Engaging primary care providers in a mobile health strategy to support lifestyle change and blood pressure management

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Abstract

Objective: The delivery of lifestyle advice concerning diet and physical activity has been found to be suboptimal in primary care settings, including for patients who require this for clinical management. This pilot study aimed to evaluate the acceptability and feasibility of integrating a mobile health intervention into primary care to support patients with improving lifestyle behaviours for high blood pressure.

Methods: Thirty-one patients aged 40–70 years were recruited by seven general practitioners to trial a 6-month mobile health intervention that included videos, web-based education and text message reminders. Semi-structured interviews with general practitioners and patients explored intervention feasibility and acceptability. Web analytics were used to measure intervention use, and pre- and post-questionnaires measured patient ratings of content and behaviour changes.

Results: General practitioners and patients perceived the intervention to be an acceptable tool for supporting high blood pressure management. However, general practitioners reported recruitment challenges and patient engagement was limited for the web and video components. Questionnaires revealed no significant changes in behaviours, although the program was generally regarded by patients as motivating and some reported acquiring new knowledge and awareness. Patient suggestions for improvement included greater individualisation of content and opportunity for interaction with their general practitioner.

Conclusions: There is scope to improve lifestyle interventions for the management of high blood pressure in the busy primary care environment using supplementary mobile health strategies. Further intervention refinement and formative evaluation is required to identify strategies that can be integrated into routine care and achieve high patient engagement.

Keywords

Telemedicine, hypertension, general practice, health behaviour, preventive medicine

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Introduction

High blood pressure (BP) is one of the leading contributors to the burden of disease in Australia and the single largest risk factor for cardiovascular disease (CVD).1 In primary care, high BP is the most treated condition.2 However, rates of lifestyle advice provided to patients in primary care have been found to be suboptimal, despite forming a critical component of national guidelines for the diagnosis and management of high BP.3 Major barriers amongst
general practitioners (GPs) include low confidence to influence patient behaviours, lack of time and limited access to allied health support.4

A 2016 American Medical Association study found that there is growing uptake and interest amongst physicians in the use of digital technologies to strengthen relationships with patients, promote adherence to medical advice and improve the efficiency of care.5 In support of this, researchers have been testing different digital modalities for the delivery of preventive counselling and support in primary care. These have included web-based patient education that can be accessed in waiting rooms and at home,6,7 interactive apps that can assist patients with goal setting and behaviour change8,9 and text messaging to provide follow-up reminders and encouragement.10 The opportunity to use mobile devices to support clinical preventive services (known as mobile health (mHealth)) has been generating interest because of their ubiquity and potential to enhance the support of patients at a relatively low cost.11 Smartphones offer a means of using multiple forms of digital communication (i.e. web, video, text) through a single device that has a high degree of population reach.

While digital technologies are being increasingly applied to improve the management of BP, there is so far limited research concerning how smartphone-based interventions could be used to address this commonly treated condition in primary care.12 Of particular interest, are the ways that this type of mHealth delivery might be integrated into routine care, and be applied to both the lifestyle and pharmacological management of high BP. The present study aimed to evaluate the feasibility, acceptability and potential impact of a model of service delivery where communication and support were provided to patients via their smartphone to build upon advice and prescriptions given by primary care practitioners for the management of high BP. The patient subgroup selected for this study was middle-aged adults who were recently diagnosed, given this is a life stage when the prevalence of hypertension increases.13

Methods

Recruitment

To recruit GPs, advertisements about the study were placed in e-newsletters circulated to GPs, and 98 practices in metropolitan Melbourne were invited by email or fax. Ten GPs were enlisted and each was offered reimbursement of $750 for the recruitment of 10 patients. GPs and their nominated support staff received face-to-face training prior to commencing patient recruitment. This addressed options for recruitment (e.g. invitation to the government-subsidised 45–49 years Health Assessment, letter or SMS text message to existing patients or opportunistically in consultations), enrolment procedures and baseline assessment. During the study, practices were contacted every 2–3 weeks by telephone or email to check progress and offer support. Inclusion criteria for patients were: (a) aged 40–70 years old and (b) BP above normal range (SBP > 130 mmHg and/or DBP > 85 mmHg).3 Exclusion criteria were: (a) limited English proficiency or cognitive impairment that would hinder participation; (b) no smartphone ownership; and (c) any medical conditions for which physical activity (PA) is contraindicated.

