators. This information is used to assess the extent to which an intervention is achieving its intended targets on time and on budget.

Evaluation is an episodic assessment of either a completed or an ongoing programme or intervention to determine the extent to which it achieved its stated objectives efficiently and effectively.

The aims of both monitoring and evaluation are similar: to provide information to inform decisions, improve outcomes and achieve objectives.

While monitoring routinely gives information on *where* a project is at any given time relative to its targets for implementation, an evaluation gives evidence of *why* targets and outcomes are or are not being achieved or the extent to which changes can be attributed to the intervention. The data to be collected for monitoring during a project should be part of the planning process.

Why do we need to monitor and evaluate mHypertension?

There is a need for robust evaluations on the benefits and risks of implementing mHypertension at scale, and its cost-effectiveness. Assessing the processes and contextual factors that influence the implementation of mHypertension programmes will help countries' future efforts, as well as helping others understand how they work, which target group they are best suited to and under which circumstances.

The data from monitoring and evaluation will provide donors, policy-makers and other decision-makers at all levels with the relevant information

to formulate policies, set priorities, plan, design and implement mHypertension projects, change the programme in a timely manner, if needed, and allocate the resources to do so.

5.1 DEVELOPING A MONITORING AND EVALUATION PLAN

Planning for monitoring and evaluation should be part of the mHypertension programme development and implemented **from the beginning of the programme.** It is especially important to collect baseline data, either before or in the early stages of programme launch, as this will allow for pre-post analysis of programme effectiveness.

As a guide for planning the evaluation process, a framework or logic model (see Figure 7) that may be expanded and adjusted to the context of the programme and the aspects that are considered key objectives and goals for the programme. For the purposes of simplifying the different interrelated areas of mHealth programmes, this logic model has been divided into two domains – the person-centred domain and the programme-centred domain. An example mHypertension logic model is provided in Figure 8.

FIGURE 7. LOGIC MODEL: FRAMEWORK FOR MONITORING AND EVALUATION OF mHEALTH PROGRAMMES AT SCALE

	INPUT	OUTPUT	OUTCOME	IMPACT
PERSON-CENTERED DOMAIN.	• Outgoing messages • Incoming messages • Surveys, interviews	• Reach and registration • Information about the user population • Ease of understanding messages	• Improved literacy/ knowledge/outreach • Behaviour change • Return on investment • Technology performance	• Improved health outcome • Improved use of resources
PROGRAMME-CENTERED DOMAIN.	• Governance • Policy data • Resources (finance, HR, ICT architecture) • Content development • Outreach and promotion • Data from "Person-centered domain"	• Coverage of intervention • Intervention quality • Interoperability	• Integration with health systems • Improved health literacy • Access to intervention	• Improved health outcomes (SDG 3) • Improved digital capacity (SDG 9) • Efficiency and efficacy

HR: human resources; ICT: information and communications technology
SDG: United Nations Sustainable Development Goal.

FIGURE 8. EXAMPLE LOGIC MODEL FOR mHYPERTENSION EVALUATION

INPUT	ACTIVITIES	OUTPUT	OUTCOME	IMPACT
• Country develops mHTN programme (staff, resources, time, funding, relationship and training with service providers, health centres established)	• Messages are adapted from the mHTN handbook for the local context • Messages are pretested with the target audience and finalized • Programme recruiters are trained • Promotion for the programme conducted • SMS fully set up with service provider	• # of programme recruiters trained • # of users enrolled • # of messages sent to users • # of press releases and amount of media attention	• Users are satisfied with the programme • Messages are received, read, and understood by target population • Improvement in knowledge, perceptions, attitudes, intentions and behaviours for each recommended behaviour • Health-care providers are satisfied with the programme • Improved adherence and compliance to medication • Improved awareness of dangers of hypertension and links with heart disease and stroke	• Users have blood pressure below 140/90 mmHg • Fewer users diagnosed with cardiovascular disease

PROCESS EVALUATION	OUTCOME EVALUATION

Table 8 lists suggested steps for planning the monitoring and evaluation of an mHealth programme.