Intervention

Participants were sent SMS messages over 6 months, each with a URL link to a webpage containing a video message from their GP and other health professionals, and educational content that was designed using social cognitive theory and behavioural self-management techniques to promote PA and healthy eating.14 Additional SMS reminders were sent to those patients prescribed medication for high BP to encourage adherence. SMS messages were unidirectional, personalised with the participant’s name and 160 characters or less. They included 6 nutrition-related messages, 4 PA messages and 18 types of medication reminders, developed based on national guidelines and previous mHealth studies15 (Table 1). SMS messages concerning health behaviours were sent twice a month and medication reminders once per week, a dosage that was decided with reference to the principles of ‘minimum intervention needed to produce change’ which are appropriate to consider when developing interventions for real-world settings that are subject to resource, time and expertise constraints.16

Data collection and analysis

Semi-structured interviews (digitally recorded) were conducted face to face with GPs and by telephone with participants to obtain insights concerning program acceptability and feasibility. Interview participants were offered a $40 voucher. Measures of intervention impact were collected at baseline and 6 months, using a questionnaire that examined: medications usage;17 PA;18 dietary salt, fat and fruit and vegetable intake;19 alcohol intake;20 smoking;21 and selected measures of self-efficacy and behavioural intentions. The follow-up questionnaire additionally assessed usage, acceptability and satisfaction with the different components of the intervention. Process measures of reach and exposure were obtained by reviewing webpage and video analytics. Semi-structured interviews were analysed using thematic analysis. Descriptive statistics were used to assess participant usage and satisfaction. Intervention impact was assessed using within-subject statistical tests.
Ethics
Ethical approval was obtained from the Monash University Human Research Ethics Committee and written informed consent was obtained from all subjects.

Results
Participants
Three of the 10 enrolled GPs withdrew during the recruitment period due to competing priorities, loss of staff and other factors. It took 5 months for the remaining GPs to recruit 31 patients (Table 2), with 2 excluded due to invalid mobile phone numbers. This was below the original target of 80 patient recruits within 2–3 months. Of the 29 participants, 90% (n = 26) completed the follow-up survey and 13 undertook semi-structured interviews. Five of the seven GPs taking part recruited participants. All GPs participated in interviews to explore recruitment barriers and enablers, and four of the five GPs who recruited participants were interviewed concerning feasibility and acceptability.

GP perspectives
Feasibility of recruitment. During the recruitment period, the age range for patient eligibility was broadened from 45 to 49 years to 40 to 70 years because several GPs reported that they saw few patients in the younger age range who had elevated BP. It was reported that the expansion of the eligibility age made recruitment more feasible. Despite this, only 2 GPs met their recruitment target of 10 patients and all reported that the recruitment process was harder than expected. A barrier during opportunistic recruitment was that many potentially eligible patients were reported to have complex needs. This was thought to lower their interest in BP because they had their own ‘shopping list’ of concerns which dominated the consultation and left little time for discussion of other issues. GPs from one practice suggested that an opportunistic approach would work best for patients who were already attending for preventive reasons (e.g. annual check-up), although a longer recruitment period may be needed to reach these patients. Patients attending in response to an invitation letter or SMS were generally found to be receptive and to present with fewer complex conditions. However, two GPs did not send out invitations because of the practice burden that this entails.

Acceptability of the intervention. Most GPs considered the time required to introduce the intervention to patients to be minimal and non-onerous. GPs generally viewed mHealth as a useful and simple way of delivering education and ongoing support to patients with high BP that the practice would not otherwise be able to deliver. GPs described patients who were receptive to participating as having few complex medical issues, educated and in a stable life situation. All GPs interviewed at the end of the study period reported using mHealth to some extent in other areas of

Table 1. Examples of messages sent to participants.

| Type   | Message                                                                 |
|--------|-------------------------------------------------------------------------|
| Introductory | **Hi [name], Welcome to RESET! We’re here to support you to improve your BP. Save this no. to your phone. If received in error respond STOP to let us know** |
| Role model | **RESET: Hi [name], Making lifestyle changes can improve your BP, but we know it’s not always easy. Learning from others can be inspiring goo.gl/xxxxxx** |
| Nutrition | **RESET: Remember to look for lower sodium (salt) food options, [name]. Less than 400 mg per 100 g is good, and less than 120 mg per 100 g is best goo.gl/xxxxxx**  |
|          | **RESET: Hungry for a snack [name]? Try a handful of nuts, a piece of fruit or some cut-up vegies for a healthy snack goo.gl/xxxxxx**  |
|          | **RESET: Remember [name], a serve of veg is equal to 1 cup of salad or 1/2 a cup of cooked veg. Try adding an extra serve to your lunch and dinner goo.gl/xxxxxx**  |
| Physical activity | **RESET: Hi [name], Make a plan about When and Where you can be active each week goo.gl/xxxxxx**  |
|          | **RESET: Had a busy week [name], and missed your physical activity goal? It happens to everyone. Our tips can help you get back on track goo.gl/xxxxxx**  |
| Medication | **RESET: Hi [name], Remember – cholesterol and BP lowering tablets need to be taken every day RESET: Hi [name]. It can be hard to remember to take your tablets every day. Try putting them next to your toothbrush or somewhere easy to remember RESET: Hi [name], Don’t cut down on your medicine to save money. You must take the full amt for them to work. Talk to your GP if you want to reduce costs goo.gl/xxxxxx**  |
| Concluding | **RESET: Congrats [name], you’ve completed the RESET program! Your GP has a message for you goo.gl/xxxxxx. Keep up the good work and best wishes from ALL of us** |

BP: blood pressure; GP: general practitioner.
Table 2. Baseline characteristics of RESET study participants.

| Demographic characteristics | Participants (n = 31) |
|-----------------------------|---------------------|
| **Age, mean (SD)**          | 50.3 (4.9)          |
| **Gender, n (%)**           |                     |
| Female                      | 14 (45.2)           |
| Male                        | 17 (54.8)           |
| **Country of birth, n (%)** |                     |
| Australia and New Zealand   | 16 (51.6)           |
| Southern Asia               | 8 (25.8)            |
| Europe                      | 4 (12.9)            |
| Other                       | 3 (9.7)             |
| **Employment status, n (%)**|                     |
| Full time                   | 12 (38.7)           |
| Part time, casual or self-employed | 9 (29) |
| Unemployed, disability, student or pension | 10 (32.3) |
| **Medication*, n (%)**      |                     |
| Yes                         | 21 (67.7)           |
| No                          | 10 (32.3)           |
| **Self-reported behaviour and intentions** |       |
| Physical activity (at least 30 min at moderate intensity, five or more times a week), n (%) | |
| Yes                         | 3 (9.7)             |
| No                          | 28 (90.3)           |
| Intention to exercise at least 30 min on most days of the week** (n = 29), n (%) | |
| Unlikely, extremely unlikely or not sure | 16 (55.2) |
| Likely or extremely likely  | 13 (44.8)           |
| Vegetable intake (five or more serves a day), n (%) | |
| Yes                         | 1 (3.2)             |
| No                          | 30 (96.8)           |

(continued)
their practice (e.g. SMS vaccination reminders). It was emphasised that the practicality of using mHealth in primary care depends on having a quick and easy way to enrol patients: ‘I need to be able to recommend it just by a couple of clicks.’ (GP03).

**Patient perspectives**

**Intervention exposure and engagement.** The survey responses revealed high exposure to the SMS component with lower levels for the web and video components (Table 3). According to Google Analytics, the webpages received the following unique page views: Welcome page (52), Role Model page (22), Dietary pages (Saturated Fat – 55; Salt – 53; Fruit and Vegetables – 28), PA pages (page - 25; page - 30) and Completion page (30). YouTube analytics showed that on average, the GP videos were viewed 16 times, the Dietary videos 15 times and the PA videos 5 times. The average view duration was 60% for the GPs’ Welcome and Completion videos, and 80% for the PA and Dietary videos. The interviews revealed that the limited use of web and video content was due to personal preferences (e.g. disinterest in videos, preference for face-to-face interaction), lack of time and limited patience to load or read the content. The SMS content was generally liked for its convenience, the perceived helpfulness of reminders and direct delivery of snippets of information.