TABLE 8. MONITORING AND EVALUATION STEPS AND CONSIDERATIONS

STEPS	KEY CONSIDERATIONS
1) **Determine the purpose of monitoring and evaluation**	▎ Does the mHypertension platform operate at optimum level? ▎ Are the messages easy for users to understand? ▎ How effective is the marketing campaign in reaching new users? ▎ How many people from the target population did the programme reach? How many stayed for the whole duration of the programme? ▎ Are users improving their knowledge, behaviour or attitudes due to the mHealth application? Are users increasing their use of health services?
2) **Select indicators***	**Output** ▎ Reach and registration ▎ Information about the user population ▎ Ease of understanding the messages **Outcome** ▎ Improved literacy/knowledge/outreach ▎ Behaviour change ▎ Return on investment ▎ Technology performance
3) **Develop a monitoring and evaluation plan**	▎ What is to be monitored and evaluated? ▎ What are the activities needed to monitor and evaluate (training, staffing, fundraising, etc.)? ▎ Who is responsible for monitoring and evaluation activities? ▎ When will monitoring and evaluation take place? ▎ How will monitoring and evaluation be carried out? What measures will be used? ▎ How will user requests for data be minimized to prevent user data overload/ fatigue? ▎ What resources and approvals are required and from whom (e.g. ethics, data security)? ▎ How will data be analysed and distributed?
4) **Collect baseline data**	**Demographic data** ▎ Minimal collection of sociodemographic characteristics, such as age, gender, ethnicity, socioeconomic status and other factors **Baseline data** ▎ Must relate directly to the indicators that have been previously identified in the monitoring and evaluation plan (e.g. physical activity and eating behaviour, theoretical constructs such as self-efficacy, blood pressure readings)

*Data collection and processing require resources. It is recommended to focus on the set of indicators that are important, feasible and cost-effective to collect, process and analyse.

5.2 SPECIFIC DATA COLLECTION METHODS

Monitoring

▌ Recommend setting up a routine reporting mechanism to monitor the core indicators and the key deliverables. Countries with web-based platforms may present the monitoring report as a data dashboard. Determine which report indicators can be automated, the frequency of data collection and the format for analysing the data.

▌ Decide who will use the monitoring reports (e.g. programme managers, stakeholders) and reflect on the questions they need to have

answered, what decisions they make and how much time they can commit to reviewing the numbers.

▌ Managers should regularly review the progress of participation, technical errors and message activity. In the beginning of a programme, daily monitoring of outgoing messages is recommended. Then weekly or monthly monitoring should be conducted and timed around activities and outputs.

Process evaluation: the periodic assessment of the implementation of a programme in relation to planned activities and overall objectives.

Outcome evaluation: a type of evaluation that is concerned with determining if, and by how much, a programme's activities achieved their intended targets.

Evaluation

▌ While the process evaluation (monitoring) should be done regularly (weekly or monthly), the outcome evaluation can be conducted pre-intervention or post-intervention. For example, baseline data can be collected before launching mHypertension (pre-intervention), and the same measures can be applied at various intervals, such as three months and six months post-launch (post-intervention). To understand long-term effects, another assessment is recommended six months to one year after the mHypertension programme finishes.

▌ A simple way to collect data from users is to use the existing mHypertension platform. For instance, survey questions with simple yes/no or numerical answers can be sent to mHypertension users at regular intervals, such as before and after each "module" of text messages. The immediate delivery of survey questions by mobile phones can improve reliability of responses. For further clarification see Figure 9 and refer to Annex 5 for survey question ideas.

Mobile phone survey question 1:

In the past week, on how many days did you do physical activity for 20–30 minutes? Respond with a number from 0 to 7.

FIGURE 9. EXAMPLE QUESTION AND ADMINISTRATION OF A SURVEY QUESTION DELIVERED BY MOBILE PHONE

Pre-programme:

Mobile phone survey Q1.

User receives physical activity module

Post-programme:
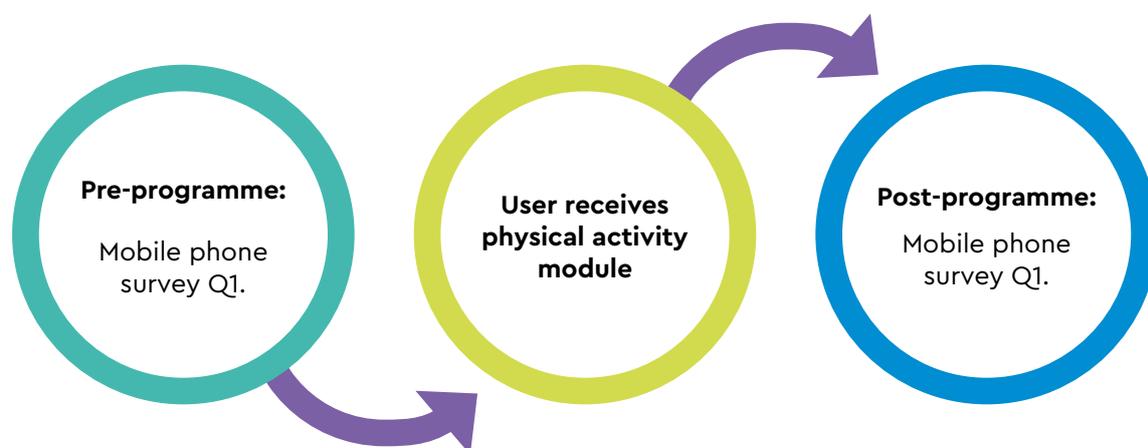
Mobile phone survey Q1.