Patient suggestions for enhancing their engagement with the content included greater tailoring to their goals and interests, stronger communication of the benefits of the program, greater emphasis on lifestyle rather than medication and making it easier to revisit or save messages. Several participants suggested that engagement could have been enhanced by personal interaction (e.g. telephone or face-to-face support from their GP) and receipt of tangible feedback (e.g. through an activity tracker).

**Acceptability of the intervention.** The 6-month program duration was perceived to be reasonable and acceptable, with some interviewees being willing to receive messages beyond this period. A few participants considered a shorter timeframe would have been sufficient for maintaining motivation and interest, with suggestions ranging from 6 weeks to 3 months, although it was also recognised that this could be individualised according to ‘when people have had enough’ (P02). Most participants regarded the number and timing of SMS messages to be appropriate (Table 3). Some interviewees expressed a preference for receiving messages at a set time or outside work hours, while others liked the varied times of delivery. Survey responses revealed high levels of acceptability in relation to the various program components (Table 3). In interviews, several participants liked the sense of feeling cared for: ‘because the text messages were coming to my phone and my name was being used...it was like having a silent partner in a way’ (P02). The web content was widely regarded as clear and easy to navigate, even for those who admitted having only basic technological proficiency. Although most survey respondents rated the amount of information on each webpage as being ‘about right’, some thought that the information could have been more

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**Table 2. Continued.**

| Fruit intake (two or more serves a day), n (%) | Participants (n = 31) |
|-----------------------------------------------|-----------------------|
| Yes                                           | 20 (64.5)             |
| No                                            | 11 (35.5)             |
| Usual addition of salt to food and use in cooking, n (%) | 9 (29) |
| Intention to eat healthy most days of the week<sup>b</sup> (n = 29), n (%) | |
| Unlikely, extremely unlikely or not sure       | 7 (24.1)              |
| Likely or extremely likely                     | 22 (75.9)             |
| Alcohol consumption (> 2 drinks on a typical day), n (%) | 6 (19.4) |
| Current smoker<sup>c</sup>, n (%)              | 6 (19.4)              |

<sup>a</sup>Defined as having a current prescription for high cholesterol or high blood pressure medication.

<sup>b</sup>Intention assessed in relation to the next 6 months.

<sup>c</sup>Defined as smoking daily or occasionally.
Table 3. Acceptability of the different components of the RESET program.

| Component                        | SMS                        | Web                        | Video                      |
|----------------------------------|----------------------------|-----------------------------|----------------------------|
| Proportion read or viewed\(^b\) | 89.50 (50, 100)\(^c\)      | 52.50 (38.75, 85.25)\(^e\) | 52.27 ± 31.17\(^d\)       |
| Amount and frequency\(^e\) (n = 25), n (%) |                             |                             |                            |
| Too few or far too few\(^f\)    | 4 (16)                     | 2 (7.7)                     | 1 (3.8)                    |
| About right                     | 17 (68)                    | 21 (80.8)                   | 24 (92.3)                  |
| Too many or far too many\(^g\)  | 4 (16)                     | 3 (11.5)                    | 1 (3.8)                    |
| Timing of SMS messages, n (%)    |                            |                             |                            |
| Mostly appropriate or neutral   | 21 (80.8)                  | −                           | −                          |
| Relevance, n (%)                |                            |                             |                            |
| Poor                            | 3 (11.5)                   | 2 (7.7)                     | 2 (7.7)                    |
| Fair                            | 4 (15.4)                   | 5 (19.2)                    | 5 (19.2)                   |
| Good, very good or excellent    | 19 (73.1)                  | 19 (73.1)                   | 19 (73.1)                  |
| Usefulness, n (%)               |                            |                             |                            |
| Poor                            | 2 (7.7)                    | 2 (7.7)                     | 2 (7.7)                    |
| Fair                            | 5 (19.2)                   | 5 (19.2)                    | 6 (23.1)                   |
| Good, very good or excellent    | 19 (73.1)                  | 19 (73.1)                   | 18 (69.2)                  |
| Clarity, n (%)                  |                            |                             |                            |
| Poor                            | 1 (3.8)                    | 2 (7.7)                     | 1 (3.8)                    |
| Fair                            | 1 (3.8)                    | 5 (19.2)                    | 3 (11.5)                   |
| Good, very good or excellent    | 24 (92.3)                  | 19 (73.1)                   | 22 (84.6)                  |
| Interest, n (%)                 |                            |                             |                            |
| Poor                            | −                          | 2 (7.7)                     | 2 (7.7)                    |
| Fair                            | −                          | 6 (23.1)                    | 4 (15.4)                   |
| Good, very good or excellent    | −                          | 18 (69.2)                   | 20 (76.9)                  |
| Layout, n (%)                   |                            |                             |                            |
| Poor                            | −                          | 1 (3.8)                     | −                          |
| Fair                            | −                          | 5 (19.2)                    | −                          |
| Good, very good or excellent    | −                          | 20 (76.9)                   | −                          |

(continued)
detailed, addressed other topics (e.g. stress management), or provided greater insight into other people’s experiences of managing high BP. Patients were divided in their opinions about the video messages from their GP; some valued their GP’s endorsement of the program and personal attention, while others found the videos somewhat patronising and impersonal.

**Impact on behaviours.** The survey responses revealed no changes in self-efficacy, intentions and behaviours in relation to healthy eating or PA (Table 4), although certain participants reported the program having transformative effects in interviews:

‘it made me look at my diet, made me look at my exercise regime, and I improved it, you know, like I said, it motivated me, inspired me to do better and to be better’ (P02)

‘it has changed my eating and that, and I’m positive it’s helped me. It’s virtually no salt intake whatsoever now… And no, like I walk every day, never used to.’ (P13)

Interviews revealed that some participants found the program reinforced existing knowledge and understanding but appreciated being reassured that they were ‘on the right track’. Other participants reported gaining new knowledge, such as the contribution of salt to high BP. Participants generally considered the program to be motivating because the SMS messages were good reminders to stay on track with exercise and healthy eating. The messages were also thought to encourage enjoyment of vegetarian meals, prompt efforts towards PA and generate guilt about inactivity or unhealthy eating.

**Table 3. Continued.**

| Visual appeal, n (%) | SMS | Web | Video |
|----------------------|-----|-----|-------|
| Poor                 | –   | 1 (3.8) | –     |
| Fair                 | –   | 5 (19.2) | –     |
| Good, very good or excellent | – | 20 (76.9) | –     |

aN = 26 except where otherwise specified.

bDefined as the proportion of total SMS messages read, each webpage read and videos viewed in full.

cMdn (25th, 75th percentiles).

dM ± SD.

eThis was assessed in relation to the number of SMS messages received, amount of information on each webpage and length of the videos.

fIn relation to the webpages, ‘Too few or far too few’ was defined as ‘Too little’ or ‘Far too little’ information on each webpage, and in relation to videos, this was defined as ‘Too short’ or ‘Far too short’.

In relation to the webpages, ’Too many or far too many’ was defined as ‘Too much’ or ‘Far too much’, and in relation to videos, this was defined as ‘Too long’ or ‘Far too long’.