Table 9 lists different types of evaluation method, along with key considerations for each method.

TABLE 9. METHODS AND DATA FOR mHEALTH EVALUATION

METHOD	PURPOSE	CONSIDERATIONS AND EXAMPLES
Survey	Assess the perceptions, behaviours, knowledge and attitudes and intentions of registered users	▌ Can be administered on the Web, on a mobile device (recommended), or by an interviewer over the phone or in person ▌ Should be short as possible and employ multiple-choice yes/no questions wherever possible (see Annex 5 for examples)
Focus group	Deepen understanding of users' experiences and explore the factors that may affect the user experience, such as language ability, gender, age, geographical location, etc.	▌ Conducted by a facilitator in groups of 5–8 people ▌ Can also be used to brainstorm ideas for increasing registration, improving the programme and enhancing desired outcomes
Interview	Interviews with users: qualitative feedback on their experience, perceptions and satisfaction with the mHypertension programme Interviews with programme implementers: information on perceived strengths, weaknesses and needs related to programme delivery, processes, staff and management structures, capacity and communications methods	▌ For qualitative methodology of focus groups and interviews, refer to *(46)*

Objective measure of outcomes	Collect data on biomechanical or physiological outcomes of performing behaviours, often collected in real time	▎ Literature searches can help identify objective assessment methods for relevant health behaviours ▎ Examples include devices such as accelerometers or pedometers to measure physical activity, and saliva cotinine test to prove smoking cessation ▎ Appointments made and held ▎ Clinical markers and biomarkers, such as blood pressure readings, weight and hospitalization for further progression of disease (e.g. cardiovascular disease) ▎ If it is not feasible to collect objective measures for all participants, the measures could be used on a subsample of the mHypertension user group, which can be generalized to the total sample after demographic matching
Cost analysis	Compare the cost per user of the mHealth approach with traditional approaches to reaching people in similar hypertension programmes	▎ Collect costs on items such as development/planning, staff, marketing and technology

Figure 8 above is an example of a logic model for process and outcome evaluations of mHypertension. Stakeholders in each participating country should be consulted when defining potential evaluation questions and identify relevant programme outcomes and measures. Other logic models are available *(47, 48, 49)*.

5.3 DISSEMINATION

Once monitoring and evaluation activities and reports are completed, dissemination should occur through the appropriate channels. The list below describes some key considerations for dissemination:

▎ Findings should be disseminated in an audience-friendly and timely manner through:

- ☐ formal and informal networks via meetings, newsletters and other forums
- ☐ local newspapers and radio programmes
- ☐ professional conferences via discussion papers or posters
- ☐ journals (professional or lay)*
- ☐ electronic media, such as webpages and email.

* Note that it can be more effective to publish the evaluation results in an academic journal prior to releasing results to the public. Greater confidence can be placed in the results of the mHypertension programme once the findings have been through a rigorous peer-review process.

Conclusion

This handbook provides guidance for the development and implementation of an mHealth programme to support people with hypertension in achieving better control. It describes how an mHypertension programme can be used to supplement existing national hypertension control programmes, and illustrates the steps required for successful implementation. The main components are: operations management, content development and adaptation, promotion and recruitment, technology specification and monitoring and evaluation. The content of the mHypertension programme will complement existing health-care services and routine care offered by health-care professionals. All content in this handbook is based on WHO guidelines, existing research evidence on effectiveness, content and delivery and expert opinions. The templates showcased here should be considered as examples and must be adapted to local context of each participating country.