**Discussion**

In this study, mHealth was perceived by GPs and patients to be an acceptable complementary strategy to support high BP management. However, while GPs considered mHealth to be value adding, recruitment of patients was a major challenge. Advantages and disadvantages were identified in respect of each recruitment approach, highlighting the value of offering general practices the flexibility of recruiting by their preferred methods. While clinical endorsement has been identified as an important facilitator of patient enrolment in mHealth interventions, this study highlights how patients’ personal needs and values affect their receptiveness to these opportunities.22 The challenges associated with recruiting middle-aged participants through preventive health checks in the primary care setting also raises the question of whether middle-aged adults might be more effectively reached through (or in conjunction with) the preventive health services offered in other settings such as workplace health checks.23

Patients found the 6-month program duration, random timing of SMS delivery and various intervention components to be acceptable. Of all the components, SMS was most preferred as an efficient, easy to read, cue to action. This is encouraging, as text messaging is an intervention modality that can be automated and delivered at a low cost. The value associated with feeling ‘cared for’ is consistent with other studies which have identified the relational aspect of SMS as an important factor in supporting patients with high BP.24

Despite high levels of satisfaction with the web and video components, engagement was limited and primarily attributed to personal preferences. Low engagement with web and video components is likely to have contributed to the lack of effect found on intentions, attitudes and
Table 4. Impact on dietary and physical activity behaviours, self-efficacy and intentions.

| Proportion                                      | Baseline n (%) | Follow-up n (%) | p  |
|------------------------------------------------|----------------|-----------------|----|
| **Healthy eating**                              |                |                 |    |
| Behaviours                                      |                |                 |    |
| Meeting recommended vegetable serves (n = 25)\(^b\) | 1 (4)          | 1 (4)           | 1  |
| Meeting recommended fruit serves\(^c\)          | 18 (69.2)      | 18 (69.2)       | 1  |
| Never or rarely add salt at the table           | 7 (26.9)       | 9 (34.6)        | 0.5|
| Never or rarely use salt in cooking or preparing food | 2 (7.7)         | 2 (7.7)        | 1  |
| Confidence to eat healthy\(^d\) (n = 25)        |                |                 |    |
| When in a hurry                                 | 15 (60)        | 15 (60)         | 1  |
| When eating out                                 | 14 (56)        | 15 (60)         | 1  |
| When feeling alone                              | 15 (60)        | 16 (64)         | 1  |
| When feeling too lazy to cook                   | 11 (44)        | 16 (64)         | 0.125|
| When visiting family or friends                 | 15 (60)        | 13 (52)         | 0.774|
| When others around you are eating unhealthy (n = 24) | 14 (58.3)      | 15 (62.5)       | 1  |
| Intention to follow a healthy diet in next 6 months (n = 25)\(^e\) | 20 (80)    | 20 (80)        | 1  |
| **Physical activity**                           |                |                 |    |
| Behaviours                                      |                |                 |    |
| Walking (at least 30 min, 5 or more times/week) (n = 25) | 2 (8)          | 3 (12)         | 1  |
| Moderate intensity activity (at least 30 min, 5 or more times/week) | 2 (7.7)       | 1 (3.8)        | 1  |
| Confidence to be physically active\(^d\)        |                |                 |    |
| When tired (n = 25)                             | 8 (32)         | 11 (44)         | 0.453|
| When no time (n = 24)                           | 5 (20.8)       | 9 (37.5)        | 0.219|
| When the weather is bad (n = 25)                | 9 (36)         | 11 (44)         | 0.625|
| When pressured (n = 25)                          | 9 (36)         | 8 (32)          | 1  |
| When feeling lazy (n = 25)                      | 4 (16)         | 10 (40)         | 0.07|
| When feeling depressed (n = 25)                 | 7 (28)         | 9 (36)          | 0.625|
| Intention to be physically active in next 6 months\(^f\) | 12 (48)       | 14 (56)        | 0.754|

\(^{a}\)n = 26 unless otherwise stated.
\(^{b}\)Five or more vegetable serves/day.
\(^{c}\)Two or more fruit serves/day.
\(^{d}\)Proportion who rated themselves as confident or very confident.
\(^{e}\)Defined as being likely or extremely likely to eat a healthy diet on most days of the week.
\(^{f}\)Defined as being likely or extremely likely to exercise at least 30 min each day on most days of the week.
behaviours, as the SMS messages (sent on a fortnightly basis for the lifestyle messages) served as a reminder rather than a means of education and may not have been delivered with adequate intensity to generate change on their own. Closer alignment of formats to participant preferences may have enhanced engagement, consistent with patient suggestions for greater personalisation, and tailoring in relation to message timing, and content according to individuals’ demographic or psychosocial characteristics (e.g. stage of change for different behaviours).26,27

Participants also provided feedback that further interaction with their GP would have enhanced their engagement in this BP management strategy. The perceived value of supplementing mHealth with peer and/or professional support has been found in other mHealth studies involving patients with chronic disease or associated risk factors.28–30 On the other hand, mHealth can also be a useful educational tool for improving awareness of behaviours and initiating behaviour change without requiring ongoing professional support, as shown in a study that used smartphones to enable self-monitoring.30

Patient-tailored, bidirectional content and evidence-based hypertension support (e.g. group sessions) have been identified as components of SMS interventions associated with greater improvements in BP.31 However, the evidence concerning these aspects of program design is still being gathered, with one review of text message-based interventions for health promotion not finding greater efficacy when complementary counselling was offered (compared to text message communication only).26 The circumstances in which supplementary peer and/or professional support may be beneficial requires further investigation given the additional time, resources and complexity that is potentially involved.

Key strengths of this study include its mixed-methods approach, and recruitment of participants from socially and culturally diverse backgrounds. However, the sample size was insufficient to detect impacts and allow for comparisons by patient characteristics.

Conclusions

The prevalence of high BP, low rates of lifestyle advice given to patients in primary care and limited patient adherence to BP management guidelines highlight the need for innovation to improve primary care support for patient medications adherence and lifestyle change. mHealth offers the potential to address this need. In this study, the utilisation of patients’ smartphones to deliver education and support that included text message, web and video components was perceived to be acceptable and value adding, however, patient reach and engagement were limited. Continued investigation is required to determine optimal design and delivery methods for strategies of this type, while being mindful of the potential consequences associated with increased intensity, complexity and cost upon the feasibility of integrating these into routine care.10

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References

1. Australian Institute of Health and Welfare. Australian Burden of Disease Study: Impact and causes of illness and death in Australia 2011, https://www.aihw.gov.au/reports/burden-of-disease/abds-impact-and-causes-of-illness-death-2011/contents/highlights (2016, accessed 4 Aug 2018).

2. Harris MF, Islam FM, Jalaludin B, et al. Preventive care in general practice among healthy older New south wales residents. BMC Fam Pract 2013; 14: 83.

3. National Heart Foundation of Australia. Guideline for the diagnosis and management of hypertension in adults – 2016, https://www.heartfoundation.org.au/or-for-professionals/clinical-information/hypertension (2016, accessed 4 Aug 2018).

4. Howes F, Warnecke E and Nelson M. Barriers to lifestyle risk factor assessment and management in hypertension: a qualitative study of Australian general practitioners. J Hum Hypertens 2013; 27: 474–478.

5. American Medical Association. Digital Health Study: Physicians’ Motivations and Requirements for Adopting Digital Clinical Tools, https://www.ama-assn.org/sites/ama-assn.org/files/corp/media-browser/specialty%20group/
6. Lygidakis C, Wallace P, Tersar C, et al. Download your doctor: implementation of a digitally mediated personal physician presence to enhance patient engagement with a health-promoting internet application. JMIR Res Protoc 2016; 5: e36.

7. Degroote L, Plaete J, De Bourdeaudhuij I, et al. The effect of the eHealth intervention ‘MyPlan 1.0’ on physical activity in adults who visit general practice: a quasi-experimental trial. Int J Environ Res Public Health 2018; 15: 228.

8. Gill DP, Blunt W, Silva NB, et al. The HealtheSteps™ lifestyle prescription program to improve physical activity and modifiable risk factors for chronic disease: a pragmatic randomized controlled trial. BMC Public Health 2019; 19: 841.

9. van der Weegen S, Verwey R, Spreeuwenberg M, et al. It’s LiFe! Mobile and web-based monitoring and feedback tool embedded in primary care increases physical activity: a cluster randomized controlled trial. J Med Internet Res 2015; 17: e184.

10. Unal E, Giakoumidakis K, Khan E, et al. Mobile phone text messaging for improving secondary prevention in cardiovascular diseases: a systematic review. Heart Lung 2018; 47: 351-359.