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Examples of mHypertension programmes at the individual and system level

mHypertension Solution Snapshot

GENERAL POPULATION

	Prevention
SMS	Message database for health promotion
APPS	Wellness apps for health promotion, workplace and community-based apps
	Data collection tools
OTHER	Cloud storage, digital health platforms, linking to electronic records
DOCUMENTS	mHypertension handbook to detail implementation

AT RISK

HIGH BLOOD PRESSURE + RISK FACTORS

CARDIOVASCULAR DISEASE AND OTHER COMPLICATIONS

Screening and management	Management
Message database for early management, screening prompts	Message database for management, medication adherence, appointment reminders, follow-up reminders
Risk score apps, medication stockpiles, workforce training	Monitoring and medication adherence, self-management apps

HCW electronic decision support tools

	ACTIVITIES	SOLUTION TYPE	OBJECTIVE	TOOL	SPECIFIC TARGETS
PREVENTION AND HEALTH PROMOTION	General health promotion	Individual	Health promotion campaign, encouraging healthy eating habits, salt reduction	SMS, apps, social media	Homemakers
	General health promotion	Individual	Health promotion campaign, encouraging healthy eating habits, salt reduction	SMS, apps, social media	Young people
	General health promotion	Individual	Comprehensive health resources to encourage healthy lifestyles	SMS, apps, social media	General population, focus on communities
	General health promotion	Individual	Comprehensive health resources to encourage healthy lifestyles	SMS, apps, social media	Workplace
	General health promotion	Individual	Informed self-monitoring and tracking		Self-selected
	Surveillance	System	Dashboard with data	Cloud-based, SMS, apps	
SCREENING AND DIAGNOSIS	Monitoring	Individual	Knowing risk score	Apps, devices	
	Screening tools	HCW	Electronic decision support	Apps, devices	HCW
	Training	HCW	Opportunities for networking and experience sharing	Apps, devices	HCW
	Access to HS	System	Improving access to health system	Apps, devices	
MANAGEMENT	Access to HS	System	Improving access to health system	SMS, apps, social media	For individuals
	Management	Individual	Improving management of hypertension	SMS, apps, social media	
	Management	Individual	Improving management of hypertension	SMS, apps, social media	
	Management	HCW	Improving diagnosis and management	SMS, apps, social media	
	Access to medication	System	Improving drug procurement	Cloud-based, SMS, apps	Pharmacists, providers
	Management	System	Improving consultation, tracking, history	Cloud-based, SMS, apps	HCW
	Management	HCW	Training HCW	Task-shifting for health workers	
	Surveillance	System	Dashboard with data	Cloud-based, SMS, apps	

SOLUTION CONSIDERATIONS	SPECIFIC EXAMPLES	BARRIERS TO CONSIDER	RELATED RESEARCH
Salt tracking, alternative food choices, recipes and suggestions, guidelines, sharing healthy cooking practices, healthy food discount policy	NHS change4 life campaign, swaps campaign, SaltSwitch, FoodSwitch, WikiHealth, DASH diet	Industry, keeping high engagement, availability and acceptability of alternatives, partnering with health insurers	m-WELLCARE (Shah Ebrahim)
Share pictures for rewards, games, salt tracker, education and other info		Targeting schools	UDAY study: comprehensive community-based hypertension and diabetes prevention programme
Availability of health info, online personal health coach	NHS Choices, Arogya World, MeYouHealth leveraging communities, Friendship Bench, mental health support app, Ground Miles, Masiluleke, SMS support messages, Anjna Patient Education		Mama platform
Incentive and follow up, bud-dy-matching based on interests and risks, activity levels and monitoring		Partner with health insurers	
Tracking apps and cloud-based ser-vices, online personal health coach	Fitbit, Runkeeper, Strava, Stepjockey	Wearables integration	
Dashboard with data, monitoring by local community	Citymapper		
	Health360		
CHW screening toolkit, integrated patient-centred care platform with cloud-based storage	Medic Mobile, SMART health		https://www.ahajournals.org/doi/full/10.1161/JAHA.114.001213
Social sharing platform	Doximity, Sermo, The Rounds		
Remote consultations	meradoctor.com, Babylon Health, HealthTap		
Tool to compare and buy health insurance	HealthSherpa, Kilimo Salama (microin-surance schemes)		
Medication adherence reminders	StAR trial for medication adherence		StAR SMS adher-ence trial
Self-monitoring tools, medication adherence reminders	Flo (SMS based telehealth), Wellframe, Omada Health, Alere healthcare, Self-Care People, PatientsLikeMe, Propeller Health		
Clinical decision-making tools	SnapDx		
Central system to aid in tracking and procurement, stock lists of drugs	Central procurement for drugs (http://eaushadhi.rajasthan.gov.in/DWH/start-up/loginAction), e-Aushadhi		
Paperless records for health care workers	eRecords		
SnapDx			
Mapping for hypertension hotspots, dashboard with data, monitoring by local community	Citymapper, Medic Mobile		

List of behaviour change techniques included in the mHypertension programme

CONSTRUCT	MICHIE BCT[a]	BCT NO.
Information	Goal setting (behaviour)	1.1
	Information about health consequences	5.1
	Information about emotional consequences	5.6
	Credible source	9.1
Reminders	Prompts/cues	7.1
	Remove aversive stimulus	7.5
Instruction	Instruction on how to perform a behaviour	4.1
	Graded tasks	8.7
Self-management	Goal setting (behaviour)	1.1
	Problem solving	1.2
	Action planning	1.4
	Self-monitoring of behaviour	2.3
	Social support (unspecified)	3.1
	Social support (practical)	3.2
	Social support (emotional)	3.3
	Monitoring of emotional consequences	5.4
	Behaviour substitution	8.2
	Verbal persuasion about capability	15.1

[a] Michie S, Richardson M, Johnston M, Abraham C, Francis J, Hardeman W et al. The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. Ann Behav Med. 2013;46(1):81–95. BCT: behaviour change technique.

ANNEX 3

The mHypertension Message Library is available upon request. To request the mHypertension message library, please contact:

BHBM@who.int
or
Pujaris@who.int

Examples of mHypertension programme algorithms

During the content development phase, it is important to test different programme algorithms with the end users. An important consideration is whether modules should be delivered simultaneously, as this provides variety and reminds users about the different lifestyle changes needed throughout the programme, or sequentially, as some users may find this overwhelming and may want to concentrate on one behaviour at a time. Here are two example algorithms, highlighting how the different mHypertension modules can be presented simultaneously or sequentially.

EXAMPLE 1. mHYPERTENSION SIMULTANEOUS BEHAVIOUR ALGORITHM

An mHypertension user has selected all five modules in simultaneous format. User receives one message from each module per week.

WEEK	DAY	MODULE	EXAMPLE MESSAGE
1	Mon	Adherence	Hello [name], welcome to mHypertension! You will start to receive supportive text messages about healthy living to control your blood pressure
	Tue	Healthy eating	You can control your blood pressure by using less salt in your food. Protect your heart
	Wed	Physical activity	Regular physical activity, like a brisk walk each day, will help control your blood pressure and protect you against heart attack and stroke
	Thu		
	Fri	Tobacco cessation	Stopping tobacco use can reduce your risk of heart attack, stroke, cancer and other diseases. There is no "safe" amount of tobacco
	Sat	Alcohol	Limiting alcohol intake can reduce your risk of heart attack, stroke, cancer and other diseases. Aim for less than 2 drinks per day
	Sun		
2–23	Mon	Adherence	If your blood pressure is high, you have likely been prescribed medication. Taking it will help control your blood pressure and keep your heart healthy
	Tue	Healthy eating	To stay healthy, you ideally need to eat at least 5 servings of fruit or vegetables a day. Try a rainbow of colours each day
	Wed	Physical activity	Regular exercise like walking, gardening, dancing, or playing a sport helps keep your mind and body strong. Make it a daily habit for good health!
	Thu		
	Fri	Tobacco cessation	Quitting tobacco is the most important thing you can do for your health and to reduce your risk of heart disease
	Sat	Alcohol	Avoid alcohol to control your blood pressure and reduce risk of heart disease. Remember that less is best!

WEEK	DAY	MODULE	EXAMPLE MESSAGE
24	Sun		
	Mon	Adherence	Keep on top of regular blood pressure screening. Your blood pressure should be less than 140/90. If it high, see your doctor
	Tue	Healthy eating	Stock cubes and ready-made soups contain a lot of salt. Try to avoid them
	Wed	Physical activity	Change your habits for healthy living! Try swapping time that you normally spend sitting down, like watching TV, with physical activity
	Thu		
	Fri	Tobacco cessation	Think about what you are gaining and why you want to quit smoking. Stay focused. It will get easier
	Sat	Alcohol	Try a quick walk if you feel the urge to drink. Your health will be rewarded two times over! Physical activity can make you feel good too
	Sun	Closing	Well done! You've finished the programme. If you stay focused, you should gain further benefits

EXAMPLE 2. mHYPERTENSION SEQUENTIAL BEHAVIOUR ALGORITHM

A non-smoking mHypertension user has selected four modules in sequential format. The user will receive four messages per week from one module at a time. Note that, if a user selects the tobacco cessation and/or alcohol modules, the number of messages per week, the number of weeks per module, and the total length of the mHypertension programme may vary.