11. Suffoletto B. Text message behavioral interventions: from here to where? Curr Opin Psychol 2016; 9: 16–21.

12. Urrea B, Misra S, Plante TB, et al. Mobile health initiatives to improve outcomes in primary prevention of cardiovascular disease. Curr Treat Options Cardiovasc Med 2015; 17: 59.

13. Australian Bureau of Statistics. Hypertension and measured high blood pressure, 4364.0.55.001 - National Health Survey: First Results, 2014–15, https://www.abs.gov.au/ausstats/abs@.nsi/Lookup/by%20Subject/4364.0.55.001~2017-18~Main%20Features~Hypertension%20and%20measured%20high%20blood%20pressure~60 (2015, accessed 12 August 2018).

14. Bandura A. Health promotion from the perspective of social cognitive theory. Psychol Health 1998; 13: 623–649.

15. Redfern J, Thiagalingam A, Jan S, et al. Development of a set of mobile phone text messages designed for prevention of recurrent cardiovascular events. Eur J Prev Cardiol 2012; 21: 492–499.

16. Glasgow RE, Fisher L, Stryker LA, et al. Minimal intervention needed for change: definition, use, and value for improving health and health research. Transl Behav Med 2014; 4: 26–33.

17. Morisky D, Green L and Levine D. Concurrent and predictive validity of a self-reported measure of medication adherence. Med Care 1986; 24: 67–74.

18. Smith BJ, Marshall AL and Huang N. Screening for physical activity in family practice: evaluation of two brief assessment tools. Am J Prev Med 2005; 29: 256–264.

19. O’Reilly S and McCann L. Development and validation of the diet quality tool for use in cardiovascular disease prevention settings. Aust J Prim Health 2012; 18: 138–147.

20. Bush K, Kivlahan DR, McDonell MB, et al. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Arch Intern Med 1998; 158L: 1789–1795.

21. Heatherton TF, Kozlowski LT, Frecker RC, et al. The fagerström test for nicotine dependence: a revision of the fagerström tolerance questionnaire. Br J Addict 1991; 86: 1119–1127.

22. O’Connor S, Hanlon P, O’Donnell CA, et al. Understanding factors affecting patient and public engagement and recruitment to digital health interventions: a systematic review of qualitative studies. BMC Med Inform Decis Mak 2016; 16: 120.

23. Mazza D, Shand LK, Warren N, et al. General practice and preventive health care: a view through the eyes of community members. Med J Aust 2011; 195: 180–183.

24. Redfern J, Santo K, Coorey G, et al. Factors influencing engagement, perceived usefulness and behavioral mechanisms associated with a text message support program. PLoS One 2016; 11: e0163929.

25. Walthouwer MJL, Oenema A, Lechner L, et al. Use and effectiveness of a video-and text-driven web-based computer-tailored intervention: randomized controlled trial. J Med Internet Res 2015; 17: e222.

26. Head KJ, Nour SM, Iannarino NT, et al. Efficacy of text messaging-based interventions for health promotion: a meta-analysis. Soc Sci Med 2013; 97: 41–48.

27. Hawkins RP, Kreuter M, Resnicow K, et al. Understanding tailoring in communicating about health. Health Educ Res 2008; 23: 454–466.

28. Fukuoaka Y, Kamitani E, Bonnet K, et al. Real-time social support through a mobile virtual community to improve healthy behavior in overweight and sedentary adults: a focus group analysis. J Med Internet Res 2011; 13: e49.

29. Harrison S, Stadler M, Ismail K, et al. Are patients with diabetes mellitus satisfied with technologies used to assist with diabetes management and coping?: a structured review. Diabetes Technol Ther 2014; 16: 771–783.

30. Knight E and Petrella RJ. Prescribing physical activity for healthy aging: longitudinal follow-up and mixed method analysis of a primary care intervention. Phys Sportsmed 2014; 42: 30–38.

31. Vargas G, Cajita MI, Whitehouse E, et al. Use of short messaging service for hypertension management: a systematic review. J Cardiovasc Nurs 2017; 32: 260–270.