WEEK	DAY	MODULE	EXAMPLE MESSAGE
1–6	Mon	Adherence	Hello [name], welcome to mHypertension! You will start to receive supportive text messages about healthy living to control your blood pressure
	Tue		
	Wed	Adherence	If your blood pressure is high, you have likely been prescribed medication. Taking it will help control your blood pressure and keep your heart healthy
	Thu		
	Fri	Adherence	Controlling your blood pressure can prevent heart attack or stroke. Check your blood pressure regularly and make any needed lifestyle changes
	Sat	Adherence	Your blood pressure medication is for the long term. Keep taking it even if you feel well
	Sun		
7–12	Mon	Healthy eating	You can help control your blood pressure by using less salt in your food. Protect your heart
	Tue		
	Wed	Healthy eating	To stay healthy, you ideally need to eat at least 5 servings of fruit or vegetables a day. Try a rainbow of colours each day
	Thu		
	Fri	Healthy eating	Prepare food using only a little bit of salt to help you and your family maintain normal blood pressure. Keep the salt shaker off the table!

WEEK	DAY	MODULE	EXAMPLE MESSAGE
13–18	Sat	Healthy eating	An adult only needs half a teaspoon of salt per day (less than 5 g, or 2 g of sodium). Look for salt and/or sodium on nutrition facts food labels
	Sun		
	Mon	Physical activity	Regular physical activity, like a brisk walk each day, will help control your blood pressure and protect you against heart attack or stroke
	Tue		
	Wed	Physical activity	Regular exercise like walking, gardening, dancing, or playing a sport helps keep your mind and body strong. Make it a daily habit for good health!
	Thu		
	Fri	Physical activity	Just starting out? See how many minutes you can walk without stopping. Then increase by 1–2 minutes each time
	Sat	Physical activity	Moderate physical activity, like a brisk walk, should make you breathe slightly faster and make your heart beat slightly faster
19–24	Sun		
	Mon	Alcohol	Limiting alcohol intake can reduce your risk of heart attack, stroke, cancer and other diseases. Aim for less than 2 drinks per day
	Tue		
	Wed	Alcohol	Avoid alcohol to control your blood pressure and reduce risk of heart disease. Remember that less is best!
	Thu		
	Fri	Alcohol	The healthiest bet is to avoid alcohol. Aim for less than 2 drinks per day with no alcohol on at least 2 days per week
	Sat	Alcohol	Despite what you may hear in the media, alcohol should not be taken for "health" reasons. Limit your use to less than 2 drinks per day
	Sun	Closing	Well done! You've finished the programme. If you stay focused, you should gain further benefits

ANNEX 5. EXAMPLES OF EVALUATION QUESTIONS

Asking simple questions by text message is a quick and easy way to collect data on outcomes at various stages throughout the programme. To simplify the two-way messaging process, responses should be limited to Yes/No or numeric values. Be specific in the question about the type of response is required. Consider ways to review incoming responses and collate the data.

MODULE	EXAMPLE MESSAGES
Adherence	▌ Have you measured your blood pressure in the last month? Reply with 1 for yes or 2 for no ▌ Was your last blood pressure reading less than 140/90 mmHg? Reply with 1 for yes or 2 for no ▌ Did you take your medications yesterday? Reply with 1 for yes or 2 for no ▌ Did you take your medications each day last week? Reply with 1 for yes or 2 for no
Healthy eating	▌ Have you eaten 5 servings of fruit and vegetables today? Reply with 1 for yes or 2 for no ▌ Have you started to use less salt in cooking and eating? Reply with 1 for yes or 2 for no ▌ Have you reduced the amount of fat you cook with and eat? Reply with 1 for yes or 2 for no
Physical activity	▌ Did you do 30 minutes of physical activity today? Reply with 1 for yes or 2 for no ▌ In the past week, on how many days did you do physical activity for 20–30 minutes? Reply with a number from 0 to 7
Tobacco cessation	▌ Have you quit smoking or using tobacco? Reply with 1 for yes or 2 for no ▌ Have you been smoke- or tobacco-free for the past 7 days? Reply with 1 for yes or 2 for no ▌ Have you been smoke or tobacco free for the past 30 days? Reply with 1 for yes or 2 for no
Harmful use of alcohol	▌ Have you had at least 2 alcohol-free days in the last week? Reply with 1 for yes or 2 for no ▌ Have you had 2 or fewer drinks per day in the last week? Reply with 1 for yes or 2 for no